The past 20 years has seen a remarkable growth in the knowledge base and skillset available in small animal practice – the range of specialist information now available may appear daunting to the relatively inexperienced vet looking for a concise answer to one of the many common problems presented in the consulting room. The BSAVA Manual of Canine Practice condenses the information from many important areas into a single volume. Written by vets with many years’ experience in general practice, this new Foundation Manual aims to provide the first port of call for the busy practitioner faced with uncertainty over a new case. Common sense, first line approaches are given in a problem-oriented setting stemming from the nose-to-tail examination.

The BSAVA Manual of Canine Practice is divided into three sections:

■ ■ The ‘art’ of canine practice
■ ■ Common consultations
■ ■ Common clinical presentations

Quick Reference Guides are provided throughout the Manual highlighting practical treatments or techniques.

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Titles in the BSAVA Manuals series

Manual of Canine & Feline Abdominal Imaging
Manual of Canine & Feline Abdominal Surgery
Manual of Canine & Feline Advanced Veterinary Nursing
Manual of Canine & Feline Anaesthesia and Analgesia
Manual of Canine & Feline Behavioural Medicine
Manual of Canine & Feline Cardiorespiratory Medicine
Manual of Canine & Feline Clinical Pathology
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Manual of Canine & Feline Dermatology
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Manual of Canine & Feline Thoracic Imaging
Manual of Canine & Feline Ultrasonography
Manual of Canine & Feline Wound Management and Reconstruction
Manual of Canine Practice: A Foundation Practice
Manual of Exotic Pet and Wildlife Nursing
Manual of Feline Practice: A Foundation Manual
Manual of Ornamental Fish
Manual of Practical Animal Care
Manual of Practical Veterinary Nursing
Manual of Psittacine Birds
Manual of Rabbit Medicine
Manual of Rabbit Surgery, Dentistry and Imaging
Manual of Raptors, Pigeons and Passerine Birds
Manual of Reptiles
Manual of Rodents and Ferrets
Manual of Small Animal Practice Management and Development
Manual of Wildlife Casualties

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# Contents

List of quick reference guides                                      v
List of contributors                                                 vii
Foreword                                                            ix
Preface                                                             x

1. The dog-friendly practice
   Kate Chitty and Laura Smith                                       1
2. Consultation technique
   Christine Magrath and Geoff Little                               14
3. Preventive healthcare: a life-stage approach
   Alan Hughes                                                      25
4. Nutrition                                                       40
   Marge Chandler                                                  
5. Reproductive management                                         49
   Angelika von Heimendahl                                         
6. Considerations for surgical cases                               68
   Julian Hoad                                                     
7. Euthanasia: considerations for canine practice                  76
   Ross Allan                                                      
8. Dealing with emergency cases                                    82
   Sophie Adamantos                                                
9. Acute collapse                                                  93
   Mark Maltman                                                    
10. The trauma patient: assessment, emergency management and wound care
    Julian Hoad                                                    100
11. Seizures, ataxia and other neurological presentations
    Alex Gough                                                     109
    Tiny De Keuster, Joke Monterny and Christel P.H. Moons         
13. Regurgitation, vomiting and diarrhoea                          154
    Sara Gould                                                     
14. Abnormalities of eating and drinking                           164
    Nick Bexfield                                                  
15. Lameness                                                       176
    Tim Hutchinson                                                 
16. Paralysis and spinal pain                                      186
    Alex Gough                                                     

Tim Hutchinson
<table>
<thead>
<tr>
<th>Page</th>
<th>Section</th>
<th>Author</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>Lethargy and weakness in endocrine disease</td>
<td>Sarah Packman</td>
<td>193</td>
</tr>
<tr>
<td>18</td>
<td>Hyperthermia and pyrexia</td>
<td>Sarah Packman</td>
<td>202</td>
</tr>
<tr>
<td>19</td>
<td>Epistaxis, sneezing and nasal discharge</td>
<td>Robert Williams</td>
<td>207</td>
</tr>
<tr>
<td>20</td>
<td>Oral and dental problems</td>
<td>Robert Williams</td>
<td>212</td>
</tr>
<tr>
<td>21</td>
<td>Ocular problems</td>
<td>Gary Lewin</td>
<td>229</td>
</tr>
<tr>
<td>22</td>
<td>Ear problems and head tilt</td>
<td>Robert Williams</td>
<td>244</td>
</tr>
<tr>
<td>23</td>
<td>Abnormalities of the throat and neck</td>
<td>Robert Williams</td>
<td>252</td>
</tr>
<tr>
<td>24</td>
<td>Cardiorespiratory problems</td>
<td>Mark Maltman</td>
<td>256</td>
</tr>
<tr>
<td>25</td>
<td>Abdominal pain and swelling</td>
<td>Scott Kilpatrick</td>
<td>274</td>
</tr>
<tr>
<td>26</td>
<td>Urination problems; genital discharge</td>
<td>Angelika von Heimendahl and Julian Hoad</td>
<td>284</td>
</tr>
<tr>
<td>27</td>
<td>Skin problems: a clinical approach</td>
<td>Ken Robinson</td>
<td>297</td>
</tr>
<tr>
<td>28</td>
<td>Lumps and bumps</td>
<td>Robert Williams</td>
<td>319</td>
</tr>
<tr>
<td>29</td>
<td>Disorders of the paw</td>
<td>Ken Robinson</td>
<td>327</td>
</tr>
<tr>
<td>30</td>
<td>Conditions of the anus, perineum and tail</td>
<td>Julian Hoad</td>
<td>339</td>
</tr>
<tr>
<td></td>
<td><strong>Index</strong></td>
<td></td>
<td>346</td>
</tr>
</tbody>
</table>
## Quick reference guides

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Author</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1</td>
<td>Head-to-tail general examination</td>
<td>Alan Hughes</td>
</tr>
<tr>
<td>5.1</td>
<td>Ovariohysterectomy: hints and tips</td>
<td>Tim Hutchinson</td>
</tr>
<tr>
<td>5.2</td>
<td>Castration (Orchidectomy): hints and tips</td>
<td>Tim Hutchinson</td>
</tr>
<tr>
<td>5.3</td>
<td>Caesarean section: hints and tips</td>
<td>Tim Hutchinson</td>
</tr>
<tr>
<td>8.1</td>
<td>Cardiopulmonary resuscitation</td>
<td>Sophie Adamantos</td>
</tr>
<tr>
<td>11.1</td>
<td>Short ‘screening’ neurological examination</td>
<td>Alex Gough</td>
</tr>
<tr>
<td>11.2</td>
<td>Emergency treatment of status epilepticus</td>
<td>Alex Gough</td>
</tr>
<tr>
<td>14.1</td>
<td>Testing for hyperadrenocorticism: some important considerations</td>
<td>Nick Bexfield</td>
</tr>
<tr>
<td>15.1</td>
<td>Assessment of anterior cruciate instability</td>
<td>Tim Hutchinson</td>
</tr>
<tr>
<td>15.2</td>
<td>Assessing hip laxity</td>
<td>Tim Hutchinson</td>
</tr>
<tr>
<td>20.1</td>
<td>Examining the mouth in a conscious dog</td>
<td>Lisa Milella</td>
</tr>
<tr>
<td>20.2</td>
<td>Scaling and polishing teeth</td>
<td>Lisa Milella</td>
</tr>
<tr>
<td>20.3</td>
<td>Tooth extraction</td>
<td>Lisa Milella</td>
</tr>
<tr>
<td>22.1</td>
<td>Ear cytology</td>
<td>Robert Williams</td>
</tr>
<tr>
<td>22.2</td>
<td>Otoscopy</td>
<td>Robert Williams</td>
</tr>
<tr>
<td>22.3</td>
<td>Surgical treatment of aural haematoma</td>
<td>Tim Hutchinson</td>
</tr>
<tr>
<td>24.1</td>
<td>Pericardiocentesis</td>
<td>Mark Maltman</td>
</tr>
<tr>
<td>24.2</td>
<td>Thoracocentesis and thoracic drain placement</td>
<td>Mark Maltman</td>
</tr>
<tr>
<td>25.1</td>
<td>FAST scan</td>
<td>Scott Kilpatrick</td>
</tr>
</tbody>
</table>
25.2 Abdominocentesis
Scott Kilpatrick

25.3 Diagnostic peritoneal lavage
Scott Kilpatrick

27.1 Skin scraping for parasites
Ken Robinson

27.2 Skin cytology
Ken Robinson

27.3 Obtaining a trichogram
Ken Robinson

27.4 Skin biopsy
Ken Robinson

28.1 Fine-needle aspiration of a superficial mass
Robert Williams

28.2 Biopsy of a superficial mass
Robert Williams

29.1 Applying a foot bandage
Ken Robinson

29.2 Toe amputation
Ken Robinson

29.3 Dew claw removal under general anaesthesia
Ken Robinson

29.4 Removal of a nail and distal phalanx
Ken Robinson
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This brand new Foundation Manual from the BSAVA is an exciting development because it condenses the information from many important areas into a single volume. The development over the last 20 years of a range of formal specialist veterinary qualifications has produced a significant surge in the range and depth of knowledge in canine practice. Whilst we should celebrate that this range and depth now exists, it is also clear that this very range is daunting to many of us. Concise answers to common questions that occur in consulting rooms are becoming harder to find. This book swings the balance back to the practitioner.

As well as traditional systems based medicine, this Manual also provides information on the ‘arts’ of practice such as consultation technique and dealing with common but testing situations. In the clinical presentations section of the book, first line approaches are given in a problem-oriented setting with a significant focus on the ‘nose-to-tail’ physical examination, a detailed clinical history and common, readily available, diagnostic tests. This book should be the first port of call for the busy clinician faced with a range of challenging issues (not all of them medical) in the consulting room.

The editors are to be congratulated on bringing together a team of authors with such an extensive experience in a wide variety of clinical practices who were able to distil volumes of veterinary textbooks to single chapters. The quality of the illustrations and flow charts, combined with the pithy practice tips will help a generation of vets to cope with life on the front line. Inexperienced vets will benefit most, but there is something in this Manual for everyone with an interest in canine practice.

We sometimes feel that we should know everything, but in truth, after a while in clinical practice, we realise that we know nothing, but it is our ability to identify and consult appropriate authoritative sources that determines our success. This new Manual is a goldmine of information that can be consulted over and over again. It will also provide a springboard to the more detailed knowledge available in the rest of the BSAVA Manuals. I would like to thank the BSAVA for having the foresight to publish this Manual and the editors and authors for all their hard work in bringing it to life.

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University of Glasgow
The last 20 years has seen a remarkable growth in the knowledge base and skillset available in small animal practice. Publications from the BSAVA have been a useful barometer of these changes: once there was a book called *Canine Medicine and Therapeutics* which, at the time, successfully captured what practitioners needed to know on a day-to-day basis. However, with the rise of the small animal profession and the increasing depth of specialization, this volume was replaced by the hugely successful series of BSAVA Manuals – a group of publications that has itself been subject to expansion in its scope and numerous new editions. This ready-made practice library now really does provide everything the practitioner needs, whatever their speciality, but may appear daunting to the relatively inexperienced vet looking for a concise answer to one of the many common problems presented in the consulting room.

This is the niche for this new Manual. Authored by vets with many years’ experience in general practice, it aims to provide the first port of call for the busy practitioner faced with uncertainty over a new case. Common sense, first line approaches are given in a problem-oriented setting, stemming from the nose-to-tail examination. We hope it will become an invaluable tool to a new generation of vets.

Tim Hutchinson
Ken Robinson
May 2015
The dog-friendly practice

Kate Chitty and Laura Smith

In recent years much has been done to make veterinary practices more ‘cat-friendly’, and now ‘rabbit-friendly’ measures are being introduced. There seems to be a feeling that all small animal practices are already ‘dog-friendly’ and that no further thought or research is therefore needed. Sadly, this can be far from true and a lot of dog owners do feel that more could, and should, be done for their pets too.

Many changes will help all dogs, some only certain individuals, but making the owners feel more comfortable and relaxed will help their dogs stay more calm. Changes can be time-consuming but helping both pet and owner is rewarding and can help bond clients to the practice.

The whole practice team can be involved in trying to make the environment more dog-friendly. Some clients perceive veterinary nurses as more approachable and accessible than veterinary surgeons, and providing a range of nurse clinics may therefore encourage clients to come into the practice for advice and support. Non-vets often see problems and can help devise solutions based on their knowledge of the clients and dogs, and on previous experience. They can also see how the clients and their pets respond to any changes implemented. By making clients and pets feel more relaxed, the whole working environment becomes happier and friendlier, and this ultimately helps the team to provide quality veterinary care.

**Practice design considerations**

Some considerations apply across the whole practice:

- Many dogs dislike walking on slippery floors. Simply using rubber mats (easily cleaned and replaced) can make a lot of difference to many dogs. The use of mats is also helpful on slippery tables and in tub-tables and sinks (Figure 1.1)
- The use of pheromone diffusers may be helpful
- Reducing certain odours, especially from anal gland secretions (a scent used when alarmed), urine and faeces, is important for clients as well as pets. Cleaning these up as quickly as possible is also important for disease control. The appropriate waste bins should be kept away from kennels, consulting and reception areas (Figure 1.2) and emptied regularly throughout the day
- Leaving doors and windows open is not helpful: they provide an obvious exit for nervous patients of all types.

**Figure 1.1** Rubber mats on consulting room tables and in baths will stop dogs slipping on the surface. (© Kate Chitty)

**Figure 1.2** These waste bins, clearly labelled, are situated in a preparation area away from the areas of the practice where dogs usually go. (© Kate Chitty)
Entrance and outside areas

A designated area outside the practice to allow dogs to relieve themselves is ideal. Otherwise, a designated dog-waste bin situated just outside the practice is helpful (Figure 1.3). Spare ‘poo bags’ should be available at reception. If there is no space for a bin outside the practice, an appropriate waste bin can be provided near to the reception area.

A designated dog waste bin close to the practice entrance.

A double door system provides good security, as animals trying to escape will have to negotiate two doors before they can leave the building; however, this could involve structural changes to an existing practice and so might not be practical. Where possible, room doors should always open inwards so that dogs cannot push against them to escape.

It is very helpful if at least part of the entrance door is made of glass, allowing owners of more nervous or aggressive dogs to see what is happening before they enter or leave the building (Figure 1.4).

Unfortunately, most reception areas are bottlenecks where many animals have to pass in close proximity to each other. Allowing a larger, potentially aggressive dog out of a back entrance or fire exit (in exceptional circumstances) can be much appreciated by owners.

Reception/waiting area

This is the first area within the practice that is seen by the public. Friendly staff, who are genuinely interested and helpful, are invaluable for keeping both owners and their pets comfortable. It is also worth considering facilities for children; many clients need to bring family members, and a fractious bored child can make it difficult for them and potentially cause distress to dogs in the waiting room.

Ideally, dogs should be separated from natural prey species, as both animals may be worried and/or excited by proximity. Although separate waiting areas are often advocated, this can be problematic for owners with both dogs and cats to bring them together, so other approaches can be appreciated (Figure 1.5).

(a) This owner can sit with both her pets. The dog is on a lead while the cat is safely in its carrier on the shelf behind. The shelf dividers can be moved to allow for different sizes of basket and box. (b) The table, although low, divides the waiting room and allows dogs to sit opposite each other without feeling too threatened. (© Kate Chitty)
An alternative waiting area can be helpful for a fearful or aggressive dog; this only needs to be small (Figure 1.6). If this is not possible, owners may be asked to wait with their pets in their cars or outside, weather permitting, and be called in when their appointment is due. It is important that reception staff keep track of their appointment slot.

The door to this small room can be closed to provide a separate waiting area. Originally the glass panel extended the whole length of the door, but as dogs could see each other through the glass, confrontations sometimes still occurred. Reception staff realized the problem and suggested a simple solution: covering the lower part of the glass with dark plastic. This meant that a dog inside was now hidden from the sight of other dogs in the main waiting room; this proved very effective and a permanent cover is in preparation. (© Kate Chitty)

Dogs may urinate in greeting, through fear or for territorial scent marking, so all surfaces must be easily cleanable and sealed (Figure 1.7). Cleaning materials and appropriate disinfectants need to be close to hand. Although it should be discouraged, many owners will still allow their dogs to sit on seats, so these also need to be easily cleanable.

It is important that all dogs are kept under control in the waiting room; they can behave in a totally unexpected way and so need to be on a lead attached to a well fitted collar, or in a suitable container, at all times.

**PRACTICAL TIPS**

- It is always worth keeping a slip lead at the desk; some owners will forget their dog’s lead; others will feel they do not need a lead; some may escape from a collar that is too loose.
- Some practices find that a hook, placed immediately adjacent to where clients stand to pay at reception, can be helpful so that the owner can attach their dog’s lead to it, leaving their hands free to deal with any paperwork, etc. while remaining in control of the dog.

**Consulting rooms**

Puppies and small dogs may be presented in carriers. Most will come out quietly for the owner but it may be best to place the carrier on the floor, as some dogs will dash out and could fall off a table. If a dog is likely to be difficult to extract, a top-opening carrier should be used. Carriers are less suitable for fearful and aggressive dogs, as they give them a territory to try to defend.

Many owners are keen to let their dog off the lead in the consulting room. It is worth explaining why this gives less control, especially if someone enters the room unexpectedly: even the best behaved of dogs can seize the opportunity and make a rapid exit.

Some small and medium-sized dogs are easier to examine on a table, while others are best left on the floor (Figure 1.8). The owner can often advise which their dog would prefer; size can play a part in this, but owners may prefer to try and place large dogs on tables.
Chapter 1 The dog-friendly practice

Considering on admission

- Checking the dog's dietary requirements, and especially intolerances, is important. This applies to treat items too. Although the diet may not be the most appropriate clinically, an ill dog is less likely to appreciate a change of diet.
- Ask what commands the dog responds to (e.g. Down! Stay!) and especially what commands the owner uses to encourage urination/defecation and the surface the dog prefers to use. Some dogs prefer to eliminate when they are off the lead; this may not be possible unless an enclosed area is accessible, but sometimes a secure loose lead will help.
- When hospitalizing a dog, ensure that all ongoing medication for that individual is brought in and is used and stored correctly.
- Always ensure any items left by the owners are clearly labelled and accounted for when the dog goes home.
- It is useful to have a formal care plan recording the above.

Housing

Metal kennels and cages can be noisy, though soft bedding can help, as can placing plastic or rubber covers for door catches to avoid clanging doors. Many dogs are affected by their reflection, either in metal surfaces, under tables/metal kennel walls or in glass doors; trying to keep reflection to a minimum by using subdued or indirect lighting can be helpful.

Where possible, cages should not face each other (Figure 1.9a). If this is not achievable, placing a towel or blanket over the door can give some privacy (Figure 1.9b). When examining an inpatient it is best to use a separate consulting room, out of sight of all other animals.

Some dogs are more comfortable in smaller kennels with a roof rather than in larger walk-in kennels. Dogs are often kept in a crate at home, and might therefore prefer a smaller space than expected from their size; asking the owner what the dog is used to can help with the choice of kennel size if there is space to choose.

Fleece beddings are good as they tend to allow liquids through (if necessary, incontinence pads or newspaper can be used underneath them); they are also thick, providing patient comfort (Figure 1.10a). Cushion beds (Figure 1.10b) can be useful for incapacitated dogs. Bedding needs to be able to withstand a hot wash (at least 60°C) to ensure elimination of infective organisms and parasites. It is best to avoid using newspaper alone as cage lining: it is bulky and can stain plastic; and puppies are often trained to urinate and defecate on it (the same can apply to incontinence/puppy pads).

Many owners will bring in food, blankets, beds and toys, whether asked to or not. An item from home can help both the dog and owner, though it is best if these have not been freshly laundered as the familiar smell is important to the dog.

Ideally, an outside run allows the dog some exercise and a chance to urinate and defecate. If no run is available, taking the dog for short walks is necessary in most cases, even for day patients.
These kennels are arranged to provide the maximum kennel space with dogs not directly facing each other. The kennels are made of moulded plastic and are easily cleaned and less noisy and bright than metal cages. Each kennel has a labelled folder for patient notes and hospital forms, and a labelled slip lead which is cleaned between patients. If necessary, a towel or blanket can be placed over the kennel door to provide some privacy.

Fleece bedding is a good cage liner. Purpose-made cushioned beds are easily cleaned. (© Kate Chitty)

Environment
A radio (this may need a licence) in the kennel area is helpful for some dogs. Consideration needs to be given to the channel selected: dogs may be used to a certain type of music at home; a talk channel may be better for other individuals.

If an individual dog is noisy, it may be possible to house it away from the general canine ward, either in the practice’s isolation area or perhaps in a collapsible crate in an otherwise uninhabited room. Sometimes reducing the lighting levels or covering the front of the cage can help. Cutting noise levels will help other patients and also the staff trying to work in that area. Although it is sometimes tempting to interact with a noisy dog, this rarely helps; in most cases the dog is trying to get attention and interaction of any type gives the dog this attention and therefore may reinforce the unwanted behaviour. However, interactions with well behaved patients are worthwhile to reinforce good behaviour and hopefully improve the dog’s experience of the visit.

Where space allows, admitting a companion dog may be helpful for calming a stressed individual (Figure 1.11). However, it is necessary to ensure that the dogs are separated during periods when there may be a chance of unexpected behaviour, such as during recovery from anaesthesia.

Owner visits: If a dog is to be hospitalized for more than a day, it is worth considering allowing the owners to visit. Consideration should be given to the timing (e.g. a quieter period when vets and nurses have time to talk to the owner) and location (e.g. a consulting room that is not in use will cause less disruption to the ward). Visits can be extremely helpful for dogs that are reluctant to eat in the hospital; having their own food/favourite items and being fed by their owner (Figure 1.12) can persuade many to start to eat.
Isolation

Isolation aims to separate the patient in order to protect it or prevent transfer of an infectious disease. To manage isolated patients effectively, a thorough understanding of the disease transfer mechanism is important.

Not all first-opinion practices are equipped with dedicated areas for hospitalizing patients requiring isolation, and patient isolation can be achieved in a variety of settings. Isolated patients should ideally be housed away from busy thoroughfares, ensuring that only necessary visits to the unit and patient are carried out, to keep disease transfer to a minimum. Where possible, isolated patients should be exercised away from non-isolated patients, and away from areas in use by the general public.

An independent isolation area can be very useful if managed effectively; staff training and awareness is vitally important to ensure that the isolation unit is managed appropriately. Clinics without a dedicated isolation area may choose to hospitalize isolated patients in collapsible wire crates (see Figure 1.15), utilizing an area of the practice which can be dedicated to the patient (e.g. a consulting room can be ‘borrowed’ for the duration of the patient’s treatment). Isolation units must be clearly labelled as such, to prevent staff from entering unnecessarily (Figure 1.13). Clear signage also acts as a prompt for the use of PPE equipment.

Items in the isolation unit must be kept to an absolute minimum; items not able to withstand disinfection and sterilization may require disposal.

All staff should know what equipment is present in the isolation unit. This ensures that should equipment be required that is not present in the isolation ward, it is brought in on first entering the unit, thus avoiding the risk of frequent trips in and out that would increase the risk of compromising the barrier function. It is useful to display on the entrance to the unit a list of materials found within the area, providing a visual reminder to staff and allowing any additional equipment required to be gathered prior to entering the unit.

Equipment and hygiene

- Equipment should be kept within the isolation unit. Care must be taken with bedding and food bowls: prior to removing them from the isolation unit, it is necessary to soak items in an appropriate disinfectant solution, cleaning these items separately from non-infectious items. Disposable bedding and food bowls should be considered in some cases.
- Appropriate protective clothing must be worn when handling isolation patients. PPE is necessary to prevent spread of disease to other patients and also to personnel in the case of zoonotic diseases. This will include aprons or full body coveralls, shoe covers, masks, eye protection, hats and gloves (Figure 1.14). All these items should be disposable, the handler changing into and out of them at the entrance and exit of the isolation unit.
- If the handler is required to care for non-isolation patients during their shift, ideally these should be dealt with first. Changes of clothing should be available for staff.
- Footbaths and hand-washing facilities should be available at the entrance and exit of the unit, with an area to dispose of consumable...
items and PPE. Disinfectant selection for footbaths and hand washing should be based on the infectious organism present. A list of suitable products and dilutions should be readily available; a list of appropriate disinfectants can be found at www.defra.gov.uk

- Thought must be given to the removal of waste from isolation units. Double bagging of waste is appropriate in most cases, and it may be necessary to increase the frequency of waste collections during times when an isolation patient is hospitalized.
- Urine, faeces and vomit should be cleaned up immediately, and the area then disinfected using an appropriate product (two staff members may be required to exercise an isolated patient, with one staff member following behind with the disinfectant solution).

**PRACTICAL TIP**

Where staff are involved in the care of both isolated and non-isolated patients, efforts should be made to attend to non-infectious patients first.

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**Owner visits to isolation patients:** While it is clear that visits from owners usually have a positive influence on the patient (and are also of great benefit to the owner), it is essential to look at the pros and cons of a visit to an isolation patient. The disease present will have an influence on the health risk for the owner, but it is important also to consider risks to other pets the owner may have and the risk associated with the wider environment. If a visit is planned, owners must be fully briefed regarding the importance of wearing necessary PPE. This is ideally done prior to their attending the clinic (preferably via telephone) as once the owner is at the clinic they may be overcome by a mixture of emotions and they are unlikely to listen as intently to any instructions given.

**PRACTICAL TIP**

Videos of the pet can be emailed to owners where it is necessary to avoid visiting for biosecurity reasons.

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**Practice equipment**

Common items required are listed below. When purchasing equipment it is important to remember that canine patients come in a wide variety of shapes and sizes.

- Slip leads: for reception and kennel areas. These should be cleaned and checked for damage between use.
- Collapsible cages/crates: can be useful for providing temporary additional kennelling and can be easily stored (Figure 1.15).

Where possible, only one or two team members should be involved in the care of an isolated patient, having no involvement with other patients during their shift. Some practices may be unable to dedicate staff to isolated patients; in these cases staff caring for isolated patients should be restricted to caring also only for those with a low risk of contracting the disease. High-risk patients, including very young patients and the immunocompromised (such as those undergoing chemotherapy treatment), must be cared for by separate staff.

**PRACTICAL TIP**

Where staff are involved in the care of both isolated and non-isolated patients, efforts should be made to attend to non-infectious patients first.
Chapter 1 The dog-friendly practice

- Food and water bowls: variety of types and sizes, including raised bowls for dogs with spinal problems or used to eating from these at home (Figure 1.16).
- Food: different types and brands as well as treat items. It may also be helpful to get owners to bring favourite items from home.
- Handling aids: e.g. dog and cat catchers (Figure 1.17).

1.16 Food bowls may be made of metal, ceramic or plastic. An upturned washing-up bowl can be used to raise a bowl for a dog used to feeding at height, if a bowl designed for the purpose is not available. (© Kate Chitty)

1.17 (a) A dog catcher. It is important that relevant staff know where to find this quickly when faced with an aggressive dog. (b) A cat grabber can be used to pick up the lead of an aggressive dog. (c,d) A pole syringe may be helpful in some cases. This is rarely required but is invaluable when faced with an extremely dangerous dog, allowing drugs to be injected from a safe distance and from behind a suitable barrier. (© Kate Chitty)

1.18 This commercially available ‘dog park’ allows the lead to be hooked over it without having to remove it from the dog. (© Kate Chitty)

1.19 Dogs may be lifted using a purpose-made stretcher or alternatives such as a blanket or duvet, as long as the material is capable of supporting the dog’s bodyweight. It is important to ensure there are enough staff to restrain the dog safely as it is lifted; in this case it would need more than the two nurses shown to ensure that the dog stayed on the stretcher. (© Kate Chitty)
Sandbags and ropes: useful for positioning for certain procedures and can be bought or handmade (Figure 1.20).

Tables: wheeled tables of adjustable height are helpful for moving large dogs and can help extend a work surface such as for radiography (Figure 1.21).

Tub-tables are useful for bathing dogs (Figure 1.22) and for dental procedures.
- Some owners are unable to carry out bathing at home for topical treatment of dermatoses.
- Returning a dog clean and comfortable after a spell in the clinic is essential and being able to bathe the patient relatively easily greatly facilitates this.

Mats:
- Bath mats or towels help prevent slipping in tub-tables or baths (see Figure 1.1)
- Non-slip radiolucent mats can be useful for radiography.

Scales: capable of recording accurately over a range of weights (Figure 1.23).

Nail clippers: small, medium and large.

Blood pressure cuffs: in a range of sizes.
Infusion pump and paediatric burettes: although an infusion pump is ideal, paediatric burettes should be used for small patients if an infusion pump is not available (some burettes can be kept in stock in case of infusion pump failure).

Warming devices: e.g. warm air blower, heat pads, reflective blankets (Figure 1.24).

1.24 (a) A warm air blower. The attached ‘blanket’ can be used underneath anaesthetized or recumbent patients. The unit can also be used to blow warm air through wire cage fronts. (b) An example of a heat pad that can be used under bedding to provide extra warmth. All heat pads must be used as per the manufacturer’s directions. (c) Solid heat pads must be used with extreme care, as they have a tendency to overheat, even when fitted with a thermostat. (d) Reflective heat blankets are very economical and work well placed over collapsed individuals. (© Kate Chitty)

PRACTICAL TIP
Pre-prepared kits can be very useful, especially for stressful situations such as anaesthetic emergencies (Figure 1.25), caesarean sections (Figure 1.26) or euthanasia (Figure 1.27; see also Chapter 7). Dose charts in kits – and also within the pharmacy – are especially useful for liquids, with an idea of how long an amount will last for in a patient of a set weight (e.g. meloxicam).

1.25 This ‘crash box’ is kept in the operating theatre in case of anaesthetic emergencies. The contents are labelled and are regularly checked and changed. Drug charts are on the lid of the box to avoid delay in checking doses. (© Kate Chitty)

1.26 This caesarean section kit is stored with the incubator. (© Kate Chitty)

1.27 This euthanasia kit contains all that is needed for a home visit, requiring only the addition of pentobarbital and a sedative. (© Kate Chitty)
Handling and restraint

It is helpful to be aware of canine body language (see Chapter 12 and the BSAVA Manual of Canine and Feline Behavioural Medicine). However, many dogs can react unexpectedly, especially if they are scared or in pain. It is best to offer help from a veterinary nurse or assistant; some owners will not ask for help but will accept gratefully if it is offered. If the owner wishes to hold their pet themselves, staff need to ensure that they are able to do so safely.

Some dogs are better held by their owner or handler, e.g. military or guard dogs. Others behave very differently without the owner present; just taking these animals to a quiet area with suitable assistance can help. It can also be very useful to have trained help for certain procedures; e.g. ear examination is much easier and less painful if the dog is held still. Some owners are good at learning to hold their dogs, once shown, but many worry that they will hurt the dog or compromise their bond with the pet, and so prefer to have a nurse hold it. It is important to assess each case individually.

Muzzles

Occasionally a dog will need to be restrained or muzzled for a procedure to be carried out safely. The dog should be examined and treated as quickly as possible, and the muzzle removed as soon as it is safe to do so. If a dog is likely to need muzzling for most visits, the owner can be advised on purchasing a muzzle and training the dog to accept it (see the BSAVA Manual of Canine and Feline Behavioural Medicine).

PRACTICAL TIP

Some owners tend to be distracted and not to listen as well whilst their pet is muzzled. If possible, it is better to talk to them after removing the muzzle or before putting it on the dog.

A good range of muzzle sizes is necessary, as certain breeds may be safer in muzzles specifically designed for them, e.g. brachycephalic breeds such as bulldogs. Common types of muzzle are shown in Figure 1.28. The muzzle must be able to be cleaned and disinfected easily between dogs.

**Tying a rope muzzle**

If a suitable muzzle is not available, or it is not possible to put a normal muzzle on the dog, a rope tie or length of bandage can be used to create one.

1. A loose knot is placed in the rope tie or bandage
2. This is placed over the dog's nose and tightened
3. The rope/bandage is crossed under the dog's chin
4. The rope/bandage is finally tied behind the dog's ears

**Chemical restraint**

Where an animal behaves in such a way that it is unsafe to muzzle or treat it without sedation, it may be appropriate to provide the owner with appropriate medication to administer at home. The choice of medication will depend on both the health of the animal and the owner's ability to administer the medication safely. Any risks to the animal or owner should be fully discussed with the owner during the process of gaining informed consent.
Managing difficult situations

It is important to remain calm at all times, especially when presented with a challenging patient. Most owners know their dog is likely to be difficult and can become very defensive, further upsetting the situation. In many cases, just getting the owner to relax and become calmer will help; it is obvious the dog is relaxing as the owner calms down. Time spent talking to the owner allows the dog to become more settled in the new environment, gives the vet time to observe the dog and allows the owner to suggest the best way to deal with their dog, especially its likes/dislikes and the things that are likely to upset it. Some owners appear to praise bad or poor behaviour. For example, ‘Good dog’ may be said by an owner when a dog is growling and snapping; it can be helpful for the vet to explain quietly that although they understand this is intended to reassure the dog, the owner is actually praising poor behaviour. It is important to take care in deciding when to say this, however, as the owner may be understandably surprised, upset and defensive. Some owners will appear to laugh, although this may show embarrassment rather than amusement.

During the examination

Certain procedures will be more unsettling and confrontational to the dog, for example, sore ears can be very painful, as can lame legs. Many dogs dislike being stared at, so eye examinations can cause more problems than expected. Kneeling during the examination can help to reassure the patient (Figure 1.29); it is important not to loom over the dog. Occasionally it is better to stop the examination and use pain relief or sedation, or to explain to the owner why it is necessary to proceed even though it appears to be painful. After a painful or frightening experience, it is helpful to try to have a dog brought back to the practice for a socialization visit.

Tips for improving experiences

- It is worth spending time during puppy consultations showing and encouraging owners how to handle their puppy’s ears, mouths and paws in a non-threatening way. It helps the dog become used to this handling while there is no pain or discomfort.
- It is also useful to offer help if it becomes apparent that a client is struggling with a procedure such as applying ear or eye drops or cleaning the dog’s ears. Nurse clinics (see below) may be useful for this, especially if the guidance can be given straight away, as owners are often busy people and may be unable to come back at a later date. A video of common procedures uploaded to the practice website can also be useful for this.
- Once a dog is already fearful of attending the veterinary practice, more will need to be done to try and build good associations. It may help if the owner comes and discusses their individual needs with an allocated nurse – without their dog.
- If owners have more than one dog, bringing a calm companion may help a nervous dog.
- Bringing a nervous dog in to the practice for a visit without treatment may help them.
- Several trips when calm and controlled will help owners, pets and staff. A more confident owner makes a huge difference to the dog’s demeanour.

Nurse clinics

Dog-friendly practices need to be appealing to owners of dogs, as well as being friendly to the patients themselves (Figure 1.30). Canine-specific nursing clinics can encourage clients, who may otherwise have sought advice elsewhere, into the practice to discuss concerns (e.g. fireworks phobia). Nurse clinics can greatly improve owner compliance and how the practice is perceived by the wider community.

Potential areas for nurse clinics

- Weight management
- Pregnancy and parturition care and advice
- Dental hygiene
- Puppy selection, care and socialization (see Chapter 12)
- Post-neutering checks
- Noise phobias and fireworks phobias
- Arthritis care and management
- Diabetic management
- Senior healthcare
- Parasite control
Chapter 1

The dog-friendly practice

Nurses also provide a good contact point for owners when dogs are hospitalized. Owners appreciate updates on inpatients, especially if they are unable to visit. It is also important that the owners are informed as soon as the dog is safely recovered from surgery and that all postoperative instructions are completely understood and followed. Indeed, talking through postoperative care before admitting the dog will help owners prepare for the return of their pet. It is also useful to follow up on postoperative care with a phone call a day or two after the dog has been discharged, before the planned postoperative check. This will help with any minor fears that the owner feels are too trivial to mention to the vet.

It is essential that all team members are trained and kept well informed regarding nursing clinics and the additional services that veterinary nurses can provide. Reception staff need to be aware of the role of the veterinary nurse in the clinic, and what services veterinary nurses can provide. Veterinary nurses need to be trained and experienced in the type of clinics they are expected to run. It may be necessary for veterinary nurses to undertake the Suitably Qualified Person qualification (the SQP qualification is regulated by the Animal Medicines Training Regulatory Authority or AMTRA) in order for them to prescribe and dispense appropriate medicines (POM-VPS and NFA-VPS anthelmintics).

References and further reading


Consultation technique

Christine Magrath and Geoff Little

Most interactions between the vet and the client start and end in the consulting room, and developing a good consulting technique is essential if all other clinical and surgical efforts are not to be wasted.

A proficient consulting technique can lead to:

- Improved satisfaction for both the vet and the client
- Improved compliance and concordance
- Reduced complaints
- Enhanced relationship building
- Improved clinical performance and outcomes of care.

The consultation can be categorized into three distinct areas (Figure 2.1), which are interdependent and not to be considered in isolation:

- Perceptual
- Content
- Process.

The veterinary consultation guide

Traditional methods for history taking and the delivery of information can end up as a direct transmission of information between vet and client rather than an interaction, and can result in some medical information or concerns not being elicited. To amend this problem a veterinary consultation guide (Radford et al., 2006) has been developed, based on the medical Calgary–Cambridge Guide, and is now used at each of the UK veterinary schools. This guide delineates the communication process skills that are needed to carry out an effective consultation. The number of skills described in the guide can seem overwhelming but not every skill is needed for every eventuality, and familiarity with this structured process strengthens the ability of the vet to obtain accurate content and deliver information that is understood by the client. To differentiate the skills, the guide is divided into six main headings (Figure 2.2).

Preparation

Even if the consultation is routine for the vet, it may be a very significant, novel and important event for the client. Adequate preparation is crucial or the smooth running of the consultation may be jeopardized. The consultation may be one small part of the vet’s working day, but it may be the sole chance that the client has to interact with the practice; so every effort should be made to ensure that it is a positive experience for the client.

- It is essential to be familiar with the clinical records, taking time to study results and past history while at the same time anticipating any individual demands that the client might have.
- The consultation room and table should be clean and tidy.
- Any necessary equipment should be checked and the room should be escape-proof.
- The last consultation or task should not impinge on the next one if, for example, examining a new puppy after breaking bad news. Problems with a difficult case must not be allowed to disrupt the one in hand.
- Personal issues and physical comfort, such as hunger or lack of sleep, can affect concentration.
These should be dealt with prior to embarking on the consultation.

- If there is adequate space in the consulting room it may be helpful to have two chairs in the room. This is obviously beneficial for less able clients, but it also has advantages for all clients; if the vet and client are both sitting that helps to build two-way communication (Figure 2.3).

- The client and patient should be greeted by name.
- Individuals should introduce themselves and explain their role in the practice. Since many clients are regular attendees at the practice it is easy to assume that they will remember those who have looked after their pet, but not knowing the role or name of the professional can be unsettling for clients and can even be a barrier to ensuring that communication is a two-way process. During the introduction it is vital to use a combination of skills such as good eye contact, a smile or suitable facial expression depending on the case, and – if appropriate – a handshake. It is worth noting that shaking hands is a personal decision and can convey a confident, trusting and professional approach. If it does not feel comfortable, however, it may convey disinterest and apathy, and if this is the case it may be more natural not to do it.
- Acknowledging the pet is an important facet in building the relationship with both the patient and client, and time spent in this way can sometimes reveal information that would otherwise be undisclosed.

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Initiating the consultation

Getting it right at the beginning of the consultation is crucial. This is when first impressions are made, an initial rapport is established, the client’s emotional state is gauged and the course of the consultation is planned. This whole process may take only a small amount of time but it has a huge impact on all that follows. The key skills needed at this juncture are not just social pleasantries, and although some of them are obvious, they can be forgotten if individuals are following a tight schedule. They have an important impact on the accuracy and efficiency of the consultation and on the relationship which is established with the client and their pet. This is a key opportunity for establishing a bond of trust with the client.
Chapter 2 Consultation technique

research at Nottingham suggested that it took only 13.5 seconds before the client was interrupted (Brightmore, 2009). Often the client is interrupted with closed or clarifying questions, but even minimal utterances or echoing the client’s words during this initial flow of information can inadvertently direct the client away from disclosing all their concerns. In contrast, active listening is a skilled process and can result in more concerns being elicited and a reduction in late-arising concerns (Figure 2.4).

2.4 Tips to improve active listening after the opening question.

- **Screening** is a very specific skill that allows the vet to discover all of the problems that the client wishes to discuss. Often the client will present with an initial complaint; exploring this avenue without making an attempt to discover if they are worried about more than one thing can lead to additional concerns arising near the end of the consultation. This can easily add time, which can mean further pressure in a tightly managed appointment schedule. Screening also helps to keep an open mind and provides a method of finding out the client’s ideas, concerns and expectations (ICE) to be expressed. According to medical research these cues often appear early on in the consultation and are expressed as non-verbal cues and indirect comments rather than overt statements. Not checking out these cues with the client can result in assumptions being made.

Making sure that any information gathered is accurate, complete and understood, and agreed by both parties. This information can be categorized into:
- **Background information**
- **Clinical content (biomedical perspective)**
- **The owner’s ideas, concerns and expectations**
- Exploring any information gathered in a structured manner while at the same time ensuring that the client is involved and understands where the consultation is going, and why
- Ensuring that the client feels valued and listened to.

To achieve these aims, an in-depth analysis of the problems outlined in the initiation stage is needed. Several process skills provide guidance towards achieving this goal and at the same time give an opportunity for personal style and individual personality to be used.

- **Knowing when to use open and closed questions.** Both open and closed questions are valuable in obtaining information from clients (Figure 2.5). It is important to start with an open question, moving to closed questions to achieve more focus. One may then need to return to an open question to explore other avenues before asking further closed questions. This is known as ‘Open to closed coning’ (Figure 2.6). Both types of questioning are valuable, but starting with an open technique introduces an enquiry without shaping the client’s response. For example: “Tell me more about Ben’s cough” or “Tell me more about Ben’s problems from the beginning”. Although using closed questions is important to investigate specific details and give more control over the dialogue, it can limit the amount and type of information if used too early. Using open questions early in the discourse encourages clients to tell their whole story and provides the vet with time to listen and think. In contrast, if closed questioning is used prematurely, the responsibility of what the next question will be lies with the vet, narrowing the field of enquiry with the possibility of missing information. Once individuals embark on closed-ended enquiries there is a tendency to follow each one with another, and thinking about the next closed question can result in the vet not listening or thinking about the client’s responses. As the consultation continues it is important to become more focused, initially using more focused open questions such as, “What makes Ben’s cough
Open questions
- Invite the client to respond in an open manner without unduly focusing or directing their response
- Direct the client, but invite them to elaborate
- Allow the vet more thinking time to better direct the consultation
- Contribute to more effective and efficient diagnostic reasoning
- Examples of open questions include:
  - “What can we do for Lilly today?”
  - “What have you noticed about Ben’s cough since it started three weeks ago?”

Closed questions
- Usually elicit a one-word answer, often “Yes” or “No”
- Benefits of closed questions include:
  - Clarification of a situation, e.g. “What I understand is that his diarrhoea contains blood; is that correct?”
  - Summarizing a situation, e.g. “So, he has been vomiting for a week, has had diarrhoea for the last 2 days and there is some blood in his motions; is that correct?”
- Other examples of closed questions include:
  - “Lilly has come in today because she is vomiting; is that correct?”
  - “Does Ben cough only during exercise?”

2.5 ‘Open’ and ‘closed’ questions.

Open questions
More specific but still open
Closed questions

2.6 Open to closed ‘cone’. Starting with open questions and moving towards more specific points is an efficient way of gathering information.

worse or better?” The gathering information stage should end with closed questions to ascertain fine detail and analyse clinical signs in detail. For example, “As I understand it, Ben’s cough is worse after exercise; is that correct?”

- Attentive listening and facilitating the client’s responses. This enables clients to tell the full story. This is equally important at this part of the consultation as it is at the initiation stage. Active listening at this juncture brings several advantages, such as appearing interested and supportive while picking up cues to the client’s concerns and emotional state. This skill may appear straightforward but in reality, especially under the pressure of a busy consulting schedule, requires a very skilled technique that actively encourages clients to continue with their account. All the skills used in active listening at the initiation phase apply to this section, and those that could be counterproductive at the earlier stage, such as paraphrasing and repetition, now come into their own. Often, repeating the last few words (echoing) a client has said helps them to keep talking, while paraphrasing goes one step further, as it also helps to check the vet’s interpretation of what the client has said. Other facilitation skills, such as pauses to allow the client to provide more information, and comments such as “go on” can also encourage the client to divulge more.

- Understanding verbal and non-verbal cues. Clients may continue, either intentionally or unintentionally, to provide cues at this stage, particularly if they have been encouraged to continue the dialogue. By this stage it is easy to miss these messages by appearing to listen but not actually registering the information or watching the body language. Often clients will repeat these cues and if they are not picked up and checked out it can give the impression of disinterest and poor client care. Research from human medicine (Levinson et al., 2000) has shown that if cues are picked up and acknowledged it shortens the consultation.

- Ensuring accuracy and facilitating further dialogue with the use of internal summarizing. Using this skill clearly conveys that the vet is listening. More importantly, it allows the client to confirm or alter the vet’s understanding. Not summarizing periodically can result in an inaccurate interpretation of the client’s statements. Summarizing also invites the client to expand on their problems. There are also advantages for the individual gathering the information, as it allows them to check the accuracy of what the client has said and rectify any misconceptions. It also provides an opportunity for the vet to order their own thought process, recall information at a later stage and help differentiate between the clinical aspects and the client’s perspective.

- Using easily understood language. Using highly technical language can overwhelm clients, and even simple day-to-day medical terminology can be ambiguous. Many clients are reluctant to ask for clarification in case they appear stupid. It is important, however, to gauge the client’s educational level at an early stage to avoid patronising comments if the client has a medical background or first-hand knowledge of the disease in question.

Using these process skills should tease out all the information the client needs to impart relevant to the patient. This may, however, be delivered in a ‘random’ manner, with the client switching between the clinical perspective (biomedical history), background information (long-term history) and their ideas, concerns and expectations (client’s perspective) (Figure 2.7).

The onus is therefore on the vet to weave back and forth and explore each contrasting perspective as it arises, and then to process it for the purpose of recording and presenting a history. Including and exploring the client’s perspective as part of this history-taking framework provides certain advantages such as:
Chapter 2 Consultation technique

It is also important to appreciate that some clients will want to know all there is about their pet’s condition, whereas others will want to know the bare minimum: ‘What is the problem, can you sort it and how much will it cost?’ The client may indicate by what they say, or by their body language, just how much they want to know (Figure 2.8). If that is not clear, the vet should not be afraid of asking the client just how much detail they would like.

Some people are better at absorbing information through the spoken word, some through the written word, and yet others through pictures or anatomical models. It is best to have all such media available when imparting information. For example, words may be quite sufficient when explaining the benefits of kennel cough vaccine to a client whose dog is due to go into kennels. But what about trying to explain a ruptured cruciate ligament and its proposed repair to a client who wants to know chapter and verse? Here, words alone are not the best medium: a simple hand-drawn diagram in conjunction with an anatomical model, or indeed a video, can be used to explain both the injury and the proposed surgical procedure.

It may be that the individual taking part in the consultation is the only person who needs to be informed, but more likely there will be others who need to know and who will be receiving the information second hand. What are the chances of that client retaining all the information they have been given if they are not provided with appropriate information to take away? And what are the chances of their relaying the information in an accurate way to other family members at home? Concordance is likely to be less than optimum unless all those concerned in the decision making feel they have been fully informed. Another concern is that family members may well seek to fill the gaps in their knowledge by referring to the Internet (see later). However, the emergence of digital multimedia atlases will bring an exciting new dimension to the clinician’s consultation technique, along with the ability to email consultation technique, along with the ability to email

When imparting any information it is important to provide it in small, bite-size pieces that the client can take in and digest, although the size of those chunks will depend on the level of understanding of the client. It is also important to ascertain whether the information is being digested by the client, so-called ‘chunking and checking’.

- Helping to support the client and build the relationship
- Providing additional clues that relate directly to the clinical perspective; using more traditional history-taking methods can deter clients from divulging their ideas and concerns, even when the information could prove useful
- Ensuring the information imparted during the explanation and planning phase addresses the client’s unique perspective; otherwise recall, understanding, satisfaction and compliance may be reduced.

Physical examination
Physical examination is discussed in detail in Chapter 3. The skilled clinician will be able to overlap the physical examination with the information gathering stage, using the time spent listening to the initial responses to open questions to set the animal at ease with a gentle, tactile approach, whilst still conveying the verbal and non-verbal encouragement to the client to confirm that their responses are being listened to. The more specific closed questions can accompany the physical examination of specific areas. For example, “She was in season two months ago; is that correct?”

Explanation and planning
Sharing information
An essential part of every consultation is the sharing of information with the client. As already discussed, a good starting point is to ascertain the client’s own ‘starting point’: a Mr or Mrs may be a surgeon; a Dr may be a doctor of divinity! If in doubt, it is better to stick to lay terms. To remove doubt, a question can be asked such as, “The blood test results indicate that Pepe is diabetic; is that something you are acquainted with?”. Even if they are not medically minded they may well have a diabetic in the family and as such will have some knowledge of the condition. Once the vet has ascertained the level of the client’s understanding, this will enable them to structure the way in which they impart information and advice. As a rule, it is better to err on the cautious side and to explain things in lay terms as opposed to using medical jargon. However, if it has been established that the client is an orthopaedic surgeon, for example, it is better to refer to an ‘osteosarcoma’ than a ‘nasty growth’.

It may be that the individual taking part in the consultation is the only person who needs to be informed, but more likely there will be others who need to know and who will be receiving the information second hand. What are the chances of that client retaining all the information they have been given if they are not provided with appropriate information to take away? And what are the chances of their relaying the information in an accurate way to other family members at home? Concordance is likely to be less than optimum unless all those concerned in the decision making feel they have been fully informed. Another concern is that family members may well seek to fill the gaps in their knowledge by referring to the Internet (see later). However, the emergence of digital multimedia atlases will bring an exciting new dimension to the clinician’s consultation technique, along with the ability to email consultation technique, along with the ability to email
The information should be provided in a logical order. "Signposting" will help in taking the client on that journey. For example, "Before Helen, the nurse who has been looking after Zac, brings him through, I just want to go through what we have done today in terms of investigating the cause of his cough. As we agreed, when you left him with us this morning, we were going to X-ray his chest and, if we thought necessary, give him an anaesthetic to look down his windpipe. Well, starting with the results of the X-rays, let me show you what we found...". The other thing about the order in which the information is imparted is that clients are more likely to remember the first information they hear. This memory can be enhanced by repeating the same information at the end of the dialogue.

What is the best way of finding out whether a client has taken in the information or not? The vet could ask them the direct question "Do you understand what it is you have to do?". However, this does sound a little intimidating and is likely to be met with a curt response such as "Yes!". Many of those clients, on the way out, may well ask the receptionist for a translation of what it is the vet was trying to convey. Much more effective, and more client-friendly, is to take a different approach, such as, "Just to make sure I’ve explained it fully, would you like to go through what it is we have to do for Pepe between now and the next consultation in 10 days?"

**PRACTICAL TIP**

It can be useful to refer to the way forward as the ‘preferred plan’ because plans can always be altered if necessary as the case progresses and a change of plan is something that is accepted by most clients.

**Consent**

It is vitally important to obtain informed consent for any procedure the vet wishes to carry out on a client’s pet. Having a signature on a consent form is not sufficient. Flemming and Scott (2004) outlined what the veterinary consent process should encompass (Figure 2.9).

- The diagnosis or nature of the patient’s ailment
- The general nature of the proposed treatment and any other alternatives
- Proposed treatments and the purpose or reason for each treatment
- The risk or dangers involved in the proposed treatments
- The probability or prospects of success with each alternative treatment
- The prognosis or risk if the client refuses treatment
- The costs of the various alternative treatments
- The name of the individual who will actually perform the surgery if it is somebody else other than the person obtaining the informed consent
- The location and method of transportation to the location if the treatment is to be administered at another site

**Factors that impede truly informed consent**

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**Planning**

Within most consultations there will be a course of action, or alternatives, that need to be put to the client for their consideration. In some cases the course of action the vet wishes to take will, in his/her mind anyway, be clear cut with no reasonable alternatives. In other situations there may well be no obvious way forward: the vet may wish to suggest further tests to help clinch a diagnosis; or there may well be a number of justifiable options, each with its own set of merits. Planning should be about shared decision making or ‘concordance’ and one way forward (and indeed a way to encourage concordance) is to involve the client. This can be done by sharing thoughts with them, by allowing them to contribute to the discussion, and by answering their ancillary questions that have been stimulated by the further light shed on the case during the consultation. When there are alternative ways forward, it is important to outline the whys and wherefores and the differing costs associated with each alternative.
**Chapter 2 Consultation technique**

**Verbal consent:** It is not always necessary to obtain written consent before going ahead. In certain cases verbal consent can be sufficient, although it still must be ‘informed’. For example, seeking verbal permission over the phone, to perform euthanasia of a patient that is under anaesthetic is perfectly acceptable. However, a written record must be made, in the clinical notes, of obtaining verbal consent.

**Financial considerations**
The question of cost normally comes into the decision-making process and it is something that should initially be broached in the consulting room. Apart from routine procedures with a fixed fee (e.g. routine castration), this is not something that should be left to the receptionist to discuss. For example, if there are alternatives and/or the possibility of ongoing costs associated with investigative work, hospitalization, etc., who better than the veterinary surgeon to pull the estimates together and discuss it with the clients? Terms such as ‘significant costs’ or ‘not too expensive’ should be avoided; these are relative terms and what you may consider ‘not too expensive’ may to some appear to be extortionate and to others very cheap.

It should always be borne in mind that when cases are hospitalized and/or where further tests become recommended, the ongoing costs can be significant for the client and the final, or indeed the interim bill, can bear little resemblance to the sum that was discussed initially. Even after careful discussion a client may still have felt pressured into proceeding down a line of therapy, with a specific outcome. Add to this disappointment a bill that was discussed initially. Even after careful discussion a client may still have felt pressured into proceeding down a line of therapy, with a specific outcome. Add to this disappointment a bill that has been met, for example in terms of the clinical outcome. The role of the veterinary surgeon is not to be judgmental but to provide balanced advice, to provide all the facts at his/her disposal and to offer alternatives that are in the best interest of the pet and the owner – and in that order.

Pressure may not necessarily be due to the influence of the vet, but it could be the client themselves who may well feel it is their responsibility to come to the aid of their pet in its time of need. They may even feel a sense of guilt for having let their pet get into its current situation. The role of the veterinary surgeon is not to be judgmental but to provide balanced advice, to provide all the facts at his/her disposal and to offer alternatives that are in the best interest of the pet and the owner – and in that order.

**Concordance and compliance**
Concordance is all about shared decision making and compliance is concerned with whether the client, or indeed the practice, adheres to the agreed course of action (Figure 2.11). It is important to bring clients along during the consultation process. It is then much more likely that they will adhere to the proposed treatment plan.

*Figure 2.11 The link between concordance and compliance.*

Although very few practices actually measure compliance rates, where they have been measured there are some common findings:

- There are differing compliance rates between practices and between different team members in the same practice.
- Compliance rates are higher when the practitioner has carried out a comprehensive consultation with the client.
- Compliance rates are higher when the client has been offered alternatives (where appropriate to do so).
- Compliance rates are higher where conditions are perceived by the client as serious.
- Practitioners often overestimate their clients’ compliance rates.

It should never be forgotten that compliance works both ways. In other words, when the vet has agreed on a way forward with a client, there is an onus on him/her and on the practice to adhere to the plan. However, it should have been explained to the client that the proposed plan may need to be altered as the case progresses. It is vital important, if the treatment plan has to be altered, that the practice does its utmost to inform the client of the proposed changes, along with the financial implications, before the change is implemented. Of course there may be a need to take immediate action when a case requires it, but to embark on another set of blood tests or another series of radiographs without first discussing this with the client may well result in an unhappy outcome.

**Estimate or quote?**
- The bill can often be the trigger for a complaint, especially if the client’s expectations have not been met, for example in terms of the clinical outcome. Add to this disappointment a bill that is double or three times the original sum discussed with the client, and that is a potentially very volatile situation.
- For most procedures it is not possible to provide the client with a quote, which by definition is a ‘fixed price’ for work undertaken. In the main, the veterinary practice will be providing clients with estimates, and this needs to be made clear to the client – both verbally, when discussing fees, and when obtaining informed consent.

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Consultation technique

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When a decision is made to refer a case, it is important to provide the other veterinary surgeon with as much relevant information as possible. In addition to providing all the paperwork, radiographs, laboratory test results, etc., it is advisable to speak with that individual, to fill them in on both the case history and the relationship with the client. This communication works both ways, and it is vitally important to ensure being brought up to speed by the referral practice as soon as practicable and certainly before seeing or speaking with the client again following the referral visit.

Closing the consultation

This is the vet’s opportunity to summarize what has gone on during the preceding part of the consultation, in terms of the clinical concerns raised by the client, the results of the examination and any proposed treatment or investigative plans.

Should there be any further action required as a result of the consultation, e.g. a further appointment or the need to admit the pet, either now or at some point in the future, this should be discussed with the client if it hasn’t already been covered. This may be the time to complete a consent form, or to go through instructions and directions if the client is to be referred.

**PRACTICAL TIP**

The client should be provided with a ‘safety net’, i.e. what action they should take if they have concerns about their pet after they have left the practice. It may well be that the practice will arrange a follow-up consultation or phone call, but irrespective of that it is a good idea to provide clients with details of what to do should they have any concerns. Something along the lines of, “If you have any concerns about Pepe, you mustn’t sit there and worry. We would much prefer you phone, even if you think it’s something trivial. There is always somebody here to help; give us a call any time”

Arranging a repeat consultation has many benefits for the patient, the owner and the clinician:

- It facilitates any necessary changes to the original treatment plan
- By keeping a better eye on the patient’s progress, it enhances healthcare
- It demonstrates to the client a genuine interest in their pet’s wellbeing
- It helps to build a relationship with the client
- It improves clinical skills by more closely monitoring the effects of differing treatment regimes.

Remember to say ‘Goodbye’ to both the client and their pet and, if appropriate to do so, walk with them back to the reception desk to help them with the next steps in the treatment plan, whether that be to book their pet in for another consultation or to be admitted as an inpatient for surgery or further investigative work.

**Troubleshooting: what to do when things don’t go according to plan**

The consultation is getting bogged down and not flowing smoothly

Everybody who has been in practice for some time will recognize that there are times when things appear to be getting out of control. The perfectly planned consultation, for whatever reason, appears to be heading off the tracks: the client has for some reason suddenly become angry; or the client has appeared to ‘switch off’. Being aware of body language, such as sudden loss of eye contact, can help a great deal in detecting a problem.

- The first thing to remember is that the internal turmoil you may be experiencing will probably not be apparent to the client; what to you seems like an eternity, when you are desperately trying to think of a way forward, will, to the client probably seem to be only a moment’s aberration.
- The consultation, like all other procedures we carry out in practice has an underlying format that we follow for maximum efficiency and effectiveness. Keeping the structure in mind gives us something safe we can fall back on, if we find ourselves off course. Where are we in the process? Can we go back a step to regain our footing?
- If you are really struggling you can always ‘take time out’ by, for example, using the stethoscope to listen to the patient’s chest, or finding a justifiable reason to leave the room.
- Other coping strategies include showing empathy with the client, describing where either you or a colleague has faced this difficult clinical problem and how you coped. Using stories about personal pets helps build a non-existent rapport or repair a broken or damaged one.

Dealing with difficult situations

Breaking bad news

The vet is often faced with the challenge of having to break bad news to a client. For example:

- Biopsy results indicate that their pet has cancer; the vet may wish to persuade a client that it would be kinder to perform euthanasia rather than to continue with treatment
- A cat that was rushed into the practice following a road traffic accident has just died in the ‘prep’ room and the vet has to go back into the waiting room to tell the client.

Although there will be subtle differences in the approaches to each of the above, there are common factors in the approach to breaking bad news.
The waiting room should never be the place in which to impart such news. Face-to-face, in a quiet, private room is far preferable. Creating as comfortable an environment as possible for the client is very important and providing seats is one way of seeking to achieve this.

When breaking bad news, it is always a good idea, where appropriate, to ‘fire a warning shot’ initially. Use can often be made of previous discussions, or notes on the clinical record. For example: “You will recall when we sent the biopsy off to the lab, I said I was concerned it may be something serious; well, unfortunately it has come back and the news isn’t good”; or “As you know, when you brought Chloe in following the traffic accident she was in a very bad way. Three of us have been working on her ever since in an attempt to save her, but despite our best efforts her heart stopped twice and unfortunately we were unable to bring her back a third time”.

Once you have fired the warning shot, pause for a short while to allow the news to sink in and to allow the client to respond before adding anything further. They may well come back with a comment such as, “So it is cancer?” or, in Chloe’s case, “You mean she’s died?”. You can respond by saying something along the following lines: “Yes it’s come back as a form of lymphoma, is this something you have heard of?”, or “Yes, I’m awfully sorry, but Chloe has passed away. She will not have suffered as she never really regained consciousness.”

It is not uncommon for clients to go through a whole range of emotions following the loss of a pet. One of the more common emotions is guilt; a feeling that they could have done more. There is really nothing to be gained from subjecting clients to more anguish and grief by reinforcing their feelings of guilt. To a certain extent the client’s welfare is our concern too, and we should do all we can to help them through the grieving process.

**Apologizing**

In these litigious times, people are often encouraged never to admit liability. All too often, however, this is linked with a fear of apologizing or saying ‘sorry’ for what has happened. There is a distinction between admitting liability and saying sorry. Professional indemnity insurance providers would never want the practice to admit liability, but clients all too often are quoted as saying, after a complaint or a claim has been resolved, “If only somebody had said ‘sorry’, we would never have taken our complaint to our solicitor”. To square this conundrum, there is a need to appreciate that there is a big difference between telling a client that “The whole practice team is devastated that Sam died unexpectedly under the anaesthetic” and “I’m very sorry, but I’ve killed Sam”.

**Dealing with emotions**

When dealing with difficult situations the veterinary surgeon may not only be faced with trying to resolve the situation clinically, but he/she may often be in a situation where he/she has to deal with clients’ emotions. These emotions can include sorrow, guilt and anger. Although these are often presented as stand-alone emotions, they can sometimes present as a cascade, with one following on from another. For example: A client brings their chronically ill pet into the practice, only to be told the only kind option is euthanasia. In this situation the client may feel guilty, followed by angry, and then sad.

The best way of dealing with clients’ emotions is to express empathy. Empathy is not the same as sympathy, which is more a feeling or an expression of pity or sorrow for the individual. Empathy is the understanding and sensitive appreciation of another person’s predicament, and the communication of that understanding back to that person.

**Apologize:** Ineffective communicators fail to apologize, either because of their egos or because they fail to understand that they can apologize without admitting guilt. Effective communicators learn to apologize for what happened and apologize for the fact that it happened without admitting to any personal contribution.

**Assure:** Complainants want assurances that what they or their animal experienced will never be repeated. Effective communicators learn to give assurances that they will take steps to prevent the problem’s recurring and outline any steps already taken.

**The triple As**

- **Acknowledge:** Clients want their feelings and their situation acknowledged. They also want it acknowledged if a problem has occurred, even if that problem was something as simple as a misunderstanding. Effective communicators locked in a difficult conversation learn to acknowledge that an event has occurred.

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After you have reflected the emotion, wait for a response from the client. Allowing the client time will often throw further light on why they are angry or why they are feeling guilty. Do not interrupt in an attempt either to hurry the process or to help the client; this is very likely to achieve neither. The process then mirrors the consultation model:

- You need to gather information and by using skills such as ‘screening’, you need to get to the bottom of what is causing the client’s anxiety
- By summarizing, you not only demonstrate that you have been listening, but you have created a list that needs to be addressed
- You can then move to the imparting information and planning stages, where you tell the client what you propose to do, checking with them that this is a mutually agreed plan
- Finally, close the process and provide a safety net.

The constant threads

Three elements are constant throughout the consultation, from the initiating stage to closing it. These continuous threads ensure that all other tasks are carried out effectively:

- Providing structure to the consultation
- Building the relationship with the client and patient
- Observation of both client and animal.

Providing structure to the consultation

Without structure the consultation can meander in an aimless fashion. Used in the right way this process can speed up the consultation but clinicians need to be aware that this is a two-way process and not a case of exerting absolute control, otherwise it may limit the client’s responses and ability genuinely to listen to the vet. It is also worth noting that these skills allow a flexible approach and are not written in tablets of stone. Key points to consider are as follows:

- The vet should ensure that the client is kept abreast of where the consultation is going; otherwise they may not be aware of why the questioning or explanation is moving in a particular direction or why the examination is proceeding in a particular fashion. For example, it is worth explaining to a client who has presented their pet, concerned about a small lump they have discovered on its flank, why you are performing a complete examination of the patient
- Summarizing has an important role in ensuring the structure of the consultation remains overt. Using the skills employed in the gathering information stage will probably result in information being delivered in a less ordered form, and there may be a tendency to revert to closed questioning prematurely to try and control the direction of the consultation
- Internal summarizing and signposting provides an alternative approach to gaining order and control without foregoing the benefits of using an open-to-closed cone. It allows the vet to draw and review simultaneously any information gathered to date. This information can then be streamed into a coherent pattern, providing the vet with time to consider where to go next and to be clear in his/her own mind what information is still needed or requires clarification. Summarizing without signposting is less likely to establish a structured way forward
- Signposting initiates and gains the client’s attention to what the vet is about to say. This can be used in two different ways:
  - To draw the client’s attention to the introduction of the first summary: “Can I check that I’ve understood you? Please let me know if I’ve missed anything”
  - To make the client aware of the progression from one section to another, or explain the rationale for the next part of the consultation: “You mentioned three important areas: first the cough; secondly, you said Baxter was scratching excessively; and thirdly you said his booster was out of date. Initially I would like to ask a few questions about the cough and then we can come back to the two other concerns. Is that OK?”

Once a clear plan of how the consultation should proceed has been agreed, the vet should be able to carry out the rest of the consultation in a logical sequence. Following a structure like this provides the vet with an opportunity to consider what has and hasn’t been achieved, thereby providing flexibility to cover missed opportunities. There is no doubt that veterinary practitioners find themselves under constant pressure and time constraints, and the time taken over each section of the consultation needs to be balanced. However, following a structure and getting all the issues out at an early juncture can actually make the time spent on the consultation quicker and more efficient.

Building the relationship with the client and patient

This starts from the moment the consultation begins and does not end until the client leaves. It can often be the foundation of an ongoing relationship. In the human medical profession, relationship problems have featured highly as predictors of poor outcome, with lack of warmth and friendliness being one of the most important variables relating to poor levels of patient satisfaction and compliance (Korsch et al., 1968).

The main advantages to building the relationship with the client and pet include:

- The establishment of trust between client, pet and vet
- The creation of an atmosphere that aids the main stages of the consultation (initiation; gathering information; physical examination; explanation and planning; closing)
- The development of a rapport where the client feels at ease, respected and understood
- The reduction of potential complaints and claims
- An increased satisfaction for both the vet and the client.

An array of skills is needed for dealing with feelings and attitudes when building the relationship, and in this context the importance of non-verbal communication cannot be underestimated. What is actually said accounts for 7% of the message and how the
words are said (tonality) accounts for 38% of the message; body language (Figures 2.12 and 2.13) accounts for the remaining 55% of the overall message (Mehrabian, 1971). Used simultaneously, non-verbal cues can strengthen and allow verbal messages to be delivered more accurately; without appropriate non-verbal signals it is easy to misunderstand the verbal message. Being able to recognize non-verbal cues is essential but unless they can be checked out verbally these feelings it is important to act on them. Not only essential but unless they can be checked out verbally.

- It is important that the amount of space between individuals is comfortable. Many factors such as prior relationships, age, sex and culture can influence this.
- Many head movements such as nodding and shaking can give polarities of meaning. Nodding or shaking the head means a different message to the listener that the speaker has made their point or taken up enough time. Shaking the head in most cultures demonstrates disagreement.
- Folded arms may act as barriers. Conversely, open palms, indicate openness and security.
- A slumped posture can indicate disinterest, while a relaxed posture and leaning slightly forward can establish rapport by giving the impression of calmness and interest.
- Genuine interest and concern can be demonstrated with good eye contact.
- Frowning, surprise and smiling can alter facial expressions and indicate how someone is genuinely feeling.
- Handshaking can demonstrate a positive, trusting and professional approach. However it may convey disinterest if it does not feel comfortable and if this is the case it may be better not to do it. A weak hand shake can have a negative effect.

2.12 Non-verbal signals.

2.13 This photograph, taken in a training environment, shows an aggressive posture.

The vet may have elicited the client’s ideas, concerns and expectations during the gathering information stage of the consultation, but having discovered these feelings it is important to act on them. Not only could these thoughts have a direct bearing on the clinical perspective but, unless they are acknowledged and addressed, they may interfere with the whole process of developing rapport. This ‘acknowledging response’ (Figure 2.14) ensures that the client’s emotions and thoughts are accepted and valued, yet does not necessarily mean that the vet agrees with the client. This supportive measure can be very effective in building the relationship.

- Use genuine comments such as, “I can see why that would cause you concern”.
- Acknowledge the client’s feelings and uneasiness by naming, restating or summarizing the sentiment. For example: “So you are worried that we might have to put Buster to sleep?”
- Use attentive silences and appropriate non-verbal behaviour to make room for the client to say more.
- Try not to answer with “yes, but…”

2.14 Tips for improving the acknowledging response.

Building a rapport with the client also relies heavily on the ability to be empathic – hearing or seeing what the client is feeling and being able to communicate that understanding back to the client: “I can appreciate how angry this is making you feel…”; “I can see how upset you are about Baxter’s condition…” Some individuals have an innate ability to empathize but many of the skills needed in this situation can be learnt. It is not necessary to have shared an experience or feel that the experience would be difficult in order to empathize. However, it is necessary to see the problem from the client’s perspective.

Observation

Again, this should commence from the moment the vet comes into contact with the client and the patient. The vet should observe both parties, and the interaction between them. He/she is looking not only for clinical signs, but to gauge the relationship between them. He/she is looking not only for clinical signs, but to gauge the relationship between the owner and their pet. It may also afford an idea as to how the patient, or indeed the owner, is going to react as the consultation progresses.

References and further reading


Mehrabian A (1971) Silent Message. Wadsworth, Belmont, CA


Preventive healthcare: a life-stage approach

Alan Hughes

Canine consultations can be divided into two main groups:

- ‘Routine’ health checks of generally healthy dogs, equivalent to the ‘wellness’ clinics that a medical practice may organize for its human patients. For dogs, these are often linked to a vaccination programme. Some practices also offer interim health checks between the annual vaccinations, particularly for senior dogs, so that they are routinely checked every 6 months.
- Consultations for dogs with injuries, illness or undergoing an inpatient procedure such as surgery. These are covered in the relevant chapters of this Manual.

The content and emphasis of a routine consultation will vary according to the life stage of the dog concerned.

Examinations for life stages

- Neonates: 1–3 days after birth
- Puppies:
  - Pre-sale checks: 6–8 weeks
  - First vaccination and health check: 6–8 weeks
  - Second vaccination and health check: 10–12 weeks
- Juveniles/adolescents: 5–8 months
- Adults: 1–7 years of age
- Pregnant and pre-whelping bitches: 3–4 weeks after mating
- Postparturient bitch: 1–3 days after giving birth
- Seniors: >7 years old (age varies with breed, see later)

Pregnancy and pre-whelping health checks

A check performed 3–4 weeks after mating can include pregnancy diagnosis, by abdominal palpation or ultrasonography (see Chapter 5).

Pre-whelping health checks have three main purposes:

- To ensure that the bitch is healthy and able to proceed with the pregnancy and the subsequent nursing of a litter of puppies (Figure 3.1).
- To check, as far as possible, that the fetuses are healthy and developing normally. Abdominal palpation of the bitch and auscultation of fetal heartbeats provides minimal information on the health of the litter. For more detailed examination, including fetal heartbeats and approximate litter size, ultrasonography is the ideal tool.
- To provide advice to the owners of the bitch (Figure 3.2), especially if they are relatively inexperienced in dog breeding.

### Examination and assessment

<table>
<thead>
<tr>
<th>Examination and assessment</th>
<th>Acceptable findings</th>
<th>Findings that may cause concern</th>
</tr>
</thead>
<tbody>
<tr>
<td>General condition and health</td>
<td>Good general health and condition with no evidence of significant disease. BCS 4/9 to 5/9</td>
<td>Any significant departure from good health is likely to be more serious in a pregnant bitch. BCS 1/9 to 3/9: If underweight the nursing bitch may not lactate effectively and is likely to lose even more weight. BCS 6/9 to 9/9: Obesity is a risk factor for dystocia, and over-feeding during pregnancy should be discouraged</td>
</tr>
<tr>
<td>Risk of dystocia</td>
<td>The risk of dystocia is lower for some breeds (e.g. dolichocephalic breeds) especially if they have a reasonably sized litter and the stud dog is of comparable size and conformation</td>
<td>Some breeds (e.g. brachycephalic breeds) are particularly prone to dystocia, especially if the litter is small in number and/or the puppies are relatively large</td>
</tr>
<tr>
<td>Mammary glands</td>
<td>Normally 5 pairs, each with a functional teat</td>
<td>Some teats may be absent, non-functional or deformed, affecting the bitch’s ability to feed puppies</td>
</tr>
</tbody>
</table>

3.1 Health checks for a pregnant bitch. BCS = body condition score (see Chapter 4).
章节3 预防性保健：一生阶段方法

- **Gestation period**: 由于狗的精子存活时间长，以及不同交配期的变化，导致可能出现不同的交配时间（较早的交配期可能导致较长的交配期），这可能导致不同的交配期差异（如第63天，从交配到发情）。但是，根据第3.2章的内容，可能需要额外的评估才能确定具体的交配期。

- **Giving birth**: 描述分娩的过程，包括妊娠的三个阶段（见第5章），并建议在分娩前进行检查。这种检查应该简单明了，易于记忆。例如，当母狗在1–2小时内未发情时，建议：
  - 第一个幼犬在2小时内未被排出。
  - 软性阴道分泌物，但没有幼犬排出。

- **Management of the pregnant bitch**: 讨论与特别注意预防卫生保健（如安全、有效的寄生虫控制）

- **Follow-up**: 解释分娩后和幼犬的检查。

### 3.2 检查

- **General health and condition**
  - 良好的一般状况
  - BCS 4/9至5/9
  - 年龄在1–6岁时
  - 体温可能被适当提高

- **Behaviour**
  - 习惯于喂养幼犬
  - 有些忧虑，但不保护过度
  - 有适当的照顾，喂养幼犬

- **Abdominal palpation**
  - 无明显异常
  - 腹部柔软，舒适

- **Vulval discharge**
  - 无明显异常
  - 无血性分泌物

- **Mammary glands**
  - 10个功能乳房
  - 非乳汁

### 3.3 检查

- **Gestation period**: 由于狗的精子存活时间长，以及不同交配期的变化，导致可能出现不同的交配期（较早的交配期可能导致较长的交配期），这可能导致不同的交配期差异（如第63天，从交配到发情）。但是，根据第3.2章的内容，可能需要额外的评估才能确定具体的交配期。

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### 3.4 检查

- **General behaviour**
  - 昏昏欲睡（尤其是首次喂食），但可以被唤醒
  - 有时会挣扎和鸣叫

- **Size**
  - 正常体型的幼犬

- **General condition**
  - 狗的皮肤应有弹性
  - 红润的粘膜

- **Sucking reflex**
  - 强烈、有力

- **Gross anatomy and conformation**
  - 如异常，可能表示先天性异常

### Post-parturition and neonatal health checks

这种咨询通常会在母狗分娩后1–3天内提供，母狗的分娩给予母狗和幼犬三重功能：

- **To ensure that the bitch is healthy, has not suffered any complications associated with parturition, and is able to nurse her litter successfully** (Figure 3.3)

- **To examine the neonatal puppies** (Figure 3.4). While they are so young, a detailed clinical examination of the puppies is not possible but gross abnormalities (e.g., cleft lip and/or palate (see Figure 5.12), polydactyly, umbilical hernia, atresia ani) can be identified.

- **This is another opportunity to advise the inexperienced breeder on the care and management of the bitch and her litter** (Figure 3.5).

More detailed information on reproduction can be found in Chapter 5.
Puppy health checks

There are usually two (sometimes three) routine consultations for new puppies, often arranged to coincide with the puppy’s primary vaccination course (see later). The first will often be shortly after acquisition by the new owner.

PRACTICAL TIP

Unless the owner has any concerns about the health of the new puppy, it is advisable that the first consultation is booked for a few days after arrival in the new home. Bringing the new puppy to the veterinary practice on the day of collection from the breeder only adds further to its physiological stress, and this is not a suitable time for its primary vaccination course to be started. A few days at home, however, allows the puppy and owners to become familiar with each other, and for any problems to be identified. For example, a reliable assessment of the puppy’s appetite can not be made whilst it is still very unsettled in its new home.

The first puppy health check (6–8 weeks of age)

This first health check (Figure 3.7) has a number of important aims.

- Any serious congenital or developmental problems should be identified and consideration given as to whether the puppy should be returned to the breeder.
- This may be the first visit to the veterinary surgery for both the puppy and its owner. Positive, constructive relationships between the veterinary practice as a whole, the individual veterinary surgeons, the puppy’s owners and their puppy may be determined at this very first consultation.
- This is an ideal opportunity to provide helpful advice on many aspects of preventive healthcare and the routine care of the new puppy. Whilst the new owner is likely to be enthusiastic and receptive to advice, it is important to avoid information overload. Many practices provide some written information (e.g. puppy booklets; Figure 3.8) for owners to take home. In some

Pre-sale examination

This consultation may be requested by a breeder, usually when the puppies are 6–8 weeks of age, to identify any congenital or developmental abnormalities or disease that may affect the value of the puppy and its suitability for its new home. In the absence of problems, the breeder may ask for written certification that the puppy has been examined by a veterinary surgeon and found to be free of evidence of abnormality or disease. This document can then be shown or passed on to the new owner. An example is given in Figure 3.6.

12th June 2013
Anytown Veterinary Clinic

Re: A black male puppy of 6 weeks of age born to the Cocker Spaniel bitch ‘Fido’ belonging to:
Mr and Mrs Smith of 1 High Street, Anytown

This is to certify that on the 10th June 2013 I examined the above-mentioned puppy and found no evidence of serious congenital or developmental abnormalities, or other disease or illness. I therefore judge him to be fit for sale.

Signed
[Name of veterinary surgeon]

An example of a certificate of pre-sale examination for a puppy.
1. Before the client is called into the consultation room, check that certain essential items of information have been recorded in the patient’s records, and note any that need to be requested:
   - The owner: Name and address, contact telephone numbers, email address, any other pets
   - The puppy: Breed (knowing this beforehand may avoid embarrassing mistakes in misidentifying the puppy’s breed), age, gender (clients may be quite upset by the simple mistake of referring to a male puppy as ‘she’)

2. Greeting. Calling the owners by name, and the puppy too, immediately sets a positive tone to the consultation and reassures the client that you are interested in them and their new puppy as individuals

3. Building rapport. Even a brief comment, such as referring to the sad loss of a previous pet, or a flattering remark about their new puppy, will help a great deal in establishing a positive relationship

4. History taking. See below for guidelines

5. Clinical examination. A systematic general clinical examination should now be performed, tailored to be appropriate for a new puppy. See below for guidelines

6. Weigh the puppy

7. Preventive healthcare
   - Vaccination. Provided the puppy is judged to be in good general health, it is usual to administer the first stage of the primary vaccination course (see later). Taking into account any vaccinations given whilst with the breeder, the first dose will usually incorporate all of the core vaccines, and any of the non-core vaccines deemed advisable depending on the puppy’s lifestyle and location (see Figure 3.18)
   - Parasite control. Regard should be given to any antiparasite treatments administered prior to this consultation. The veterinary surgeon should emphasize the importance of regular treatment
   - Diet recommendations. A puppy will often arrive in its new home with advice on diets from its breeder, and sometimes a small supply of the recommended food. Unless this is judged unsuitable, or the puppy requires a special diet (e.g. a light diet to manage a gastrointestinal problem), the author’s usual advice is to continue to feed the breeder’s choice of diet for 1–2 weeks after acquisition, and only then to switch to the owner’s preferred diet if desired, but taking 1–2 weeks to accomplish this change. There are many good quality proprietary diets carefully formulated for puppies that are readily available
   - Neutering. If there is no intention to breed from the puppy in the future, the advantages (and any disadvantages) of neutering (see Figure 3.11) should be introduced for the owner to consider, and details given of timing and costs
   - Tooth brushing. Owners should be shown how to brush the puppy’s teeth correctly, and encouraged to do so every day as an important element of dental homecare

8. Other advice for new owners. Some of this may be presented by the practice nurse:
   - Pet insurance
   - Microchipping. It is recommended that all new patients should be checked for the presence of a microchip and, if found, the new owner asked for the registration documents as proof of their legitimate ownership. If they are not able to provide them, or if the details do not correspond with those of the client, the database company should be contacted and the situation reported
   - Health schemes. There are a variety of these, from those in a single-site practice, to those across large corporate groups. They generally offer a programme of preventive healthcare for a fixed fee, sometimes linked to other potential benefits such as discounts or special offers; if these are operated by the practice, they should be explained to the new owner
   - New clients. If the client is new to the practice, services such as out-of-hours emergency provision, requests for prescriptions, home visits, etc. can be described. Some practices take this opportunity to provide a guided tour of the practice

9. Closing remarks. The owner should be advised when the puppy needs to return for the next part of its vaccination course (usually 2–4 weeks later and at least 10 weeks of age when maternally derived antibodies will no longer be present to affect vaccine efficacy). It is usually practice policy to advise that the puppy is not adequately protected to mix with other potentially disease-carrying dogs, or to walk them where they may have been, until a certain time (usually 1–2 weeks) after the second vaccination. However, the importance of socialization should be discussed and tips given on how to do this safely (see Chapter 1). Some practices offer ‘puppy parties’ to the owners of new dogs, often run by veterinary nurses, where the puppies have an opportunity to socialize under controlled conditions, whilst their owners can learn about various aspects of their care

10. Provide summary sheets of all recommended advice (possibly in the form of a booklet), as there will be too much information presented for the new owner to take on board in one go

3.7 The first puppy consultation. Following a modified version of the Calgary–Cambridge Guide (see also Chapter 2), a number of stages can be identified.

3.8 An example of a puppy guide written for owners.
practices the time available is shared with a practice nurse, allowing some of the healthcare messages to be reinforced. In any event, significant time must be allowed for this all-important consultation.

History taking
There are a number of essential questions to ask the owner of a new puppy:

- How long have you owned the puppy?
- What was the source of the puppy – a breeder, rescue shelter, dealer, pet shop or private home?
- Have you owned a dog before?
- Are there any health issues with this puppy that you are concerned about?
- If so, were these apparent immediately after acquisition or were they mentioned by the breeder?
- If possible problems are identified, specific questions relating to these should be asked. For example, if the owner complains that the puppy has diarrhoea: What is the nature of the diarrhoea? Has there been any vomiting? Is the puppy eating? What diet is being fed?
- If the owner reports that the puppy has been given any vaccinations or other preventive healthcare measures (e.g. worming treatments) prior to acquisition, are there any written details to clarify and support this (e.g. vaccine records)?
- If the puppy has had its tail docked, does the new owner have the correct documentation certifying that the breeder had this performed in the correct circumstances?

Tail docking regulations in England
*NB Regulations vary in other parts of the UK*

An exemption from the ban on the tail docking of puppies is allowed for those puppies intended for certain working uses such as gun-dogs. The owner of the puppy should have documentation to demonstrate that:

- The procedure was performed by a veterinary surgeon
- The puppy was less than 5 days old
- The veterinary surgeon performing the procedure had seen evidence that the puppy is likely to be used for working in the future
- The puppy has been microchipped (or is to be microchipped by a certain age)

These are correct at time of going to press; further information and up-to-date regulations are available at [www.rcvs.org.uk](http://www.rcvs.org.uk). There is also a leaflet available from the BVA Animal Welfare Foundation ([www.bva-awf.org.uk](http://www.bva-awf.org.uk))

Clinical examination
The systematic head-to-tail approach to clinical examination (see QRG 3.1) should be tailored for a new puppy to look for common abnormalities and conditions such as those noted below:

- Head and neck:
  - Teeth: Deciduous dentition. Check that the correct complement of teeth is present and correctly erupted. Check for malocclusion, especially prognathia or brachygnathia
  - Oral cavity: Cleft palate
  - Eyes: Congenital abnormalities of the eyelids (e.g. entropion, coloboma). Congenital ocular abnormalities (e.g. persistent pupillary membranes, microphthalmia)
  - Ears: Parasitic otitis
  - Forelimbs: Congenital deformities (e.g. carpal valgus or varus)
  - Hindlimbs: Congenital deformities (e.g. hip dysplasia, patellar instability)
  - Thorax:
    - Congenital deformities of the sternum or ribs
    - Congenital heart murmurs
  - Abdomen:
    - Inguinal or umbilical hernias
    - Females: Intersex variations
    - Males: Cryptorchidism
  - Anal area: Anal gland impaction
  - Skin and coat: Skin parasites (e.g. fleas (Figure 3.9), lice, mites).

The second puppy health check (10–12 weeks of age)
The main purpose of this check is to administer the second (and usually final) part of the puppy’s primary vaccination course (see later). This is a good opportunity to check on the puppy’s progress and development (including weight gain) with a brief clinical examination, and to address any concerns that the owner may raise. There may be items from the first consultation (e.g. microchipping) that the practice or the owner has chosen to delay until this consultation.
Juvenile/adolescent health checks

It is recommended that adolescent dogs are examined at approximately 6 months of age. As well as a thorough physical examination (see later) and addressing any clinical concerns, this allows the veterinary surgeon to discuss a range of issues, some of which may also have been raised when the puppy was first presented.

- **Vaccination.** The veterinary surgeon should check that the course of recommended core vaccines has been completed correctly, and discuss any non-core vaccines. Owners should be reminded that a booster vaccination will be required annually, with the first due 12 months after completion of the puppy’s primary course.

- **Parasite control.** Six months is often the age at which the dog is switched from a puppy worming programme (e.g. monthly) to an adult programme (e.g. every 3 months). It is important to discuss the ongoing requirement for regular, routine ectoparasite control (see later).

- **Diet.** Feeding appropriate to the growing dog’s age and breed is important to ensure correct development.

- **Other services.** This is an ideal time to promote valuable services such as microchipping (Figure 3.10) and pet insurance if not taken up when a puppy.

- **Travel abroad.** Owners may be planning to take their dog abroad in the future and this may be a suitable time to explain the PETS Travel Scheme (see Figure 3.13), as some forward planning may be required.

- **Neutering versus breeding.** Now that the dog is approaching puberty (usually occurs at 6–10 months of age) this is an ideal time to discuss neutering, or ambitions to breed. Most practices advocate the routine neutering of dogs if there is no intention to breed. Advantages of neutering are listed in Figure 3.11. Some clients still believe that allowing a bitch to have one litter confers some physical or behavioural benefits on her but this has not been proven. It is important to inform clients about the commitment and responsibility required in breeding dogs, which should not be undertaken lightly.

### Male dogs
- Reduces the risk of aggression especially towards other (male) dogs
- Prevents testicular neoplasia
- Prevents some prostatic disease
- Reduces the risk of perineal hernias
- Reduces ‘antisocial behaviour’, e.g. territorial urination
- May facilitate training and behaviour control
- Prevents unwanted pregnancies

### Bitches
- Prevents pyometra
- Prevents neoplasia of the uterus and ovaries
- May prevent or reduce the incidence of mammary gland neoplasia, particularly if performed before the second ‘season’
- Prevents unwanted pregnancies
- Prevents the bloody vulval discharge during oestrus
- Prevents pseudopregnancy

3.10 Arguments in favour of routine neutering (see also Chapter 5).

A thorough examination, again using a systematic approach to avoid omissions (see later and QRG 3.1), should be performed during this consultation. There are a number of aspects of the adolescent dog’s health to be considered:

- **Growth and development.** Large breeds may still be growing rapidly at 6 months of age, whereas small breeds may be approaching their adult size. Apart from checking for normal general development, congenital or developmental conditions not apparent in the puppy may now be identified, e.g. orthopaedic conditions such as hip dysplasia.

- **Weight and condition.** Incorrect weight or poor body condition, possibly associated with inappropriate nutrition, may be apparent at this time. Steps should be taken to remedy this.

- **Specific concerns** raised by the owner, or conditions identified during the examination.

### Routine health checks for adult dogs

These consultations are usually timed to coincide with the dog’s annual booster vaccinations.

A clinical examination employing a systematic approach (see below and QRG 3.1) should be employed during this consultation. It is important that an accurate weight is measured (Figure 3.12) and recorded in the dog’s clinical notes. Any health problems identified at this time, raised by the owner, or possibly ongoing from the dog’s previous medical history, should prompt a closer examination of relevant areas. This is a good time to ‘catch up’ with a dog’s progress if it has a chronic, ongoing or recurrent problem. Should a specific problem require deeper investigation, it may be advisable to book the dog in for a further appointment.

Other matters that might be addressed at the routine annual examination include:

- **Vaccination.** Core vaccination should be administered as outlined in Figure 3.18 to maintain protection against these important diseases. Non-core vaccinations may be given in...
addition, depending on the owners’ requirements, the dog’s lifestyle and regional considerations

- **Parasite control.** This is an ideal opportunity to check that a parasite control programme is in place and that it is appropriate for the dog in question. Dogs travelling abroad may have specific parasite control requirements which can be addressed at this examination, and the requirements of the PETS Travel Scheme for dogs intended to be returned to the UK should also be borne in mind (Figure 3.13)

- **Blood screening tests.** Some veterinary practices recommend an annual blood screen, usually comprising haematology and biochemistry panels, with the intention of identifying problems not found during the clinical examination. In an otherwise healthy dog in which the owner does not raise any concerns, and no problems are identified during the clinical examination, the value of this is questionable. Conscientious owners may, however, be reassured by this being offered as a service.

Under the current scheme (modified in January 2012) dogs may return to the UK after travel to an EU or one of the listed non-EU countries provided that the following apply:

- They are microchipped. This must be performed before any other travel-related procedures, to ensure correct identification of the pet concerned
- They are vaccinated against rabies and given their rabies boosters at the intervals required by the data sheets of the vaccine used. There must be a time interval of 21 days between the first rabies vaccination and return to the UK
- They have the correct accompanying documentation. For pets travelling from within the EU, this will be the EU Pet Passport completed and signed, and issued by a veterinary surgeon licensed by Defra (i.e. an LVI)
- They have been treated for tapeworm 1–5 days prior to arrival in the UK

Dogs returning to the UK after travel to an unlisted non-EU country should have a blood test taken at least 30 days after vaccination to demonstrate satisfactory protection from rabies, and there is then a 3-month wait from the date the blood was taken before entry is permitted

![Figure 3.13](image)

**3.12** Obtaining an accurate measurement of bodyweight is an important part of the clinical examination.

**Routine health checks for senior dogs**

Depending on the dog’s general condition and the presence of any specific clinical problems, the veterinary surgeon may decide to increase the frequency of health checks to every 6 months for some senior dogs.

Dogs over 7 years of age should be classed as ‘senior’, as the problems associated with ageing may begin to develop in this group. It should be remembered, however, that this process may begin 1–2 years earlier in giant breeds, and 3–5 years later in smaller breeds

A thorough clinical examination using a systematic approach (see QRG 3.1) is important. A large number of problems associated with ageing may be identified more commonly now. These include:

- Eyes – cataracts
- Skin – seborrhoea
- Heart – valvular disease
- Kidneys – renal dysfunction
- Limbs – osteoarthritis.

If suspected, attention can then be focused on these specific problems to enable accurate diagnosis, and correct treatment and management as appropriate.

Other matters that might be addressed at the routine annual examination include:

- **Preventive healthcare:**
  - The annual core vaccination programme (plus any non-core vaccines required) (see later) should continue. Clients often ask whether it is necessary to continue with booster vaccinations in older dogs. It is important to remind them that protection cannot be assured beyond the time intervals described in the vaccine’s data sheets, and that if the dog is still active and socializing with other dogs then it is still susceptible to infectious disease, probably more so with the reduced innate immunity of older pets
  - A parasite prevention programme appropriate to the dog’s lifestyle should continue for life

- **Diet:**
  - Even in the absence of specific disease conditions being identified, consideration should be given to whether the dog’s diet should be modified
  - Just as with people, the most common diet-related problem is obesity; this can affect (Figure 3.14), or predispose to, a number of clinical conditions seen especially commonly in

  | Ostearthritis | Other orthopaedic conditions (e.g. patellar luxation) | Skin disease (e.g. seborrhoea, skin fold dermatitis) | Cardiac disease (e.g. congestive heart failure) | Respiratory disease (e.g. chronic pulmonary airway disease) | Endocrine disorders (e.g. diabetes mellitus) |

**3.14** Types of disease that may be exacerbated by obesity.
older dogs. If not addressed at previous health checks, it now becomes even more important that dietary modification is instituted in the older obese dog. Senior diets, sold as part of the proprietary life-stage diet ranges, will usually have a lower calorie content to help tackle this problem. Sometimes, however, a diet with even fewer calories is required to address a significant obesity problem. It is important that advice and support from a veterinary surgeon or veterinary nurse with experience in pet nutrition is available to manage and monitor the more significant weight loss intended in these cases. Return to the maintenance diet is only advisable once the target weight is achieved.

- Senior proprietary diets will often have other modifications designed to help manage specific age-related problems (e.g. joint supplements for osteoarthritis, reduced protein content for renal dysfunction). Sometimes specific clinical diets may be recommended, as in other life stages, to address specific diseases.

**Laboratory screening:** Although it was argued above that routine blood screens in otherwise apparently healthy adult dogs may be of limited value, there may be greater clinical advantage to be gained from these in senior dogs, as many of the problems associated with abnormal blood results may present initially with no signs, or with non-specific or subtle signs. A routine blood screen for senior dogs may be recommended at the time of their annual health check. This is of most use if also combined with urinalysis (Figure 3.15), and clients may be asked to bring a fresh urine sample from their dog at this time. As at other times, any abnormalities detected in these may prompt further diagnostic investigation.

### Blood biochemistry
- Total protein
- Albumin
- Globulin
- Urea
- Creatinine
- Alkaline phosphatase (ALP)
- Alanine aminotransferase (ALT)
- Bilirubin
- Glucose
- Cholesterol
- Ketones
- Phosphorus
- Calcium
- Sodium
- Chloride
- Potassium
- Total T4

### Haematology
- Red blood cells (RBC)
- Haemoglobin
- Haematocrit
- Mean cell volume (MCV)
- Mean cell haemoglobin (MCH)
- Mean cell haemoglobin concentration (MCHC)
- Platelets
- Absolute white blood cell count (WBC)
- Differential white blood cell count
- Segmented neutrophil count
- Lymphocytes
- Monocytes
- Eosinophils
- Basophils
- Atypical cells

### Urinalysis
- Glucose
- Ketones
- Blood
- Protein
- Nitrites
- Leucocytes
- Specific gravity
- pH

A routine blood and urine test panel for senior dogs.

### End-of-life examinations
Veterinary surgeons are frequently asked to advise on whether euthanasia is appropriate for an older dog. Whilst any individual clinical condition must be considered, often it is the dog’s overall health, condition, comfort and apparent enjoyment (its ‘quality of life’) that is being assessed at this time.

Old age is not a disease and of itself is no justification for euthanasia of a pet (although often owners feel under some pressure from friends or family to act at this time). Due consideration also needs to be given to the owner’s welfare, however. For example, an elderly dog that regularly toilets indoors may be quite content in itself but could cause the owner considerable distress. It should also be borne in mind that most significant chronic disorders (e.g. neurological deterioration with age) are usually only likely to worsen with time, and whilst elderly animals should not be euthanased prematurely, it should be considered that in these cases, if the owner is initially dissuaded from losing their pet, they often express regret when preventing the dog again a short time later when the condition has deteriorated further.

Quality of life is clearly a very subjective concept but one that veterinary surgeons are often asked to judge. They are usually well placed to do so, provided this is after careful questioning of the owner who will be familiar with the dog’s normal habits. If an elderly dog has deteriorated beyond the point at which its comfort and wellbeing can be assured, the veterinary surgeon should discuss euthanasia with the owner. Hopefully this can be performed whilst the dog retains some dignity, and such that the owners’ final memories of their pet are not dominated by a protracted and miserable end of their companion’s life. Euthanasia is discussed in more detail in Chapter 7.

### General clinical examination
It is important to develop a routine and systematic approach to this, so that the examination can be completed in the limited time available during a consultation, but without overlooking anything (see QRG 3.1). The clinical examination may be varied depending on three factors:

- The signalment of the dog – age, breed, gender
- Any previous clinical history which may be relevant to the dog’s current health status. For example, in a dog with a previous history of chronic skin disease, special attention should be devoted to examining the skin at each routine health check, as a means of monitoring this problem
- Any clinical abnormalities that are identified during the examination. For example, if enlarged submandibular lymph nodes are identified, a more careful examination of the other superficial and internal lymph nodes would be appropriate to assess their size.

Adopting and practising a systematic approach (see QRG 3.1 and Figure 3.16) will ensure that all available parts of the body are assessed. If an abnormality is identified, further information can be gained by focusing on this body system.
Preventive healthcare: a life-stage approach

Head and neck
- Nares, planum nasale, nasal bones
- Lips: external surfaces, mucous membranes, mucocutaneous junctions, commissures
- Gums
- Teeth: buccal, lingual and occlusal surfaces
- Oral cavity: tongue, hard and soft palates, oropharynx
- Temporomandibular joints
- Eyelids: external and conjunctival surfaces, canthi, margins, nictitating membranes
- Eyes: conjunctivae, sclerae, corneas, pupils, irises, anterior chambers
- Cranial bones
- Ears: pinnae, opening of external canals and vertical canals
- Submandibular lymph nodes
- Salivary glands
- Larynx and trachea

Forelimbs
- Scapula and associated muscles
- Precapular lymph nodes
- Axilla
- Shoulder, elbow and carpal joints
- Humerus and associated muscles
- Antebrachium
- Feet: metacarpals, digits, pads, claws, interdigital skin

Thorax
- Thoracic spine, sternum, ribs, intercostal spaces
- Auscultation of lungs
- Auscultation of heart

Abdomen
- Lumbar spine, abdominal wall
- Inguiæs
- Umbilicus
- Costal arch, caudal border of liver, kidneys, spleen, bladder, abdominal lymph nodes, stomach, small and large intestines

Hindlimbs
- Pelvis and associated muscles
- Popliteal lymph nodes
- Femur and associated muscles
- Tibia, fibula and associated muscles
- Hip, stifle and hock joints
- Feet: metatarsals, digits, pads, claws, interdigital skin

Perineum and tail
- Anal sphincter
- Anal glands
- Tail

Female features
- Vulva
- Teats
- Mammary glands
- Uterus

Male features
- Penis and prepuce
- Scrotum and testes

Skin and haircoat

With a gentle, tactile approach to the examination (Figure 3.17), as well as gaining an overall assessment of the health status of the dog, the examination can be used to help the patient relax before proceeding to concentrate on a specific area. Handling and restraint is discussed in Chapter 1.

A ‘head-to-tail’ approach to a systematic clinical examination. See also QRG 3.1.

**3.17** A short time spent trying to reassure and relax the patient is not wasted, and may actually save time later in the examination.

Body temperature, heart and pulse rate, and respiratory rate (the ‘TPR’) are often considered the baseline parameters to measure in a clinical examination.

- Body temperature is most rapidly and accurately measured using a digital thermometer (see Figure 18.3), preferably with a disposable cover for hygienic reasons, inserted into the rectum.
- Heart rate is measured during auscultation (counting in groups of ten for 15 seconds).
- Pulse rate (rhythm and quality) is assessed most easily by palpation of the femoral artery on the inside of the thigh.
- Respiratory rate is counted over a 15-second period, preferably before the dog becomes stressed by the examination (i.e. a resting rate).

**Vaccination**

The regular (annual) health check for dogs often coincides with routine vaccination. It is essential that a full clinical examination (see above) is performed whenever a dog attends for vaccination.

- It is important to ensure that the dog is healthy. Vaccines should never be administered to a patient that may be immunocompromised, either through a significant illness or treatment such as ciclosporin.
- This is an ideal opportunity to provide a general health check for a canine patient that often would not arise otherwise. Indeed, it could be argued that one of the principal benefits of annual booster vaccinations is the chance to perform a health check (see above).
- This examination is an essential element in reassuring the client that the practice is providing good value for money. It should be made clear that the fee charged for vaccination includes that for a clinical examination.

As a result of changing patterns of disease, improvements in vaccine design, and concerns expressed by a minority of dog owners about problems perceived to be associated with ‘over-vaccination’, canine vaccination programmes have undergone considerable debate and scrutiny in recent years. From this controversial topic has emerged the notion of ‘core’ and ‘non-core’ vaccines.
Core vaccines

In discussing a suitable vaccination programme for a dog with their owner, it is important to remember that a core vaccine:

- Is highly effective at providing protection
- Is safe
- Protects against diseases that have high mortality and/or are highly infectious
- May protect against zoonotic disease.

Thus, core vaccines are considered essential to protect ALL dogs against a number of serious, often potentially fatal, infections:

- Canine distemper
- Canine parvovirus
- Infectious canine hepatitis
- Canine leptospirosis.

These vaccines should be boosted as required to maintain an adequate level of immunity against these diseases at all times (although it should be remembered that no vaccine provides 100% protection). Due to improvements in vaccine design, and studies evaluating the immunity they achieve, it is now not always considered necessary to boost all of these vaccines every year (Figure 3.18). Generally, leptospiral vaccines are required annually to maintain immunity but vaccines against parvovirus, distemper and hepatitis can be administered less frequently to the adult dog, often every 3 years. It is important that a new graduate seeks advice from a senior member of the practice as to what is that practice’s protocol for vaccination programmes.

The strain(s) of organism used to produce a particular vaccine may vary from one manufacturer to another, and it is important to know which is in use in a practice so that any recent or local variation is taken into account, and so that dogs which have previously been vaccinated elsewhere are given the correct booster.

### A typical programme of core vaccinations. The programme should maximize a dog’s protection against these diseases, whilst minimizing any accusations of ‘over-vaccination’.

<table>
<thead>
<tr>
<th>Age of dog</th>
<th>Core vaccinations required</th>
</tr>
</thead>
<tbody>
<tr>
<td>6–10 weeks</td>
<td>Distemper, parvovirus, leptospirosis and hepatitis</td>
</tr>
<tr>
<td>At least 10 weeks</td>
<td>Repeat of the above 2–4 weeks later (depending on data sheet recommendations). This second puppy vaccination must be given at an age of at least 10 weeks to ensure that all maternally derived antibodies have been exhausted. The new Lepto4 vaccine designed to protect against newly emerging serovariants in Europe and the USA requires a 4-week gap between the first and second doses</td>
</tr>
<tr>
<td>15 months</td>
<td>First adult booster, including distemper, parvovirus, leptospirosis and hepatitis</td>
</tr>
<tr>
<td>2 years</td>
<td>Leptospirosis</td>
</tr>
<tr>
<td>3 years</td>
<td>Leptospirosis</td>
</tr>
<tr>
<td>4 years</td>
<td>Distemper, parvovirus, leptospirosis and hepatitis</td>
</tr>
<tr>
<td>5 years</td>
<td>Leptospirosis</td>
</tr>
<tr>
<td>6 years</td>
<td>Leptospirosis</td>
</tr>
<tr>
<td>7 years</td>
<td>Distemper, parvovirus, leptospirosis and hepatitis</td>
</tr>
<tr>
<td>Older</td>
<td>Leptospirosis every year; distemper, parvovirus and hepatitis every 3 years</td>
</tr>
</tbody>
</table>

The role of serological testing

Theoretically, serological testing would be used as an integral part of designing a suitable vaccination programme for an individual dog, as it would provide information regarding the diseases that the dog could be susceptible to, and those that it appears still to be adequately protected against. The practical reality is, however, that such testing is far from reliable, overlooks the role of cell-mediated immunity and completely uneconomical for most owners. Thus, the veterinary surgeon should use their knowledge and experience, the available data on vaccines, and the disease risks for that individual dog, to devise and recommend a suitable programme of vaccination.

Non-core vaccines

These are to protect against diseases that:

- Have a low mortality or can be treated effectively (e.g. kennel cough)
- Only affect specific populations as a result of their lifestyle or geographical location.

Thus, these may be considered less essential for every dog. Examples of non-core vaccines available in the UK include:

- Rabies: usually only essential for dogs travelling abroad to countries where rabies is endemic, either in the dog population or in a wildlife reservoir. The vaccine protects individual dogs and reduces the risk of importing this serious and zoonotic disease into the UK. This vaccine is compulsory for dogs requiring a passport under the PETS Travel Scheme (see earlier)
- Bordetella bronchiseptica: protects dogs against a major cause of kennel cough; this intranasal vaccine is often administered to dogs that are regularly in contact with others, and especially prior to entry to boarding kennels
  - Immunocompromised owners (e.g. transplant patients, chemotherapy patients) should avoid contact with vaccinated dogs for 6 weeks, as stated on the data sheet
  - Concurrent use of antibacterial drugs should be avoided
- Parainfluenza virus; protects against another cause of the kennel cough syndrome
- Leishmania: provides some protection for dogs travelling to hot climates where leishmaniosis is endemic, and should be used alongside protection from biting insects that transmit the disease
- Herpesvirus: administered to breeding bitches where there is a risk of losing puppies to ‘fading puppy syndrome’, one cause of which is believed to be canine herpesvirus.
Common parasites

Ecto- and endoparasites are a common cause of clinical problems in dogs, varying from the relatively trivial nuisance (e.g. harvest mites) to the severe, even life-threatening (e.g. lungworm). Owners often express distaste at their pet’s harbouring a visible parasite burden, and some infections carry a zoonotic risk. Safe and effective parasite control therefore forms an important component of the routine healthcare programme for all dogs, although requirements may vary according to the dog’s age, lifestyle and role.

Common ectoparasites and helminth endoparasites of dogs are discussed in Figures 3.19 and 3.20.

<table>
<thead>
<tr>
<th>Species (most common in bold)</th>
<th>Transmission</th>
<th>Clinical signs and health risks</th>
<th>Diagnostics</th>
<th>Treatment and control</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fleas</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ctenocephalides felis</td>
<td>Life cycle 14–140 days depending on environmental conditions; most rapid in warm moist surroundings. Pupae relatively resistant; can survive for months until suitable conditions develop. Vibrations, heat and inhaled carbon dioxide from the dog stimulate adult fleas to jump aboard</td>
<td>Pruritus and self-traumatic dermatitis. Allergic dermatitis. Very severe infestations in young puppies may cause anaemia (see Figure 3.9). The flea is the intermediate host to Dipylidium tapeworm larvae, transmitted via ingestion (zoonotic)</td>
<td>Fleas found on dog. Use a fine comb through the coat; identify fleas, eggs and flea faeces (containing host’s blood; dissolve in drop of water or on damp cotton wool)</td>
<td>Treat infested dog and all in-contact animals in household with appropriate adulticides; ideally combined with treating all animals in household with insect growth inhibitors (IGRs). Apply ovividal/farvical drugs to dog that are then shed into immediate environment; usually combined with adulticides. Treat environment with appropriate insecticides/IGR combinations. Thorough cleaning, especially soft furnishings and bedding, and careful disposal of infected materials. Avoid contact with potentially infested animals (e.g. cats, hedgehogs). Owner education paramount to ensure adequate preventive control</td>
</tr>
<tr>
<td>Ctenocephalides canis</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| **Ticks**                    |              |                                 |             |                      |
| Ixodes ricinus               | Life cycle up to 12 months. Dogs infested by walking through long grass, rough grazing. Some regions of UK (e.g. East Anglia, Scotland) have a far greater prevalence of ticks | Skin irritation and pain at attachment site. Heavy infestations in young or debilitated dogs may cause anaemia. Transmission of infectious diseases: Lyme disease (Borrelia burgdorferi) uncommon in UK but potentially serious (and zoonotic). Ticks on dogs that have travelled abroad, including Europe, may transmit ehrlichiosis, babesiosis (both zoonotic) and Mycoplasma haemocanis | Close inspection of dog may enable ticks to be found | Treat dog with appropriate acaricides; some have tick-repellent activity. None is completely effective. Frequent inspection and careful removal of ticks: preferably use proprietary device to ensure mouthparts are extracted from skin (note slight risk of zoonotic borreliosis and ensure device does not squeeze ingested blood from tick back into dog). Avoid exercising dogs in tick-prevalent areas |
| Ixodes hexagonus             |              |                                 |             |                      |

| **Lice**                     |              |                                 |             |                      |
| Trichodectes canis           | Life cycle entirely on dog host; survival off host short lived. Transmission by direct contact with infected host or via shared grooming equipment | Very young, old or debilitated dogs are at greater risk of infestation, suffering marked pruritus and resultant self-trauma | Finding lice and eggs in the dog’s coat | Regular examination and grooming. Apply suitable insecticides |
| Linognathus setosus          |              |                                 |             |                      |

| **Ear mites**                |              |                                 |             |                      |
| Otodectes cynotis            | Entire life cycle (approx. 3 weeks) in external ear canal of host. Transmission by direct contact with infected host. Mite commonly found on cats, ferrets and foxes | Marked aural pruritus and an accumulation of dark wax in the external ear canals, leading to otitis externa | Otoscopic examination will reveal the mites, seen as small white parasites moving about in the canal | Systemic acaricide, including all in-contact animals even if asymptomatic. Topical medication to clean external ear canals and treat any inflammation or secondary infection (some cleaning preparations also have acaricidal action) |

**3.19** Common ectoparasites of dogs. See also Chapters 27 and 29. (Illustrations © Susan Paterson) (continues)
### Skin/fur mites

<table>
<thead>
<tr>
<th>Species (most common in bold)</th>
<th>Transmission</th>
<th>Clinical signs and health risks</th>
<th>Diagnostics</th>
<th>Treatment and control</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sarcoptes scabiei</strong></td>
<td>Life cycle 10–21 days, entirely on host. Adults can survive up to 2 weeks off host in ideal conditions. Transmission by direct contact. Highly contagious</td>
<td>Causes scabies, an intensely pruritic dermatitis, initially in less hairy parts such as pinna margins (see Figure 27.8). Zoonotic: S. scabei var. canis will not breed on humans but causes pruritus</td>
<td>Microscopic examination of multiple deep skin scrapes. Mites often present in small numbers, risking false negative results. Serology</td>
<td>Appropriate acaricidal treatment, including in-contact animals</td>
</tr>
<tr>
<td><strong>Demodex canis</strong></td>
<td>Adults live in hair follicles and sebaceous glands. Life cycle approximately 3 weeks, entirely on host. Transmission from nursing bitch to puppies by direct contact within first few days after birth</td>
<td>Small number of mites usual, producing no clinical signs. On some individual hosts (possible genetic predisposition or immunocompromised) mites multiply and cause disease. Can be localized or generalized, and latter either juvenile-onset or adult-onset</td>
<td>Squeeze affected skin to expel mites from follicles, and then make deep skin scrapes (see QRG 27.1). These and hair pluckings examined microscopically for adult mites and immature stages</td>
<td>Localized disease may resolve spontaneously. Generalized forms may require prolonged and extensive treatment. Treat secondary bacterial infections. Investigate and treat underlying conditions in adult-onset demodicosis</td>
</tr>
<tr>
<td><strong>Cheyletiella parasitovorax</strong> (rabbit fur mite)</td>
<td>Obligate parasites with life cycle on a single individual. Transmission is direct or via fomites such as grooming equipment</td>
<td>Dry scaly pruritic dermatitis. Can be zoonotic</td>
<td>Identification of mites on tape strips examined microscopically (see QRG 27.1)</td>
<td>No authorized product but insecticides such as fipronil and selenium sulphide may be effective. Treat environment with insecticidal spray and wash bedding</td>
</tr>
<tr>
<td><strong>Trombicula (subgen. Neotrombicula) autumnalis</strong> (harvest mite)</td>
<td>Adults live in soil. Parasitic larvae produced in late summer and autumn. Clusters of mites seen as bright orange specks, frequently on interdigital skin and around the base of the pinnae</td>
<td>Can be associated with localized pruritus</td>
<td>Visible to the naked eye</td>
<td>Fipronil may be effective, although infestation is self-limiting</td>
</tr>
</tbody>
</table>

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### Intestinal nematodes

<table>
<thead>
<tr>
<th>Species (most common in bold)</th>
<th>Transmission</th>
<th>Clinical signs and health risks</th>
<th>Diagnostics</th>
<th>Treatment and control</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Toxocara canis</strong> (dog roundworm)</td>
<td>Transmission to adult dogs through ingestion of infective embryonated eggs from the environment. Puppies are infected via placenta or milk or from mother’s faeces</td>
<td>Heavy infestation in puppies may lead to poor growth and typical pot-bellied appearance. GI disturbances often occur. Tracheal migration of many larvae in puppies may cause respiratory signs. Zoonotic: especially in children through ingestion of eggs from environment. In aberrant human host, visceral larval migrans may develop – larvae travel to organs such as brain or retina where they encyst and may cause disease</td>
<td>Identify eggs microscopically after faecal flotation</td>
<td>Ubiquitous: all adult dogs should be treated regularly without recourse to a specific diagnosis. Give anthelmintics at regular intervals (3, 6 or 12 months depending on lifestyle) throughout life. Treat pregnant bitches with fenbendazole from day 40 of pregnancy to 2 weeks postpartum. Treat puppies from 2 weeks of age, monthly until 6 months old. Client education: encourage owners to collect and hygienically dispose of dog faeces promptly, to prevent environmental contamination</td>
</tr>
<tr>
<td><strong>Toxascaris leonina</strong></td>
<td>Transmission to adults is through ingestion of infective embryonated eggs from the environment</td>
<td>More likely to infect older puppies and adults. Zoonotic risk lower than for T. canis</td>
<td>Identify eggs microscopically after faecal flotation</td>
<td>Regular anthelmintic treatment. Prompt hygienic disposal of faeces</td>
</tr>
</tbody>
</table>

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(continued) Common ectoparasites of dogs. See also Chapters 27 and 29. (Illustrations © Susan Paterson)
### Preventive healthcare: a life-stage approach

#### References and further reading


#### Common helminth parasites of dogs

<table>
<thead>
<tr>
<th>Species (most common in bold)</th>
<th>Transmission</th>
<th>Clinical signs and health risks</th>
<th>Diagnostics</th>
<th>Treatment and control</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Ancylostoma caninum</em>, <em>Uncinaria stenocephala</em> (hookworms)</td>
<td>Infective larvae enter host by direct ingestion, via paratenic host, or by passage through pedal skin. Transmission may be common in kennelled dogs</td>
<td>Anaemia: may be severe and acute, especially in heavy infestations in young puppies. Intestinal or respiratory disease. Pedal dermatitis. Zoonotic: larval migration through skin causes dermatitis; adult worms in bowel may cause enteral bleeding</td>
<td>Identify eggs microscopically after faecal flotation</td>
<td>Regular anthelmintic treatment. Prompt hygienic disposal of faeces</td>
</tr>
<tr>
<td><em>Trichuris vulpis</em> (whipworm)</td>
<td>Transmission through ingestion of eggs from contaminated environment. As with hookworms, grass paddocks on which dogs have been kept for years may become very heavily infected</td>
<td>Heavy infestations may cause haemorrhagic colitis, anaemia, and stunted growth of puppies</td>
<td>Identify eggs microscopically after faecal flotation</td>
<td>Regular anthelmintic treatment. Prompt hygienic disposal of faeces</td>
</tr>
<tr>
<td><em>Echinococcus granulosus</em>, <em>Echinococcus multilocularis</em></td>
<td>Life cycle approximately 10–18 weeks. Transmission via ingestion of infected intermediate host; these slugs and snails are often quite small and can be ingested accidentally when dog eats vegetation, plays with toys or drinks from bowls kept outside. Until recent years was confined to restricted areas of UK (e.g. SW England, South Wales, Surrey) but now reported in most counties, possibly partly due to increasing urbanization of fox (also a definitive host)</td>
<td>Potentially very serious, even fatal: respiratory signs; bleeding diatheses; neurological signs. Non-specific signs (e.g. inappetence, vomiting, diarrhoea, weight loss)</td>
<td>Identify L1 larvae in faeces (Baermann technique). Egg shedding intermittent; examine separately faecal samples collected on 3 consecutive days to reduce risk of false negatives. L1 larvae may also be detected in bronchoalveolar lavage (BAL) samples</td>
<td>Treat with an appropriate systemic anthelmintic authorized for use against this parasite, e.g. products containing milbemycin or moxidectin</td>
</tr>
<tr>
<td><em>Oslerus osleri</em></td>
<td>Life cycle 10–18 weeks. Transmission via ingestion of larvae in contaminated environment. Associated with grass paddocks used regularly to exercise dogs for many years</td>
<td>Inflammatory nodules formed around worms in airways cause respiratory signs, especially a persistent cough</td>
<td>Visualization of airway nodules by bronchoscopy or radiography. Detection of L1 larvae in a BAL sample</td>
<td>Avoid keeping dogs on ‘stale’ grass paddocks where contamination levels are high. Appropriate anthelmintic treatment</td>
</tr>
<tr>
<td><em>Crenosoma vulpis</em> (fox lungworm)</td>
<td>Transmission via ingestion of larvae in mollusc intermediate host. Main definitive host is the fox: increasing urbanization of this species may have led to parasite becoming increasingly common</td>
<td>Mild to moderate respiratory signs</td>
<td>Baermann faecal analysis technique</td>
<td>Treat with an appropriate systemic anthelmintic authorized for use against this parasite or against A. vasorum</td>
</tr>
<tr>
<td><em>Dipylidium caninum</em>, <em>Taenia saginata</em>, <em>Taenia multiceps</em>, <em>Echinococcus granulosus</em>, <em>Echinococcus multilocularis</em></td>
<td>Transmission via ingestion of intermediate host. D. caninum: fleas ingested accidentally when dog grooms. Taenia, Echinococcus: infected cysts eaten by dog through hunting or scavenging activities, or in raw/undercooked meat. E. multilocularis mainly confined to Continental Europe</td>
<td>Motile proglottids may cause minor irritation to perianal area. Heavy infestations may lead to GI disturbance and weight loss. Echinococcus carry serious zoonotic risk</td>
<td>Proglottids may be detected in faeces, in environment or adherent to coat around anal area</td>
<td>Treat with appropriate cestocides. Treatment for fleas is an integral part of <em>Dipylidium</em> control. Taenia. Echinococcus: prevent dogs hunting and scavenging; do not feed raw or undercooked meat. For animals whose lifestyle potentially brings them into contact with infected intermediate hosts (e.g. farm dogs in Welsh hill farms) cestocide treatment should be repeated regularly (monthly) to limit reinfection. NB PETS travel scheme (see Figure 3.13)</td>
</tr>
</tbody>
</table>

3.20 (continued) Common helminth parasites of dogs.
Preventive healthcare: a life-stage approach

Chapter 3

QUICK REFERENCE GUIDES

QRG 3.1 Head-to-tail general examination

See also Figure 3.16. More detailed ocular, neurological and oral examinations are described in Chapters 21, 11, 16 and 20.

1 Examine the cornea, sclera, anterior chamber, pupil and iris in both eyes, the external surfaces and margins of the upper and lower eyelids, the nictitating membranes, the conjunctivae and the periorbital skin.

2 Examine the buccal surfaces of all the teeth, the gums and the lips. The external nares are also inspected.

3 Open the mouth and examine the lingual and occlusal surfaces of the teeth, the oral mucosal membranes, the oropharynx and the hard and soft palate. The range and ease of movement of the temporomandibular joints can also be assessed.

4 Examine both surfaces of the pinnae and the dorsal aspects of the external auditory canals, as well as the skin and coat of the face in that area.

5 Palpate around the head and face on both sides, particularly caudal to the angles of the jaw to assess the submandibular lymph nodes. Also palpate around the ventral neck and throat, and assess tracheal sensitivity.

6 Gently palpate the abdomen to assess size and shape of the abdominal organs (liver, kidneys, gastrointestinal tract, bladder, uterus) and for the presence of abnormal structures, fluid or gas. Any apparent pain on palpation should be noted. The spine, ribs and sternum are also palpated.

7 Inspect the skin and haircoat for skin lesions, coat abnormalities, cutaneous/subcutaneous masses and evidence of ectoparasites (grooming with a flea comb may assist this).

8 Palpate and inspect the structures on the ventral body surface (mammary glands in the bitch; scrotum, testes and prepuce in the dog). The femoral pulse is also palpated at this time.

9 Lift the tail to examine the anal sphincter, perianal skin (and the vulva in the bitch). The anal gland area should also be palpated externally.
10 Palpate each leg in turn along its length and then gently manipulate it to assess movement. The superficial lymph nodes (popliteal and prescapular) are also assessed at this stage.

11 Examine each foot, including the pads, toes and claws.

12 The heart, and then the lung fields, are carefully auscultated on each side.

The clinical examination may be varied depending on signalment, previous clinical history and clinical abnormalities identified.

- If indicated by the history or by the initial external examination, the external auditory canal and the tympanic membrane are examined using an otoscope with a clean speculum of the correct size (see also QRG 22.2).

- If the history or initial examination indicate, the eyes, including their internal structures, are examined in a darkened room with magnification from a direct ophthalmoscope (see also Chapter 21).
Dogs are often considered to be omnivores, meaning that they will eat both plants and animals; however, they do have some nutritional limitations. Like cats, dogs conjugate bile acids only with taurine, cannot synthesize vitamin D, and require dietary arginine. Unlike cats, however, dogs can live on a balanced and complete vegetarian diet. If food is available ad libitum, dogs will eat larger and fewer meals (four to eight per day) than cats. Obesity and weight management are mentioned below; see Chapter 14 for consideration of polyphagia and unintended weight loss.

Nutritional assessment

The World Small Animal Veterinary Association (WSAVA) has established an initiative to establish nutritional assessment as the fifth vital assessment (5VA) after temperature, pulse, respiration and pain; and the WSAVA has set up guidelines and tools for assessing nutritional status (www.wsava.org/educational/global-nutrition-committee).

Nutritional assessment includes consideration of animal-specific, diet-specific, feeding management and environmental factors.

- Animal-specific factors include age, life stage, activity, and disorders requiring specific dietary management.
- Diet-specific factors include diet safety and appropriateness (considerations include balance, quality, spoilage, contamination).
- Feeding factors include feeding frequency, timing, location and method (considerations include over- or underfeeding, treats, scavenging).
- Environmental factors include housing, other pets, access to the outdoors, and environmental enrichment.

The nutritional assessment has two parts: a screening evaluation and, when needed, an extended evaluation.

Screening evaluation

The screening evaluation should be performed for every pet at every visit, together with routine history-taking and physical examination. It includes:

- Dietary history
- Bodyweight
- Body condition score (BCS)
- Muscle condition assessment
- Evaluation of the haircoat.

Methods for assessing body condition score use either a 9- or a 5-point scale (Figure 4.1), with 4/9–5/9 or 3/5 ideal for dogs. Body condition is determined using visual appearance (e.g. is a waist apparent) and palpation of the amount of fat over the ribs. A body fat index (BFI) has also been developed, which is especially useful for overweight dogs (Figure 4.2).

The BCS and BFI evaluate body fat, but muscle loss can occur separately from fat loss, especially during illness (Figure 4.3). Disease may cause loss of muscle mass due to cytokine and neurohormonal effects on metabolism. Muscle mass scoring systems are based on palpation of skeletal muscle over the skull, scapulae, spine and pelvis (Figure 4.4).

If abnormalities are found during the screening evaluation of the dog, or an unconventional diet is being fed, an extended evaluation may be indicated.

Extended evaluation

Additional animal-specific factors include changes in food intake or eating behaviour.

The diagnostic investigation usually includes a minimum database (haematology, serum chemistry, urinalysis, possibly blood pressure) and other indicated tests, e.g. faecal tests, serum folate, vitamin B12, thyroxine, canine-specific pancreatic lipase, and imaging. The effects of nutrient wasting diseases such as diabetes mellitus or protein-losing enteropathies should be considered. Serum electrolyte concentrations or appetite may be affected by medications.

Diet-specific factors include the caloric density of the food. Any additional foods, e.g. treats, scavenging and food given to administer medication, should be evaluated for their effect on the overall diet balance and caloric intake. If contamination of the food is suspected, testing should be performed (e.g. for aflatoxins, *Salmonella*). The diet should also be assessed to determine whether it is complete and...
Body Condition Score

**UNDER IDEAL**

1. Ribs, lumbar vertebrae, pelvic bones and all bony prominences evident from a distance. No discernible body fat. Obvious loss of muscle mass.
3. Ribs easily palpable and may be visible with no palpable fat. Tops of lumbar vertebrae visible. Pelvic bones becoming prominent. Obvious waist and abdominal tuck.

**IDEAL**

1. Ribs easily palpable, with minimal fat covering. Waist easily noted, viewed from above. Abdominal tuck evident.
2. Ribs easily palpable without excessive fat covering. Waist well defined behind ribs when viewed from above. Abdomen tucked in when viewed from side.

**OVER IDEAL**

1. Ribs palpable with slight excess fat covering. Waist is discernible viewed from above but is not prominent. Abdominal tuck apparent.
2. Ribs palpable with difficulty due to heavy fat cover. Noticeable fat deposits over lumbar area and base of tail. Waist absent or barely visible. Abdominal tuck may be present.
3. Ribs not palpable under very heavy tail cover, or palpable only with significant pressure. Heavy fat deposits over lumbar area and base of tail. Waist absent. No abdominal tuck. Obvious abdominal distention may be present.

**Characteristics:**

- **Very Thin:**
  - More than 20% below ideal body weight
  - Ribs, spine & hip bones are very easily seen (in short-haired pets)
  - No fat can be felt under the skin

- **Thin:**
  - Between 10-20% below ideal body weight
  - Ribs, spine & hip bones easily seen
  - Visible waist with an abdominal tuck
  - Very little fat can be felt under the skin

- **Ideal:**
  - 5-15% above ideal body weight
  - Ribs, spine & hip bones easily felt
  - Visible waist with an abdominal tuck
  - A small amount of fat can be felt

- **Overweight:**
  - 15-55% above ideal body weight
  - Ribs, spine & hip bones are hard to feel
  - Waist, barely visible with a slight back
  - Layer of fat on belly and at base of tail

- **Obese:**
  - More than 5% above ideal body weight
  - Ribs, spine & hip bones extremely difficult to feel under a thick layer of fat
  - No fat can be seen and belly may drop significantly
  - Heavy fat pads on lower back and at the base of tail

- **Pet Size-O-Meter:**
  - Your pet is at healthy weight
  - Seek advice about your pet’s weight
  - Seek advice if your pet could be at risk

**All dogs should be assigned a body condition score (BCS).** (a) This WSAVA chart scores body condition out of 9. (b) A 5-point scale may also be used for body condition scoring.

(Courtesy of WSAVA Global Nutrition Committee)
Hill’s BFI risk chart

<table>
<thead>
<tr>
<th>BFI</th>
<th>Body Fat</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>16-25%</td>
<td>Low risk</td>
</tr>
<tr>
<td>30</td>
<td>26-35%</td>
<td>Mild risk</td>
</tr>
<tr>
<td>40</td>
<td>36-45%</td>
<td>Moderate risk</td>
</tr>
<tr>
<td>50</td>
<td>46-55%</td>
<td>Serious risk</td>
</tr>
<tr>
<td>60</td>
<td>56-65%</td>
<td>Severe risk</td>
</tr>
<tr>
<td>70</td>
<td>&gt;65%</td>
<td>Extreme risk</td>
</tr>
</tbody>
</table>

Ribs
- Slightly prominent. Easily felt.
- Thin fat cover.

Abnormal curve is detectable.
- Slightly to not prominent. Can be felt. Moderate fat cover.
- Very thick fat cover.

Shape from above
- Detectable lumbar waist.
- Broadened back.

Shape from the side
- Slight abdominal tuck.
- Markedly broadened back.

Shape from behind
- Round to square appearance.
- Square appearance.

Tail base bones
- Slightly to not prominent.
- Very difficult to feel.

Tail base fat
- Thin fat cover.
- May have a small fat dimple.
- Very thick fat cover.
- Large fat dimple or fat fold.

Muscle Condition Score

Muscle loss is typically first noted in the epaxial muscles on each side of the spine; muscle loss at other sites can be more variable. Muscle condition score is graded as normal, mild loss, moderate loss, or severe loss. In severely affected animals, the shape and general appearance of the body change. In the BFI, animals can have a few body fat categories, but not all have minimal muscle loss. Therefore, assessing both body fat index and muscle condition score on every animal at every visit is important. For example, severe muscle loss may be seen in the example below.

This 2-year-old Gordon Setter is showing severe muscle loss. The dog had a thoracic mass and was eating poorly.

Determining muscle condition score. (Courtesy of WSAVA Global Nutrition Committee)
balanced. Many homemade diets are not balanced, including many published in books or online. Some commercial diets are incomplete treats and should be labelled as ‘complementary’ food. Pet foods that are complete and balanced will state this on the label.

**Dietary recommendations**

Ideally, every dog should have a dietary recommendation on its discharge sheet. If no change is recommended, the owners should be advised that the current diet is adequate.

Therapeutic diets may be indicated; however, not all patients with a disease (e.g. hepatic, renal, cardiac) need a commercial therapeutic diet labelled as being for such disease. A concurrent disease may take precedence for diet recommendations, or a specific commercial diet may not be appropriate for the individual dog because of the disease stage or manifestation. For example, some diets for liver disease are protein-restricted, which is most appropriate when hepatic encephalopathy is present. In early (e.g. International Renal Interest Society (IRIS) Stage 1) chronic kidney disease however, a senior diet may initially be better than a severely protein-restricted diet. While the use of therapeutic diets for specific disorders is beyond the scope of this chapter, Figure 4.5 notes the features of some of the available diets that may be appropriate for a range of conditions. For more detail on clinical nutrition the reader is directed to the BSAVA Manual of Canine and Feline Rehabilitation, Supportive and Palliative Care.

### Life-stage feeding

Life-stage feeding means feeding to suit the needs of a dog of a specific age or physiological state, e.g. maintenance, reproduction, growth, old age. Requirements are summarized in Figure 4.6 and discussed further below.

#### Adult maintenance

Healthy adult dogs not doing hard work or exercise and neither pregnant nor lactating have ‘maintenance’ nutritional requirements. Further division is sometimes made into young adult or junior dogs, and mature or middle-aged dogs. One definition of ‘junior’ dogs includes those still growing but sexually mature; while young adults may be up to 5 years old.

#### Energy requirements

As healthy adult dogs vary in bodyweight from about 1 kg to 115 kg, energy requirements are often determined by the metabolic weight, which reflects actively metabolizing tissues. Various calculations are proposed for estimating metabolic weight; the most commonly used is bodyweight in kg to the power of 0.75. This, in turn, is used to calculate the resting energy requirement (RER), the calories needed at rest in a thermoneutral environment.

**Resting energy requirement**

RER is usually estimated as:

\[
RER (\text{kcal}) = 70 \times \text{bodyweight (kg)}^{0.75}
\]

For dogs between 2 kg and 30 kg, an alternative linear equation may be used:

\[
RER (\text{kcal}) = (\text{bodyweight (kg)} \times 30) + 70
\]

Healthy, non-working, pet dogs require 1.4–1.8 x RER for maintenance energy requirements (MER), also called daily energy requirements (DER). This is not an exact science, however, and the DER should be used as a starting guide only. As individual requirements vary greatly, dogs should be fed in order to achieve their ideal (not necessarily current) bodyweight and BCS. Variation occurs due to differences in activity, neutering status, individual metabolism and sometimes environmental temperatures. Due to this variation, owners may find that their dog gains or loses weight if fed according to the package label, and should be advised accordingly. Adjustments are made by estimation until the desired BCS is achieved. There is no magic formula for this, so consistency and patience are required. Owners should be encouraged to bring their dogs for regular weight checks and assessment of BCS until the ideal is reached.

#### Protein

Protein requirements are dependent upon the quality (amino acid profile) and digestibility of the food. The

**Disorder** | **Potentially beneficial dietary attributes**
--- | ---
Chronic kidney disease | Restricted phosphorus, moderate protein restriction, increased vitamins, high palatability, omega-3 fatty acids, medium-chain triglycerides
Cognitive dysfunction | Antioxidants, omega-3 fatty acids
Chronic small intestinal diarrhoea | Hydrolysed protein or novel protein, high digestibility, moderate to low fat
Colitis (chronic, idiopathic) | Increased mixed fibres (soluble and insoluble)
Constipation | Increased mixed fibres (soluble and insoluble)
Food hypersensitivity | Hydrolysed protein or novel protein
Hyperlipidaemia | Low fat (not necessarily low in calories unless weight loss is needed)
Liver disorders with hepatic encephalopathy | Vegetable proteins and moderate to restricted protein level, high palatability
Obesity | Low fat, low calories, a high fibre, increased protein, possibly l-carnitine
Osteoarthritis | Omega-3 fatty acids
Pancreatitis | Low fat (not necessarily low in calories unless weight loss is needed)
Urolithiasis | Exact diet depends upon type of stone; generally decrease urine concentration, may adjust urine pH and decrease constituent stone minerals

**4.5 Beneficial dietary attributes for dogs with selected disorders.**
Chapter 4 Nutrition

<table>
<thead>
<tr>
<th>Life stage</th>
<th>Energy (kcal)</th>
<th>Protein</th>
<th>Fat</th>
<th>Carbohydrates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult</td>
<td>1.4–1.8 x RER</td>
<td>18–23% DMB</td>
<td>10–15% DMB</td>
<td>No specific requirement</td>
</tr>
<tr>
<td>Work</td>
<td>2.0–5 x RER</td>
<td>22–34 % DMB</td>
<td>15 to &gt;50% DMB</td>
<td>15–65% DMB</td>
</tr>
<tr>
<td>Adult (after weaning):</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;50% adult weight</td>
<td>3 x RER</td>
<td>22–32% DMB</td>
<td>10–25% DMB</td>
<td>20% DMB</td>
</tr>
<tr>
<td>&gt;50–80% adult weight</td>
<td>2.5 x RER</td>
<td>22–32% DMB</td>
<td>10–25% DMB</td>
<td>20% DMB</td>
</tr>
<tr>
<td>&gt;80% adult weight</td>
<td>1.8–2.0 x RER</td>
<td>22–32% DMB</td>
<td>10–25% DMB</td>
<td>20% DMB</td>
</tr>
<tr>
<td>Gestation</td>
<td>1.8–2.0 x RER in first 4 weeks</td>
<td>20–25% DMB</td>
<td>&gt;8.5% DMB</td>
<td>&gt;20% DMB</td>
</tr>
<tr>
<td>Lactation</td>
<td>2–4 x DER</td>
<td>25–35% DMB</td>
<td>&gt;20% DMB</td>
<td>&gt;23% DMB</td>
</tr>
</tbody>
</table>

Approximate macronutrient guidelines for canine life stages. Always feed calories to ideal body condition as there is great individual variation in requirements. Amounts required by working dogs will depend upon the type and duration of the work.

Growth after weaning:

- From weaning to 50% of mature bodyweight, estimated DER = 3 x RER
- For 50–80% adult weight, estimated DER = 2.5 x RER
- During the remaining growth period, estimated DER = 1.8–2.0 x RER

Protein and other nutrients

Protein requirements of puppies are highest at weaning and decrease until maturity. For puppies 14 weeks and older, minimum protein requirements are estimated to be 17.5% DMB, with a recommended range of 22–32% DMB, consistent with most commercial puppy foods.

4.6. Absolute minimum allowance for crude protein on a dry matter basis (DMB) for adult dogs is 10%, with a recommended range of 15–30%.

Feeding frequency

Adult dogs may be fed once or twice a day, though feeding only once a day may increase the risks of gastric dilatation–volvulus in deep-chested dogs and of hypoglycaemia in toy breeds.

Puppies and feeding for growth

Most commercial puppy foods are higher in calories than adult maintenance foods. After weaning, puppies should be fed for an optimal growth rate for bone development and maintenance of appropriate BCS (Figure 4.7), rather than at maximal growth. Excessively rapid growth, especially in large-breed dogs, increases the risk of orthopaedic disorders. If puppies are fat during growth, they are more likely to become overweight adults. Feeding for a slower growth rate does not decrease the final adult size of the dog, although that size will be achieved at a greater age.

Energy requirements for puppy growth

Per kilogram of bodyweight:

- From weaning to 50% of mature bodyweight, estimated DER = 3 x RER
- For 50–80% adult weight, estimated DER = 2.5 x RER
- During the remaining growth period, estimated DER = 1.8–2.0 x RER

Calculating DMB

To convert from an ‘as fed’ to a dry matter basis

1. Subtract the percentage of moisture (water) from 100% to determine the percentage of dry matter:
   - If the moisture is >14% it will be stated on the label
   - For dry foods, either obtain the figure from the manufacturer or, less accurately, estimate it at 10%
   - If, for example, for a canned food this might be: 100%–83% water = 17% dry matter
2. Divide the percentage of the ‘as fed’ nutrient by the percentage of dry matter (as a fraction)
   - For example, for the same canned food diet with 20% protein on an ‘as fed’ basis: 7.5% as fed protein (on the label) ÷ 0.17 = 44.1% protein DMB

Notes:

- When calculating using percentages, first divide the percentage by 100: e.g. 17% becomes 0.17
- The amount of a nutrient on a dry matter basis will always be larger than it is on the ‘as fed’ basis
- Remember to use the percentage dry matter, not the percentage moisture.

To convert from a dry matter basis to an ‘as fed’ basis

Multiply the ‘as fed’ figure by the percentage dry matter:

- For example: 44.1% (DM) x 0.17 = 7.5% as fed

Growing puppies also have a requirement for the omega-3 fatty acid docosahexanoic acid (DHA) for normal neural, retinal and auditory development. Fish oils containing omega-3 fatty acids have been shown to improve trainability in puppies.
Growing dogs require more dietary calcium and phosphorus than do adults. However, if puppies are fed a correctly formulated puppy food these minerals should not be supplemented, especially in large breeds, as this can result in orthopaedic developmental disorders. Supplements may contain an incorrect ratio of calcium to phosphorus, and maintaining the correct Ca:P ratio of 1:1 to 1.8:1 in the diet is also important for correct bone growth. It is important to emphasize this to owners.

**Feeding frequency**
After weaning, most puppies should be fed a measured or weighed amount of food, as free choice or timed feeding are more likely to result in too rapid growth. From 6 weeks to 6 months, puppies should be fed two or three times a day. NB: Toy or other small-breed puppies can become hypoglycaemic if not fed at least this frequently.

**Feeding during reproduction and lactation**
Prior to breeding, bitches should be in ideal body condition. Most bitches gain 15–25% bodyweight during pregnancy. Most canine fetal growth occurs in the last trimester (about 3 weeks) of gestation. Energy requirements during pregnancy
- In early pregnancy, energy requirements are only about 18 kcal/kg more than maintenance DER
- After day 40 of gestation, energy needs increase to about 36 kcal/kg more than DER (i.e. an increase of 30–60% of DER), depending upon litter size. After whelping, the energy requirements increase even further and peak between 3 and 5 weeks of lactation. Requirements during this time are 2–4 times maintenance DER

As food intake may be limited by the size of the uterus during pregnancy, a food of higher energy density (>4 kcal per kg of food) may be necessary. Similarly, as the energy requirements of lactation are high, dietary energy density should continue to be high.

**PRACTICAL TIP**
The energy density of a diet is not always obvious from the packaging. In order to be able to give good advice, it may be necessary to contact the manufacturer.

**Protein and other nutrients**
During late pregnancy, protein requirement also increases by 40–70% above maintenance, which requires a diet with 20–25% crude protein DMB. The protein quality should be good, as deficiencies may decrease birth rates and increase early puppy mortality. During lactation, the protein requirement increases more than the energy requirement, so diets should contain high-quality protein at 25–35% DMB. As commercial diets for gestation and lactation are uncommon, a good puppy food, which should be adequate in energy and protein, is often fed during gestation and lactation.

During late pregnancy, dogs may have a requirement for dietary carbohydrates, as >50% of the energy for fetal development comes from glucose. Feeding a diet with 20% carbohydrate calories or >23% carbohydrate DMB should help prevent hypoglycaemia and ketosis in the dam. Sufficient carbohydrate intake also provides for adequate production of milk lactose (Figure 4.8).

Providing fat as at least 20% DMB and including all essential fatty acids is important during late pregnancy and lactation. Increased dietary fat increases caloric density. Inclusion of fish oils in the diet of pregnant and lactating bitches may aid fetal neurological and retinal development (Bauer et al. 2006).

**Feeding older dogs**
Dogs are considered older when they reach about half their life expectancy, e.g. 7 years for small dogs, 5 years for large dogs, and even earlier for some giant breeds. Changes with ageing may include weight gain, arthritis and behavioural changes, as well as increased risk for many other diseases.

**Energy requirements**
At around 7 years of age there is often a decrease in energy expenditure, and a DER of about 1.4 x RER or less may be appropriate. This is very individual and the diet should be appropriate for body condition and any concurrent disorders. An increase in dietary fibre may help prevent constipation and usually decreases the caloric density.

**Protein and other nutrients**
Recommendations for protein intake for older dogs are controversial. As muscle mass loss (sarcopenia) is common with ageing, more protein may be needed; however, as the incidence of renal insufficiency increases with age, this must be addressed carefully. High-protein diets have not been shown to increase the risk of kidney disease, but if renal function is already impaired they may or may not affect disease progression (Elliott, 2006). High-quality protein at 15–25% DMB is appropriate for many older dogs. Phosphorus should be adequate but not excessive, with recommended concentrations of 0.3–0.7% DMB.
The use of diets containing omega-3 fatty acids and antioxidants, such as vitamins E and C, has been researched in older dogs. Oxidative metabolism creating free radicals has been associated with the signs of ageing, and some antioxidant combinations have been shown to decrease oxidative stress and improve cognition. Increased dietary concentrations of omega-3 fatty acids can improve the signs of osteoarthritis. The use of medium-chain triglycerides has also been recommended as an energy source for brain tissue in older dogs and to improve age-related cognitive decline (Taya et al., 2009; Pan et al., 2010).

**Feeding for exercise and work**

Dietary recommendations for exercise or work depend upon the intensity and duration of the work. Sprinting dogs such as racing Greyhounds have more type II (fast-twitch) muscle fibres, which have more glycolytic capability than type I (slow-twitch) fibres. Dogs performing endurance tasks, e.g. sledge dogs, have more muscle oxidative capacity and type I fibres. Agility dogs, hunting dogs, and dogs doing similar exercise are intermediate athletes; they are more similar to endurance dogs than to sprinting dogs in energy use and muscle type. The determination of fibre type is mostly genetic, although it can be influenced by training.

Muscles need adenosine triphosphate (ATP) for energy. In the first seconds of exercise the source is muscle creatine phosphate. Glucose from muscle and then liver glycogen stores is then metabolized anaerobically by glycolysis. After several minutes the body shifts towards aerobic glucose oxidation. With prolonged exercise, fatty acid oxidation begins, first from fatty acids stored in muscles, and then from lipid stores.

As sprinters depend on anaerobic carbohydrate metabolism and endurance athletes rely on oxidative metabolism, their dietary and caloric requirements differ.

**Energy requirements for working dogs**

- In dogs sprinting for short periods DER may be 1.6–2 x RER
- For intermediate athletes DER ranges from 2 to 5 x RER
- Dogs doing extremely high levels of work may need >5 x RER

**Protein and other nutrients**

Sprinting dogs may require a high-carbohydrate diet, although research results are conflicting on the effects on speed of high-carbohydrate versus high-fat diets. The more endurance that is required, the more dietary fat may be needed to delay fatigue, although increased fat should be introduced slowly and the diet should remain balanced. Many sporting dogs benefit from the increased caloric density of commercial performance diets, although they should not be allowed to become overweight.

Protein requirements increase slightly with increased work, to maintain protein synthesis. Protein is used as an energy source during work, although for only 5–15% of energy. Generally, fat and carbohydrates should provide energy, and protein should be used for muscle anabolism. High-protein diets (37% of calories) decrease the performance of sprinting dogs compared with a diet containing 24% calories as protein. Intermediate athletes should have at least 24% of calories in the form of protein, which may not be met by some commercial diets.

There is some evidence that vitamin E, at 500 IU/kg DM, can improve performance in endurance dogs through its antioxidant properties improving resistance to muscle fatigue. Selenium may also have beneficial antioxidant effects, but no good evidence exists in dogs.

**Choosing a food**

The food chosen should be appropriate for the life stage and have appropriate caloric density for the dog’s activity and body condition (see above).

**Commercial petfoods**

The label of a commercial petfood should state that it is a ‘complete’ food for the life stage, as some are ‘complementary’ treats. Supplementing with complementary foods, human foods, or treats can cause dietary imbalance, especially if these represent >10% of calorie intake. Ideally, petfood companies should do controlled feeding trials, employ veterinary or animal nutritionists and have good quality control. Top petfood companies support and publish good evidence-based pet nutrition research.

**PRACTICAL TIP**

Packaging may state ‘premium’, ‘human grade products’ or ‘hypoallergenic’; these terms have no legal labelling definition and should not be taken into consideration when choosing a food.

**Homemade and raw diets**

If an owner wishes to feed homemade or raw diets, the veterinary surgeon should inform them of the potential benefits and risks. The lack of preservatives or additives is appealing to some owners, but means the diets may spoil or become rancid more quickly. Owners should also be aware that a properly balanced homemade diet is not necessarily cheaper than a commercial diet.

The feeding programme for some homemade diets is meant to balance over weeks rather than per meal; however, in a study of such feeding programmes none was found to be balanced and complete (Stockman et al., 2013). A study of a bones and raw food (BARF) diet showed deficiencies in calcium, phosphorus, potassium and zinc (Dillitzer et al., 2011). When human vitamin supplements are used there is a risk of excessively high vitamin D content. Similarly, diets published in books or on websites are often unbalanced or incomplete. Some adult dogs may be able to cope with dietary imbalances, but these may negatively affect the bones, coat, faecal quality, skin and immune system of growing dogs.

Studies on bacterial contamination of canine raw food diets have shown that 80% of diets tested positive for *Escherichia coli* and *Yersinia enterocolitica* (Weese et
Nutrition

11/06/2015   09:42

by a veterinary nutritionist. A homemade diet should be checked or formulated
fully aware of the risks of inducing malnutrition; any safer than feeding cooked bones. If an owner wishes
is no objective evidence that feeding raw bones is bones obstructing the oesophagus, stomach or intestines with potential fatal complications. There is no objective evidence that feeding raw bones is safer than feeding cooked bones. If an owner wishes to feed a homemade diet, they should be made fully aware of the risks of inducing malnutrition; any homemade diet should be checked or formulated by a veterinary nutritionist.

Obesity

Overweight or obesity is the most common canine nutritional disorder in many countries, and there has been an estimated 400% increase in the last 25 years in Britain. A survey by Courcier et al. (2010b) of prevalence in different countries reported rates of between 24% and 59% in adult dogs.

Severely obese dogs with body fat >40% (Figure 4.9) are at greater risk for anaesthetic and surgical complications, heat or exercise intolerance, cardio-respiratory disorders, dermatopathies, neoplasia, urogenital disorders, abnormal glucose tolerance, and early mortality. Obesity also exacerbates signs of tracheal collapse and laryngeal paralysis. In a study of obese dogs with osteoarthritis, clinical signs of lameness improved when they lost 6–9% of their bodyweight (Marshall et al., 2010). A lifelong feeding trial in Labradorors showed that lean dogs on restricted feeding lived almost 2.5 years longer and had less chronic diseases (e.g., arthritis) than those fed ad libitum (Kealy et al., 2002). Feeding highly palatable diets ad libitum is one of the most important factors influencing obesity. Giving table scraps and treats to dogs also contributes. In some adult dogs, up to 50% of calorie intake may be table scraps or human foods, particularly in toy breeds.

Feeding frequency may affect food intake and metabolic efficiency. Increased frequency of meals results in more energy loss due to meal-induced thermogenesis; however, in a small study (Bland et al., 2009) the number of meals fed was not linearly associated with canine body condition. Smaller food bowls can help regulate portion size (Murphy et al., 2012). Many dogs increase their food intake in the presence of other animals, but being a sole dog in a household has also been associated with increased risk of obesity. Low activity levels are a predictor of obesity in both dogs and cats (Courcier et al., 2010ab).

Weight management

Many obesity management programmes exist, and options should be discussed with owners of overweight dogs. Referral to a veterinary nutritionist or a weight loss clinic may help. Losing weight is more difficult than preventing obesity, as the metabolic rate is lowered during calorie restriction. As weight gain often starts after neutering if calorie intake is not adjusted, owners should be advised of the risks at that time. If weight gain and an increase in BCS is noted during the nutritional assessment, an intervention should occur. Further details on obesity and weight management can be found in the BSAVA Manual of Canine and Feline Rehabilitation, Supportive and Palliative Care.

References and further reading


47

This 5-year-old male neutered Corgi had a BCS of 9/9 and almost 50% body fat. He was at serious risk of obesity-related disease and a weight loss programme was instigated.

WARNING

When handling raw foods, hygiene is very important. Raw meat should not be handled by small children, the elderly or the immunocompromised


**Useful websites**

American Academy of Veterinary Nutrition: [www.aavn.org](http://www.aavn.org)

American College of Veterinary Nutrition: [www.acvn.org](http://www.acvn.org)

Pet Food Manufacturers Association: [www.pfma.org.uk](http://www.pfma.org.uk)

WSAVA: [www.wsava.org/educational/global-nutrition-committee](http://www.wsava.org/educational/global-nutrition-committee)
Chapter 5

Reproductive management

Angelika von Heimendahl

This chapter considers the management of canine reproduction: how to prevent unwanted pregnancies; pre-breeding advice; and normal whelping. It also discusses common neonatal problems. Details of reproductive physiology can be found in the BSAVA Manual of Canine and Feline Reproduction and Neonatology. A clinical approach to some disorders of the reproductive tract is given in Chapter 26.

Prevention of breeding in the bitch

Prevention of breeding in the bitch is one of the most common requests in general practice. Neutering advice varies greatly throughout the world, depending very much on welfare views of managing canine populations and the rights of the individual. In the UK most practices recommend spaying at 6 months of age or waiting until the bitch has had one season. In the USA many puppies are neutered before 12 weeks of age while in the possession of the breeder or a rescue centre. At the other end of the spectrum, in Norway ovariohysterectomy is considered mutilation and prohibited under an animal welfare act, as it is defined as invasive elective surgery on a healthy animal.

There are temporary and permanent, invasive and non-invasive methods to choose from. When advising on which method to choose to prevent oestrus in the female, or whether to leave them entire, it is important to inform the owner of the different options and also to take known factors (e.g. previous accidental matings, entire dog cohabiting) into consideration.

Non-invasive, temporary approach

Drugs can be used for the temporary suppression of oestrus (Figure 5.1).

Progestogens

Synthetic analogues of progesterone are often used for the short-term postponement (given in early pro-oestrus) or prolonged delay (given in anoestrus) of oestrus. Care should be taken if administering proges- terone analogues during pro-oestrus as the combination of oestrogen and progesterone may induce uterine disease and subsequent pyometra. Progesterone also alters behaviour, libido and appetite, leading to decreased activity and weight gain. Progestogens have also been reported to lead to mammary gland tumours, diabetes mellitus and Cushing’s syndrome.

GnRH superagonist

In some countries implants of the gonadotrophin-releasing hormone (GnRH) superagonist deslorelin are inserted during oestrus and then subsequently every 12 months to suppress oestrus. This has far fewer side effects than progestogens as it works at the pituitary level to suppress GnRH receptors. The drug is not yet authorized for this use.

Invasive, permanent approach

The most common technique used is ovariohysterectomy (OHE; see QRG 5.1). As the removal of the ovaries and uterus is irreversible, it is important to be aware of the advantages and disadvantages of the procedure for each individual.

Advantages of neutering

- Decreased incidence of mammary gland neoplasia
- No uterine or ovarian disease
- No oestrus and associated problems (male attention, roaming, pseudopregnancy, vaginal hyperplasia)
- No pregnancy-related problems
- Early neutering decreases the incidence of mammary gland neoplasia. Bitches that have been neutered before puberty have an incidence of

<table>
<thead>
<tr>
<th>Drug</th>
<th>Example of commercial product</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Progestone</td>
<td>Delvosteron Injectable</td>
<td></td>
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<td>Medroxyprogesterone</td>
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<td>Megestrol</td>
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 nymphal and never on its own. Pyometra is a common problem in entire females and about 15% will develop it during their lifetime. With the removal of the gonads and uterus, the occurrence of any diseases of these organs is eliminated.

Problems with oestrus range from difficulties of giving bitches their usual walk, through not wanting to have an animal with sanguineous discharge in the house twice a year, to not being able to avoid accidental matings. The practicalities of non-surgical options should be discussed with the owners.

The disadvantages of neutering are often not discussed, as spaying is presented as the ‘responsible pet ownership’ option. There are, however, certain problems that may arise with neutering.

### Disadvantages of neutering

- Surgical procedure and potential complications
- Risk of urinary incontinence
- Increased risk of obesity

- Short-term surgical complications range from haemorrhage of the ovarian and/or uterine pedicles, to postoperative infections and the breakdown of sutures. Long-term problems are mostly ovarian remnants and granulomas.

- Urinary incontinence is caused by the lack of stimulation of the external urethral sphincter by oestrogen. Incontinence can start from 6 months to many years after removal of the gonads, but on average, if it does occur, onset is about 2.5 years after neutering. Leaving bitches entire for longer has no preventive benefit. Urinary incontinence is much more common in breeds with an adult bodyweight >30 kg and in some breeds in particular, such as Boxers. Neutering before 3 months of age also increases the likelihood of developing urinary incontinence later in life.

- The decrease in mammary gland tumours is a well known advantage of early neutering. It is less well known that certain uncommon high-morbidity tumours (e.g. haemangiosarcoma, osteosarcoma and transitional cell carcinoma; Society of Theriogenology (2009)) may occur after early neutering, which in the UK is carried out at 6–8 weeks of age. The reasons given are a reduction in the tendency for weight gain, giving a fat body on a longer limb and greater leverage on susceptible joints. Dogs are very trainable and unwanted behaviour can easily be avoided. In the case of aggression, i.e. in particular fear aggression, castration neither helps nor aggravates the problem. If the dog lives in a controlled responsible pet ownership situation there is no compelling medical reason why the animal should be castrated at a young age.

### Pregnancy termination

Before embarking on any treatment to terminate a possible pregnancy, the likelihood of conception at the time of mating should be established. This is possible without any risk to the outcome as the drug used, aglepristone, may be used throughout pregnancy.

Aglepristone is a synthetic steroid that has a strong binding affinity for progesterone receptors in the uterus of the bitch. It has a short half-life of around 4 days. As it blocks progesterone, it is important to administer during late pro-oestrus or oestrus, as there is a danger of sperm ‘outliving’ the treatment or further later matings, still achieving fertilization. Another approach is to wait for 3–4 weeks to establish whether the bitch has become pregnant, and then treat.

#### Using aglepristone (Alizin) in the bitch

- Inject 10 mg/kg s.c.: two injections over 24 hours
- Accurate bodyweight required for correct dose
- Can be used on days 0 to 45 of pregnancy
  - Prior to day 22 = ~100% efficacy
  - After day 22 = 95% efficacy
- Use at the end of oestrus

### Prevention of breeding in the male dog

Routine neutering of male dogs is increasing in the UK. Many practices will recommend castration at 6 months of age. The reasons given are a reduction in testicular and prostate gland disease, and the prevention of unwanted male sexual behaviour such as marking and aggression. Most testicular neoplasia is benign, however, and the common prostatic hyperplasia is very treatable. It is also worth mentioning that castration delays physeal closure and may affect the circumference of long bones. This can be a problem in large breeds prone to osteoarthritis, as there is the tendency for weight gain, giving a fat body on a longer limb and greater leverage on susceptible joints. Dogs are very trainable and unwanted behaviour can easily be avoided. In the case of aggression, in particular fear aggression, castration neither helps nor aggravates the problem. If the dog lives in a controlled responsible pet ownership situation there is no compelling medical reason why the animal should be castrated at a young age.

### Non-invasive, temporary approach

There have been several approaches using progestogens, androgens and prolactin, but the drug of choice is the deslorelin implant. Deslorelin is a GnRH...
superagonist that reduces the production of follicle-stimulating hormone (FSH) and luteinizing hormone (LH) from the pituitary gland, preventing spermogenesis (Figure 5.2) and testosterone production. Serum testosterone drops to <1 ng/ml within 2–3 weeks and sterility should be achieved by 4–6 weeks post-implantation. Implants are available in different strengths: 4.7 mg and 9.7 mg, one lasting 6 months and the other for 12 months, although individual response may vary greatly. One of the side effects is that testicles shrink markedly but increase in size again when the deslorelin wears off.

**Breeding advice**

There are four main groups of breeders:
- **Show and pedigree breeders** (organized through the Kennel Club in the UK)
- **Breeders of working dogs**, mainly Border Collies
- **Breeders of racing Greyhounds**
- **Pet owners**, who may wish to have just one litter from their pet.

It is usually the owner of the bitch who approaches the owner of the stud dog to ask for use of the male. Pet owners should be advised on health testing prior to breeding, the demands of a litter on space and time, and possible complications during pregnancy, birth and lactation. Owners who believe that every bitch should have one litter before she is neutered should be informed that this is not the case. First whelpings have a higher complication rate, and subsequent neutering could then mean a second surgery.

**Advisories of neutering**
- No testicular neoplasia
- Reduced incidence of benign prostatic hyperplasia
- Reduced incidence of marking, roaming and overt male sexual behaviour

**Disadvantages of neutering**
- Potential complications during surgery
- Increased risk of certain cancers, e.g. prostatic carcinoma
- Increased risk of obesity

**Immunosterilization** is a technique that promises to become available in the future. Several targets of immunocontraception have been identified, such as GnRH, LH and sperm antigens.

**Invasive, permanent approach**

Castration using an open surgical approach is described in QRG 5.2. Ease of surgical sterilization depends on age (paediatric, adult, geriatric) and the location of the testes (descended, monorchid, cryptorchid). Males castrated before 7 weeks of age have smaller penile and preputial development, with a higher incidence of paraphimosis.

**BVA Health Schemes**

Canine health schemes provide dog breeders with the option of testing for certain inherited diseases. The following schemes are available and a list of breeds and conditions are attached to each one. Latest information can be found at www.bva.co.uk
- Hip scheme
- Elbow scheme
- Eye scheme
- Chiari malformation/syringomyelia scheme

Most general practices will also deal with Kennel Club (KC) members. The KC has subgroups of breed societies, which are very knowledgeable about their specific breed, its characteristics, problems and any health testing they will recommend before choosing a breeding animal. Many people are not aware of the fact that even when the animals fail testing the offspring can still be registered through the KC as long as the pedigree proves that they are pure-bred. The KC will register puppies born to a dam over 12 months of age, although most breed societies recommend waiting until 2 years of age for a first litter.

**Some physiological considerations**

**Puberty**
- The age of puberty (i.e. first oestrus, sperm production) varies greatly between individuals and also between breeds.
  - Bitches usually ‘come into season’ for the first time aged 6–12 months, but for some this may be as late as 24–30 months of age.
  - Dogs usually produce sperm by the age of 6 months, but should not be used for breeding until they are at least 12 months of age, in order to produce sufficient numbers of mature fertile spermatozoa.
- Puberty is affected by age, weight and body condition. The bitch or dog needs to have reached about 80% of its adult bodyweight, with some accessory fat deposits. Larger breeds tend to reach that weight later and therefore start puberty later.
The first oestrus of a bitch is sometimes unovulatory, with long periods of sanguineous vulval discharge and low progesterone levels. The next oestrus will usually follow shortly afterwards and follow through normally with ovulation occurring; this is sometimes referred to by breeders as a ‘split season’. This has no bearing on her future fertility.

The canine oestrous cycle

The normal bitch cycle is unique in the world of mammals, having the following characteristics.

- Long inter-oestrus interval, which is non-seasonal: bitches will cycle on average every 7 months, although inter-oestrus intervals of 5–12 months are normal. Some more ‘primitive’ breeds (e.g. Basenji) will have only one oestrous cycle a year.
- Long duration of pro-oestrus/oestrus: up to 30 days.
  - Outward signs of pro-oestrus are a serosanguineous vulval discharge and an enlargement of the vulval lips. ‘Days in season’ are counted from then on. Increased interest from male dogs and frequent urination are further signs.
  - During early oestrus, oestrogen declines and cells inside the unovulated follicles begin to produce progesterone, so that mating technically takes place in the early luteal phase (Figure 5.3). The change from oestrogen to progesterone also causes characteristic changes in vaginal cytology (see later) and visible shrinkage of the vulval mucosa, resulting in small wrinkles.
  - A bitch is said to be ‘in season’ when she will accept mating. Behavioural changes include standing, turning of the tail, and spinal lordosis. Bitches in oestrus produce pheromones that can be detected by male dogs and also seem to stimulate GnRH release in other females. However, mating behaviour is not a good indicator of the fertile period.
- Bitches are spontaneous multiple ovulators. Ovulation may occur as early as 5 days into pro-oestrus/oestrus or as late as 25 days, although most bitches will ovulate between 10 and 15 days after the onset of pro-oestrus.
- Unlike in other mammals, the oocytes produced are immature and cannot be fertilized for at least 48 hours after ovulation, even if sperm are present.
  - After maturation is completed, the oocyte remains viable for up to 3 days, which is defined as the ‘fertilization period’ (Figure 5.4). The combination of long oocyte survival and long sperm survival time means that matings that occur over a long period during oestrus can result in pregnancies.
- Non-pregnant and pregnant females undergo similar physiological changes.
  - Progesterone influences the transport time of the ova/embryos through the oviduct and encourages the closure of the cervix. The progesterone phase of the cycle lasts for 61–65 days regardless of whether the bitch is pregnant or not. In pregnant bitches, the progesterone phase ends at parturition (see Figure 5.11). The luteal phase in the pregnant and non-pregnant bitch is almost identical. The fall in progesterone level at the end of 2 months induces a rise in prolactin and, with it, lactation. The changes caused by the long progesterone phase and the subsequent prolactin phase in the non-pregnant female, such as increased appetite, change in character, mammary gland development, lactation and nesting, have been described as ‘pseudopregnancy’. In other species this refers to females that have had sterile matings or have uterine contents that will keep them in a ‘state of pregnancy’. In the bitch this phase is physiological and only sometimes causes problems, which are easily treated with 5–7 days of anti-prolactins such as cabergoline.
  - The influence of oestrogen followed by progesterone may lead to cystic endometrial hyperplasia and/or pyometra. Fertility in the bitch will deteriorate over successive seasons if she does not become pregnant.
Inducing oestrus
Predicting the start of a season is impossible because of the variation in inter-oestrus intervals between bitches, and even within one individual. Oestrus can sometimes be brought on by the presence of other bitches in oestrus, by changes of environment or by the introduction of an unknown male. This great variation makes planning the year ahead very difficult for breeders, especially when they want to use a stud dog from overseas.

Drugs that have been used to induce oestrus in the bitch
- Prolactin antagonists, e.g. cabergoline
- GnRH agonists, e.g. deslorelin
Note that these drugs are not specifically authorized for this use

Pre-breeding examination
Bitches and dogs presented for breeding purposes should be examined for general health and possible previous breeding history.

- Animals with known conditions such as epilepsy, diabetes mellitus, disc prolapses, hip dysplasia or degenerative eye diseases should be excluded from breeding.
- Although many registered breeds have specific health problems, there is also over-optimism that ‘crosses’ are always healthy.
- Vaccinations and worming should be up to date before the bitch comes into season, if at all possible.
- Some breeders still request swabbing dogs or bitches for possible infections. These swabs have no clinical relevance, as they tend to grow a mixture of staphylococci, streptococci and Escherichia coli that will not be a problem. Only if there is an unusually copious amount of malodorous discharge is an investigation useful. Routine use of antibiotics is detrimental to the commensal bacterial flora of the mucosa and counterproductive, as well as potentially creating resistance in the long term.

Assessing fertility in the male dog
Fertility in the male dog can be evaluated by collecting and assessing semen. Testosterone production and Leydig cell maturation starts at about 5 months of age and most dogs will produce viable sperm by the time they are 10–12 months old, with smaller breeds maturing slightly earlier than larger breeds. Total sperm output increases from then on until about 2 years of age, when it plateaus.

Spermatogenesis
- Spermatogenesis in the dog follows the same path as in other species
- Spermatogenesis and final maturation take about 60 days
- Dogs will store large numbers of spermatozoa (400–1200 million) depending on body size and testicular volume
- Daily production of sperm in a frequently ejaculated dog will reach about 400 million per day

Semen collection: There are several collection kits available commercially. A dog handler or familiar person should be present. It is usually best to have a teaser bitch in season available in order to achieve ejaculation.

1. Once the bulbous part of the penis begins to swell, the prepuce is pushed backwards over the bulbous penis.
2. The base of the penis is held by the person collecting and turned backwards, so that collection takes place between the hindlegs of the dog.
3. Dogs ejaculate in three fractions. In a medium-sized dog the following volumes may be produced:
   i. A small amount of prostatic fluid (0.5–1.0 ml)
   ii. Sperm-rich fraction (0.5–3.0 ml)
   iii. Prostatic fluid (5–20 ml).
4. Once ejaculation occurs, the first and second fractions are collected (Figure 5.5).
5. The semen is kept at room temperature for evaluation.

Collection tubes with different fractions of the ejaculate. The prostatic fluid is clear whereas the sperm-rich fraction is a cloudy white.
Semen evaluation: The following parameters can be assessed.

- Volume: can be measured easily using calibrated collection tubes.
- Colour: should be assessed to record possible contamination with urine or blood.
- Sperm concentration: can be determined using specialist equipment or a haemocytometer counting chamber. Total sperm output (TSP) can be calculated by multiplying volume by concentration.
- Motility: assessed subjectively by placing a small amount of sperm on a warmed slide under the microscope. Sperm motility is extremely temperature-dependent and care must be taken to achieve and maintain body temperature on the slide during assessment. In a normal fertile dog, >80% of the sperm will show forwardly progressive motility.
- Morphology: requires vital staining of spermatozoa, which will kill them and allow assessment under high magnification (Figure 5.6). Spermatozoa are made up of the head (containing the nucleus and acrosome), the midpiece (containing the mitochondria) and the tail. A normal fertile dog will have 80% normal live spermatozoa.

5.6 Abnormal spermatozoa, showing one sperm with three tails and another with a swollen midpiece. Both heads also have several vacuoles on the surface.

Optimum mating time

Breeders have determined optimum mating times for dogs over thousands of years. They use behavioural changes and outward signs of the drop in oestrogen and rise in progesterone to find the right time for mating:

- Bitch standing and receptive
- Dog showing mounting and mating behaviour
- Mating on set days (e.g. days 11 and 13 when ovulation is likely)
- Colour change of vulval discharge from sanguineous to serum colour
- Decrease of vulval swelling and wrinkling of the inner vulval mucosa.

When these parameters are recorded carefully and accurately, and animals are of a reasonable breeding age (2–6 years), pregnancy rates are remarkably high, at between 70 and 80%.

Veterinary surgeons are often contacted when a bitch has been mated several times and not become pregnant, or when breeders have used progesterone testing successfully before. Stud dog owners find it particularly useful to have bitches tested before the stud is brought over as they often have no other control over the suitability of mating dates. It is also useful to emphasize to breeders that once the ovulation date is determined, whelping dates can be predicted accurately as well.

Once ovulation has taken place, matings may be attempted from +1 to +4 days from then. Usually two matings are booked with the stud dog within this period.

Veterinary techniques that can be used to determine optimal mating time are:

- Vaginal cytology
- Plasma progesterone assay
- Endoscopy
- Ultrasonography.

Vaginal cytology

Vaginal cytology is used routinely to determine different stages during pro-oestrus and oestrus in the bitch. It is cheap and easy and requires just a little experience. Samples are collected by aspiration with a plastic catheter and 1 ml syringe, or using a cotton bud. The cells (not too many) are transferred on to a microscope slide and spread into a thin film. Smears are then stained using Wright–Giemsa (or Diff-Quik) in the usual way.

The cells found will indicate whether there is any hormonal influence:

- With the increase of oestrogen, the cells become larger and rounded, with a small nucleus (Figure 5.7a)
- A rise in progesterone causes the cells to keratinize (Figure 5.7b); the percentage of anuclear cells usually increases to >80% during the fertilization period
- Once large numbers of polymorphonuclear leucocytes are found, the fertile period has ended.

5.7 (a) Large rounded cells with small nuclei are typical of the oestrogen phase. (b) Keratinized squamous cells are typical of the fertile phase. (Diff-Quik; original magnification X400)
Plasma progesterone assay

Progesterone is produced in the bitch by pre-ovulatory follicles and corpora lutea. Plasma levels accurately reflect stages in the oestrous cycle (see Figure 5.3). They can be used to:

- Predict ovulation
- Confirm ovulation has taken place
- Determine the end of the fertile period
- Monitor ‘silent seasons’
- Monitor the luteal phase during pregnancy
- Predict parturition.

Progesterone can be measured in house, using semi-quantitative ELISA kits (Figure 5.8), or sent to commercial laboratories.

Once progesterone starts to rise, it roughly doubles every 2 days, and testing should be spaced accordingly so as to limit expense to the breeder. Given the 2 days’ maturation time for canine oocytes and the long fertilization period, testing should not be more frequent than every 48 hours.

Endoscopy

Endoscopy reveals the changes in the vaginal mucosa relating to the different stages in the cycle (Figure 5.9). Unlike in other species, the mucosa changes from being moist, pink and oedematous during pro-oestrus to a shrinking and wrinkly appearance with a pale colour during peak oestrus. As the bitch moves into metoestrus the mucosa takes on a patchy thin-walled appearance.

Endoscopy is a helpful tool, if available, and most bitches will not require sedation, but it cannot be used alone to determine optimum mating time.

Ultrasonography

Using real-time B-mode ultrasonography and 5 MHz, 7.5 MHz and 10 MHz probes it is possible to visualize the ovaries of the bitch. Follicular growth can then be monitored on a daily basis to detect ovulation. However, the corpus haemorrhagicum, which follows ovulation, has a very similar appearance to pre-ovulatory follicles. In most animals some clipping of the flank area is required; this is very unpopular with breeders as it can take many months for the hair to grow back and excludes them from showing the dog.

Mating

The act of mating takes longer in dogs than in most other animals. The dog and bitch will display courting behaviour when they first meet but it is usually the bitch who decides whether she will accept the
male, unless he is very experienced and dominant. The dog will then mount the bitch and try to achieve intromission, with a partially erect penis, helped by the penile bone. Once intromission has been achieved, the bulbous part of the penis will extend fully inside the vagina and thus ‘tie’ the male to the female. This is followed by ejaculation. The tie can last for 5–60 minutes. Breeders refer to matings where a tie is not achieved and the dog ejaculates as ‘slip matings’: they can still lead to pregnancies but pregnancy rates are lower and fewer puppies are usually born.

Sperm survival in the female tract is particularly long: good-quality semen can survive and fertilize for up to 7 days.

**Pregnancy diagnosis**

Early pregnancy diagnosis in the bitch is difficult and unreliable. Owners will sometimes notice a persistent swelling of the vulva, change in behaviour, swelling of the nipples and occasional malaise. A small amount of white sticky non-odorous discharge can sometimes be observed in mid-pregnancy.

**Manual palpation**

Depending on the size of the bitch and the experience of the veterinary surgeon, the pregnant uterus can be palpated at around 3 weeks of gestation. Each conceptus has a circumference of around 15 mm and they are well separated from each other. At 4 weeks they have grown to around 25 mm; they then start to become soft, and the uterus extends overall.

**Ultrasonography**

B-mode real-time scanners using a 5–10 MHz probe can be used to detect pregnancy from about 17 days onwards, although given the long sperm survival time it is better to wait until about 25–28 days. As well as establishing an estimate of the number of puppies, viability through imaging heart beats can also be assessed. Figure 5.10 shows an ultrasound image of a 4-week pregnancy.

**Relaxin assay**

Relaxin is the only pregnancy-specific hormone in the bitch and is produced in measurable amounts from about 25 days of pregnancy. It can be assessed using whole blood and an in-house ELISA kit or by a commercial laboratory. Persistence of relaxin for a few days after possible fetal reabsorption sometimes leads to false-positive results.

**Radiography**

Radiography is a very useful tool in later pregnancy, from about 42 days onwards. It is also helpful close to birth to establish accurate numbers and positioning of the puppies.

**Normal pregnancy**

**Physiological changes in the bitch**

The bitch has to undergo certain changes to accommodate a pregnancy.

- Blood volumes are increased by about 40%, which is achieved mainly through haemodilution.
- Cardiac output and oxygen demand increase by 20%.
- Pregnancy may induce transient type 2 diabetes. Calcium demand increases with fetal growth and mineralization and with initiation of lactation. Supplementation with calcium should be avoided, however, as it hinders the secretion of parathyroid hormone.
- Food intake increases to around 125% of the normal ration, depending on the number of puppies, during the last trimester of pregnancy. Changing bitches on to puppy food at this stage of the pregnancy will give them a higher concentration of nutrients and sufficient calcium intake. Puppy food is also useful during lactation when food intake has to increase still further.

**Gestation length**

The range in time from mating to parturition in the bitch is not down to a varying length of gestation, but rather to the long survival time of the sperm. **Gestation length is consistent at 63 days from ovulation or 61 days from fertilization.** It is, however, influenced by litter size, with larger litters inducing birth slightly earlier. As a rule of thumb, every puppy over the breed average will decrease gestation length by 0.25 days (Bobic Gavrilovic et al., 2008).

**WARNING**

If ovulation has been monitored, bitches should not be allowed to go over the due date for more than 24 hours. Primary inertia is a very common condition in the bitch and care must be taken not to miss it due to the mistaken belief that pregnancy may be extended without any problem.

Pre-whelping health checks are advised (see Chapter 3).
Parturition

Determining the day of parturition
As noted above, the easiest way is to determine when ovulation occurred and count 63 days from then. Other indicators that can be used are listed below.

- **Behavioural changes**: including nesting, panting, separation from other animals and sometimes vomiting and diarrhoea.

- **Outward signs of impending birth**: including marked relaxation of the pelvic, abdominal and perineal musculature, due to elevated relaxin levels.

- **Drop in body temperature**: body temperature fluctuates in the last week before parturition, but drops markedly 12 hours before birth, induced by the drop in progesterone. This does not always happen in single puppy pregnancies.
  - Rectal temperature drops from 38.5°C to:
    - 35°C in small breeds
    - 36°C in medium-sized breeds
    - 37°C in large breeds
  - This difference is due to changes in the ratio between body surface area and volume (bodyweight).

- **Drop in plasma progesterone to base levels** (Figure 5.11): veterinary surgeons can confirm the end of gestation by measuring plasma progesterone levels, which drop from 12–15 nmol/l (4–5 ng/ml) to <6 nmol/l (<2 ng/ml) 24 hours before birth. The in-house ELISA tests are fast and reliable for these measurements.

**PRACTICAL TIP**
It is not possible for the veterinary surgeon to palpate the cervix in a bitch as it is too cranial to reach digitally

Stages of parturition

- **First-stage labour** usually lasts for 6–12 hours, but may take as long as 36 hours in primiparous bitches. Signs are panting, shivering and occasional vomiting, although it may not be obvious in some bitches.

- **Second-stage labour** is marked by the first puppy engaging in the pelvis and subsequent strong uterine contraction expelling the puppy. Rectal temperature returns to normal.

- Each puppy is usually born inside an intact amniotic membrane and the mother has to turn and remove it quickly by licking after the birth.

- 60–70% of puppies are born in anterior and 30–40% in posterior position.

- A breech birth presents with only the tail protruding and both hindlegs forward.

**Initiation of parturition**
As in other species the release of adrenocorticosteroid hormone by the puppies stimulates the production of prostaglandin F2α, which in turn leads to a rapid decrease in progesterone. The change in the progesterone:oestrogen ratio is the major cause for placental separation, receptor sensitivity to oxytocin and the dilation of the cervix.
Chapter 5 Reproductive management

Third-stage labour is not easily distinguishable in bitches, as placentas are delivered at different times during the birth and do not always immediately follow the birth of a puppy.
- Retained placentas are extremely rare in the dog and not too much emphasis should be placed on ‘missing’ placentas.
- Bitches should be discouraged from eating the placenta, as it leads to vomiting and diarrhoea. In nature eating the placenta cleans the nest and keeps predators away, rather than having any nutritional value.

Normal time parameters around birth
- First-stage labour: around 6–12 hours (longer for first litter)
- Active pushing in second stage: around 30 minutes
- Time between puppies: not more than 3 hours
- Birth from first to last puppy: never more than 24 hours

Birth complications
Manipulation and treatment of inertia and dystocia are successful in less than one third of cases and early decision-making towards caesarean section is often life-saving for puppies and sometimes the dam.

Indicators for caesarean section
- Greenish-black vaginal discharge at full term, without second-stage labour
- More than 61 days after mating, body temperature <37°C and serum progesterone <2 ng/ml (primary inertia)
- >24 hours first-stage labour with no puppies
- >3 hours since last puppy born, and majority of litter still in utero
- Three administrations of oxytocin have not resulted in all puppies being delivered

The caesarean operation is described in QRG 5.3.

Postpartum care of the dam
Once the last puppy has been delivered, the bitch will usually settle down and make sure the puppies are clean and settled, then have a drink and possibly something to eat.

Lochia (vaginal discharge after giving birth) will be brownish-black and it is normal for the bitch to pass the occasional blood clot. Discharge usually occurs after feeding the puppies, as the release of oxytocin for milk let-down will also induce uterine contractions, helping involution.

It is important to make sure that all the mammary glands look normal in colour and are not hardening. Bitches that do not clean themselves may need some help to make sure the perineal area stays clean and does not become odorous and dirty, especially in long-haired breeds.

Postpartum complications are relatively rare in bitches, compared with many other species.

Neonatal care
The most important contribution towards the wellbeing of puppies is a warm environment. Room temperature in the first week should be between 26 and 28°C, possibly uncomfortable to the lactating bitch but vital to the puppies. Heat lamps and heat pads are of limited use.

It is important that the bitch has enough milk for the number of puppies she has given birth to (puppies are content and putting on weight) and that she cares for them (bitch will clean puppies meticulously, including all urine and faeces). Well fed puppies will only cry for a short time at the start of feeding (squabbling over the best place) and then settle down to drink. Neonates that are fed sufficiently will have a well rounded abdomen, which is soft and shows no pain reaction on palpation. Puppies will feed every 2–4 hours and sleep most of the time between feeding.

Post-parturition and neonatal health checks are also discussed in Chapter 3.

Physical examination
- Neonates have no thermoregulation in the first 2 weeks of life and need to be examined in a warm environment (28–32°C). Heart rate in the first week is 200–250 beats/min and body temperature 36–37°C, well below the adult temperature.
- Checking oral mucous membranes will help to assess hydration, with tacky to dry mucous membranes indicating 5–7% dehydration. When puppies reach 10% dehydration they also have a noticeable decrease in skin elasticity.
- Neonates presented to the veterinary surgeon or born at the surgery (oxytocin, caesarean section) should always be checked for cleft palate (Figure 5.12), atresia ani and any other obvious abnormalities.
- Haircoat (covering of the paws and tips of the ears) can give some indication of prematurity or heavy ectoparasite infestation.
- Any discharge from eyes or nose, urine staining or diarrhoea should be noted.
- The abdomen should be well rounded without tension or pain response during palpation.
- The sucking reflex should be present.

Clinical signs of any problems are often unusual or non-specific, and a comprehensive history from the owners and comparisons with littermates may be needed.
Common paediatric emergencies

Neonatal mortality in puppies in the UK is around 10–20% in the first 3 months of life, with most deaths occurring at birth or in the first week. This is high compared with other veterinary species. In most cases one or two puppies in the litter will die, but it is not unusual to lose whole litters. It is important to stress to owners that early intervention in neonatal disease can make a significant difference to the outcome of treatment. One should also be realistic about the support that can be provided and explain the different possible outcomes as well as the costs involved.

Hypothermia

Puppies have little subcutaneous fat at birth and use non-shivering thermogenesis for heat regulation. Due to the high surface area to volume ratio in newborns, heat loss is much greater than in older animals.

Mild hypothermia is expressed through restlessness, crying, reddened mucous membranes and the skin feeling cold to the touch. In more severe cases the neonates become lethargic and uncoordinated. Moisture appears around their lips, and heart and respiratory rates start to fall. Hypothermia in the neonate decreases gut motility, which eventually leads to ileus.

Hypothermia in newborns

- <34°C at birth
- 35.5°C days 1–3
- <37°C at 1 week of age

**WARNING**

Owners will often try and treat ‘cold puppies’ by encouraging food intake in whichever way possible. Tube-fed or syringe-fed hypothermic neonates will either regurgitate and aspirate food – resulting in pneumonia, or will become bloated – resulting in respiratory distress.

It is important to rewarm neonates slowly. If outside heat sources (lamps, heat pads, hot water bottles) are used the patient must be checked frequently and its position relative to the heat source changed at regular intervals. In severe cases warm fluids can be given intravenously, intraperitoneally or intrasosseously. The temperature of the fluids should never be more than 2 degrees warmer than the body temperature of the patient; otherwise they may develop cyanosis, diarrhoea and fitting. Only when the neonate has reached its normal body temperature should feeding be attempted.

Trauma

Unfortunately, dropping or stepping on young puppies is a common occurrence, with owners becoming very distressed. If the puppy has survived the fall and shows no obvious sign of injury it is best to send it home under close observation. In cases of fractures, prognosis in young animals is very positive. Internal organ damage or bleeding are very difficult to treat.

Infectious diseases

More than 90% of the passive immunity of the neonate is provided through colostrum intake and thus depends on the immune status of the dam, who should therefore not be moved to another environment during pregnancy. Permeability of the gut to immunoglobulins starts to decline after 8 hours and is no longer possible after about 48 hours. Passive immunity can last for 6–16 weeks and may interfere with vaccinations.

Canine herpes has been much discussed by breeders recently, although the number of confirmed cases is low. The virus is acquired in utero or at birth and causes neurological signs. Puppies cry continually and die within 24–48 hours. Treatment is usually unsuccessful and mortality is close to 100%. The most useful diagnostic tool is post-mortem examination of the puppies, as there are classic changes (small white ischaemic dots) on the liver and kidneys. There is now a vaccine available that is given to the bitch after mating and before parturition.

‘Fading puppy’ is a general term used to describe the loss of neonates through lack of suckling and weight loss. The onset can be sudden and can start from 24 hours to 2 weeks of age. Clinical signs are not specific and causes may be as varied as bacterial infections, poor mothering, inadequate whelping facilities and congenital abnormalities. Treatment needs to be immediate, with antibiotics, fluids and glucose; the still healthy puppies in the litter also need to be treated.

Diarrhoea in neonates is very common and is usually caused by overfeeding. The puppies should be removed from the dam for 12 hours so that they cannot feed, followed by small frequent meals and oral rehydration. Antibiotics should be avoided in these cases as they further upset the gut flora.

Hypovolaemia

The neonate is particularly susceptible to dehydration, as water makes up >80% of its bodyweight, and water turnover is double that of an adult. Due to the neonate’s limited ability to conserve fluids and the immaturity of the kidneys, fluid requirements are high (13–22 ml/100 g bodyweight per day), but total volumes that can be given are low. Maintenance dose is 6 ml/kg/h with an addition of 50% of the deficit over 6 hours. Fluids may be given intravenously, intraperitoneally or subcutaneously, the latter two routes not having very high absorption rates. In most cases lactated Ringer’s solution with 20 mmol/l maintenance potassium is sufficient. In severely acidic patients (on blood sampling) bicarbonate should be added.

Hypoglycaemia

Clinical signs of hypoglycaemia are tremors, excessive crying and irritability, followed by more severe signs of lethargy and coma. Puppies are born with very little stored glycogen and a poor gluconeogenic response of the liver but in a warm healthy environment will survive 24 hours without feeding before blood glucose levels fall below normal levels. Other common causes of hypoglycaemia, besides starvation, are congenital metabolic diseases (e.g. glycogen storage disease and hepatic shunts). Most
hypoglycaemic puppies will respond to feeding (making sure also that body temperature is ade-
quate). In severe cases, dextrose at 0.5–1 g/kg i.v.
as part of a 5–10% Ringer’s or normal saline solution
can be administered.

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QRG 5.1 Ovariohysterectomy: hints and tips
by Tim Hutchinson

Positioning and preparation

■ The bitch is placed in dorsal recumbency. It is preferable to
support the thorax with sandbags or a rolled towel rather than using a
trough to maintain position: troughs may interfere with access and tend to
compress the abdomen, making exteriorization of the ovaries more
difficult.

■ Hair is clipped and the skin prepared aseptically from the costal arch to the
pubis and to 5 cm lateral to the line of the nipples. This may seem excessive
to many surgeons, but will facilitate extension of the incision should
difficulties be encountered. Most practices will use a single fenestrated
drape rather than a four-quadrant technique.
■ An assistant is not usually required. However, inexperienced surgeons
may value a scrubbed assistant to help with exteriorizing the ovary and
ligating the ovarian pedicle, or for obese bitches.

Technique

■ A right-handed surgeon will usually
stand on the bitch’s right flank, as this facilitates manipulation of the
intra-abdominal structures (especially the ovarian pedicles). A left-handed
surgeon may prefer to stand on the bitch’s left flank.

Note: The dog’s head is to the right in all the photographs here and the
surgeon is right-handed.

1 With the right hand holding the
scalpel, the surgeon uses the left
hand to tense the skin away from the
midline, so that the skin and
subcutaneous tissue part easily with a
confident scalpel cut.

2 As a rule of thumb, a useful starting
incision is one that is half the length of
the distance between the umbilicus
and the pubic brim and centred
midway between those two
landmarks.

In lean animals the linea alba
may be visible at this stage, but if
there is significant fat coverage a thin
connective tissue line between the left
and right subcutaneous abdominal fat
can usually be seen, and separated with
the scalpel to expose the linea alba.
Subcutaneous vessels will ooze gently,
which can frustrate the surgeon, but
there is no need for active haemostasis;
they will stop oozing by themselves with
simple pressure once the wound is
closed at the end of the procedure.

The incision is continued caudally. The linea
alba is now visible through the subcutaneous
fat. Small amounts of cutaneous haemorrhage
can be ignored.

The incision is continued caudally. The linea
alba is now visible through the subcutaneous
fat. Small amounts of cutaneous haemorrhage
can be ignored.

Tension is applied to the skin with the thumb
and forefinger of the left hand, whilst the
scalpel incision is made from cranial to caudal
with the right hand.

The incision should be as long as is
required to access the relevant
intra-abdominal structures without
compromise. There are no prizes for
short incisions and healing time is the
same regardless. In fact, it may be
argued that an incision that is too
short may be more uncomfortable
postoperatively, due to increased
stretching required intraoperatively,
and may delay healing due to
bruising caused by that increased
stretching.

Tension is applied to the fat with the left hand
as it is incised, to expose the linea alba. NB The
connective tissue is not cleared from the
underlying muscle.
Contrary to advice given in many surgical texts, the author prefers not to elevate the fatty tissue from the body wall: this creates a dead space that cannot be closed easily and will often lead to seroma formation. A seroma beneath the midline laparotomy wound can often be erroneously mistaken for herniation, prompting unnecessary surgical intervention at a later stage.

3. The linea alba is grasped with thumb forceps and elevated.

4. With sufficient elevation the linea alba can be penetrated by a stab of the scalpel (with the scalpel held horizontally, cutting edge away from the body) without fear of damage to the viscera.

5. The abdomen can then be opened along the linea alba using scissors; the lower blade is introduced through the stab incision and used to elevate the linea alba so that it can be cut confidently without fear of visceral damage.

6. One horn of the uterus is grasped and elevated, then followed cranially to locate the attached ovary.

7. The ovary is exteriorized.

8. Paired artery forceps are placed across the pedicle. Placement of the forceps can be made easier by holding the ovary between the first finger and thumb and using the other three fingers to depress the abdominal wall.
The ovarian pedicle is clamped.

- The pedicle is ligated 1 cm below these clamps. This may be facilitated by first placing a third pair of artery forceps to crush the fat at the desired location for ligation.

The third pair of clamps has been removed and the area of crushed tissue is ligated.

- Most absorbable suture materials that provide short- to medium-term support are suitable but inexperienced surgeons might prefer the security of a 3 metric (2/0 USP) braided synthetic absorbable suture material such as polyglactin 910 (e.g. Vicryl) or lactomer 9–1 (e.g. Polysorb).

With the pedicle ligated, the clamps can be twisted apart to tear through the tissue, or the tissue can simply be cut between the clamps.

The clamps are twisted to shear through the pedicle.

One forceps is left attached to the ovarian end of the pedicle to control haemorrhage and the other released from the ligated stump.

- It is helpful to hold the stump with thumb forceps prior to release, to ensure that the ligature is firm and there is no haemorrhage.

The ligated pedicle is checked for haemorrhage before it is released into the abdomen.

10 The procedure is then repeated for the other ovary.

The ovaries have been elevated and retracted caudally to allow the ovarian ligament to be broken down using the digits of the left hand.

The broad ligament of each uterine horn should be sectioned (with scissors) from the level of the ovary to the cervix, through the least vascular portion, to allow the whole uterus to be elevated from the body. Paired clamps are then placed across the cervix or the body of the uterus.

- The two uterine vessels can be ligated together with the body of the uterus (or cervix) in small dogs, but in larger dogs it may be helpful (and give peace of mind to the inexperienced surgeon) to place transfixing ligatures through the uterine body and around each vessel separately.

- Once ligated the uterus can be sectioned between the clamps and removed.

The uterine stump is inspected for haemorrhage before it is released into the abdomen.

12 The procedure is then repeated for the other uterine horn.

The cervix is ligated, clamped, sectioned and checked for haemorrhage before being released into the abdomen.

- It is likely that every surgeon will experience, at least once, an ovarian or uterine stump that is inadequately ligated and haemorrhages after release into the abdomen. In such circumstances the following steps should be taken:
  1. Don't panic – you are not the first surgeon to experience this!
  2. Alert a colleague that you might require their assistance.
  3. Provide adequate exposure of the bleeding stump:
     1. The uterine stump can be exposed by retraction of the bladder
ii. The left ovarian pedicle can be exposed by elevating the descending colon and pulling it to the right to use the mesocolon to separate the abdominal viscera from the bleeding vessel.

iii. The right ovarian pedicle can be similarly exposed by elevating the duodenum and pulling it to the left.

4. Use a swab to remove the accumulated blood to allow examination of the stump or pedicle – it may be helpful to have the abdominal wall retracted with gusset retractors and use a scrubbed assistant to hold the abdominal viscera away.

5. Place forceps on the vessel and ligate below the tip of the forceps. NB Bleeding ovarian pedicles are often quite friable and attempts to elevate them by pulling on the forceps may lead to further tearing and bleeding. It is better to have an assistant maintain exposure and for you to work with two hands to ligate the vessel intra-abdominally.

■ ■ Dead space within the fat is closed using continuous absorbable suture material. Again, it is preferable to use monofilament suture material to avoid tracking of infection should the bitch interfere with the wound postoperatively.

The linea alba is closed using a continuous suture pattern.

14 The skin can be closed either subcutaneously or with non-absorbable sutures, which are usually removed 10 days after surgery.

The uterus and ovaries after removal. Both ovaries can be seen to have been removed completely.

Whilst it may seem a bold step for an inexperienced surgeon, it is preferable to close the linea alba with a simple continuous suture pattern, so that tension is dissipated along the entire wound.

- A monofilament suture material suitable for tendons should be used, such as polydioxanone (e.g. PDS II) or polyglyconate (e.g. Maxon).
- 3 metric suture (2/0 USP) is suitable for small to medium-sized dogs (up to 30 kg), with 4 metric suture (1 USP) used for larger dogs.
- Good knot security is essential, with at least six throws on the first knot and seven on the last.

The skin is closed, here using a subcuticular continuous pattern.

This wound was closed with cruciate mattress sutures. Whilst this is a popular pattern amongst inexperienced surgeons, there is a tendency to tie the sutures too tightly, with the result that the wound tends to invert. This causes discomfort and leads to self-mutilation. Following removal of these sutures it can be seen that the wound is healing poorly where the sutures have been placed.

The practice might have a preferred policy for suture choice and closure pattern, so this should be discussed with the practice principal.

It is a common mistake to place skin sutures too tightly, especially on the ventral midline. When the bitch is placed in an upright position the skin will naturally fall together, so relatively loose sutures are preferable, which will allow for the anticipated postoperative swelling along the line of the incision without inducing cheese-wiring! Sutures that are placed too tightly will be uncomfortable and lead to self-trauma. This may introduce infection and is the commonest cause of wound problems after ovariohysterectomy.
Reproductive management

Chapter 5

QUICK REFERENCE GUIDES

**QRG 5.1 continued**

**Postoperative care**

- Postoperatively the wound should be covered for at least 24 hours with a sterile adhesive dressing (e.g. Primapore). After this, provided there is no discharge, the wound may be left uncovered.
- It is vital that the bitch does not lick the wound, so use of a barrier collar or T-shirt should be advised.
- Whilst neutering is often considered routine, the client should be advised that their bitch has had major abdominal surgery. She should be taken for short toilet walks only (on a lead) for the first few days and kept restricted to gentle lead exercise for at least 10 days postoperatively.
- Analgesia requirements will vary from bitch to bitch and each should be assessed as an individual.
- The client should be encouraged to contact the practice at any point if they are concerned. However, a routine examination should be arranged 48 hours after surgery. The bitch should be checked for adequate pain control and for any obvious post-anaesthetic complications (ensure eating and drinking, urinating and defecating are normal). The wound should be checked to ensure there is no abnormal swelling or discharge.

**QRG 5.2 Castration (Orchidectomy): hints and tips**

by Tim Hutchinson

It is this author’s firm opinion that castration should be performed using an open rather than a closed technique. Closed castration relies on indirect occlusion of the spermatic vessels by ligation of the soft tissues around them. Ligatures that at the time of surgery may appear to have been placed well may subsequently prove to be inadequate, with the result that the vessels may slip through the tunica and haemorrhage intra-abdominally. With open castration, ligatures are placed directly on to the vessels and afford greater security from haemorrhage.

**Positioning and preparation**

- The dog should be positioned in dorsal recumbency. If castration is routine, with both testicles descended into the scrotum, a trough may be used for positioning, but if either of the testicles is undescended then it is preferable to use a rolled towel or sandbags to avoid the edges of the trough compromising access.
- Whilst it is good practice – and part of standard aseptic technique – to remove hair from a wide area around the site of the incision, prescrotal castration is one procedure where the author prefers to keep hair removal to a minimum. Many male dogs become profoundly irritated by excessive hair removal in the inguinal region, especially if there is clipper rash. Postoperative licking can be intense, leading to wound infection, dehiscence and often a massively swollen and oedematous scrotum. The author’s preference is to remove a small strip of hair from directly in front of the scrotum, but to ensure that a wide area of surrounding hairy skin has been scrubbed.

**A normally healing ventral midline incision, viewed at the 48-hour postoperative check.**

- A further examination is usually booked for a week later and the bitch should be kept to short lead walks in the intervening period.

**The closed wound is covered by a sterile adhesive dressing.**

**The dog is positioned in dorsal recumbency, with the legs splayed.**

**Hair has been removed only over the site of the incision. A broad border, including the inguinal region and scrotum, has been prepared with skin disinfectant.**

- A small fenestration in the surgical drape is used.
Technique

- The author’s preference, as a right-handed surgeon, is to stand on the dog’s right flank.

Note: The surgeon is right-handed in all the photographs here.

1. The first testicle is squeezed cranially out of the scrotum into the prescrotal region and the left hand used to tense the skin over it and hold firmly. A scalpel is used to cut through the skin (at the midline) and subcutaneous tissues directly down to the spermatic sac, with the left hand continuing to squeeze the testicle through the incision.

2. The scalpel is used to incise the spermatic sac, so that the testicle can be squeezed through the incision and the sac pulled down around the cord.

3. The sac must be detached from the caudal pole of the testicle by tearing, to free the testicle completely from its soft tissue attachments.

- With gentle traction a large portion of the spermatic cord can be exteriorized, so that paired forceps can be placed proximal to the pampiniform plexus.

4. The spermatic cord is ligated 1 cm proximal to the forceps. Ligatures may also be transfixed through the vas deferens for greater security if required.

- Most absorbable suture materials giving short- to medium-term support are suitable for these ligatures, but inexperienced surgeons might prefer the security of a 3 metric (2/0 USP) braided synthetic absorbable suture material such as polyglactin 910 (e.g., Vicryl) or lactomer 9–1 (e.g., Polysorb).
Reproductive management

Chapter 5

QUICK REFERENCE GUIDES

QRG 5.2 continued

5. The spermatic cord is then cut between the forceps. The ligated pedicle should be held after release of the forceps, to ensure that there is no haemorrhage or slippage of the ligature.

6. The process is then repeated for the second testicle.

7. There is no need to suture the spermatic sac, so closure consists of suturing the subcuticular tissues and the skin.

Inguinally retained testicles

- When testicles have descended through the inguinal ring but not into the scrotum, they are usually palpable within the inguinal region as firm rounded structures that are usually smaller than a fully descended testicle. Occasionally they may be pushed into a pre-scrotal incision; if this is not possible, they are accessed by grasping between the fingers and thumb of the non-dominant hand, tensing up to the overlying skin and incising directly on to them with a scalpel.

- Ligation and closure is then performed as for a fully descended testicle.

Abdominally retained testicles

- If either (or both) testicles cannot be palpated, it should be assumed that they have not passed through the inguinal ring and are still within the abdominal cavity. The dog should be prepared for a caudal abdominal approach, with hair clipped to 5 cm cranial to the umbilicus, lateral to the nipples and around the penis. The skin incision is made parallel to the penis and continued through the subcutaneous fat (ligating vessels as required). By retracting the penis away from the surgeon the ventral midline is exposed, allowing routine entry into the abdominal cavity via the linea alba.

- Locating the testicle is then straightforward: the vas deferens is identified between the bladder and colon. Tracing the path of the vas deferens will lead to the testicle, which will often be considerably smaller than a descended counterpart.

- Ligation is routine, as is closure of the abdomen.

- There will be a pocket of dead space that is difficult, if not impossible, to close between the penis and body wall. Seroma formation at this site is not uncommon.

Postoperative care

- Analgesia should be tailored to the individual patient. Antibiosis is unnecessary for a short clean surgical procedure such as routine castration.

- As castration wounds can often be irritating to the dog, a barrier collar should be offered in all cases. Owners should be alerted to the fact that the scrotum has not been removed but will shrink gradually over the coming weeks.

- Owners should be instructed to contact the surgery at any time if they are concerned; however, a routine re-examination should be scheduled for 48 hours after the surgery. The dog should be checked for adequate pain control and for any obvious post-anaesthetic complications (ensure eating and drinking, urinating and defecating are normal). The wound should be checked to ensure there is no abnormal swelling or discharge. A further examination is usually booked a week later and the dog should be kept to short lead walks in the intervening period.
Preoperative preparation
Preparation for a caesarean section will differ from that for a routine bitch ovariohysterectomy because preparation must take into account the delivery of (hopefully) a litter of live puppies.

The following should be available:
- Extra personnel to assist with reviving puppies
- An incubator for the puppies – this can be purpose-made or consist of an enclosed box with hot water bottles and blankets
- Access to doxapram to stimulate breathing in neonates
- Intravenous fluids for the bitch
- Towels: there will be a large volume of fluid from the uterus; towels placed around the animal and the operating table will be necessary to absorb this.

Patient preparation
- Consider withholding standard premedication agents and not administering opiate drugs until after all the puppies have been delivered, to avoid respiratory suppression in the puppies.
- Give careful consideration to the use of other analgesics, as it is unlikely that any will be authorized for use in pregnant or lactating bitches. Analgesia needs to be assessed on an individual basis and ‘off-licence’ permission granted by the owner of the bitch.
- Positioning the bitch on her back for surgery may compromise her respiration due to the pressure of the distended abdomen on the diaphragm. It may be necessary to elevate the head end of the table.
- Skin preparation, draping and the surgical approach to the abdominal cavity are as for ovariohysterectomy (see QRG 5.1).

Technique
With any caesarean section there is the need to deliver puppies quickly and return the bitch to consciousness promptly, to facilitate suckling and promote puppy survival. It is therefore necessary to work swiftly.

1. Create a longer abdominal incision than is usually required for ovariohysterectomy, so that the uterine horn can be exteriorized on to the surgical drape.
2. Incise the antimesenteric surface of the uterus between two puppies, to allow removal of at least two (and sometimes three or four puppies) from the same incision.
3. Break the membranes from around the puppy. Clamp the umbilical cord approximately 3 cm from the puppy. Cut the cord at the placental side of the forceps and pass the puppy immediately to a nurse to begin reviving it with vigorous towel rubbing. The placenta can then be removed from the uterus by gentle traction.
4. Repeat the procedure for the other uterine horn and create additional incisions in the uterus if required to facilitate rapid access to the puppies.

- There is no need for active haemostasis of vessels in the uterine wall; bleeding will stop quickly as the uterus contracts and involutes.
- Complicated suture patterns are not required for the uterine incisions. A simple inverting continuous pattern can be placed quickly and it should be appreciated that the rapid contraction and involution of the uterus will render any incision a fraction of its original size within a few hours.
- There will be contamination of the abdominal wound by uterine fluids. However, this is likely to be sterile, so quickly sluicing with sterile saline is sufficient prior to routine closure, using continuous suture patterns for the abdominal wall, subcutaneous tissues and skin.

Postoperative care
The puppies should be encouraged to suck from the bitch as soon as she is returned to her kennel, but she should be supervised at all times. As soon as she is able to walk she should be discharged to allow her to settle more readily back into her home environment.

Caesarian section should be considered to be relatively clean surgery of short duration and there is rarely indication for the use of antibiotics.
The vast majority of pet dogs will, at some stage or another, require some form of surgical intervention. This may be a ‘routine’ elective procedure, such as neutering, or a non-routine non-elective procedure, such as removal of a foreign body or tumour, or repair of a fracture or traumatic wound. In all but a very few cases this will entail the patient undergoing general anaesthesia. Whilst with modern anaesthetics and monitoring equipment the risk of mortality has reduced dramatically over recent years, the perioperative period is still associated with appreciable morbidity and mortality. Although the surgeon may have clear ideas about what this means and what precautions to take, it is important to realize that the owner may have very different concerns (Figure 6.1). Addressing these concerns adequately will undoubtedly reduce client anxiety and will also reduce the veterinary surgeon’s level of stress and minimize the risk of client complaints or financial disputes.

Proper planning of the perioperative requirements of the patient will reduce the risks of surgery and anaesthesia, and also improve the chances of a successful outcome. Details of specific surgical procedures can be found in the appropriate chapters of this Manual. Further information on anaesthesia and surgical principles may be found in the BSAVA Manual of Canine and Feline Anaesthesia and Analgesia and the BSAVA Manual of Canine and Feline Surgical Principles: A Foundation Manual.

**Economic considerations**
- Cost
- How quickly does money need to be made available?
- Will insurance cover it?
- Will further costs be likely (follow-up radiographs, etc.)?
- Are there different options (lesser procedure, fewer associated tests, reduced hospital time)?

**Patient considerations**
- How likely is the procedure to succeed?
- How risky is the procedure?
- Is it painful?
- Will it impact on the pet’s temperament?
- Is the procedure ‘worth it’ with regards to age or health?

**Practical considerations**
- When can it be done (will it interfere with a family holiday or a business trip)?
- Can the owner cope with any aftercare (bandage changes, aiding mobility)?

**Moral/personal considerations**
- Has a relative had a similar procedure or condition?
- Has the owner had an unfortunate experience before?
- Is there disagreement or dispute in the owner’s household which could affect whether the procedure is carried out?
- Does the owner have confidence in the veterinary surgeon performing the procedure?

**Informed consent and client preparation**

Written consent should always be obtained from an owner prior to any surgical procedure. In some circumstances it may be necessary to obtain oral consent, for example if, during the course of an investigation, an alternative procedure becomes necessary and the client is phoned for permission. In such cases it is important to make a clear record in the patient’s notes of the advice given, in particular that any risks were made clear. The written consent should be in the structure of a consent form, an example of which may be found on the Veterinary Defence Society website (www.veterinarydefence.co.uk). It is important to ensure the client has actually read and understood the form.

For consent to be valid, it must be voluntary and informed.

- **Voluntary:** An owner has the right to decline or refuse consent for a procedure. Generally, where there is refusal, explaining the benefits and risks of the technique compared with alternative techniques may change the client’s mind. However, it is never acceptable to try to force a client to consent to any procedure, nor would it be wise to do so, as this will only cause more anger (and potentially legal problems) should complications occur.
Informed: It is the duty of the veterinary surgeon to explain the procedure in terms that the client may understand. This must include any known risks associated with the technique or the anaesthetic (information should not be withheld just because it may upset or worry the client). The costs should be discussed: not only of the procedure itself, but also of any likely follow-up consultations, radiographs or bandage changes. In any non-routine surgical case the option of referral should be made available if the procedure is not usually performed at the practice. Clearly, to give this due attention can take some considerable time and it may not easily be fitted into a consultation period at the time of diagnosis. It may be preferable to make a separate appointment to discuss the surgery, ideally the day before the planned procedure.

Many disputes in veterinary practice are caused by a failure to provide fully informed consent. This may be a failure to provide an adequate estimate of costs, or it may be that the owner’s expectations of recovery were unrealistic due to being misinformed. Time spent explaining the procedure to the client should improve client satisfaction and reduce any incidence of reprisals.

**PRACTICAL TIPS**

- The client should be made aware that the dog’s hair will need to be shaved for the surgical procedure. Some owners may find this more alarming than the procedure itself, so it is worth preparing them. Additionally, some owners, especially those breeding or showing dogs, may be reluctant to have their animals shaved. These concerns must be addressed prior to admission, as shaving the dog against the owner’s wishes may constitute ‘surgical trespass’, rendering the vet liable to legal proceedings.

- It is also worth describing the likely size of the surgical wound, or any disfigurement.

Preoperative assessment

Patient assessment prior to surgery provides the most important means of increasing patient safety and reducing perioperative complications. An overview of pre-anaesthetic assessment is provided here; the reader is directed to the BSAVA Manual of Canine and Feline Anaesthesia and Analgesia for more detailed information.

**ASA classification**

It is helpful to categorize patients as being at ‘low’ or ‘high’ risk from procedures and to take further precautions as appropriate. A scale of patient physical condition has been developed by the American Society for Anesthesiologists (ASA) that enables the user to predict the level of risk for individual patients (Figure 6.2). A thorough preoperative assessment on the day of admission allows the clinician to assign an ASA score to the patient.

<table>
<thead>
<tr>
<th>Patient class</th>
<th>Physical condition</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Normal healthy patient</td>
<td>No disease detectable</td>
</tr>
<tr>
<td>II</td>
<td>Mild systemic disease</td>
<td>Mild compensated cardiac valvular disease, well controlled diabetes, uncomplicated fracture</td>
</tr>
<tr>
<td>III</td>
<td>Severe systemic disease</td>
<td>Malignant heart failure, poorly controlled diabetes mellitus, hyperadrenocorticism, pyrexia, mild to moderate dehydration</td>
</tr>
<tr>
<td>IV</td>
<td>Severe systemic disease that is a constant threat to life</td>
<td>Heart failure, severe dehydration, anaemia, toxoaemia, uraemia, cachexia</td>
</tr>
<tr>
<td>V</td>
<td>Mortally, unlikely to survive beyond 24 hours without surgery</td>
<td>Severe trauma, shock, severe infection, terminal malignancy</td>
</tr>
</tbody>
</table>

**6.2 American Society of Anesthesiologists (ASA) physical condition scale.**

**Signalment**

Breed and age are relevant factors to be considered prior to general anaesthesia.

- **Breed:** Not all dogs have the same tolerances to anaesthetic or sedative agents. For example, Boxers and many giant breeds have a low tolerance of acepromazine. Additionally, brachycephalic dogs often have mild hypoxia prior to anaesthesia (it is not unusual to find a PaO2 of <70% in a British Bulldog breathing room air) and may benefit from preoxygenation or may require relatively small endotracheal tubes.

- **Age:** Immature or elderly patients may have relatively inefficient liver metabolism, resulting in a lower tolerance of anaesthetic or sedative agents. Additionally, elderly patients are more likely to be suffering from systemic illness.

**Medical history**

Details of the patient’s history that may be relevant include any difficulties or problems associated with previous surgery, or the presence of any other condition. It is important to confirm the presenting complaint: for example, to check which limb is to be radiographed. If removing multiple lumps, it is important to make sure that all lumps to be removed are documented and marked with indelible marker if appropriate. It may be worth discussing with the owner what course of action should be taken if further lumps are found intraoperatively, as occasionally an incidental finding can turn out to be clinically important (Figure 6.3).

**Clinical examination**

Where possible, the patient should have been given a full clinical examination (see Chapter 3) no more than one week prior to surgery. Any significant problems noted on auscultation should be followed up by radiography, electrocardiography or echocardiography as indicated.

In addition, special considerations on the morning of surgery should include the following:

- **General health:** This should take in hydration status (it is worthwhile asking whether there has been any diarrhoea or vomiting in the week prior to
surgery) and body condition score (see Chapter 4). Obese dogs may have cardiorespiratory compromise; dogs with cachexia may be prone to hypoglycaemia whilst anaesthetized.

- **Thoracic auscultation:** Murmurs or arrhythmias may require further investigation prior to anaesthesia. Clients should be asked whether there have been any coughing or breathing problems in the last few weeks. A cough may indicate airway disease (see Chapter 24) and should always be investigated prior to anaesthesia.

- **Skin:** In particular, any skin changes that may indicate a chronic disease such as hyperadrenocorticism; also any damaged or infected skin that may interfere with aseptic catheter placement or increase the risk of postoperative infection at the surgical site.

- **Nervous system:** Mentation should be assessed, as central nervous system depression may reduce tolerance to anaesthetic agents. Ensure that any epileptic patients have been given their medication that morning, and adjust the anaesthetic protocol by avoiding acepromazine premedication and tapering the anaesthetic dose.

### Pre-anaesthetic testing

Most practices have in-house laboratories that enable relatively inexpensive biochemistry and haematology tests to be run. However, it is important to balance what can be tested with what should be tested. It is pointless running a 12-point biochemistry panel on every patient, regardless of age, breed and clinical condition. Indeed, since normal variations in blood parameters occur, it is likely that a proportion of ‘normal’ animals could have surgery delayed, and the owners incur further costs, on the basis of an outlying blood result. It is far better to adapt screening protocols specifically to identify ‘at-risk’ patients. Studies have shown that preoperative blood tests in young healthy animals have little or no benefit.

The decision to perform pre-anaesthetic laboratory testing should be based on the findings of the clinical examination. The tests should preferably be carried out in advance (though ideally no longer than one week in advance), rather than on the day of surgery, so that steps can be taken where appropriate, based on the findings (Figure 6.4).

A good basic panel of tests would include:

- Packed cell volume (PCV; Figure 6.5)
- Total protein (TP)
- Albumin
- Blood glucose
- Urea.

As a general rule, any pre-anaesthetic test is only valuable if the results will direct a change in anaesthetic protocol. Figure 6.6 provides suggestions for ‘tailor-made’ pre-anaesthetic protocols.
### Considerations for surgical cases

#### Preoperative preparation

**Starvation**
Since the presence of food in the stomach is associated with an increased risk of aspiration should vomiting occur whilst the dog is anaesthetized, a period of starvation is advised. Generally speaking, food need only be withheld for 5–6 hours prior to surgery, and water need not be withheld. Very young animals and those suffering from malnutrition may be at risk of hypoglycaemia with prolonged starvation. There is an increased risk in some dogs of postoperative gastritis if food is withheld for more than 8–10 hours.

**Voiding**
Owners should be asked to take the dog for a short walk on the morning of surgery to give the patient an opportunity to empty its bowel and bladder, as some dogs do not like to void in unfamiliar territory. It is not just unpleasant to have leakage during a procedure but it may be uncomfortable for the patient and compromise aseptic technique.

#### Bathing
A heavily soiled or muddy coat may be a source of postoperative infection, so owners should be instructed to bathe any particularly soiled pets. Care should be taken, particularly in long-coated breeds, to ensure the dog is completely dry as this could predispose to hypothermia.

#### Special considerations

- Intravenous fluid therapy is recommended for all procedures involving anaesthesia: not only does the administration of fluid help to guard against hypotensive episodes, but it is reassuring to have immediate access to a vein in the event of an emergency. Elderly patients, particularly those with mild renal insufficiency, must have intravenous fluid therapy to try to instigate mild diuresis perioperatively.

- It is worthwhile planning the surgical caseload to allow special cases to be treated early in the day, in order that recovery occurs while there is a full

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**Table: Suggested pre-anaesthetic tests for specific patient categories and procedures.**

<table>
<thead>
<tr>
<th>Patient group</th>
<th>Tests</th>
<th>Rationale</th>
<th>Response if abnormalities found</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Younger dogs (&lt;7 years) with concerns raised on clinical examination (e.g. weight loss, polyuria/polydipsia, malaise, weakness)</td>
<td>PCV, TP, albumin, blood glucose, urea</td>
<td>PCV will give an indication of anaemia and hydration status (together with TP). Low albumin may lead to poor/delayed healing and may indicate cachexia or neoplasia. Hypoglycaemia may occur in juvenile starved patients, in cachexic patients, or over-controlled diabetics. High urea may indicate poor renal function.</td>
<td>Full haematology, including evaluation of a fresh blood smear. Ultrasonography and/or radiography. Diabetics: check fructosamine levels, commence glucose therapy. Check urine specific gravity, measure creatinine.</td>
</tr>
<tr>
<td>2. Older dogs (≥8 years) showing no sign of disease</td>
<td>As above, but consider full haematology and more comprehensive biochemistry panel, full urinalysis</td>
<td>Occult disease may be present</td>
<td>Further tests (e.g. radiography, ultrasonography, bile acid function) as directed by abnormal results.</td>
</tr>
<tr>
<td>3. Older dogs (≥8 years) showing signs of disease (e.g. weight loss/gain, hair loss, coat/skin changes, lethargy)</td>
<td>As for group 2, but consider thyroid testing in overweight dogs</td>
<td>Hypothyroid dogs may be at increased risk of haemorrhage and anaesthetic complications</td>
<td>Stabilize on thyroid medication prior to surgery, if possible.</td>
</tr>
<tr>
<td>4. Dogs with bruising; certain breeds (e.g. Dobermann); dogs in lungworm endemic areas; dogs undergoing spleen, liver or kidney biopsy</td>
<td>As for groups 1–3, depending on age and signalement, plus coagulation tests</td>
<td>Any abnormal coagulation results should be investigated. Any underlying cause (neoplastic, hepatic) should be controlled if possible</td>
<td>With von Willebrand's disease, no treatment may be needed provided strict attention is paid to haemostasis. However, fresh blood (or at least fresh-frozen plasma) should be on hand if required. If lungworm is suspected, a Baermann test should be performed on faeces prior to surgery and treatment instigated as required.</td>
</tr>
<tr>
<td>5. Dogs with neoplastic disease</td>
<td>As for group 3, but include calcium in biochemistry profile. Ultrasonography of the pelvis and abdomen. Thoracic and abdominal radiography</td>
<td>Some tumours (e.g. anal sac adenocarcinoma) cause a paraneoplastic syndrome resulting in hypercalcaemia which dramatically increases the risk of fatal cardiac arrhythmia during anaesthesia. Imaging is necessary to detect metastatic or contemporaneous disease and to stage the tumour.</td>
<td>Plan for additional treatment, such as chemotherapy, or consider referral, palliative care or euthanasia.</td>
</tr>
<tr>
<td>6. Dogs with urinary tract disease</td>
<td>As for groups 1–3, depending on age and signalement, plus electrolytes, blood urea nitrogen and creatinine, full urinalysis (including specific gravity, microscopy and urine culture), haematology</td>
<td>Urine culture is frequently negative, even when there are obvious signs of infection. However, it is important to try to obtain a culture if possible to direct antibiotic selection. Azotaemia together with hyposthenuric urine suggests chronic renal failure and indicates ASA grade III and above. Chronic renal failure is frequently associated with non-regenerative anaemia.</td>
<td>Mild azotaemia may be improved by 24–48 hours of intravenous fluid therapy prior to surgery. The pros and cons of performing surgery on patients with a poor ASA score should be discussed with the owner.</td>
</tr>
</tbody>
</table>

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6.6 Suggested pre-anaesthetic tests for specific patient categories and procedures.
Complement of staff. This also gives patients longer to recover from the anaesthetic if discharge is planned for the same day. Another reason for scheduling elderly, cachectic and immature dogs early in the day is that these animals have low glycogen reserves and may be prone to hypoglycaemia.

- Diabetic dogs should be well monitored in the days leading up to surgery, and a pre-anaesthetic blood glucose sample should be assessed. Recommended protocols for administering insulin to these patients may be found elsewhere (see BSAVA Manual of Canine and Feline Anaesthesia and Analgesia).

- Aggressive or nervous dogs should be treated with care, not only from the view of personal safety (and that of others), but also because the release of catecholamines due to stress sensitizes the cardiovascular system to the effects of anaesthetic agents and can precipitate hypovolaemic shock or cardiac disturbances. It may be advisable in most cases to sedate aggressive dogs away from their owners, as they may relax when not in their owner's presence. In some circumstances, however, the owner may be the only person capable of safely handling an aggressive dog, e.g. guard dogs, military dogs, police dogs.

- Dogs with cardiovascular compromise or traumatized patients are similarly at risk of sudden decompensation or vascular compromise. Attempts should be made to stabilize these patients as well as possible prior to anaesthesia (see Chapters 8 and 10) and to modify the anaesthetic protocol accordingly.

- Any animals falling into category III or above on the ASA scale (see Figure 6.3) have a 3–4 times increased morbidity rate compared with those in groups I and II, and have a commensurately higher mortality rate. Special attention should be paid to these dogs (Figure 6.7) and the anaesthetic protocol should be adjusted accordingly (Figure 6.8). The owners should be informed of the higher risks, and the potential risk:benefit balance should be assessed. Dogs with respiratory or cardiac disease may benefit from 5–10 minutes of preoxygenation prior to induction of anaesthesia (Figure 6.9).

### Postoperative care

The patient should be monitored continuously postoperatively until the endotracheal tube has been removed and the patient is able to support itself in sternal recumbency. At this stage a little water may be offered and, as soon as the patient is fully conscious, food may be given. It is important to try to encourage the patient to urinate prior to discharge, as this implies reasonable hydration and kidney function.

The surgical wound should be checked periodically to ensure that there is no sign of haemorrhage or self-mutilation. In most cases, self-mutilation is a sign of poor theatre technique (e.g. clipper rash, overtight sutures) or inadequate analgesia, so consideration should be given to improving theatre protocols and pain relief. The patient should be assessed for pain using an objective pain scoring system, and analgesia balanced to effect. The author's preference is to use the Colorado State University Pain Scale (see www.vasg.org/pdfs/CSU_Acute_Pain_Scale_Canine.pdf).
although there are several other very good pain scales available (e.g. Glasgow Composite Measure Pain Score (short-form version); www.gla.ac.uk/faculties/vet).

Any postoperative medication should be made ready, and postoperative rehabilitation or physiotherapy plans discussed with the nursing team. For further information the reader is encouraged to consult the BSAVA Manual of Canine and Feline Anaesthesia and Analgesia and the BSAVA Manual of Canine and Feline Rehabilitation, Supportive and Palliative Care: Case Studies in Patient Management.

Discharging the patient
It is vital that the patient is not discharged until fully recovered from anaesthesia.

**WARNING**

It is never acceptable to allow a dog to leave the surgery prior to full recovery from anaesthesia; this may be tantamount to negligence

Dogs should be ambulatory and able to eat a little food, and ideally should have urinated before going home. Prior to discharge, wounds should be examined to ensure there has been no further bleeding and any bandages assessed for slippage. The perineal and urinary regions should be checked: it is very poor practice to discharge a patient that has soiled itself.

The client should be informed as to the specific surgical procedure performed and the success or otherwise of that procedure. If any tests are outstanding, or if biopsy samples have been taken, the client should be made aware of when to expect the results.

**PRACTICAL TIP**

It is a good idea to clarify whether the client should contact the practice or the practice will contact the client. Not receiving results can be an understandable cause for complaint

Finally, it is worth remembering that most owners are unused to surgical wounds, and some may be quite ‘squeamish’. If a wound is left uncovered, it may be wise to mention the size and position of the wound to the owner before discharging the dog, just to prepare them (Figure 6.10). On occasion, it may be necessary to place a bandage or dressing to spare the owner’s feelings.

Postoperative advice to clients
In addition to the general advice above, specific advice should be given to the owner concerning the following:

- **Feeding:** Generally, unless there is specific reason not to, dogs should be allowed a little food once they have recovered enough to maintain sternal recumbency or stand. Clients should be advised to feed a small amount of food shortly after returning home: there is no reason not to give the patient’s normal food, but a ‘timed recovery diet’ may be given if preferred and is usually appreciated by the owner. The dog should be given free access to drinking water

- **Exercise:** Regardless of the procedure, exercise should be kept to a minimum for 24–48 hours following anaesthesia. Provided there are no specific contraindications, such as after fracture repair or cruciate surgery, there is no reason why exercise cannot be increased in the following days, although on-lead exercise may be more appropriate for 10–14 days, or until the sutures are removed

- **Medicines:** The client must be given clear instructions for any medicine dispensed: in particular, when they should be started or whether any side effects may be seen. In some cases slow recoveries from anaesthesia or surgery are perceived by clients to be side effects of medication and this can adversely affect compliance
Pain: Although pain assessment in dogs is reasonably subjective, the owner should be made aware of the expected pain this type of procedure may cause. Clear guidance should be given to enable the owner to monitor for pain (Figure 6.12); client handouts can be sourced online at www.aahanet.org

- Restlessness and vocalization may be signs of pain, but are occasionally seen as post-anaesthetic phenomena when no invasive procedure has been carried out, suggesting that they may be anaesthetic ‘hangover’ responses. Instructing the owner to touch gently around a wound may elicit whether there is post-surgical pain present
- Postoperative pain is always pathological and serves no useful function. It is never acceptable to use pain as a method of reducing patient activity. Consideration should be given to using combinations of analgesic agents if a single one proves insufficient. Analgesic drug dosages may be found in the BSAVA Small Animal Formulary, or in the BSAVA Manual of Canine and Feline Anaesthesia and Analgesia

Postoperative check-up: A date should be made for the postoperative check-up (see below). The client should be made aware of the importance and role of this check, and whether any charge will be made for it.

Postoperative check-up

Postoperative check-ups fulfil several functions (Figure 6.13). It may be a matter of practice policy whether every routine and non-routine surgical procedure is subject to a postoperative check-up, but generally speaking it is advisable to check every patient following general anaesthesia to ensure that no complications have arisen as a result either of the anaesthetic or of the surgical procedure itself. Timing of the postoperative check will depend on the patient’s signalment and the nature of the operation; as a general guideline, the author tends to see most cases again between 48 and 72 hours postoperatively.

In some instances it may be acceptable to allow the owner to make the decision as to whether they are happy with progress following a routine neutering, although the author would urge inexperienced
Considerations for surgical cases

Chapter 6

Surgeons to re-check every case: this will not only improve surgical satisfaction at seeing ‘completed tasks’ but will also improve recognition of stages of wound healing by building up a mental database of post-surgical cases. Certainly, any non-routine surgical case (e.g. tumour resections, orthopaedic cases) should receive at least one postoperative check.

What to check for will depend to some extent on the nature of the surgery; however, all post-surgical patients should be examined for general health, including temperature, pulse and respiration. Lack of urination may indicate renal failure (acute or exacerbation of occult chronic) or dehydration and should be investigated thoroughly. Vomiting or diarrhoea may be transient and should be investigated as suggested in Chapter 13. Wounds should be carefully checked for signs of infection, suture failure or other complication; for example, failure to close dead space adequately may result in seroma formation – these are generally non-painful, but a scrotal seroma or haematoma can be extremely painful and is a relatively common complication of castration when performed by inexperienced surgeons.

When rechecking non-routine cases, it is important to tailor the postoperative check-up to cover specific points. In these circumstances it is advisable to consult a book, or a more experienced colleague, for more precise guidance for that procedure. In this way the most appropriate advice can be given with regard to, for example: levels or types of exercise; at what stage physiotherapy is recommended; when repeat radiographs should be scheduled (Figure 6.14).

References and further reading


Function | Examples
--- | ---
Allows assessment of the patient – to look for any anaesthetic morbidity | Acute kidney injury, dehydration, inappetence, vomition, exacerbation of occult illness
To check for complications after surgery | Wound infection or breakdown, self-mutilation, blood loss
To improve surgeon satisfaction, or to learn from complications | A good outcome may boost confidence. A poor outcome should be used as a learning exercise
Allows the client to voice any concerns or queries | Changes in behaviour or mobility may prompt concerns. The aims and treatment targets should be reinforced at this point and appointments made for further follow-up
To reinforce postoperative care requirements | Improve medicine compliance or emphasize importance of physiotherapy techniques (see BSAVA Manual of Canine and Feline Rehabilitation, Supportive and Palliative Care)
To discuss results of investigations | Present radiographic findings or indicate the next level of treatment, and discuss prognosis

6.13 Functions of the postoperative check-up.

6.14 Appearance at a 3-day postoperative check-up following cranial cruciate ligament repair. The wound looks comfortable, with no sign of infection. The owner should be fully informed about ongoing exercise and physiotherapy requirements.
Euthanasia: considerations for canine practice

Ross Allan

As a vocation, the drive for those entering the veterinary profession is to diagnose illness in animals, successfully treat them and make them well. However, in the course of their training, students become increasingly aware that this is not always possible, nor always practical for the owner. For the recent graduate working in general practice, the reality becomes even starker. Since it is not always possible to maintain the animal’s health and quality of life, euthanasia and the decisions surrounding it are part and parcel of the working day of the veterinary surgeon. As a profession, vets owe it to their patients, their clients and themselves to evaluate the factors influencing the decision to perform euthanasia, and to examine how stress can be minimized for both the owner and the pet, and how mishaps can be prevented. Euthanasia is not, nor ever should be, considered as clinical failure or automatically the only option for those with restricted funds.

Decision-making and consent

Rapid progress in veterinary medicine, coupled with increasing clinical ability, means that most conditions presenting in practice have scope for further treatment. Clients rely on vets for information and advice on the condition that their pet has and on the treatment options available. The advice given should be impartial and should not pre-empt the clients’ thoughts. It is wrong to prejudge their decisions or choice of treatment.

Approach to the client

Although we know that all life will inevitably end at some point, the loss of a pet may be exceptionally hard. For many owners, especially those that are young, it may be the first time they have been faced with decisions concerning a loved one. In some instances the decisions they have to make are more complicated than when a relative is unwell. Many discussions with clients will be over clinical options, but as a pet ages the treatment choices will gradually become intertwined with the possibility of euthanasia.

At the time of euthanasia, clients’ emotions can be heightened to a level that they may experience only a few times in their lives. Emotions last experienced at the loss of a close family member often arise, as do memories of the relationships the client had with their pet and family member in the past. What is said, and the way the vet behaves in front of the client at this time is crucial. Whilst empathy comes naturally to many within the veterinary profession, there are also pointers to learn that can help to ensure the client feels that the vet cares about them and, most importantly, their pet:

- Ensure that you know the client’s name, as well as the pet’s name and sex
- If you have not met the client before, make sure to introduce yourself and the veterinary nurse
- When discussing quality of life, or at the time of the decision-making, it may help to sit down
- Remove the stethoscope from around your neck. This conveys that you are concentrating on what the client is saying – and caring about their pet, not thinking about anything else
- Do not stand on the other side of the table from the client; move around to be on the same side of the table as the owner
- Stand with an ‘open’ posture: hands should not be crossed or in pockets; feet should be slightly apart
- Stand in a similar posture to the one the client is taking. This shows that you are concentrating on what they have to say
- Take your time – ‘silence says a thousand words’. Take care to speak slowly and give time for the owners to think about what you have said. There is a natural tendency for vets to rush the euthanasia consult; allowing time will ensure the client feels you care.

The points above are no substitute for genuine empathy and concern – clients will know if the veterinary staff genuinely care (Figure 7.1); the clients deserve this, as do their pets.

Quality of life

What determines ‘quality of life’ (QoL) is open to debate. The owner should have a key role in the discussion and will often begin to form an opinion of what to do; whether to continue to treat (if an option), or whether euthanasia would be the right thing.
Euthanasia: considerations for canine practice

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Questions that may help guide an owner to consider their pet’s quality of life are listed in Figure 7.2.

- Does your pet play with you, or enjoy being petted/brushed?
- Does he/she look forward to food?
- Does he/she still want to go out for a walk?
- Does he/she suffer urinary or faecal incontinence?
- Does he/she want to interact with you and your family?

PRACTICAL TIP

Clients may find it helpful to compile a diary, especially if their pet has a chronic illness. Such a diary can have two columns per day: one listing the good points of the day; the other listing the bad points. This may give clients a better appreciation of the state of their pet’s health and allow them to recognize when quality of life is deteriorating.

Pain is often an owner’s prime concern, and it is important to try to explain as well as possible whether a dog could be experiencing pain and, if so, whether the management of that pain could be improved. It is important to consider and explain the level to which pain can now be controlled. In many cases this will mean that quality of life can be increased, or managed better from day to day.

At this stage many owners will commonly ask, “What would you do if it was your pet?” While it can be appropriate to give an opinion, it is important to make clear that the final decision has to be theirs – they know their dog better than anyone else. Once the decision has been made, it is essential to support them in that decision, and reinforce that the correct choice has been made. The owner should also sign a euthanasia consent form. This serves to document that permission was given for euthanasia of the dog and that a conversation took place around the decision to euthanase. The completed form should be retained by the practice.

Acting without consent

Situations may occur when euthanasia is required without direct owner consent. The vet’s overriding professional obligation is to the welfare of the animal under their care. If euthanasia is truly required it is incorrect to postpone it simply to give time for the owner to be contacted or traced. Should this situation arise, it would be wise to get a second opinion from a colleague. The details of the clinical deliberation that occurred, resulting in the decision being made without the owner being present, should be clearly put into the clinical notes. Detailing this deliberation – and the efforts that have been made to contact the owner – reduces the risk of complaint should the owner appear at a later date.

Intraoperative euthanasia

In some circumstances exploratory surgery may be performed to confirm a diagnosis, or to assess whether surgery could be performed depending upon what is found. While modern diagnostic imaging means that it is rarer to have to do so, in some cases a decision regarding euthanasia may have to be made while the dog is on the operating table.

Preparation is essential to avoid a difficult situation. The client must be fully aware of what may be found during surgery, the possible merits of performing surgery, and any issues affecting surgical recovery.

- The worst situation would be to call the owner during surgery and get either an engaged tone, or an owner unable to make a decision on whether to proceed with surgery, euthanasia, or recovery from anaesthesia. In any of these circumstances, if in doubt, euthanasia should NOT be performed as long as the animal does not suffer.
- For any surgical procedure where there is the prospect that euthanasia may be required, full discussion must be held with the client prior to surgery. They should be given an anticipated time that surgery may be performed and all routes of contact must be clarified.
- In some instances it may be that a consent form is signed giving permission for euthanasia if the surgical findings are hopeless, but even in these circumstances it is prudent to attempt to contact the client to discuss the findings prior to administering the lethal dose.

The decision to perform euthanasia is one for which the client may require time to reflect and consider. With modern analgesics, recovery from anaesthesia and euthanasia later in the day is far preferable to clients feeling regret at making the decision too quickly, or feeling that they were at all pressurized into making a decision.

Preparation for euthanasia

At the practice

Sometimes the choice of euthanasia will require prompt decision-making, but in most circumstances there will be the opportunity to get to know the owner
and the pet prior to the time of euthanasia. This is important. Clients will feel more open and trusting when a relationship has developed. In addition, there will be the opportunity for the clinician to plan the final euthanasia consultation. This is preferable, as it enables stress to the owner, pet and the vet to be minimized; simple things can make all the difference (Figure 7.3).

### Reducing stress for pets, owners and staff during a euthanasia consultation.

The decision on whether or not to stay for the euthanasia is one the owner must make. Some owners prefer to remember their dog as it was; others would rather be with the dog until the euthanasia has been performed and the vet has said that the dog’s heart has stopped beating. It is wise to offer owners both options, and let them make the decision. At this stage it is useful briefly to describe the process (see later).

### Home visits

Home visits may be preferable, especially if a pet is very elderly or collapsed. In many cases this removes any suggestion of the procedure being rushed, and can result in the euthanasia event itself being one of the most rewarding many vets experience.

Suggestions to ensure that home visits are smooth and proceed without distress are given in Figure 7.4. Equipment required for euthanasia is shown in Figure 7.5.

### Preparation for a home visit for euthanasia.

- Quiet waiting room and practice: no barking dogs or staff laughing.
- Arrange a consultation time for the last appointment before a break or the end of the day.
- Ensure all staff members are aware.
- No staff intrusions into the consulting room: have a spyglass in the consulting room door, or a slide sign showing that the room is in use.
- Vet who knows the pet and owner: ideally, you will have met the clients before, and have read the history.
- A nurse to help: ideally one that knows the clients as well. If not, introduce them.
- Turn any phones in the room to silent. Make sure no mobile phones are in pockets.
- Intravenous access: use a preplaced intravenous catheter if possible. If this has not been possible, take more than one needle into the room.
- Bed for the dog – on the table whenever possible.
- Tissues to hand for owners.

### Equipment for a home visit for euthanasia.

- Clipping
- Venous access
- Restraint
- Movement at time of injection
- Discomfort
- As injection is administered
- Predict the unexpected
- Eyes remain open
- Relaxation
- Agonal gasps and twitching

### Explaining the process

One difficulty of euthanasia is that often clients will have misconceptions over what happens prior to the event itself, whether from TV, relatives or previous experiences. No two euthanasia events are the same, however, and it is important to take the client on the journey through the consultation to ensure that they are aware of the process and feel part of it.

For this reason it is helpful to explain to the client both prior to and during the event what is happening (Figure 7.6). At this time clients will be acutely sensitive and will notice if veterinary staff speak of their pet impersonally. Using words like ‘they’ or ‘it’ should be avoided at all costs: use the pet’s name!

### Action/occurrence

**Explanation examples**

- Clipping
  - “I will need to clip a small patch of hair.”
- Venous access
  - “I will place the injection into the vein in Buster’s leg.”
- Restraint
  - “The nurse, Jenny, will help to support Buster as he gets the injection.”
- Movement at time of injection
  - “There can often be a small movement as the needle goes in. This is normal.”
- Discomfort
  - “Apart from the needle going in, Buster won’t feel anything.”
- As injection is administered
  - “You may notice Buster taking a few deep breaths. These are the last breaths as his body shuts down. It wouldn’t be unusual for some to occur even after he’s passed away.”
- Predict the unexpected
  - “Kidney problems often mean a few deep breaths can be taken after the injection has been given. This is normal.”
- Eyes remain open
  - “When Buster passes away his eyes will stay open. They do not close over.”
- Relaxation
  - “As Buster passes away his muscles will relax. This may mean that his bladder leaks a little. I will place some tissues under him just in case.”
- Agonal gasps and twitching
  - “Buster has passed away now. His body may tremble a little and take some large gasps as if he is breathing, but these are just reflexes, and settling.”
Euthanasia techniques

It is important to have a nurse available to help perform euthanasia; they should restrain the dog (Figure 7.7), but take care not to appear to be holding it too tightly as clients may find that extremely upsetting.

It is preferable to have a nurse that is familiar with the client had with their pet. Asking questions such as “How old was Rusty when you got him?”, or saying “He has been a lucky dog to have you look after him for so long”, will often bring a torrent of emotions and memories of the times your colleague prior to commencing euthanasia. You must work together to make it as smooth as possible – communication is key.

A Whippet being held by a nurse for intravenous injection.

PRACTICAL TIPS

- Do not be afraid to discuss what you are going to do with your colleague prior to commencing euthanasia. You must work together to make it as smooth as possible – communication is key.
- It is better to have the dog supported in sternal rather than lateral recumbency – this makes finding a vein slightly easier by improving cephalic vein pressure.

Sedation

There is debate in many practices over whether sedating the dog prior to euthanasia is appropriate. Some vets believe that owners may not wish it, as it can mean that their pet is not fully conscious when it receives the injection; others feel that sedation can reduce the risk of the dog struggling whilst restrained as the injection is administered – this may be distressing to owners and staff should it occur. The response to the administration of pentobarbital may be less predictable in a sedated animal and venous pressure may be reduced, thereby making injection administration more challenging. The use of sedation should be discussed with the individual owner, and they should be made aware of what the vet is doing – prior to doing it.

If sedation is deemed appropriate the following protocols could be considered:

- Buprenorphine (20 µg/kg) + acepromazine (20 µg/kg); suitable for older or quiet animals – and can be administered subcutaneously
- Butorphanol (0.1 mg/kg) + medetomidine (10 µg/kg); will ensure profound sedation but ideally needs to be given intramuscularly or intravenously. It may be particularly useful for aggressive or boisterous dogs, though owners should be warned that if intravenous access is not readily available (due to aggression) intramuscular administration may provoke an aggressive reaction from their pet; the owner should be counselled that this is only while the sedative is being administered, with the aim of allowing the euthanasia to be performed peacefully.

NB: The dosages above are for sedation; the actual doses used for sedation prior to euthanasia may be greater, especially in aggressive or boisterous dogs, as oversedation is not then a concern.

The time required between sedation and euthanasia is liable to variation depending on the dosages administered, the infirmity of the pet and the degree of stimulus the pet is experiencing at the time. If too much time passes, venous access may be difficult due to decreasing blood pressure. Generally 5–10 minutes is long enough.

PRACTICAL TIP

If sedation is not possible or appropriate, pre-clipping the area for injection and then applying a local anaesthetic skin cream (e.g. EMLA) is helpful for reducing the risk of the dog moving while the euthanasia injection is being administered.

Following sedation, dogs may be left with owners in the consulting room. It should be remembered however that a sedated dog is under veterinary care and the veterinary surgeon is responsible for its actions. Many owners will appreciate the time to speak to someone about the memories they have of their pet. Asking questions such as “How old was Rusty when you got him?”, or saying “He has been a lucky dog to have you look after him for so long”, will often bring forth a torrent of emotions and memories of the times the client had with their pet.

If a dog is very fractious, oral sedation at home prior to euthanasia might be considered. Acepromazine tablets are of use, but their sedative effect is variable; there are reports that using the oral forms of acepromazine and phenobarbitone in combination can be more effective. Many vets prefer not to use oral sedation, instead opting for injectable sedation as it is more reliable.
Chapter 7  Euthanasia: considerations for canine practice

Routes of euthanasia

Intravenous injection via the cephalic or saphenous vein is the recommended method for administering pentobarbital (150 mg/kg or higher). Where venous access is anticipated to be difficult, it is preferable to preplace a venous catheter.

PRACTICAL TIP

In circumstances where pre-placement is not possible and access is difficult but euthanasia is urgently required, e.g. after a severe road traffic accident or for an emaciated animal, it can be useful to use a tourniquet around the upper limb. This often helps more than digital pressure. Rubber bands and artery forceps can suffice if there is no tourniquet available.

Other routes for euthanasia are possible but have disadvantages that mean they are normally unsuitable for performing in front of an owner:

- Intraperitoneal: slow, unpredictable and can be stressful when the owner is present; doses of 200 mg/kg are required.
- Intrarenal: rapid, but likely painful due to distension of the renal capsule; doses of 200 mg/kg are required.
- Intrahepatic: not as rapid as renal injection, but reasonably quick and does not normally elicit pain; doses of 200 mg/kg are required.
- Intracardiac: rapid and predictable, especially where venous access is not possible. Generally, if the dog is collapsed or unconscious doses of 150 mg/kg are required. Very unsuitable for performing in front of owners, especially due to risk of the injection entering the lungs, leading to coughing and distress.

Owing to the ready availability of pentobarbital, using overdoses of intravenous medications such as propofol, thiopental or potassium chloride for the purpose of elective euthanasia is unjustified.

What to do if something goes wrong

Situations occur where things do not go to plan; there may be no nurse available; the injection may be preplaced a venous catheter.

- No nurse available: Sedation will help – “I am going to give Flossie a sedative to enable me to give her the euthanasia injection”
- Perivascular injection: “The needle has slipped out of the vein. This happens occasionally, especially when the blood pressure is poor. What I need to do is shave a small patch of hair from another leg to give the injection there. This will just take a few moments”
- Aggressive or distressed dog: “I appreciate that you are not keen for me to sedate Rex, but unfortunately I do need to give him a sedative so that I can give the injection while causing minimal distress for him, and for you and me as well.”

After euthanasia

Often owners wish to stay with their dog for a time after euthanasia, though some do not. Provision for the owners to exit rapidly should be prepared prior to the event itself in case it is required.

Clients will often share memories of their pet’s life at this time. It is important to share this time with them and reassure them that they gave their pet the best home they could.

Options for cremation or burial

It is necessary to discuss the options for disposal of the body. Most pet crematoria companies will offer a variety of caskets, or biodegradable containers if the client wishes to have their dog’s ashes returned.

Home burial is a way of owners personalizing the loss of their pet. Dogs should be buried around a metre deep and may be wrapped in a biodegradable material – not plastic. The site chosen should not be close to water courses. It is advisable for owners to discuss home burial with their own Local Authority prior to burying, as there may be local or regional variation in the guidance provided.

Pet cemeteries have grown in popularity recently and may be the preferred choice of clients who wish to have a coffin or headstone for their dog. Clients should be aware that there may be an initial fee and an annual maintenance charge associated with this.

Options for disposal are preferably discussed with the owner pre-euthanasia, possibly at the time the decision is made on whether the owner wishes to be present during the euthanasia event itself. If this is not possible, however, the question can be raised afterwards; a phone call later that day or the next is probably most suitable. This small delay is often necessary because clients wish to discuss the options with their family. Care must be taken to ensure that the pet is not transported to a crematorium in the intervening time, as this would be embarrassing and very distressing for all involved.

The practice will have a protocol for storage of cadavers and for disposal where owners do not wish to be involved (see BSAVA Manual of Small Animal Practice Management and Development).

Payment

Asking for remittance at this time can be very difficult. Some owners feel this is wrong, but if the practice has no experience of the client, or if they have a poor history of settling their account it is not inappropriate to ask for the bill to be paid, especially if owners have elected for private cremation. If the client is well known, however, payment may be left for another day.

Bereavement

The death of a pet may mean that the owner experiences more heightened emotions than they have for some time.

Kübler-Ross (1969) researched the emotions experienced by people who were themselves terminally ill. As she researched these she hypothesized that the emotions experienced at this time were similar to those experienced during any catastrophic personal...
loss in life; such as the loss of a loved one. Kübler-Ross noted that those going through any major stressful event involving some element of loss experienced five key components (Figure 7.8). The level to which any one individual experienced these stages varied; not all people experienced all of them, they were not necessarily chronological and neither did all stages necessarily occur in all people.

The theory might be applied to veterinary medicine as follows:

- **Denial:** This may manifest as owners being unwilling to accept that the time to make the decision to perform euthanasia has arrived.
- **Anger:** Clients may become verbally abusive, or want to leave the consulting room far more quickly than anticipated.
- **Bargaining:** This is often encountered in veterinary medicine where a decision to perform euthanasia is not time-critical. Often clients will wish to postpone for a few days, or try another avenue of treatment, even when it is not likely to be effective. This is normal human instinct and not necessarily a sign that the client does not trust the vet’s diagnosis.
- **Depression:** Clients will often be inconsolable after the euthanasia event itself, often more than they ever expected.
- **Acceptance:** Clients realizing that they have made the correct decision, at the right time, and that their pet was well looked after, is what is hoped will happen before the client leaves the consulting room. The reality is, however, that it can take a while for clients to digest what has happened and arrive at this point.

Realizing that these are normal emotions, should help vets to speak to clients appropriately, and guide them through what is a stressful time.

Remembrance cards (Figure 7.9) or phone calls on the day or a few days after the event can be useful, and there are some who are strong advocates of this. Clients may often go through emotions of self-blame, feeling that they have let their pet down or else kept them alive for too long. An empathetic phone call can help resolve these feelings. It must be cautioned, however, that these contacts a few days after the event can also unearth emotions clients would rather not experience again. For this reason, any such decision should be based on knowledge of the individual client.

### Client resources

- **Coping with The Loss of your Pet. BSAVA PetSavers client leaflet** [also available online to BSAVA members]
- **Pet Bereavement Support Service. A telephone and online service run jointly by SCAS [www.scas.org.uk] and the Blue Cross [www.bluecross.org.uk]]

### References and further reading


Dealing with emergency cases

Sophie Adamantos

In most small animal practices true emergencies will be relatively uncommon, but with the increase in emergency centres within the UK there will be practices where emergency cases are in the majority. Although emergency medicine can be stressful it can also be extremely satisfying. Maintaining a calm approach is vital and makes everything easier. With a standardized, logical approach to patient management the veterinary team can make the difference between life and death. This truly is the area of practice where interventions can have an immediate effect! Common emergency presentations are listed in Figure 8.1.

- Acute distress/pain
- Acute gastrointestinal problems
- Choking
- Collapse
- Dyspnoea
- Heart failure
- Seizures
- Toxicity
- Trauma

8.1 Common emergency presentations in canine practice.

Telephone triage

In most emergency situations the first person in contact with the owner will be the receptionist or veterinary nurse who answers the telephone. Those answering the telephone should maintain a calm and professional manner at all times. It is vitally important that staff are briefed as to how to deal with owners who may be emotional or distressed. Staff must have received appropriate training for the recognition and management of emergency situations over the telephone. Outside normal working hours it is often better for a nurse or vet (rather than a receptionist) to deal directly with owners calling in, but during the day this is not usually possible and in these circumstances having lists of what to do and when can be helpful. Identifying what constitutes an emergency can be challenging over the telephone: what constitutes an emergency in the mind of a worried owner may be anything but; however, there are a number of situations where the dog should be seen immediately (Figure 8.2). Where there is any doubt, the owner should always be advised that their pet is seen as soon as possible.

The dog should be seen immediately
- Loss of consciousness
- Unable to stand or move
- Problems breathing
- Severe bleeding (including vomiting blood)
- Severe trauma
- Acute-onset fits (seizures) or ‘funny turns’
- Fainting
- Bloating
- Witnessed toxin ingestion
- Trying to vomit and cannot
- Severe pain

The owner should be advised that the dog should be seen urgently
- Severe vomiting or diarrhoea
- Trauma
- Bleeding
- Acute-onset eye problems (pain, clouding, redness)
- Severe acute-onset lameness
- Less serious wounds

A vet or nurse should speak to the owner
- Problem after surgery
- Straining
- Not eating
- Coughing or wheezing

8.2 Recognizing emergency situations. This list is not exclusive; there are other situations in which the dog should be seen promptly. Speaking to the owner may help to clarify the situation.

It may be useful to provide receptionists with a checklist or to have a standard operating procedure so that correct advice is given. It is useful to obtain some information about the pet and its main problems, but spending too much time doing this should be avoided.

- The owner’s name and phone number must be obtained early in the call in case there is a loss of contact.
- Limited information such as signalment of the dog (to allow preparation), the pet’s name and the
Dealing with emergency cases

8.3 Condition First aid advice

<table>
<thead>
<tr>
<th>Condition</th>
<th>First aid advice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bleeding</td>
<td>Apply pressure using clean absorbent material, e.g. a T-shirt or sheet</td>
</tr>
</tbody>
</table>
| Seizures    | Do not attempt to restrain the dog
|             | Transport the dog carefully to the veterinary surgery
|             | Do not place blankets over the dog as this may lead to overheating |
| Burns       | Apply cool water to the burnt area for at least 10 minutes
|             | Avoid ice packs; use a tap, bath or hose |
| Heat stroke | Wet the dog using cool water (tap, bath or hose) |

Basic equipment for an emergency patient

- Materials for skin preparation (swabs, surgical spirit, antiseptic solution)
- No. 11 scalpel blade (for facilitative skin nick prior to catheter placement)
- Intravenous catheters (various sizes)
- Connector, bungs and extension set
- Adhesive tape
- Needles and syringes (various sizes)
- 5 ml saline to flush syringe after placement
- Tubes for blood collection (EDTA for haematology; heparin for plasma; plain for serum)
- Capillary tubes (for PCV measurement)
- Facemask and anaesthetic circuit connected to oxygen supply

Hospital triage

Once the patient arrives it should be assessed immediately and a decision made as to the urgency of the problem. Rapid major body system assessment for identification of serious abnormalities (see Figure 8.4) allows this decision to be made. A suggested protocol for cardiopulmonary resuscitation (CPR) is provided at the end of the chapter (QRG 8.1).

If the patient is considered to be unstable, the dog should be removed from the owner and consent obtained for basic investigation and therapy. Owners are frequently distressed and someone should be made available to talk with and calm them; a cup of tea is often much appreciated. If this is not possible immediately, the owner should be reassured that their pet is in the best place and that experienced people are dealing with it and that the vet will be back as soon as possible once treatment is underway. Separating the clinical problem from the emotionally anxious owner reduces stress for the clinical team and allows them to concentrate fully on the patient.

Preparation

Following the telephone conversation, preparation should begin for the dog’s arrival. This is made easier by having some idea of the main problem.

Basic equipment for any emergency case should include that necessary for placement of an intravenous catheter, blood sampling and for measuring packed cell volume, total protein, glucose and urea or creatinine. Oxygen supplementation should also be easily available. If the patient is known to be dyspnoeic or collapsed, easy access to an endotracheal tube and laryngoscope and emergency drugs, including anaesthetic agents, is advised.

**WARNING**

Owners will often ask for advice rather than coming to the practice. If there is any doubt about the clinical state of the dog this should be avoided. It is useful to remember that the majority of owners are not medical professionals and may not accurately assess the health status of their pet or the urgency of the situation.

Owners should not be asked to administer any medications unless previously advised for a known medical problem.

Basic first aid information may be provided if necessary for situations such as bleeding, burns and seizures (Figure 8.3) but veterinary care should not be delayed due to this. Owners should be warned that dogs in pain may behave abnormally and therefore should be approached and handled with extra care.

**WARNING**

Basic first aid advice for owners. Further information on management of these conditions is given in Chapters 10, 11 and 18.

Under no circumstances attempt to stabilize a patient with the owner present. It induces stress and the clinician’s concentration is distracted by anxious questioning; it is in no-one’s best interest!

A full, complete medical history is not required at this stage. Basic information for immediate management of the case is all that is required. A full history may be obtained at a later stage when everything is under control.
Major body system assessment and stabilization

The aim of the major body system assessment is to identify problems that are immediately life-threatening, and allow initiation of therapy and instigation of an investigative plan. The major body systems are the cardiovascular, respiratory and neurological systems (Figure 8.4); once these have been assessed, significant findings should prompt interventions for stabilization. Once the patient is more stable, a complete physical examination should be performed to allow more directed therapy.

**Body system** | **Assessment**
--- | ---
Cardiovascular | Heart rate, Pulse quality, Mucous membrane colour, Capillary refill time, Auscultation
Respiratory | Respiratory rate, Respiratory effort, Observe and listen for pattern and noise, Auscultation
Neurological | Mentation, Posture, Pain sensation

**PRACTICAL TIP**

A few dogs presenting as emergencies may have no abnormalities on physical examination but this does not mean that they do not require immediate therapy. A classic example of this is toxin ingestion.

Dogs requiring hospitalization should have intravenous access established for administration of medications. A cephalic vein catheter is most appropriate, as it is simple and quick to place and secure (see BSAVA Guide to Procedures in Small Animal Practice). Once the catheter is in place, a small amount of blood can be obtained for a minimum database; this is required for all dogs unwell enough to require hospitalization for medical problems, and for surgical patients requiring anaesthesia.

Wounds and open fractures should be covered with a sterile temporary dressing during initial assessment and stabilization; then managed appropriately as soon as possible.

**Minimum database**

This should include:

- Packed cell volume (PCV)

**PCV and TP**

PCV and TP measurements can identify the presence of anaemia and help identify the aetiology (Figure 8.5).

<table>
<thead>
<tr>
<th>PCV</th>
<th>TP</th>
<th>Possible causes</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased (&gt;55%)</td>
<td>Increased (&gt;75 g/l)</td>
<td>Normalization (50–75 g/l)</td>
<td>Normal for breed (e.g. sight hounds) Polycythaemia Haematology</td>
</tr>
<tr>
<td>Normal (37–55%)</td>
<td>Increased</td>
<td>Hyperglobulinaemia Arterial</td>
<td>Biochemistry</td>
</tr>
<tr>
<td>Decreased (&lt;50 g/l)</td>
<td>Decreased (&lt;37%)</td>
<td>Acute haemorrhage Hypoproteinaemia</td>
<td>Administer intravenous fluids if hypovolaemic Biochemistry</td>
</tr>
<tr>
<td>Normal</td>
<td></td>
<td>Chronic anaemia Haemolytic anaemia</td>
<td>Haematology</td>
</tr>
<tr>
<td>Decreased</td>
<td>Haemorrhage Anaemia and hypoproteinaemia</td>
<td>Haematology and biochemistry</td>
<td></td>
</tr>
</tbody>
</table>

Common abnormalities of PCV and TP; suggested causes and interventions.

**Blood glucose**

Blood glucose should be measured in any collapsed patient, as hypoglycaemia is easy to identify and address. Furthermore, hypoglycaemic dogs will not respond to other therapies until their blood glucose is normal. In a collapsed dog, a blood glucose concentration of <3.0 mmol/l should prompt administration of glucose (0.25 g/kg i.v.) and investigation for the underlying cause (Figure 8.6).

Hypoglycaemia as a result of seizure activity is extremely rare and it is more likely that in a seizuring patient the hypoglycaemia is the cause of the seizure. Investigation should therefore be directed at the cause of the hypoglycaemia.

**Blood glucose concentration** | **Common causes** | **Action**
--- | --- | ---
<2.5 mmol/l | Insulin overdose, Insulinoma, Toy dog hypoglycaemia, Puppy hypoglycaemia, Sepsis | Consider serum insulin measurement. Administer glucose 0.25 g/kg (i.v. (0.5 ml of a 50% glucose solution diluted 1:1 with saline) Maintain on 2.5–5% glucose infusion |
2.5–3.5 mmol/l | As above | Monitor |
>14 mmol/l | Stress (rare), Diabetes mellitus, Fructosamine assay, Urinalysis | Rehydrate prior to considering insulin administration if ketotic |

Common abnormalities of blood glucose concentrations; suggested causes and interventions. Reference level is approximately 4–6 mmol/l.
Dealing with emergency cases

Hypoglycaemia is rarely seen as a result of stress in dogs, except in severe hypoperfusion and head trauma, and in these situations blood glucose is still generally <12 mmol/l. A blood glucose concentration above 14 mmol/l should therefore prompt investigation for diabetes mellitus.

**Urea and creatinine:** Serum urea or creatinine concentration gives an indication of kidney function (Figure 8.7). If serum concentrations are increased, a urine sample should be obtained (if easily possible) prior to starting fluid therapy, in order to allow differentiation of prerenal, renal and postrenal causes.

<table>
<thead>
<tr>
<th>Urea</th>
<th>Creatinine</th>
<th>Common causes</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased</td>
<td>Normal</td>
<td>Prerenal azotaemia Gastrointestinal haemorrhage</td>
<td>Urinalysis Faecal examination Consider fluid therapy</td>
</tr>
<tr>
<td>Normal</td>
<td>Increased</td>
<td>Muscular animal/normal for breed</td>
<td>None</td>
</tr>
<tr>
<td>Increased</td>
<td>Increased</td>
<td>Prerenal azotaemia Renal azotaemia</td>
<td>Careful physical examination Urinalysis Consider fluid therapy</td>
</tr>
</tbody>
</table>

**Cardiovascular abnormalities – assessment and management**

**Hypoperfusion (shock)**

The main aim of the cardiovascular assessment is identification of hypoperfusion (shock). There are four common types of hypoperfusion and careful cardiovascular examination will allow differentiation between them.

- **Hypovolaemic shock**. The most common cause of hypoperfusion in dogs is hypovolaemia, typically as a result of blood loss or fluid loss into the gastrointestinal tract.
- **Cardiogenic shock** is caused by failure of the pump mechanism, as a result of either decreased myocardial function or arrhythmias.
- **Obstructive shock** is caused by interference with filling of the right side of the heart, for example as a result of cardiac tamponade or gastric dilatation–volvulus (GDV).
- **Distributive shock** is caused by excessive vasodilatation as a result of overwhelming inflammation or infection, and is also known as endotoxic or septic shock.

Hypoperfusion, whatever the cause, should be treated as a matter of urgency, as prolonged hypoperfusion is associated with organ dysfunction and increased mortality. In many forms of hypoperfusion, fluid therapy is the primary intervention required for stabilization. This is particularly true in hypovolaemic and distributive shock, where there is either a true or relative deficit in intravascular volume. Careful cardiovascular assessment will enable the clinician to rule out underlying cardiac disease as the cause of hypoperfusion. The presence of a murmur, jugular distension or arrhythmias should prompt further examination of the heart for the presence of cardiogenic shock.

**WARNING**

**Fluid therapy is contraindicated in cardiogenic shock**

As the most common cause of hypoperfusion is hypovolaemia, assessing patients with cardiovascular compromise for this as a priority is a sensible approach. The dog should be assessed for the severity of the hypovolaemia (Figure 8.8), which will allow the clinician to titrate therapy.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Mild (compensatory)</th>
<th>Moderate</th>
<th>Severe (decompensatory)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart rate (beats/min)</td>
<td>130–150</td>
<td>150–170</td>
<td>170–220</td>
</tr>
<tr>
<td>Mucous membrane colour</td>
<td>Pinker than normal</td>
<td>Pale pink to normal</td>
<td>White/muddy/grey</td>
</tr>
<tr>
<td>Capillary refill time (CRT)</td>
<td>Vigorous; &lt;1 second</td>
<td>Reduced vigour; 1–2 seconds</td>
<td>&gt;2 seconds or absent</td>
</tr>
<tr>
<td>Pulse amplitude</td>
<td>Increased</td>
<td>Normal to decreased</td>
<td>Decreased</td>
</tr>
<tr>
<td>Pulse duration</td>
<td>Short</td>
<td>Normal</td>
<td>Very short</td>
</tr>
<tr>
<td>Mentation</td>
<td>Normal</td>
<td>Slightly depressed</td>
<td>Obtundied</td>
</tr>
<tr>
<td>Suggested initial isotonic</td>
<td>10 ml/kg i.v. over 20 minutes</td>
<td>20 ml/kg i.v. over 15–20 minutes</td>
<td>30–40 ml/kg i.v. over 15 minutes</td>
</tr>
</tbody>
</table>

**8.8 Assessment of severity of hypovolaemia, with suggested initial fluid therapy.**

Most dogs respond in a similar way to increasing severity of hypovolaemia (see Figure 8.8). Initially, the response to hypovolaemia results in a hyper-responsive picture on cardiovascular examination:

- Mucous membranes appear pinker than normal
- Capillary refill time (CRT) is shortened
- Pulse pressure is heightened or bounding.

As the severity of hypovolaemia worsens:

- Heart rate will increase
- Pulse quality will decrease
- Mucous membranes will become paler
- CRT will become prolonged.

Where there are deviations from the expected pattern, careful examination for other forms of hypoperfusion should be undertaken. This should include looking for signs of cardiac failure, infection/inflammation or obstruction to venous filling, e.g. jugular vein or...
abdominal distension. Historical information may also be useful, such as the presence of a chronic cough and heart murmur which may indicate the presence of congestive heart failure, or in entire bitches where pyometra may be a consideration leading to distributive shock.

**Management**

Management of hypoperfusion should be a priority if identified. Prolonged hypoperfusion increases the risk of complications including organ dysfunction.

Fluid therapy must be titrated to the individual patient. When devising a fluid therapy plan the following questions should be considered:

- What route?
- What type?
- How much?
- Over what period?

**WARNING**

**Contraindications to fluid therapy**

Whilst fluid therapy is vital for successful management of many types of shock, in certain circumstances it may make the situation worse. Fluid therapy should not be administered in the initial stabilization period, unless there are specific indications to do so, if any of the following signs/conditions is present:

- Left-sided congestive heart failure
- Jugular distension
- Pericardial effusion
- Supraventricular tachycardia (heart rate >250 beats/min)

**Hypovolaemic shock:**

Hypovolaemia is managed with intravenous fluid therapy. Despite a large volume of research in this area in human medicine, there is no evidence to suggest that there is a benefit associated with the use of another type of fluid over isotonic crystalloids. For this reason, isotonic crystalloid fluids such as 0.9% saline or lactated Ringer’s solution should be used for initial resuscitation.

**PRACTICAL TIP**

Fluid therapy for hypoperfusion is an inexact science and all doses should be administered to effect; if the initial dose is not effective this should prompt re-evaluation of the patient.

When using isotonic crystalloids it is helpful to think about the ‘shock dose’. This is a safe volume to administer to a healthy dog without evidence of cardiovascular/respiratory or renal disease. It is also a reflection of the complete blood volume. A full shock dose is 60–90 ml/kg, but it would be unusual to administer this as a single dose. More commonly, a proportion of the shock dose is administered, depending on the severity of the signs. Suggested initial doses are listed in Figure 8.8. These initial doses should be administered rapidly, i.e. as a bolus, typically over 10–20 minutes. In large dogs this is best achieved using a pressure bag (Figure 8.9).

**8.9** Administering a bolus of Hartmann’s (lactated Ringer’s) solution, using a pressure bag, to a 5-year-old female neutered Labrador Retriever with hypovolaemia as a result of severe haematuria.

Once the initial bolus has been given, the patient should be reassessed.

- If the patient is stable, fluid therapy can be stopped.
- If the dog still has signs of hypovolaemia, a further dose can be administered.
- If a full shock dose has been administered and the patient is still unstable, the dog should be carefully reassessed for ongoing haemorrhage or the presence of other forms of hypoperfusion (distributive, cardiogenic or obstructive).

**Other types of hypoperfusion:**

Management of other forms of hypoperfusion is aimed at the underlying condition. In some circumstances more than one type of hypoperfusion can co-exist, generally in conjunction with hypovolaemia, and therefore fluid therapy may be involved in the management of these cases.

**Cardiogenic hypoperfusion:**

This indicates myocardial dysfunction, either as a result of pump failure or arrhythmias. Management of arrhythmias requires electrocardiogram (ECG) analysis. Commonly utilized therapies include lidocaine for the management of ventricular arrhythmias and beta-blockers and calcium channel blockers for the management of supraventricular arrhythmias. If there is an underlying myocardial disease, such as dilated cardiomyopathy, therapy is aimed at improving inotropy. Ventricular arrhythmias can occur as a result of both cardiac and non-cardiac disease; if these are identified and cardiac disease is excluded, careful examination for concurrent abdominal (particularly splenic) or respiratory disease should be performed.
Dealing with emergency cases

Obstructive hypoperfusion: This is most commonly seen as a result of GDV or pericardial effusion. In these situations therapy is aimed at the underlying cause; i.e. drainage of the pericardial effusion or gastric decompression. In GDV, gastric decompression should occur at the same time as, or after, fluid therapy. Gastric decompression is very important in stabilizing these dogs, as it removes the cause of obstruction.

Distributive hypoperfusion: This is more challenging to manage as affected dogs have widespread vascular dysfunction as a result of systemic inflammation. This results in global vasodilatation and a relative hypovolaemia and, hence, hypoperfusion. Therapy should be aimed at addressing the underlying disease. Due to the relative hypovolaemia, intravenous fluid therapy is extremely important in the management of these cases.

In infectious causes of distributive hypoperfusion, such as septic peritonitis and pneumonia, antimicrobials play a vital role in management, and the collection of samples for culture and sensitivity testing should be prioritized alongside the administration of early appropriate antimicrobials. Fluid therapy remains the mainstay of management in these cases. In some cases inotropes and vasopressors are necessary for the management of perfusion, but the use of these is beyond the scope of this Manual.

The findings from each of these assessments should be cross-referenced, and unexpected findings should alert the clinician to perform further investigations. The presence of injected mucous membranes with severe tachycardia may indicate sepsis or systemic inflammation. Weak pulse quality with a normal heart rate may indicate the presence of an arrhythmia or electrolyte disturbances.

WARNING
Corticosteroids are not required for the emergency management of any type of shock and should not be given. High-dose corticosteroid administration is not indicated in any emergency.

Other parameters
In addition to measurement of heart rate, pulse rate, pulse quality, mucous membrane colour and CRT, cardiovascular examination of the emergency patient includes venous filling, cardiac auscultation and palpation of the apex beat.

Apex beat

- Palpation of the apex beat is an often overlooked part of the cardiovascular assessment but can provide useful information
- The apex beat is quicker to palpate and easier to feel than a pulse in dogs with suspected cardiopulmonary arrest
- Absence of an apex beat, in association with weak pulses, is suggestive of a pericardial effusion

Respiratory abnormalities – assessment and management

During the major body system assessment (see above) the dog should be examined for signs of dyspnoea. Dyspnoea alone rarely causes complete collapse and if a patient has signs of collapse as well as dyspnoea, then examination for the presence of cardiovascular compromise, e.g. left-sided congestive heart failure (CHF) or sepsis, should be instigated.

All patients presenting with dyspnoea should be provided with oxygen therapy (Figure 8.10) and have their stress levels reduced. This is most easily achieved through the use of an oxygen tent at a distance from human interactions. Once the patient is calmer, a more thorough examination can take place. Oxygen should be provided during this assessment, and an anaesthetic circuit (without a mask) is an easy way to do this; using this method, an inspired oxygen concentration of approximately 30–40% is possible.

Examination of the respiratory tract should include observation initially. Signs commonly associated with upper airway obstruction that can be observed include audible noise (stertor or stridor) and a prolonged inspiratory phase. Paradoxical respiration (the thoracic wall moving in during inspiration) is commonly associated with pleural space disease in dogs, and an expiratory push is often seen with lower airway disease.

Auscultation can provide valuable information, but is performed more easily when the dog is not panting. However, panting should not be prevented in dyspnoic dogs; it can allow assessment of pleural space disease as breath sounds are amplified and so the absence of breath sounds is easier to identify. Commonly heard sounds include: fine end-inspiratory crackles that are associated with pulmonary oedema; coarse inspiratory crackles associated with airway disease; and expiratory wheezes which are associated with bronchoconstriction. It is also common to hear generalized harshness, which is non-specific and may be associated with a variety of respiratory diseases. As respiratory signs are commonly caused by left-sided heart failure, the heart should be auscultated carefully as well. An increased heart rate (>120 beats/min) or arrhythmia in association with a loud murmur should increase the suspicion of heart failure.

Useful investigative tests in the dyspnoeic patient include imaging, particularly ultrasonography, which can be used even in inexperienced hands to identify pleural effusion. Thoracic radiography for evaluation of the parenchyma can aid in diagnosis (see Chapter 24), as the distribution and pattern are typically associated with specific diseases, for example:

- Peripheral alveolar/interstitial pattern in Angiostrongylus vasorum infection
- Perihilar alveolar pattern in cardiogenic oedema
- Ventral alveolar pattern in aspiration pneumonia; always evaluate the lung fields overlying the cardiac silhouette if this is a concern.

Management
Management of respiratory signs should be aimed at treating the underlying cause and relieving the dyspnoea. A quiet environment can provide as much improvement in a dog as oxygen therapy, and
Chapter 8 Dealing with emergency cases

Modes of oxygen therapy. (a) Oxygen cages are very expensive but are well tolerated and can provide high concentrations of oxygen to dogs of a variety of sizes. (b) A Bulldog puppy with pneumonia. During the initial examination, flow-by oxygen was provided using a T-piece. This is a non-invasive and low stress way to provide oxygen while allowing full access to the dog. (c) An 8-year-old Border Collie receiving oxygen supplementation via tubing during stabilization for hypovolaemia. (d) Endotracheal intubation, as in this Pug, allows any upper respiratory obstructions to be bypassed and can provide 100% oxygen supplementation. (e) A 4-year-old Cocker Spaniel receiving oxygen using nasal prongs. These provide up to about 40% oxygen supplementation and are variably well tolerated. A bridge of tape over the nose can make keeping them in place easier. (f) A 5-year-old Dobermann with pulmonary thromboembolism secondary to immune-mediated haemolytic anaemia receiving oxygen via nasal catheters. If placed bilaterally, these will provide up to 70% oxygen.

Minimal stress should continue. Longer-term oxygen therapy can be provided using nasal insufflation or an oxygen cage. Medium-sized and large dogs will overheat in oxygen tents and so these should be avoided for all but the smallest dogs.

In dogs with upper respiratory obstruction as a result of airway disease, judicious sedation can play an important role in management. Very low doses of sedatives such as acepromazine (0.005 mg/kg i.v.) and butorphanol (0.1 mg/kg i.v.) can be given as required. The dogs should be watched very carefully after administration as some dogs can deteriorate following sedation.

Where there is a suspicion of left-sided CHF, treatment with furosemide should be given at an initial dose of 2–4 mg/kg i.v. or i.m. This dose may be repeated if the dog does not urinate or there is no reduction in respiratory rate after an hour.

If pleural space disease is suspected, thoracocentesis should be performed as a priority as it will provide both relief of respiratory distress and diagnostic information. This technique is described in the BSAVA Guide to Procedures in Small Animal Practice.

Neurological assessment and management

The aim of neurological assessment of the emergency patient is to assess mentation, pain perception and ability to ambulate, i.e. function of the brain and spinal cord. This should enable the clinician to exclude significant central nervous system (CNS) disease. It is important to assess patients when they are cardiovascularly stable, as hypoperfusion has significant effects on mentation and the ability to respond to pain due to the CNS’s high metabolic requirement.

Seizures

Seizures, if present, should be managed as a priority (Figure 8.11) in order to prevent ongoing effects on the body such as hyperthermia. When presented with dogs with acute-onset seizures and no prior history, it is important to rule out metabolic causes prior to loading the dog with long-acting anti-epileptic drugs. This approach is somewhat different to a dog with epilepsy, where metabolic problems have already been ruled out (see Chapter 11).

1. Place an intravenous catheter as soon as possible
2. Provide flow-by oxygen if possible
3. Administer diazepam 0.5 mg/kg – i.v. if possible, rectally if not
4. Check blood glucose. If <3.0 mmol/l, administer 0.25 g/kg glucose i.v. as a bolus
5. Check body temperature. If >41°C begin active cooling (see Chapter 18)
6. If still seizing, repeat diazepam intravenously up to a total of three doses
7. Perform testing for an emergency database to include electrolytes, urea and calcium if possible
8. Where there is a suspicion of hepatic encephalopathy, consider other anti-seizure medication such as propofol
9. Ongoing management will depend on the aetiology
   – Where a toxic cause is suspected, management of seizures with propofol is most appropriate as it acts rapidly
   – Where the dog is a known epileptic, or metabolic causes have been excluded and epilepsy or intracranial causes are suspected, a long-acting epileptic agent should be given (see Chapter 11)

Emergency management of seizures. It should be noted that seizures very rarely cause hypoglycaemia, if a dog is found to be hypoglycaemic during a seizure, the investigation should be aimed at identifying the cause of the hypoglycaemia.
Other conditions
Severe neurological diseases and signs often benefit from specialist intervention and may require advanced imaging such as magnetic resonance imaging (MRI), therefore, referral should be considered early in the course of the assessment.

Intracranial disease
Intracranial disease can be more immediately life-threatening to the pet than spinal disease and therefore should be prioritized. In many situations stabilization of the intracranial signs will rely on a combination of some or all of the following: seizure control; airway protection; provision of oxygen and perfusion; and exclusion of metabolic or physiological derangements, e.g. hypoglycaemia, hyperammonaemia or hyperthermia that may promote ongoing signs.

Intracranial hypertension (ICH) is a sequel of intracranial disease or trauma, which requires rapid management. It can be difficult to detect, as many of the findings relied upon for diagnosis are relatively late changes. The presence of deteriorating mentation in the face of adequate perfusion or alterations in pupillary responsiveness or symmetry should alert the clinician to the possibility of ICH. Peripheral hypertension and bradycardia (the Cushing response) may be seen. This is a protective mechanism to ensure perfusion to the brain. If ICH is suspected, management with hyperosmolar solutions (e.g. mannitol or hypertonic saline) should be used and their effect monitored. Typically they should result, at least, in improved mentation. The use of scoring systems such as the Modified Glasgow Coma Scale (MGCS) (see BSAVA Manual of Canine and Feline Neurology) are to be recommended; the MGCS is repeatable and provides a subjective way to monitor patients at risk of, or being treated for, ICH.

Spinal disease
Spinal disease, while usually less immediately life-threatening, should also be prioritized, as severe lesions where there is loss of pain perception respond more favourably to early intervention. Dogs with high cervical injury should also be prioritized due to the risk of respiratory compromise related to respiratory muscle paralysis.

Traumatic spinal injuries with loss of pain perception associated with palpable spinal deviation have a very poor prognosis for full recovery. It may be advisable to discuss with the owners early on, whether they would like to proceed with further emergency care with such a poor prognosis. Care should be taken in this assessment, however, and the patient should be cardiovascularly stable prior to the examination being performed. Dogs with spinal trauma should be transported strapped firmly to a flat, firm board to immobilize the spine. Immobilization while on the treatment table may also be necessary (Figure 8.12). Where there is any doubt, advice from a neurologist should be sought.

WARNING
High-dose corticosteroid therapy is not indicated in the emergency management of any type of neurotrauma.

8.12 Dogs with spinal injuries may need to be strapped down to immobilize the spine and avoid further injury.

Monitoring during stabilization
The most useful method of monitoring during the stabilization period is repeated physical examination, concentrating on the major body systems. Where abnormalities have been identified in the emergency database, the tests should be repeated regularly (as frequently as every 30 minutes where they are life-threatening; up to 1–4 hours apart for others) to detect progression. Other monitoring that may be useful includes electrocardiography, blood pressure and in some cases pulse oximetry, though this is prone to errors in conscious dogs.

Secondary assessment
Once the major body system assessment is complete, and life-saving or stabilizing therapy has been administered, the patient should undergo a secondary assessment. The initial assessment will often have allowed the veterinary surgeon to create an initial problem list and the start of a diagnostic plan. The secondary assessment should include a full history and thorough physical examination of the whole dog, with repeat cardiovascular, respiratory and neurological assessments in greater detail where necessary. Once this has been completed, further diagnostic tests can be performed, or therapeutic agents administered where a diagnosis has been reached.

Useful additional diagnostic tests
- Full haematology and biochemical testing, while useful, will rarely change the management of emergency patients immediately. It is far more useful to tailor tests and expedite those that are important for the individual case, e.g. a platelet count estimation on a blood smear in a dog with signs of haemorrhage. Full profiles can then be submitted to an external laboratory for interpretation by a clinical pathologist.
- Common causes of emergency presentations in dogs often involve the gastrointestinal tract and therefore imaging of the abdomen, e.g. radiography or ultrasonography, is useful for diagnosis.
Complicated echocardiographic evaluation is rarely required, although it is useful to learn how to assess left atrial size for dogs presenting with signs of heart failure (see BSAVA Manual of Canine and Feline Cardiorespiratory Medicine).

Radiography of the thorax and abdomen and ultrasonography are also useful for detecting the presence of fluid in body cavities. The utilization of ultrasonography to identify small volumes of fluid within the peritoneal space (sometimes referred to as a FAST scan) in dogs presenting with an ‘acute abdomen’ is a particularly useful skill and can enable sampling and therefore therapeutic planning.

When a fluid sample is obtained from a body cavity, further analysis including cytology should always be performed. Where there is a suspicion of sepsis, sampling and cytology should be performed in house, with a further sample submitted for culture and sensitivity testing.

Ongoing management

Once the patient is stable and a plan has been created, the care does not end! The patient should be monitored appropriately to ensure it is stable and remains so. Fluid therapy plans should be created, and modified depending on the progression of the patient. In many cases dogs presenting as emergencies will need ongoing care for a period of time before they are well enough to go home. Many patients will need regular monitoring and assessment, and consideration should be made as to whether this is possible within the practice.

References and further reading


King L and Boag A (in production) BSAVA Manual of Canine and Feline Emergency and Critical Care, 3rd edn. BSAVA Publications, Gloucester


QRG 8.1 Cardiopulmonary resuscitation

CPR should be used:

■ In a dog with confirmed cardiopulmonary arrest (CPA)
■ In any unresponsive apnoeic dog (until CPA has been ruled out).

Recognition of an unresponsive apnoeic patient is all that is initially required (rapid assessment of Airway, Breathing, Circulation) as basic CPR must not be delayed.

Personnel

■ Ideally, a minimum of three people are required for effective CPR: one person to perform cardiac compressions; one to ventilate; and one to monitor, administer drugs and obtain equipment. If a team is not present, the team leader should give clear orders that are repeated back by the team member carrying out the task, to ensure the task is completed correctly.
■ If only two people are available, they should concentrate on basic life support, ensuring that cardiac compressions and ventilation are optimized. The person administering ventilation can also monitor the effectiveness of the compressions by palpating for pulses between ventilations.
■ If there is only one person available, effective CPR is almost impossible. The caregiver should shout or call for help (use bystanders if possible) and intubate the dog. Flow-by oxygen at a high rate should provide enough oxygen while the operator delivers cardiac compressions. Basic life support should be optimized in this situation, as continuous cardiac compressions are essential for a positive outcome.

PRACTICAL TIPS

■ Good training and regular rehearsals will help towards a successful outcome.
■ When animals are at risk of cardiopulmonary arrest, a crash box should be easily accessible and ready for use.
Dealing with emergency cases

PRACTICAL TIPS

1. Supplement inspired oxygen.
   - If arterial blood gas data are available, titrate to \( P_{O_2} \) of 80–105 mmHg or \( S_{O_2} \) >95%.
   - If arterial blood gas data are unavailable, giving 100% of \( F_{O_2} \) is reasonable.

2. Establish vascular access via an intravenous catheter (preferable) or intraosseous cannula.

3. Give low-dose adrenaline (0.01 mg/kg i.v.) during every other cycle of BLS. If CPA persists for >10 minutes, consider single high-dose adrenaline injection (0.1 mg/kg i.v.).

4. If there is pulseless electrical activity or vagally induced cardiopulmonary arrest, give atropine (0.04 mg/kg i.v.).

5. If there is ventricular fibrillation (VF) or pulseless ventricular tachycardia (VT), perform electrical defibrillation:
   - If VF or pulseless VT is detected within 4 minutes of CPA, perform defibrillation immediately.
   - If VF or pulseless VT is detected after 4 minutes of CPA, perform 1 cycle of BLS before defibrillation.

   For information on defibrillation protocols, see the BSAVA Guide to Procedures in Small Animal Practice.

6. Administer reversal agents for opioids (naloxone), alpha-2 agonists (atipamezole) or benzodiazepines (flumazenil) if these drugs are implicated in CPA (see table above for doses).

7. Consider intravenous fluid therapy.
   - In euvoalaemic or hypertensive patients, do not give fluids.
   - In hypovolaemic patients, give intravenous fluids to restore blood volume.

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**Patient preparation and positioning**

The dog should be positioned in lateral recumbency.

**Technique**

The priority is to begin basic life support. If possible, advanced life support and monitoring (see below) should be started simultaneously.

**Basic life support (BLS)**

This consists of chest compressions and ventilation.

---

**Chest compressions**

- **Perform 100–120 compressions per minute.**
- **Compress the thorax by a third to a half of its resting width and allow full chest recoil between compressions.**
- **Each compression should be associated with a pulse. If no pulse is palpable, change technique (or operator).**

**Small dogs:** Wrap a single hand around the sternum at the level of the heart and compress the thorax between your thumb and fingers; or use the technique for deep and narrow-chested dogs.

**Medium and large dogs:** Place the palm of one hand on the widest part of the chest. Place your hands centrally over the place your thumbs and fingers interdigitated. For most dogs, compress the thorax by a third to a half of its resting width and allow full chest recoil between compressions.

**PRACTICAL TIPS**

- **Each BLS cycle lasts 2 minutes.**
- **Begin the first cycle as soon as possible, and complete it uninterrupted.**
- **Chest compressions and ventilation are carried out simultaneously.**
- **If possible, change the person performing chest compressions between cycles to avoid fatigue**

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**PRACTICAL TIPS**

- **Intratracheal drug dosing can be considered for adrenaline (0.02–0.1 mg/kg) and atropine (0.15–0.2 mg/kg), though it may be ineffective:**
  - Insert a dog urinary catheter via the ET tube to the level of the carina
  - Dilute the drug with saline or sterile water prior to administration and follow up with a breath
  - Intracardiac administration of drugs is NOT recommended

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**Drug reversal**

- **Cardiac arrest**
  - Adrenaline (1:1000; 1 mg/ml): 0.01 mg/kg
  - Adrenaline (1:1000; 1 mg/ml): 0.1 mg/kg
  - Atropine (0.6 mg/ml): 0.04 mg/kg

- **Ventricular fibrillation or pulseless ventricular tachycardia**
  - Lidocaine (20 mg/ml): 2 mg/kg
  - Naloxone (0.4 mg/ml): 0.04 mg/kg
  - Flumazenil (0.1 mg/ml): 0.01 mg/kg
  - Atipamezole (5 mg/ml): 100 µg/kg

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**Advanced life support (ALS)**

**Monitoring**

- **Attach an ECG monitor, capnograph and pulse oximeter**
- **Electrolytes and arterial blood gas analysis:** not mandatory but useful where electrolyte disturbance may be involved in causing CPA
Dealing with emergency cases

Chapter 8
QUICK REFERENCE GUIDES

QRG 8.1 continued

Open-chest CPR. Only consider this if a specialist veterinary team and a dedicated intensive care unit are available.

Post-CPR care
- Referral to a specialist centre should be considered.
- Continue monitoring: ECG; ETCO₂; S_pO₂; arterial blood gases; blood pressure; blood electrolyte, lactate and glucose concentrations; and body temperature.

Basic life support (BLS)
Perform in uninterrupted cycles of 2 minutes each:
- Chest compressions: 100–120/min; compress thorax width by one-third to one-half
- Intubate and ventilate: 10 breaths/min; tidal volume 10 ml/kg; inspiratory time 1 second

Monitoring
- ECG to check for arrhythmias
- ETCO₂ >15 mmHg
- Palpate pulse between and during BLS cycles

Supplement oxygen
- Give F_iO₂ of 100%, or titrate to P_aO₂ of 80–105 mmHg

Obtain vascular access

Treat arrhythmias
- Asystole or pulseless electrical activity:
  - Give low-dose adrenaline every other BLS cycle
  - Give atropine every other BLS cycle
  - If no response after 10 minutes, give high-dose adrenaline

Administer reversal agents
- For opioids: naloxone
- For alpha-2 agonists: atipamezole
- For benzodiazepines: flumazenil

Reproduced from the BSAVA Guide to Procedures in Small Animal Practice, 2nd edn
Acute collapse is a common presenting complaint in first-opinion practice and can be a source of enormous stress for inexperienced clinicians. There is a vast list of differential diagnoses (Figure 9.1), ranging in severity from conditions requiring only simple treatment (e.g. osteoarthritis in an old dog) to those where there is immediate life-threatening compromise (e.g. haemoperitoneum).

It is easy to be drawn into the panic of the owner and start clutching at diagnoses, but a logical approach which builds on history and thorough physical examination with a simple minimum database of

<table>
<thead>
<tr>
<th>Cardiac disease</th>
<th>Respiratory disease (including pleural space and chest wall)</th>
<th>Endocrine/metabolic disease</th>
<th>Gastrointestinal disease</th>
<th>Genitourinary disease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dilated cardiomyopathy</td>
<td>Laryngeal obstruction: laryngeal paralysis, eversion of laryngeal sacculles, neoplasia</td>
<td>Hypoadrenocorticism (via muscle weakness)</td>
<td>Gastric dilatation-volvulus (GDV)</td>
<td>Pyometra</td>
</tr>
<tr>
<td>Endocardiosis</td>
<td>Brachycephalic obstructive airway syndrome (BOAS)</td>
<td>Hyperadrenocorticism</td>
<td>Gastroenteritis: vomiting and diarrhoea: fluid loss, pain</td>
<td>Prostatitis</td>
</tr>
<tr>
<td>Endocarditis</td>
<td>Tracheal collapse</td>
<td>Hypoglycaemia: insulinoma, hunting dog hypoglycaemia, liver dysfunction, sepsis, non-pancreatic neoplasia, xylitol toxicity</td>
<td>Ulceration: idiopathic; secondary to inflammation, neoplasia or non-steroidal anti-inflammatory drugs (NSAIDs)</td>
<td>Pyelonephritis</td>
</tr>
<tr>
<td>Angiostromylosis</td>
<td>Pulmonary oedema</td>
<td>Diabetic ketoacidosis</td>
<td>Intestinal obstruction: foreign body, intussusception, neoplasia, torsion</td>
<td>Acute kidney injury</td>
</tr>
<tr>
<td>Pericardial effusion and other forms of pericardial disease</td>
<td>Pulmonary thrombosis</td>
<td>Phaeochromocytoma</td>
<td>Severe constipation/obstipation</td>
<td>Chronic renal failure</td>
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<tr>
<td>Outflow tract obstruction: aortic stenosis, pulmonic stenosis, hypertrophic obstructive cardiomyopathy</td>
<td>Hypocalcaemia: primary hypoparathyroidism, pancreatitis, renal dysfunction</td>
<td>Hypokalaemia: chronic renal dysfunction, anorexia, vomiting and diarrhoea, hyperaldosteronism</td>
<td>Severe colitis</td>
<td>Urolithiasis</td>
</tr>
<tr>
<td>Tachyarrhythmia: atrial fibrillation, ventricular tachycardia</td>
<td>Hypocalcaemia: primary hypoparathyroidism, chronic renal failure</td>
<td>Hypokalaemia: chronic renal dysfunction, anorexia, vomiting and diarrhoea, hyperaldosteronism</td>
<td>Dysautonomia</td>
<td>Ruptured urinary tract: ureter, bladder or urethra</td>
</tr>
<tr>
<td>Bradyarrhythmia: profound sinus bradycardia/arrhythmia, sinus arrest/block, atrioventricular block</td>
<td>Hypokalaemia: chronic renal dysfunction, anorexia, vomiting and diarrhoea, hyperaldosteronism</td>
<td>Hypokalaemia: chronic renal dysfunction, anorexia, vomiting and diarrhoea, hyperaldosteronism</td>
<td>Urinary obstruction: calculus, prostatic enlargement, bladder neck or urethral tumour, urethral dysynergia</td>
<td>Urinary obstruction: calculus, prostatic enlargement, bladder neck or urethral tumour, urethral dysynergia</td>
</tr>
<tr>
<td>Mixed tachy/bradyarrhythmia: sick sinus syndrome</td>
<td>Mixed tachy/bradyarrhythmia: sick sinus syndrome</td>
<td>Mixed tachy/bradyarrhythmia: sick sinus syndrome</td>
<td>Vasovagal syncope secondary to gastrointestinal disease or abdominal pain</td>
<td>Postural hypotension</td>
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<td>Vasovagal syncope secondary to gastrointestinal disease or abdominal pain</td>
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Differential diagnoses for acute collapse. Common examples are given in each category. (continues)
blood tests, urinalysis and survey imaging should be practised in a calm and consistent manner. If this is done, the diagnosis is often surprisingly obvious without too much stress. Even when this is not the case, large parts of the differential list can be ruled out and thus leave one much nearer the answer.

Immediate considerations

First Aid
The basics of first aid must be immediately considered in ensuring that there is:
- A patent airway
- Good respiratory function
- Adequate circulation

External bleeding requires pressure to be applied whilst measures are taken to re-establish the circulation with a blood transfusion or crystalloid fluid therapy.

In general, it is always good practice to take a thorough history and perform a diligent clinical examination. However, there may be situations where immediate action is required in order to save the patient’s life. For example, a cyanosed dog with severe respiratory compromise due to a pharyngeal foreign body, such as a ball or rawhide chew, will receive far greater benefit from examination of this area and foreign body removal than it will from further delay. If one focuses on the primary considerations of Airway, Breathing, Circulation and haemorrhage control, then cases requiring immediate intervention should be easily recognized. General supportive nursing with warmth and oxygen is helpful; analgesia should be considered in the early stages.

Such attention to basic first aid may be life-saving and at the very least will turn an emergency situation into a stable patient, giving the clinician time to obtain a thorough history and plan the line of investigation.

In less urgent cases, once the history and clinical examination have been completed, the following minimum database should be acquired in all acute collapse patients:

- Haematology: if not complete, then a centrifuged in-house haematocrit (packed cell volume, PCV) is vital and also allows for measurement of total solids (TS) in the serum using a refractometer
- Chemistry: the minimum would be considered to be urea, creatinine, alanine aminotransferase (ALT), alkaline phosphatase (ALP) and blood glucose ± bile acids
- Electrolytes: sodium, potassium, chloride, calcium
- Urinalysis: specific gravity measured on a refractometer; dipstick chemistry
- Survey radiography of the chest and abdomen
- Survey abdominal ultrasonography to rule out free peritoneal fluid.
An animal collapsed with seizures or status epilepticus will need anticonvulsant therapy concurrently with the establishment of this database (see Chapters 8 and 11).

**History**

Taking a careful history can reveal subtle signs that may have been present prior to collapse, and will allow the list of differentials to be reduced. For example:

- An untreated cough will allow one to focus on differential diagnoses associated with cardiothoracic disease
- Weight loss may suggest neoplasia
- The presence of polyuria/polydipsia (PU/PD) highlights its own differentials from the list of those associated with collapse.

General questions should be asked, in particular regarding:

- Levels of food and water intake
- The presence or absence of vomiting and diarrhoea
- Observation of any other signs such as coughing, sneezing, bleeding, vaginal discharge, seizures and other neurological signs.

Other pertinent history includes the possibility of trauma or access to obvious toxins (e.g. rodenticide, ethylene glycol, metaldehyde, pesticides) and to substances that owners may not recognize as toxic (e.g. grapes, sultanas, raisins, currants, dark chocolate and, in certain chewing gums, xylitol). Parasiticides containing avermectins may lead to coma and seizures when inadvertently administered orally or chewed by a dog, especially in certain breeds such as collies.

Signalment is important, as younger dogs are likely to experience a different set of conditions from older dogs (e.g. neoplasia is more common with advancing age). Certain breed dispositions can help but one must not jump to conclusions. For example: a collapsed Doberman with pale mucous membranes and increased respiratory rate probably has dilated cardiomyopathy; but it could also have immune-mediated haemolytic anaemia or splenic rupture causing the same clinical signs.

The point in the oestrous cycle is helpful in cases of pyometra and type II diabetes mellitus. In some cases, there may be no relevant history prior to the onset of clinical signs.

**Observation**

Observation will allow assessment as to whether collapse is complete, partial or intermittent.

**Is there any ability to walk?**

- Dogs with immune-mediated polyarthritis may be able to shuffle along with multiple sore joints but collapse regularly due to pain.
- Dogs with severe metabolic, circulatory or cardiorespiratory disease may not be able to rise at all.
- Dogs with hypoglycaemia or myasthenia gravis may have collapse interspersed with periods of normality.

Assessment of respiration may be made simply by watching the patient before examination; signs such as tachypnoea, hyperpnoea, orthopnoea and dyspnoea point towards a cardiorespiratory origin, but can also be present with increased respiratory drive associated with anaemia, acidemia, pain or pyrexia, or less commonly with respiratory muscle failure in cases with peripheral neuromuscular disorders.

**Physical examination**

**Head and neck**

Mucous membrane colour should be examined, but capillary refill time is a less reliable indicator. Pale membranes (Figure 9.2a) are associated with poor peripheral perfusion (shock – hypovolaemic, cardiogenic, endotoxic) or anaemia (haemorrhage, haemolysis or bone marrow dysfunction) (see also Chapter 20).

![A 13-year-old Labrador Retriever that presented acutely collapsed.](image-url)

(a) The mucous membranes were pale and the dog had a PCV of 19%. (continues)
Significant enlargement of peripheral lymph nodes may be associated with lymphoma, but can also be a non-specific response to inflammatory diseases.

**Thoracic auscultation**

Auscultation of the thorax will provide information that can be tied in with that gleaned from the initial observation. Abnormal cardiac sounds such as murmurs (see Chapter 24), or pulmonary noise such as crackles or wheezes may be present. Alternatively, these sounds may be muffled in cases with pleural or pericardial effusion, and lung sounds may be lost altogether when lungs are collapsed in the presence of pneumothorax. The heart rate and rhythm should be noted; many cases with heart disease of sufficient severity to cause collapse will have concurrent cardiac arrhythmias, but ventricular arrhythmias are also commonly present with non-cardiac disease such as gastric dilatation–volvulus (GDV), splenic disease, pancreatitis and severe sepsis.

Combining auscultation with assessment of the **peripheral pulse** allows one to assess the state of the circulation, as well as to identify pulse deficits associated with arrhythmias. A strong pulse is an appropriate response to sympathetic stimulation associated with physical disease of sufficient severity to induce collapse, unless that disease is characterized by low blood pressure in cases of shock, classified as:

- **Hypovolaemic**: acute, internal or external haemorrhage or severe fluid loss
- **Cardiac** (cardiogenic or obstructive): low cardiac output associated with any cardiac disease
- **Endotoxic** (also known as distributive or septic shock): classically seen with pyometra.

In contrast to acute anaemia, patients with chronic anaemia of mild to moderate severity, where there has been time for the body to compensate, are likely to have good pulse quality.

**Abdominal palpation**

Palpation of the abdomen may reveal (see Chapter 25):

- Gaseous distension associated with GDV
- Ascites associated with:
  - Right-sided cardiac failure (including cases caused by pulmonary hypertension, possibly induced by *Angiostrongylus vasorum*)
  - Pericardial effusion
  - Portal hypertension
  - Hypoproteinaemia (protein-losing enteropathy or nephropathy, or end-stage liver disease)
  - Abdominal neoplasia
  - Pancreatitis
  - Torsion of a liver lobe, the spleen or mesenteric root
  - Peritonitis.

More specific fluid can accumulate with haemoperitoneum (traumatic or neoplastic organ rupture, coagulopathy) and urinary or biliary tract rupture.

In the absence of fluid, enlargement of the liver and/or spleen, and the presence of solid neoplastic masses may be detected. Generalized enlargement of the liver and spleen can be seen with cardiac disease,
lymphoma, leukaemia and multifocal abdominal neoplasia. Abdominocefectasis will assist in narrowing the list of differentials for free peritoneal fluid.

**WARNING**

An important cause of a modified transudate is the compromised venous return to the right side of the heart associated with pericardial effusion. This should be considered early on, rather than allowing oneself to be side-tracked into finding an abdominal aetiology at all costs, and certainly before inadvertently carrying out surgical exploration of the abdomen.

**Body temperature**

Pyrexia (see Chapter 18) may be associated with any inflammatory or infectious process in the body and, even where this can be easily addressed with antibiosis, may lead in the short term to collapse purely through malaise. If there is ongoing pyrexia of unknown origin, one should consider the possibility of intractable infectious or septic disease, immune-mediated disease or neoplasia.

**Orthopaedic examination**

A common cause of collapse in older dogs, especially in first-opinion practice and involving large breeds, is an acute flare-up of osteoarthritic pain (see Chapter 15). Care should be taken not to confuse symmetrical orthopaedic disease, such as immune-mediated polyarthritis or bilateral cruciate rupture, with spinal lesions. Polyarthritis is usually associated with pyrexia. The stress caused by pain in these dogs may present as changes in cardiac rhythm, which may settle when the pain is controlled.

**Neurological examination**

A neurological examination is vital in cases of collapse. Specific points to consider are as follows:

- Have there been any seizures? If so, are these ongoing such that anticonvulsant treatment is required (see Chapter 11); or is the collapsed patient post-ictal, with the owners having found it after the seizure had finished?
- One should assess the animal for its general demeanour. Obtundation is non-specific for intracranial disease (e.g. space-occupying lesion, raised intracranial pressure, cerebrovascular accident) or extracranial disease (e.g. hepatic encephalopathy, hypoglycaemia)
- Proprioception should be assessed (see Chapter 16):
  - Unilateral proprioceptive deficits of both the forelimb and hindlimb are indicative of contralateral cerebral disease
  - Bilateral proprioceptive deficits in only the hindlimbs points toward spinal disease caudal to T3 (upper motor neuron signs: T3–L3; lower motor neuron signs: L4–S3)
  - Proprioceptive deficits in all four limbs suggests generalized brain disease, spinal lesions C1–T2 (Figure 9.3) or peripheral neuropathies. The latter may be distinguished by the absence of withdrawal reflexes

**Diagnostic tests**

The minimum database outlined above leads to a diagnosis in many cases.

**Blood tests**

**PRACTICAL TIP**

It must be remembered that in the case of acute blood loss, PCV and total protein (TP) levels remain normal in the acute stage because equal proportions of plasma have also been lost. PCV and TP levels will fall later, once the fluid component of the circulation has been replaced by resorption from the extracellular space or as a result of fluid therapy.

**Haematology**

The most commonly identified haematological cause of collapse is anaemia. A slide agglutination test is an easy patient-side test to perform and is used to identify immune-mediated haemolytic anaemia.
Chapter 9 Acute collapse

Slide agglutination test

1. One drop of blood from an EDTA tube is applied to a warm slide and one drop of 0.9% saline added, before gently rolling the fluid round on the slide. Failure to add a drop of saline does not allow for the possibility of rouleaux formation; this is not abnormal but has a granular gross appearance that can produce a false-positive result. Saline will disperse any rouleaux.

2. A negative result is seen when the blood continues to show a homogeneous watery appearance.

3. A positive result is seen when granular autoagglutination is present, confirming immune-mediated haemolytic anaemia.

4. Agglutination may also be confirmed on the slide microscopically where the red cells are seen adhered together like ‘bunches of grapes’, whereas the microscopic appearance of rouleaux is that of ‘stacks of coins’.

Internal blood loss as a cause of anaemia may be identified as free pleural and/or peritoneal fluid using radiography or ultrasonography, but internal haemorrhage may still occur insidiously through the gastrointestinal system or urinary tract, so tests to identify blood in faeces or urine may be required.

Hypercoagulable conditions may be identified where there is: marked polycythaemia (primary polycythaemia vera or secondary to kidney disease, or as an appropriate response to chronic hypoxia) on haematology; or monoclonal hyperproteinanaemia (multiple myeloma, lymphoma) on serum protein electrophoresis.

Biochemistry

Biochemistry may identify: liver or kidney dysfunction; hypoalbuminaemia as a cause of effusions; hyper/ hypoglycaemia; and electrolyte derangements. Pancreatic-specific lipase is assayed when pancreatitis is suspected from vomiting and/or abdominal pain. Reductions in either plasma potassium or sodium may lead to weakness, whilst the combination of azotaemia, hyperkalaemia and hyperproteinanaemia is indicative of hypoadrenocorticism or acute kidney injury. An adrenocorticotropic hormone (ACTH) stimulation test is used to confirm hypoadrenocorticism in such situations, but may also be required for those cases where sodium and potassium are normal (so-called ‘atypical hypoadrenocorticism’), although this latter subset is more likely to present with gastrointestinal signs than with acute collapse. Azotaemia may be prerenal or primary renal in origin (or postrenal in cases of urinary rupture or blockage) and urine specific gravity (USG) must also be assessed:

- Prerenal azotaemia (e.g. in hypovolaemia, severe dehydration, cardiac failure) will be notably hypersthenuric (USG >1.030, usually >1.050) owing to the kidneys producing an appropriate response in an attempt to conserve fluid.

- In primary renal failure there is an inability to concentrate urine (USG <1.030, usually <1.020).

The exception to this rule is in hypoadrenocorticism, which leads to azotaemia due to hypovolaemia but is characterized by isosthenuria because hyponatraemia means there is insufficient sodium in the renal interstitium for concentration to occur.

Occasionally, myopathy (including that secondary to severe exertion in trialling dogs or racing Greyhounds) may be seen, shown by a marked increase in creatine kinase (CK) and aspartate aminotransferase (AST). These cases may also present with acute kidney injury. Myoglobin in the urine causes red discoloration of the supernatant after urine centrifugation; this is distinguished from haemoglobinuria by inspecting the colour of the patient’s plasma: this is not discoloured in myoglobinuria, but in haemoglobinemia the plasma will also be red.

Diagnostic imaging

Radiography of the chest may reveal cardiorespiratory causes of collapse, such as: cardiac failure (cardiomegaly and pulmonary oedema); lung disease; pleural space disease (pneumothorax or effusion); neoplasia; or trauma to the chest wall. Echocardiography can be used to evaluate the function of the heart in cases where murmur, cardiac failure or cardiomegaly have been identified and will allow easy visualization of pericardial fluid in cases of pericardial effusion. Electrocardiography must be undertaken to assess the rate and rhythm of the heart, with severe bradyarrhythmias (most commonly, 3rd degree atrioventricular block) and tachyarrhythmias (e.g. ventricular tachycardia or atrial fibrillation) both potentially causing collapse. Intermittent arrhythmias in dogs with episodic weakness or collapse may be investigated using a Holter monitor. Electrolytes (sodium, potassium, chloride) and thyroid function (hypothyroidism for bradyarrhythmia and, rarely in dogs, hyperthyroidism for tachyarrhythmia) should be considered as systemic causes of disturbance to cardiac function. Further discussion on cardiorespiratory disease may be found in Chapter 24 and its associated suggested reading.

Imaging of the abdomen allows assessment for: gastric dilatation ± volvulus (Figure 9.4); free peritoneal fluid; neoplasia (intact or ruptured) of the major organs; intestinal obstruction; abdominal lymphadenopathy; pancreatitis; biliary obstruction; and adrenal gland hyperplasia/neoplasia.

Radiography of the skeleton is needed to assess for generalized osteoarthritic pain or multiple myeloma (multiple luencies seen in the long bones, pelvis and/or vertebrae).

Further tests

More specific diagnostic tests include arthrocentesis and cerebrospinal fluid (CSF) analysis, most commonly used to assess immune-mediated polyarthritis and sterile steroid-responsive meningitis, respectively. The latter condition is most commonly seen in young Beagles in conjunction with arteritis an marked neck...
Acute collapse

Chapter 9

pain. Aspiration of synovial fluid from multiple joints in a collapsed patient, especially if pyrexic, should be undertaken early on if the minimum database does not yield a result, as immune-mediated polyarthritis is not that uncommon and, in such cases, one must consider whether the arthropathy is primary or secondary to distant inflammation or neoplasia, gastrointestinal disease or tick-borne infections.

Suspicion of central nervous system disease may dictate the need for magnetic resonance imaging (MRI) of the brain and/or spine in order to arrive at a definitive diagnosis. Serology for Toxoplasma and Neospora may be indicated in neurological cases; alternatively, PCR may be carried out on CSF when available.

Angiostrongylosis is diagnosed by detection of parasite antigen on patient-side blood testing, or identification of the parasite in faeces or broncho-alveolar lavage fluid, as well as assessment of clotting function (platelet numbers, prothrombin time (PT) and activated partial thromboplastin time (APTT)). Secondary coagulation function tests (PT, APTT) are also required to confirm other forms of coagulopathy such as rodenticide toxicity and disseminated intravascular coagulation.

References and further reading

The trauma patient: assessment, emergency management and wound care

Julian Hoad

Wounds may be caused by a number of different insults to the body, and may involve just the skin, or many body systems. Correct management of trauma relies on being able to make a fairly rapid assessment of the patient as a whole, identifying injuries, coming up with a plan for treatment, estimating the prognosis, and conveying all that to the client, together with an estimation of costs involved. Clearly, doing all this from first principles would be difficult and time-consuming. Thus it is important to develop or follow various action plans for initial triage, wound assessment, wound management and ongoing patient care. Only in this way can one be sure of covering all eventualities and not missing a serious complicating factor. This chapter attempts to provide a basic understanding of the principles involved in developing a standard procedure for trauma patients.

Triage and emergency stabilization

Triage involves an initial assessment to determine whether the patient should be dealt with immediately or whether it is stable enough to wait while more urgent cases are seen. For notes on triage over the telephone and subsequent preparation, see Chapter 8.

When a trauma patient is presented at the surgery, it is very important to establish some idea of:

- The severity of the injuries
- The signalment of the patient
- The time elapsed since the injury
- Any pertinent facts relating to the patient’s medical history (e.g. presence of a chronic illness such as diabetes, heart disease, hypoadrenocorticism).

The process of asking the owner questions can often do much to reduce stress or panic, and may allow a really anxious owner some time to calm down. Watching the patient while questioning the client allows an appreciation of the dog’s respiratory function so that assessment can begin.

PRACTICAL TIPS

- It is useful to have a checklist of questions, although it is better to have a mental checklist than to present the client with a long and tedious form, which will do nothing to allay their anxiety.
- Talking reassuringly to the patient will allow an assessment of consciousness (whether or not a response is obtained) and will help calm the dog.

Visual examination

Whilst asking the owner questions, a full visual examination of the animal can be performed. However, if the dog is obviously collapsed, haemorrhaging or seizing, or the owner is distressed or showing signs of panic, it is best to separate the dog and owner at this stage.

Initially, a superficial ‘hands-off’ examination should be done, checking for:

- Breathing
- Consciousness (and whether the dog is alert)
- The presence of bleeding (with a rough visual estimate of amount: this need be no more involved than ‘a lot’ or ‘a little’ at this stage).

WARNING

Before touching or palpating the patient, it should be established whether or not the dog is usually aggressive, or whether it has bitten anyone. Regardless of this, precautions should be taken to avoid anyone being bitten, as even the friendliest dog may exhibit aggression when in pain; but forewarned is forearmed.

D–ABC

D: Danger (to yourself or others from an aggressive dog)
A: Airway
B: Breathing
C: Circulation
This initial check should take no more than 2 or 3 minutes. If any immediate life-threatening problem is identified during this process, the dog should be removed to the treatment room and emergency procedures instigated (e.g. cardiopulmonary resuscitation (CPR; see Chapter 8), assisted ventilation, tourniquet for arterial bleeding).

**Main body systems**

Provided there is no immediately life-threatening problem, at this stage a more in-depth assessment can be made. This should include (see Chapter 8 for more detail):

- Respiratory rate and effort
- Heart rate and evaluation of the mucous membranes
- A brief evaluation of the nervous system (to include presence of anisocoria, pupillary light reflex (PLR), limb movement (ability to walk))
- Presence or absence of a palpable bladder.

The above checks cover the four main body systems: dysfunction of any of these can rapidly become life-threatening. This does not mean that any other injuries or problems can be forgotten, but assessing and attending to the above buys time for further examination and further investigation. It may be helpful for a veterinary nurse or another suitably trained member of staff to take notes.

**Additional checks**

- Wounds should be assessed for ongoing blood loss. Haemorrhage from an extremity may be addressed at this time by swift application of a sterile non-adhesive dressing, held in place by a conforming bandage; definitive wound care can be carried out later.
- Limbs should be palpated for fractures and the whole patient should be examined for the presence of bulges or asymmetry, which may indicate body wall rupture.
- The anus and vulva should be examined for prolapse.

By this stage it should be fairly well established whether the patient needs to be admitted immediately for intensive emergency stabilization (see Chapter 8), or whether the injuries can be dealt with over a longer time. These latter cases will clearly require attention, but immediate care may simply include:

- Application of a wound dressing
- Administration of analgesia and/or antibiotics (see later)
- Regular (every 5–10 minutes) checks to ensure there is no deterioration in the dog’s condition and vital signs: temperature, pulse, respiration (TPR); mucous membrane colour; assessment of mentation; palpation of the bladder.

Figure 10.1 demonstrates a simplified triage algorithm.

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**Figure 10.1**

An approach to triage for the trauma patient. This allows division into those patients that require immediate treatment or else death may ensue, and those for whom treatment can be delayed. Note that ‘delayed’ treatment does not mean that the patient may be sent home and seen later: any trauma patient should be admitted and assessed every 5–10 minutes. The acceptable delay will depend on the nature of the injury and treatment required.
Informed consent

- It is vital to obtain informed consent from the owner (see also Chapter 6) and to give some estimate of costs.
- Informed consent should be as detailed as possible and should cover all eventualities; it is not acceptable to fail to mention the possibility of death occurring in order to spare an owner’s feelings. An agreement to contact the owner with updates must be adhered to: it is both frustrating and worrying not knowing what is happening to one’s pet.

- It may not be possible to state exactly what the costs will be, as the full extent of injury may not be apparent until further investigations have been performed; however, a ‘ball park’ figure should be given that can be revised later in the light of further information. It is important to phrase discussions about money carefully, to avoid giving the client the impression that money is the overriding concern, rather than the wellbeing of their pet. It may be useful to ask a more experienced colleague for advice on delivery.

Emergency stabilization and treatment

Once the patient’s status has been determined, treatment can commence.

Fluid therapy

In all cases an intravenous catheter should be placed: this is not only helpful for correction of fluid loss or circulatory function, but also ensures that there is intravenous access if required for the administration of emergency drugs. Fluid therapy (including blood transfusion if appropriate) should be given unless there are specific contraindications (see Chapter 8). For details of fluid therapy see Chapter 8 and the BSAVA Manual of Canine and Feline Emergency and Critical Care. For details of blood transfusion protocols see the BSAVA Manual of Canine and Feline Haematology and Transfusion Medicine.

Any patient with blood loss should have its packed cell volume (PCV) assessed, although initially this may remain within normal limits as whole blood is lost and it is only as circulating volume recovers that the haematocrit drops. Blood biochemistry may be useful to rule out the presence of contemporaneous disease (see Chapters 8 and 9.

Analgesia

Analgesia should be a high priority: patients in pain may rapidly deteriorate and are at greater risk of cardiorespiratory decompensation. In any trauma case, a pure opioid (e.g. morphine) is the first-line drug of choice (Figure 10.2). Local analgesia is extremely effective and should be considered wherever possible, following initial stabilization of the patient. Wound infiltration, local nerve blocks, intravenous regional analgesia (IVRA) and epidural administration are all possible, though care must be given not to exceed the toxic dose.

Figures 10.3 and 10.4 suggest ongoing analgesics for stabilized and discharged patients.

10.2

<table>
<thead>
<tr>
<th>Analgesic class</th>
<th>Example</th>
<th>Dose and route</th>
<th>Duration of action</th>
<th>Contraindications and cautions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opioids</td>
<td>Buprenorphine</td>
<td>0.02 mg/kg i.v., i.m., s.c.</td>
<td>6–8 hours</td>
<td>All full-opioid agonists cause dose-dependent respiratory depression and should be used with caution in respiratory-compromised cases. Advise client that the use of morphine is ‘off label’; client must sign an ‘off-label’ drug consent form</td>
</tr>
<tr>
<td></td>
<td>Methadone</td>
<td>0.1–0.5 mg/kg i.m.</td>
<td>3–4 hours</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Morphine</td>
<td>0.5 mg/kg i.v., i.m., s.c.</td>
<td>2–4 hours</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Epidural: 0.1 mg/kg, diluted with 0.26 ml/kg sterile saline (max. total volume 6 ml)</td>
<td>18–24 hours</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pethidine</td>
<td>2–10 mg/kg i.m., s.c.</td>
<td>1–2 hours</td>
<td></td>
</tr>
</tbody>
</table>

10.3

<table>
<thead>
<tr>
<th>Analgesic class</th>
<th>Example</th>
<th>Dose and route</th>
<th>Duration of activity</th>
<th>Contraindications, cautions and comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSAIDs</td>
<td>Carprofen</td>
<td>4 mg/kg i.v., s.c.</td>
<td>24 hours</td>
<td>Do not use in dehydrated, hypovolaemic patients, or those with coagulopathies. Do not use if there has been damage to the gastrointestinal tract</td>
</tr>
<tr>
<td></td>
<td>Meloxicam</td>
<td>0.2 mg/kg s.c.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tolfenamic acid</td>
<td>4 mg/kg i.m., s.c.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Opioids</td>
<td>See Figure 10.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fentanyl patch</td>
<td>4 µg/kg/h</td>
<td>72 hours</td>
<td>May take up to 24 hours to begin providing appreciable analgesia</td>
</tr>
<tr>
<td>Local anaesthetics</td>
<td>Bupivacaine</td>
<td>Local: no more than 1–2 mg/kg (usually a dose of 1–2 ml of a 0.5% solution will suffice)</td>
<td>6–8 hours</td>
<td>Avoid overdosage and inadvertent intravenous administration. Much smaller amounts than the suggested doses are usually effective. There are many useful specific nerve blocks which can be used. Spraying a little directly on to a wound is also effective (‘splash block’)</td>
</tr>
<tr>
<td></td>
<td>Epidural: 1.6 mg/kg</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lidocaine</td>
<td>Local: no more than 4 mg/kg</td>
<td>1–2 hours</td>
<td></td>
</tr>
</tbody>
</table>

10.4

Commonly used analgesics for trauma cases: in-house treatment of the stabilized patient. (continues)
Antibiotics should always be used in cases with:
- Diaphragmatic hernia with liver entrapment
- Compound (or ‘open’) fractures
- Severe tissue damage.

Broad-spectrum, intravenous antibiotics (Figure 10.5) should be used in trauma patients. Antibiotics should be administered following current guidelines and indications (see BSAVA Small Animal Formulary).

10.3 (continued) Commonly used analgesics for trauma cases: in-house treatment of the stabilized patient.

10.4 Commonly used analgesics for trauma cases: ongoing analgesia (or for the discharged patient).

‘Soft’ analgesia
Other forms of analgesia – such as cold compress, bandage/dressing, petting/stroking – are often neglected, but do play an important role in patient recovery. There are few contraindications to stroking, but the patient’s demeanour should be appraised beforehand.

10.5 Antibiotics appropriate for intravenous use in trauma patients.
Chapter 10 The trauma patient: assessment, emergency management and wound care

An approach to the road traffic accident case

A common presentation of trauma, potentially involving many body systems, is the road traffic accident (RTA) case. When presented with a dog involved in an RTA, the triage procedure above should be followed. The driver of the car should be aware that the RTA should be reported to the police as soon as possible and certainly within 24 hours under the provision of the Road Traffic Act 1988.

Once the triage assessment has been performed, and any immediate life-threatening injuries have been dealt with, a problem list should be drawn up of all injuries to the body systems.

Physical examination

This should begin with the head, and progress along the body in the usual way.

1. Examine the head.
   - Check jaw alignment: if possible, gently open the mouth to check for damage to the temporomandibular joint. Sedation may be necessary for this; if so, it is best to wait until other checks have been completed, to ensure the patient is as stable as possible prior to sedation.
   - Re-examine the pupils for pupillary light reflex (PLR) and anisocoria.
   - Re-assess mentation.
   - Perform an otoscopic examination: the presence of blood near the tympanum can indicate severe skull fracture.
   - The skull should be examined for symmetry and any swelling or fluctuant masses which could suggest skull fracture.
   - If it has been possible to open the mouth, then the tongue and as much of the oral cavity as possible should be examined for any bleeding, which could affect airway patency.
   - Examine the nostrils for any bleeding.
   - A microscope slide held up to the nostrils will help indicate any blockage of the nasal cavity.

2. Palpate the neck and spine for any injury.
   - Take care if the patient is paralysed: such patients should have a full neurological assessment performed (see Chapters 11 and 16 and the BSAVA Manual of Canine and Feline Neurology).
   - Since nerve damage can often improve once neuropathia has resolved, or when with ongoing inflammation, it is wise to be cautious in giving any prognosis at the time of injury.
   - Intense pain and shock can affect deep pain assessment: it is important to allow time for stabilization and analgesia before repeating neurological tests.

3. Palpate the trunk for any sign of rib or body wall damage.
   - Rib fractures may be felt as lumps or painful areas. If several ribs are fractured in two or more places, this can lead to ‘flail chest’, in which there is an incongruous dipping of a region of the chest wall on inspiration, and bulging on expiration. Although several methods of complex splinting procedures have been reported for this condition, in practice no treatment is required in most cases. The dyspnoea tends to improve after analgesia and the ribs usually ‘knit’ without surgical intervention.
   - Any crepitus under the skin should alert one to the possibility of subcutaneous emphysema, which may be caused by puncture to the lungs, or by a ‘sucking’ skin wound. Radiography will help distinguish these conditions.
   - Any bulges in the abdominal wall may be due to subcutaneous bleeding, or may indicate ruptures and herniation.
   - It may be possible to palpate a tear in the abdominal musculature; this can be confirmed by radiography and/or ultrasonography.

4. Palpate the abdomen. This should initially be done with the dog conscious. Sedation may be required to assess the viscera adequately: if so, it is best to wait until the rest of the checks have been completed and the animal is as stable as possible prior to sedation.
   - Free fluid palpated may be blood, urine, or the result of over-vigorous fluid replacement. Haemoabdomen is usually associated with marked abdominal pain, and so increasing tenseness on abdominal palpation should be a warning sign.
   - Care should be taken to try to identify the bladder, although its presence does not rule out bladder rupture or leakage. If bladder rupture is suspected, measurement of raised urea and creatinine within aspirated abdominal fluid compared with systemic blood proves the presence of urine. This test may be performed on most in-house biochemistry machines.

5. Examine the external genitalia for any injury that might interfere with voiding urine.
   - If necessary, insert a urinary catheter (Figure 10.6).

6. Examine the anus and tail, including checking for traumatic rectal prolapse, bleeding from the anus and neurological assessment of the tail.

Placement of a urinary catheter is a priority when there is damage to the urethra and external genitalia. This 3-year-old male cross-breed dog suffered extensive trauma to the hindlimbs and penis. Treatment involved amputation of one hindlimb and a perineal urethrostomy. The dog went on to make a good recovery.
Diaphragmatic hernia

- Diaphragmatic hernia is much less common in dogs following an RTA than in cats.
- It results from increased intra-abdominal pressure against a closed glottis. This causes rupture of the diaphragm and herniation of some of the abdominal contents into the thorax, or occasionally into the pericardial sac (traumatic peritoneopericardial diaphragmatic hernia).
- The increased intra-abdominal pressure is likely to have caused additional damage, and so careful radiographic examination of the pelvis and urinary bladder is strongly advised.
- In most cases the liver is involved in the hernia; however, it is not unusual for other abdominal organs to herniate, particularly the stomach and intestines.
- The reduction of thoracic space causes dyspnoea, which may worsen dramatically if incarcerated viscera become bloated. Respiratory function can be assisted in the short term by maintaining the patient in a confined and calm environment to utilize its respiratory reserve.
- Strangulation of the herniated contents may sometimes occur and lead to compromise of the vasculature, resulting in tissue necrosis and further inflammation.
- Timing of repair is a balance between the need to restore pulmonary function and prevent ischaemic injury of incarcerated viscera on the one hand, and the risk of general anaesthesia in an animal with potential pulmonary and cardiac contusions on the other.
- For further discussion see the BSAVA Manual of Canine and Feline Abdominal Surgery.

Wound management

Basic wound management should include immediate bandaging of bleeding wounds to reduce ongoing blood loss and also to reduce the risk of infection. More precise wound care will depend on the type of wound (Figure 10.7) and the degree of contamination (Figure 10.8). For detailed treatment of degloving injuries and for wound care in general, the reader is recommended to consult the BSAVA Manual of Canine and Feline Wound Management and Reconstruction.

For the first 6 hours after trauma, the proliferation of microorganisms within a wound is insufficient to cause infection: the wound is considered to be contaminated. This is known as the ‘golden hour’ and wounds treated appropriately within this period are amenable to primary wound closure. Contaminated wounds should be flushed with copious amounts of sterile lactated Ringer’s solution; attaching a fluid bag to a 19 G needle using a giving set, syringe and three-way tap is an excellent way to facilitate this (Figure 10.9).

<table>
<thead>
<tr>
<th>Wound type</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abrasion (graze)</td>
<td>Shearing or friction injury. Usually superficial, but can expose bone. There is minimal bleeding, but the wounds tend to be very painful when touched</td>
</tr>
<tr>
<td>Avulsion (tear)</td>
<td>Includes degloving injuries, and involves creation of skin flaps by tearing the skin away from its attachment. Depending on the direction of tear, the flap may dehisce if the blood supply is lost</td>
</tr>
<tr>
<td>Burn (chemical or thermal)</td>
<td>Necrosis of skin and subcutaneous layers by contact with heat or certain chemicals. Thermal burns tend to be extremely painful. Chemical burns should be lavaged copiously to remove any residual chemical. The true extent of any burn may take several days to become apparent</td>
</tr>
<tr>
<td>Contusion (bruise)</td>
<td>Haematoma caused by blunt trauma. Haematomas within muscle bellies can reduce blood flow and constrict nerves, causing compartment syndrome</td>
</tr>
<tr>
<td>Incision</td>
<td>A cut or breach in the skin and deeper tissues caused by a sharp object or instrument</td>
</tr>
<tr>
<td>Laceration</td>
<td>Tearing of the skin and deeper tissues with a blunt object. Often confused with incision. No skin flap is produced (compare with Avulsion)</td>
</tr>
<tr>
<td>Puncture (with or without foreign body)</td>
<td>Caused by a pointed implement penetrating the skin (e.g. tooth, stick, thorn). There is usually only a small entry wound, but there may be much damage to underlying tissues and organs. These wounds often require multimodal imaging and extensive surgical exploration</td>
</tr>
<tr>
<td>Firearm</td>
<td>These wounds may range from ‘puncture wounds’ caused by airgun pellets, to devastatingly damaging wounds caused by bullets. Fortunately, the incidence of the latter in the UK is very low; shotgun wounds may be seen, especially in rural areas</td>
</tr>
<tr>
<td>Crush</td>
<td>Crush wounds show aspects of several types of wound. They are caused by squeezing between two hard objects. Crush injuries may result in fractures, lacerations, contusions or nerve injury (directly and as a result of compartment syndrome) and are prone to infection due to the low redox potential of the devitalized tissue</td>
</tr>
</tbody>
</table>

10.7 Classification of wounds by type.

WARNING
Fractures are rarely life-threatening; emergency stabilization should not be compromised in order to obtain a perfect radiographic view.
Classification of wounds by degree of contamination.

<table>
<thead>
<tr>
<th>Classification</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clean</td>
<td>A surgically incised wound that does not enter a visceral cavity (e.g. gut, oral, respiratory, genitourinary). Can be assumed to have little or no bacterial presence. Primary repair is possible. Antibiotics are generally not required unless infection would be catastrophic (e.g. spinal surgery, orthopaedic surgery when implants are placed)</td>
</tr>
<tr>
<td>Clean–contaminated</td>
<td>A surgically incised wound in which there has been entry to a visceral cavity but no leakage has occurred. Primary repair is possible. Prophylactic antibiotics are generally indicated</td>
</tr>
<tr>
<td>Contaminated</td>
<td>A surgically incised wound that has experienced leakage of gut contents or infected urine, or where a major disruption to aseptic technique has occurred. Also traumatic wounds within the ‘golden period’. Prompt attention to debridement and lavage can alter these to clean wounds, and primary repair is often possible. Prophylactic antibiotics are required</td>
</tr>
<tr>
<td>Dirty</td>
<td>Traumatic wounds with infection. There may be necrotic tissue, purulent exudate or foreign bodies present. Also surgical wounds with faecal contamination. Primary repair is not possible in these cases and they must be managed by antibiotic therapy, lavage, and often several cycles of dressings and debridement</td>
</tr>
</tbody>
</table>

After this initial period, the burden of pathogens should be assumed to have risen above the critical infectious level (around $10^5$ colony-forming units (CFU) per gram of tissue) and the wound is considered to be infected. Such wounds may require debridement and several days of wound management and antibiosis prior to closure.

A summary of dressing types and their uses is given in Figure 10.10.

### Types of wound dressing and their use. Only a few examples are given, for clarity. For more details see the **BSAVA Manual of Canine and Feline Wound Management and Reconstruction**.

**PRACTICAL TIP**

The requirement for repeated ongoing dressing changes can often be very expensive (especially if sedation or anaesthesia is required) and should be included in any estimate given to owners.
Burns

Burns are less common in veterinary practice than in human trauma units. Unfortunately, a common cause remains iatrogenic burn from incorrect use of patient heating devices, especially microwaveable heating pads (Figure 10.11) or discs.

Thermal burns cause tissue breakdown secondary to cell death. The cell death may be immediate or it may be ongoing, due to infection or the release of vasoactive compounds. Initially, there may be little evidence of tissue damage unless the burn has been caused by a naked flame. Hair loss and tissue sloughing may only occur several days after a low-intensity contact burn. A burn wound is characterized by a necrotic, exudative central area, demarcated by a line of hyperaemia, sometimes referred to as the ‘tide mark’. Until this line has appeared, it is difficult to assess the true extent of a burn, and this must be borne in mind when attempting to debride the wound margins. It may be more appropriate to dress the wound for another 24 hours or so to allow the margins to ‘declare’.

Assessment

A full triage assessment should be carried out on a burn victim: it may be that other injuries are present. Additionally, burn wounds often result in the loss of protein (TP) and albumin. An estimate should be made of the size of the burn with respect to the affected body surface area (ABSA).

The ABSA can be estimated using the ‘rule of nines’:
- Each forelimb = 9% TBSA
- Each hindlimb = 18% TBSA
- Ventrum = 18% TBSA
- Dorsum = 18% TBSA
- Head and genitalia account for the rest
- Dogs with >15% of their total body surface area (TBSA) affected will require intensive emergency stabilization
- Patients with >50% TBSA burns rarely survive, and so consideration should be given to euthanasia

The burn wound should be covered with a sterile, non-adherent dressing as soon as possible, reducing the risk of infection and providing analgesia. Once the patient has been stabilized, debridement of a large burn should be carried out without delay. The hard leathery covering of a burn wound, the eschar, should be removed by sharp dissection. It has been shown that early removal of this necrotic tissue improves healing and reduces infection rates. At this stage, silver sulfadiazine-containing dressings may be used, as these reduce the incidence of sepsis in burn wounds.

Definitive closure of burn wounds will depend on the size, depth and position of the wound. More detailed treatment protocols are given in the BSAVA Manual of Canine and Feline Emergency and Critical Care and there is an excellent review of burn pathophysiology and treatment by Bohling (2012).

Dog fight injuries

The most common presentation of dog fight injuries is biting to the head and neck (see also Chapter 23), but a surprise attack can result in an injury anywhere on the body. It is likely also to be quite a traumatic experience for the owner, as they may be shocked to see true aggression from or toward their pet. It is very important to question the owner as to exactly how the fight occurred. The incidence of dogs attacking other dogs is closely linked to dogs attacking people.

Triage assessment for a dog fight injury is carried out as above, with damage to the airways and blood vessels being of overriding importance. Although puncture wounds may be the only superficially obvious injury, the bitten dog will tend to pull away from the aggressor in any fight, causing a tooth that has penetrated the skin to gouge through underlying tissues. Even if there is only damage to the subcutaneous fat, there can still be ongoing tissue necrosis and discharge. Such wounds should always be left open to drain and heal by secondary intention.
Where skin damage requires excision and primary closure, temporary drainage is strongly recommended (Figure 10.12). Broad-spectrum antibiotic cover should be commenced and continued for at least 5 days; bacteria commonly isolated from dog bites include Pasteurella canis, Staphylococcus and Fusobacterium spp.

**PRACTICAL TIP**

Meticulous examination of the patient is required, as puncture wounds may be easily missed in haired areas.

Dogs’ jaws can inflict a massive biting pressure, and it is quite common for a seemingly insignificant small wound to oversew a severe injury. Bite wounds over the thorax should be carefully palpated for any sign of subcutaneous emphysema, which could be a sign of tearing of the intercostal muscles or rib fracture. Wounds over the abdominal cavity should be checked for bulges that could indicate body wall rupture and herniation. If these are suspected, radiography or ultrasonography may be useful to demonstrate ruptures, although it may be necessary to investigate the bite tract of each wound surgically to ensure that no tears in the muscle have been missed. If an abdominal tear is discovered, exploration of the entire abdominal cavity may be justified to rule out the presence of damage to the viscer.

**Fractures**

Specific fracture treatment is described in the BSAVA Manual of Small Animal Fracture Repair and Management. The following points should be borne in mind.

- As fractures are rarely life-threatening, they should take second place to emergency treatment and stabilization.
  - However, a judiciously applied support dressing can dramatically improve analgesia for distal limb fractures. The dressing must immobilize the joint above the fracture site or the extra weight of the bandage will actually increase movement at the fracture site and lead to increased discomfort and the potential for further damage of adjacent soft tissues.
  - With proximal limb fractures it may be more appropriate to rely on analgesia and padded bedding than to concoct complex splints.
  - Luxations should similarly await patient stabilization, although if the patient is already sedated or anaesthetized for investigation, then it would make sense to attempt a non-surgical reduction and placement of a support bandage.

**References and further reading**


Dogs presented with neurological problems are often viewed as particularly challenging to diagnose and manage. Animals with neurological diseases may present with a variety of clinical signs, including seizures, ataxia, pain, paresis/paralysis and behavioural changes. Neurological emergencies may present as:

- Status epilepticus
- Severe cluster seizures
- Stupor/coma
- Ataxia
- Paresis or paralysis (see also Chapter 16)
- Pain.

**History**

As with all medical investigations, the neurological work-up should begin with a detailed medical history. Certain questions become more pertinent for the neurological patient. Some clinicians prefer to take a full history before becoming more focused. However, the owner will often want to discuss the chief complaint straight away, and it can be useful to clarify their concerns at the start of the consultation, both to make the owner feel they are being listened to, and to direct further enquiries. For example: an animal presenting with a history of seizures should prompt more in-depth questioning regarding other forebrain signs such as behavioural changes and pacing; for an animal presenting with a head tilt, details of any history of ear disease could be important. **NB: An animal presenting in status epilepticus requires immediate emergency treatment.**

It is also important at this stage to clarify the owner’s description. Seizures, faints and collapses can all mean different things to different people, so the owner should be asked to describe exactly what they have observed, including:

- Time/date of onset
- Association with pain
- Speed of progression
- Associations with the animal’s activity (e.g. rest or exercise)

- Whether the complaint is of an episodic nature
- What happens immediately before, during or after an episodic event
- Frequency of episodic events.

**PRACTICAL TIPS**

- It can be extremely useful to view episodic events on video; if the owners do not have any video footage at the time of consultation they should be encouraged to obtain some, for example on a mobile phone
- There are many examples on the Internet of animals showing neurological signs and for the clinician unfamiliar with different types of movement disorders and seizures, viewing these can be useful, as can showing a typical video to the owner and asking if their pet is behaving the same way. Be wary, as the diagnosis accompanying these videos is not always correct!

Specific historical information that should be obtained includes:

- Signalment
- How long the animal has been in the owner’s possession
- Vaccination status
- Parasite treatment
- Travel history
- Current medication and recent changes in medication
- Diet
- Similar problems in animals in the same household or in related animals
- Exposure to toxins.

Questions relating to the animal’s general health should include details about:

- Appetite
- Thirst
- Urinary and faecal continence
- Exercise tolerance
Chapter 11 Seizures, ataxia and other neurological presentations

- Vision
- Vomiting/regurgitation
- Diarrhoea
- Respiratory problems such as coughing, sneezing or dyspnoea.

PRACTICAL TIP
While the history is being taken, allowing the animal to wander freely in the consulting room allows observation of gait and behaviour.

Physical examination
Once the history has been taken, a full physical examination should be undertaken, including:
- Temperature
- Pulse rate
- Thoracic auscultation (see Chapter 24)
- Mucous membrane assessment (see Chapter 20)
- Abdominal palpation (see Chapter 25).

If the problem is still deemed to be neurological at this stage, a full neurological examination should be performed; an example of a results form is given at the end of the chapter. This can take half an hour to perform in detail, and so time needs to be allowed in the consulting schedule for this. Alternatively, the animal can be admitted for examination at a later stage.

PRACTICAL TIPS
A quick ‘screening’ neurological examination may be of use in a short consultation to help confirm the presence or absence of common neurological deficits. QRG 11.1 shows the author’s suggestion for a ‘screening’ neurological examination, which should take around 5 minutes.

- A full neurological examination and further investigations should be undertaken in cases where neurological deficits are found or the history is suggestive of neurological disease.
- The short neurological examination may be of more use in animals with vague signs or history to give some clues as to whether resources should be concentrated on the neurological system or elsewhere.

After the history has been taken and the neurological examination performed, it should be possible to classify the disease using the aide mémoire of five categories corresponding to the five fingers of a hand (Holger Volk, personal communication):
- Onset
- Clinical course
- Lateralization
- Pain
- Neurolocalization.

For example: a thoracolumbar disc extrusion may present as an acute-onset, static, left-sided, painful myelopathy; whereas seizing due to a brain tumour may be characterized as a chronic, progressive, right-sided, non-painful forebrain disease.

Common conditions
Seizures and other forebrain disease
An epileptic seizure is the physical manifestation of abnormal electrical activity in the cerebral cortex. Seizures always originate in the forebrain (cerebrum and thalamus), although the underlying cause may be intracranial or extracranial. Seizures may or may not be accompanied by other signs of forebrain disease, including:
- Behavioural changes (e.g. aggression, loss of house training, disorientation, hemi-inattention)
- Depression
- Stupor (response only to aversive stimuli; more commonly associated with brainstem disease)
- Head pressing
- Paresis (mild).

Figure 11.1 lists some common causes of forebrain disease.

- Degenerative (e.g. cognitive dysfunction syndrome)
- Anomalous (e.g. hydrocephalus)
- Metabolic (e.g. hepatic encephalopathy, hypoglycaemic encephalopathy)
- Neoplastic, including primary tumours (e.g. glioma, meningoma) and secondary tumours (metastatic and locally invasive)
- Nutritional (e.g. thiamine deficiency)
- Inflammatory (e.g. meningoencephalitis of unknown origin)
- Infectious (e.g. canine distemper virus, Protozoa, bacteria)
- Toxic (e.g. lead, organophosphate)
- Vascular (e.g. thromboembolic disease, haemorrhage)

11.1 Common causes of forebrain disease.

Clinical signs and history
Seizures can be recognized by certain characteristics that help differentiate them from other intermittent events such as syncope and movement disorders.
- There is occasionally a prodromal phase, a change in mood or behaviour that can last for 1 to 24 hours before the seizure occurs.
- A little more frequently, there is a pre-ictal phase or aura, which lasts for a few seconds to minutes before a seizure starts. The aura may involve behaviour such as agitation, seeking the owner or vomiting.
- After the seizure, there is often a post-ictal phase in which the animal may be lethargic and sleepy, wander aimlessly, appear blind, exhibit depression and urinate/defecate involuntarily. This phase can last for minutes to days.

The seizure event itself can present in several ways:

Generalized seizures:
- Characterized by loss of consciousness, involuntary motor activity of the whole body and autonomic signs such as salivation, defecation and urination
• May be clonic (rhythmic muscle contractions), tonic (increased muscle tone) or have tonic and clonic phases
• Rarely, may be atonic (lack of muscle tone; can be hard to differentiate from syncope) or myoclonic (spasmodic jerky contractions of groups of muscles; myoclonus can occur because of non-seizure causes).

■ Partial seizures:
• Involve only part of the forebrain and may or may not be associated with altered consciousness
• Simple partial seizures are characterized by brief, recurring, stereotyped movements or autonomic signs, such as flexion of a paw or hypersalivation
• Complex partial seizures usually involve altered consciousness and abnormal behaviour such as fly catching, star gazing, chewing, barking at nothing or unprovoked aggression.

Seizures should be differentiated from other causes of collapse or abnormal movement and behaviour such as syncope, vestibular disease, episodic weakness, behavioural disorders, movement disorders and pain and/or pruritus. This is best achieved by obtaining a detailed history and ideally observation of the event.

PRACTICAL TIP
Ask the owner to video an event. This gives a much clearer assessment than a simple description

Diagnosis
The diagnostic approach to forebrain disease is similar, whether the manifestation is seizure, disorientation or head pressing. Once the history has been obtained, and physical and neurological examinations carried out, a full blood count, urinalysis and routine serum biochemistry panel help rule out the common metabolic causes. A bile acid stimulation test is also important at this stage, as seizures can occur due to hepatic encephalopathy at any age and in some cases without any other clinical signs.

If no cause of the seizures has been identified, advanced imaging and cerebrospinal fluid (CSF) analysis should be considered. The utility of this should be weighed against the financial costs and risks to the animal of anaesthesia and CSF collection. Details of the technique for CSF collection are given in the BSAVA Guide to Procedures in Small Animal Practice.

The most common cause of seizures in dogs that have their first seizure at an age between 1 and 6 years, that have generalized seizures and that are normal inter-ictally, is idiopathic epilepsy. These patients usually have normal magnetic resonance imaging (MRI) and CSF findings. It is therefore acceptable in these cases to treat on this presumptive diagnosis if the owner is unwilling or constrained from pursuing advanced imaging. Owners may still want to proceed with these investigations to rule out more unusual conditions such as early-onset neoplasia (Figure 11.2), or late onset of signs related to congenital disease, but they should be warned of the low diagnostic yield. Duration of signs may also assist in diagnosis: if seizures have been occurring for weeks to months without progressing, then inflammatory brain disease is less likely; whereas, if seizures have been present for over 6 months without progressing, then intracranial neoplasia is less likely.

Advanced imaging should be encouraged in dogs under 1 or over 6 years of age, to look for congenital (Figure 11.3) or neoplastic disease. Dogs with abnormal findings on inter-ictal neurological examinations will often have abnormalities on brain MRI. If there is neck pain or pyrexia, CSF analysis becomes more important for investigating inflammatory and infectious brain disease. MRI is preferred to computed tomography (CT) for the investigation of brain disease, due to its superior resolution of soft tissue and the difficulty of viewing the caudal brain with CT due to artefacts.

T1-weighted sagittal MRI scan of a 3-year-old Beagle with depression, head pressing and neck pain. The gadolinium contrast material is enhancing an intracranial mass, suspected to be a choroid plexus tumour.

Emergency treatment: Emergency treatment is required if an animal is in status epilepticus, i.e. a seizure that is not self-limiting, or is having clusters of seizures (several close together). Since the onset of status epilepticus cannot be predicted, it can be useful to supply the owner with rectal diazepam, to be administered in the event of a seizure lasting more than 5 minutes, with advice that the vet should be called if it is necessary to use this. For a dog presenting to a surgery in status epilepticus, the first priority is to stop the seizure; a protocol is given in QRG 11.2. Although some dogs may be heavily sedated for
24–48 hours, many cases of status epilepticus can be controlled with this protocol and, although they may have post-ictal signs that can last 1–2 weeks, many dogs will return to a good quality of life, depending on the underlying cause.

Long-term management: Treatment of underlying causes of epilepsy is beyond the scope of this chapter, but even serious brain diseases may respond for variable lengths of time to treatment. For example, dogs with brain tumours can have extended survival times following various combinations of radiotherapy, surgery and chemotherapy, and even prednisolone can have a palliative effect for weeks to months in some cases. Meningoencephalitis of unknown origin is associated with a guarded prognosis, but extended survival times or remission can be seen in animals treated with combinations of immunosuppressive drugs.

Owner education
Owner education is important in the management of seizures
- Owners need to be aware that it is rarely possible to prevent seizures completely, the aim being to reduce them to a frequency compatible with a good quality of life
- If seizures are occurring more frequently than every 2–3 months, seizure control should be considered suboptimal and treatment should be commenced, or ongoing treatment reviewed. However, it is not always possible to achieve a level of control in which seizures only occur every 3 months, and the dog’s quality of life regarding seizure frequency and severity should be balanced against drug side effects such as liver disease
- The owners should be aware that side effects from treatment are common, although many of these are self-limiting within the first couple of weeks after starting treatment
- Beneficial effects of drugs may also take some time to be established
- Owners need to be aware of the importance of regular blood testing for therapeutic levels of the drug, and blood testing for adverse effects such as liver disease
- The owners should know that missing doses of drugs, or stopping them abruptly, may cause rebound seizures
- The owners should keep accurate records of seizure frequency, character and timing, and seek advice if the frequency increases, occurs in clusters, or the dog has a seizure lasting more than 5 minutes

There are three drugs authorized in the UK for the long-term treatment of epilepsy in dogs.

Phenobarbital is the first-line treatment, as it is generally better tolerated and more effective than potassium bromide (Boothe et al., 2012).
- The initial dose is around 2–3 mg/kg twice daily. Data sheet recommendations for initial dose are either 2.5 mg/kg twice daily or 2–5 mg/kg twice daily, depending on brand. However, the dosage is best adjusted by monitoring serum concentration.
- As the drug has a long half-life, blood testing should be performed 2 weeks after starting therapy or 2 weeks after a dose change to ensure that drug concentration is steady. The blood test is generally performed 1–2 hours before a dose is due, to obtain a trough level, although in most cases the timing of blood sampling is not significant.
- Hepatic enzyme induction can mean the amount of drug required increases over time, so 6-monthly monitoring of serum concentration is recommended.
- Common side effects include sedation and ataxia after initiating treatment or increasing the dose. This is usually self-limiting over a period of 2 weeks. Increased thirst and appetite may be seen.
- Rarely, hepatotoxicity occurs, and this is more common at higher serum concentrations. As hepatic enzymes are induced by the drug, monitoring of these is not helpful, but liver function should be monitored regularly by checking dynamic bile acids, albumin and urea.

Imepitoin is a new anti-epileptic drug that was authorized in the UK in 2013 for ‘the reduction of the frequency of generalized seizures due to idiopathic epilepsy in dogs... after careful evaluation of alternative treatment options’.
- The dose is 10–30 mg/kg twice daily, with the dose being varied depending on the severity of the disorder. It is recommended to start with an initial dose of 10 mg/kg twice daily, and if the drug is well tolerated but seizure control is not adequate after a minimum treatment duration of 1 week, the dose can be increased in 50 to 100% increments up to the maximum dose.
- As bioavailability is greater in fasted dogs, the timing of tablet administration in relation to feeding should be kept constant.
- Adverse effects, including polyphagia, polydipsia, polyuria and hyperactivity, have been reported to be generally mild and transient.
- Imepitoin should not be used as the primary treatment for cluster seizures or status epilepticus.
- The efficacy as an add-on drug has not been evaluated, but the author has used imepitoin in combination with phenobarbital, potassium bromide and/or levetiracetam in a small number of cases without adverse effect.
- Transition to or from other types of anti-epileptic therapy should be done gradually and with close supervision.
Potassium bromide is authorized in the UK as an anti-epileptic agent for use as an adjunct to phenobarbital in the control of refractory cases of epilepsy in dogs. A patient may be considered refractory to phenobarbital when its quality of life is affected by frequent and/or severe seizures, despite an adequate serum concentration of the drug. Approximately 50% of dogs that are resistant to phenobarbital achieve good control of seizures with the addition of potassium bromide. Potassium bromide can be considered as a sole agent if there is a reason not to use phenobarbital, e.g. pre-existing hepatic disease.

- The recommended dose in the data sheet is 15 mg/kg twice daily with food.
- The half-life of potassium bromide is 24 days, so it can take weeks to months to achieve an adequate steady concentration.
- If more rapid control is required (such as in a dog with cluster seizures), a loading dose of potassium bromide can be given (e.g. 600–1000 mg/kg orally) but this has an increased risk of adverse reactions, such as sedation and ataxia, and the author’s preference is to add one of the quicker acting anti-epileptic drugs such as levetiracetam, either long term or temporarily while adequate serum concentrations are achieved.
  - Alternatively, giving a loading dose of potassium bromide of 200 mg/kg orally q24h for 5 days may reduce the incidence of side effects, after which the dose can be decreased to the maintenance dose.
- Serum concentrations should be assessed at 2 and 4 months after initiation or a dose change.
- Side effects include sedation, ataxia, vomiting, polyuria, polydipsia, polyphagia, an erythematous rash, and possibly pancreatitis.

Diazepam has too short a half-life in dogs to be of use in maintenance therapy. However, tactical use of the oral or rectal form may be of benefit in controlling cluster seizures. It is also prudent to give the owner of an epileptic dog a small supply of rectal diazepam to be used in the event of a prolonged seizure (the author recommends that this is used in the event of a seizure lasting 5 minutes or more).

Levetiracetam has a short half-life and appears to be very well tolerated. It appears to be effective as a third anti-epileptic drug in cases refractory to phenobarbital and potassium bromide, and may be superior to those drugs in the treatment of partial seizures. It can also be used tactically for a few days in the event of cluster seizures, as it has a rapid onset of activity. It can be very expensive for bigger dogs and tolerance may develop to it in the long term, which can limit its usefulness.

Other anti-epileptic drugs that may be used include gabapentin and zonisamide. Gabapentin appears to decrease seizure frequency. It is also effective as an analgesic in cases of neuropathic pain. It can be difficult in some cases to distinguish between unusual behaviour due to intermittent pain and complex partial epilepsy; gabapentin can sometimes be of use in these cases, though it will not be possible to know whether a response to treatment is due to analgesic or anticonvulsant effects.

Refactory cases
If a dog fails to respond to anti-epileptic treatment, or becomes refractory at a later stage, consider or investigate:

- Owner compliance: it is important that doses are not missed as this can lead to rebound seizures
- Incorrect dosage: check therapeutic levels
- Malabsorption, e.g. due to gastroenteritis
- Drug interactions affecting metabolism
- Incorrect diagnosis: are these really seizures? Is there an underlying cause that has not been diagnosed, or has newly occurred?

Epilepsy is a treatable condition in dogs, but the owners should be aware that not all dogs can have their seizures controlled adequately and that there is a significant emotional and financial commitment to owning an epileptic dog. Euthanasia may be considered in cases where the owner is not prepared to make that commitment, or in cases where the dog is refractory to treatment and its quality of life is adversely affected.

Ataxia and gait abnormalities
Ataxia is a failure of muscle coordination, excluding weakness, musculoskeletal problems and abnormal movements such as tremor. It can be classified as:

- Cerebellar ataxia:
  - Loss of ability of fine control of movement
  - Characterized by high stepping or over-reaching gait (hypermetria)
  - May be accompanied by intention tremor and loss of menace response
- Vestibular ataxia:
  - Characterized by leaning, falling or tight circling to one side with unilateral disease
  - Usually accompanied by head tilt and nystagmus
  - In bilateral disease the patient is reluctant to move, and will often stay crouched and show side-to-side movements of the head
- Sensory ataxia:
  - Loss of sensation of limb position (conscious proprioception)
  - Characterized by clumsiness and incoordination, leading to a wide-based stance, swaying gait, scuffing of toes and a longer than normal stride length
  - May be accompanied by a variety of signs, depending on neurolocalization.

Observation of gait and head position, along with conscious proprioception testing in the neurological examination will usually allow neurolocalization of ataxia.

- Cerebellar ataxia is usually caused by cerebellar disease
- Vestibular ataxia may be due to peripheral (i.e. middle/inner ear disease) or central vestibular disease (i.e. brainstem and parts of the cerebellum).
Sensory ataxia may be due to a lesion involving the forebrain, brainstem, spinal cord (see Chapter 16) or peripheral nerves.

Figure 11.4 indicates ways of differentiating peripheral from central vestibular disease.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Central vestibular disease</th>
<th>Peripheral vestibular disease</th>
</tr>
</thead>
<tbody>
<tr>
<td>History of otitis externa</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>History of ototoxins</td>
<td>-</td>
<td>++</td>
</tr>
<tr>
<td>Conscious proprioceptive deficits</td>
<td>++</td>
<td>–</td>
</tr>
<tr>
<td>Head tilt</td>
<td>++</td>
<td>++</td>
</tr>
<tr>
<td>Spontaneous nystagmus</td>
<td>+</td>
<td>++</td>
</tr>
<tr>
<td>Positional nystagmus</td>
<td>++</td>
<td>–</td>
</tr>
<tr>
<td>Vertical nystagmus</td>
<td>++</td>
<td>–</td>
</tr>
<tr>
<td>Rotatory nystagmus</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

Differentiating central from peripheral vestibular disease. – = rarely associated; + = sometimes associated; ++ = frequently associated.

Localizing the lesion in ataxic animals is important in directing further investigation, treatment and prognosis. For example:

- A dog with acute-onset head tilt, horizontal spontaneous nystagmus, ataxia with no conscious proprioceptive deficits and no history of otitis externa would be strongly suspected to have idiopathic vestibular syndrome, and a limited investigation with monitoring might be appropriate.
- A dog with gradual-onset vestibular signs accompanied by lateralized conscious proprioceptive deficits would prompt an investigation of central disease, such as MRI of the brain.
- A dog with hindlimb proprioceptive deficits only, and brisk segmental spinal reflexes, would benefit from a spinal investigation such as myelography or MRI/CT of the spine.

Figure 11.5 lists the most common causes of ataxia.

**Weakness**

Weakness may be episodic, exercise-induced (more properly termed fatigue) or persistent. It can be difficult to differentiate from other causes of reluctance to move, such as pain and paresis. A physical examination can help identify areas of pain, and assessing reflexes such as the withdrawal reflex can help identify reduced strength. Consideration should be given as to whether the weakness is persistent, or worsens with exercise as in the case of myasthenia gravis (see below). The approach to weakness (see Chapter 17) involves careful history-taking and physical examination; blood testing (e.g. haematology, biochemistry, electrolytes) is usually appropriate. Common differential diagnoses for weakness are listed in Figure 11.6.
Neuromuscular diseases and myopathies

Weakness and fatigue are common signs of neuromuscular diseases and myopathies. Common myopathies include polymyositis and masticatory myositis.

Polymyositis can be suspected when generalized weakness is present, together with muscle pain on palpation (although some dogs will be more sensitive than others) and pyrexia. Muscle biopsy is required for definitive diagnosis, and electromyography can be supportive. Testing for infections that can affect the muscles, e.g. *Neospora*, is important, as treatment of idiopathic polymyositis involves immunosuppression.

Myasthenia gravis and other neuromuscular junction diseases often present with generalized weakness. Acute flaccid tetraparesis is more likely to be seen with tick paralysis and botulism, whereas generalized myasthenia gravis is more likely to be characterized by weakness occurring after a short period of exercise. Diagnosis is by detection of anti-acetylcholine receptor antibodies on serology, although an edrophonium response test (see BSAVA Guide to Procedures in Small Animal Practice) is supportive. Myasthenia gravis may also present in a focal form, characterized by regurgitation due to megaesophagus, although this sign is also often present in the generalized form. Megaesophagus worsens the prognosis due to the common sequel of aspiration pneumonia. A chest radiograph of the conscious dog will aid in the diagnosis of megaesophagus.

Masticatory myopathy is a type of myositis confined to the masticatory muscles of the head and is usually an idiopathic immune-mediated disease. It can present either with muscle weakness and inability to close the jaw, or with trismus (locked jaw) due to fibrosis of atrophied muscles. In the acute stages the masticatory muscles may be swollen, but more commonly the condition is noticed in the chronic form when they become atrophied. Diagnosis is by muscle biopsy and serology for anti-2M antibodies, and ruling out infectious diseases such as toxoplasmosis and neosporosis using serology. Treatment is with immunosuppression: steroids are useful in this condition for their antifibrotic effects as well as their immunosuppressive effects. Other causes of masticatory muscle atrophy include hyperadrenocorticism/glucocorticoid administration, cancer cachexia and other systemic diseases.

Cranial nerve disorders

Certain cranial neuropathies present in characteristic ways. Treatment and prognosis will depend on the underlying cause.

A dropped jaw can be a sign of bilateral trigeminal nerve lesions. Diseases that might cause a dropped jaw include: idiopathic trigeminal neuropathy, which is often self-limiting; infections; inflammatory diseases; and lymphoma.

*WARNING*

Be aware of animals that have been in countries where rabies is endemic, as a dropped jaw can also be a sign of rabies.

Lesions affecting a single trigeminal nerve can lead to severe unilateral masticatory muscle atrophy (Figure 11.7). These lesions are often neoplastic. As a rule of thumb, unilateral masticatory muscle atrophy is likely to be neurogenic, whereas bilateral is likely to be due to masticatory myopathy (see earlier). Further testing is required to clarify this.

Facial paralysis can be idiopathic and self-limiting. It may also be related to brainstem or middle ear disease, or to trauma. Flaccid paralysis of the facial muscles is noted, together with a loss of the palpebral reflex.

Horner’s syndrome is characterized by miosis, narrowing of the palpebral fissure and protrusion of the third eyelid (Figure 11.8). It is caused by a lesion affecting the autonomic nerve supply to the eye. This is a complicated pathway, and so the lesion can be anywhere from the midbrain, through the spinal cord to T1–T3, up the vasovagal sympathetic trunk in the neck, to near the middle ear. The condition can be idiopathic, and Golden Retrievers are over-represented (Boydell, 1995).
References and further reading


Downward flexion of the neck should be avoided in dogs at risk of atlantoaxial subluxation, such as young small-breed dogs

1 Visual assessment of the head: look from the front for signs of asymmetry, e.g. masticatory muscles, head tilt, anisocoria, drooping lip.
2 With a bright light, look for evidence of strabismus and nystagmus, and check pupillary light reflexes (see Chapter 21).
3 Palpate the head and neck for pain.
4 Open the mouth wide to assess for pain, jaw strength and the presence of trismus. Test gag reflex at this time if it is safe to do so.
5 Tilt the head upwards, to assess for both neck pain and positional nystagmus.
   • Move the head from side to side to assess for neck pain and for normal physiological nystagmus. A normal young dog should be able to have its neck gently flexed: laterally in both directions so that its nose is flat along its flank; upwards so it is looking at the ceiling; and downwards so its mandible is flat along its chest.

WARNING
Downward flexion of the neck should be avoided in dogs at risk of atlantoaxial subluxation, such as young small-breed dogs

• If possible, turn the dog on its back to assess for positional nystagmus.

6 Check palpebral and menace reflexes.
Testing for the palpebral reflex by lightly tapping the medial canthus of the eye. A normal response is a brisk blink.
Testing for the menace response by making a threatening gesture towards the eye. A normal response is a blink. Be careful not to make a draft of air, which will trigger the palpebral or corneal reflexes.

7 Palpate the spine for pain, and the limbs for pain, muscle tone and atrophy.
8 Check the paw placing response on all four feet.
9 Check withdrawal response in all four feet by pinching between the toes.

Testing for conscious proprioception by turning the paw on to its dorsal aspect. A normal response is briskly returning the foot to its normal position.

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For a dog presenting to a surgery in status epilepticus, the first priority is to stop the seizure. The following protocol can be followed in these cases.

1. Administer diazepam: 0.5–1.0 mg/kg i.v. or rectally, for up to three doses, 5 minutes apart.

2. If this stops the seizure, administer a loading dose of phenobarbital slowly intravenously:
   - If the dog has not previously been on phenobarbital treatment, the dose is 12 mg/kg
   - If the dog is already on phenobarbital treatment, 4–6 mg/kg of phenobarbital can be given slowly intravenously to increase the blood levels slightly
   - If the diazepam does not stop the seizure, administer phenobarbital 2–4 mg/kg i.v. every 20–30 minutes to effect, not exceeding 24 mg/kg over 24 hours. The dose will be lower if the animal is already being treated with oral phenobarbital.

3. If diazepam and phenobarbital fail to halt seizure activity, other options include:
   - A continuous diazepam infusion of 0.1–0.5 mg/kg/h
     - Note that diazepam can become adsorbed on to the plastics of syringes and giving sets, but once the initial dose has passed through them, the plastic should become saturated, allowing further diazepam to pass through normally
   - Propofol, initially in boluses of 1–2 mg/kg i.v., followed by 0.1–0.6 mg/kg/min constant rate infusion
   - Intravenous levetiracetam (20 mg/kg q8h) has recently been shown to have some effect and to be well tolerated in status epilepticus (Hardy et al., 2012). It also has the advantage of causing minimal sedation, which is useful in assessing response, although it is very expensive
   - Inhalant anaesthesia with isoflurane is a last resort.

4. Supportive care should be instituted, including: airway support; oxygenation or ventilation if required; fluid therapy to maintain hydration; and treatment of hyperthermia.

5. Blood tests for electrolytes, glucose, calcium, packed cell volume (PCV) and total protein should be performed and deviations corrected where possible.

6. Monitor blood pressure, body temperature and hydration status.

7. Turn the patient every 4 hours, express the bladder as required and keep the patient warm, clean and dry.

8. Give a loading dose of an anticonvulsant drug if not already given. Start maintenance treatment (see main text).

9. Continue to monitor for 24–48 hours.

Although some dogs may be heavily sedated for 24–48 hours, many cases of status epilepticus can be controlled with the above protocol, and although they may have post-ictal signs that can last 1–2 weeks, many cases will return to a good quality of life, depending on the underlying cause.
### OBSERVATION

<table>
<thead>
<tr>
<th>Mental state:</th>
<th>Alert</th>
<th>Obtunded</th>
<th>Stuporous</th>
<th>Comatose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posture:</td>
<td>Standing</td>
<td>Sitting</td>
<td>Lying</td>
<td></td>
</tr>
<tr>
<td>Stance:</td>
<td>Head tilt</td>
<td>Lameness</td>
<td>Involuntary movement</td>
<td></td>
</tr>
<tr>
<td>Gait:</td>
<td>Normal</td>
<td>Circling</td>
<td>Ataxic</td>
<td>Knuckling</td>
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<tr>
<td>Stride length:</td>
<td></td>
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</tr>
</tbody>
</table>

### PALPATION/MANIPULATION

- Muscle tone
- Muscle atrophy
- Skeletal abnormalities
- Neck pain
- Joint pain
- Spinal pain

### POSTURAL REACTIONS

Score 0 for absent, 1 for reduced, 2 for normal and 3 for exaggerated

<table>
<thead>
<tr>
<th>Reaction</th>
<th>L thoracic limb</th>
<th>R thoracic limb</th>
<th>L pelvic limb</th>
<th>R pelvic limb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hopping</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Knuckling</td>
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<tr>
<td>Wheelbarrow</td>
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<tr>
<td>Hemiwalking</td>
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<tr>
<td>Tactile placing</td>
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<tr>
<td>Visual placing</td>
<td></td>
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<tr>
<td>Extensor postural thrust</td>
<td></td>
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</tbody>
</table>

### CRANIAL NERVE TESTS

- Smelling non-irritant substance (I)
- Pupil size/anisocoria (retina, II, III)
- Pupillary light reflex (II, III, sympathetic, retina)
- Menace (II, VII, forebrain, cerebellum, brainstem)
- Corneal reflex (V, VI, VII)
- Throw cotton wool (II)
- Auditory response (VIII)
- Strabismus:
  - Permanent: III, IV, VI
  - Positional: VIII
- Spontaneous nystagmus:
  - Horizontal
  - Vertical
  - Rotatory
- Positional nystagmus (III, VIII, brainstem)
- Facial sensation, nasal stimulation (V, forebrain)
- Facial symmetry (VII)
- Palpebral reflex (V, VII)
- Swallowing/gag reflex (IX, X)
- Tongue (XII)
- Oculocardiac (V, X)
- Jaw tone (V)

### SPINAL REFLEXES

- Thoracic withdrawal (C6–T2)
- Pelvic withdrawal (L6–T2)
- Patellar (L4–L6)
- Gastrocnemius (L6–S1)
- Perineal (S1–S3)
- Extensor carpi radialis (C7–T2)
- Tail movement

### URINARY FUNCTION

- Voluntary urination? Yes | No
- Full bladder? Yes | No
- Easily expressed? Yes | No

### PAIN SENSATION

<table>
<thead>
<tr>
<th>Sensation</th>
<th>L thoracic limb</th>
<th>R thoracic limb</th>
<th>L pelvic limb</th>
<th>R pelvic limb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deep pain</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Hyperaesthesia</td>
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<tr>
<td>Superficial pain</td>
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</table>

### PANNICULUS REFLEX

| CUT-OFF POINT | |
|---------------||

An example of a form that can be used for a neurological examination.
Behaviour problems: 
a brief guide

Tiny De Keuster, Joke Monteny and Christel P.H. Moons

Behavioural problems may be a reason for presenta-
tion by the owner or may be noted during a consulta-
tion for another reason. In either event it is important
to investigate them. As well as affecting the dog itself,
behavioural problems can threaten the human–
animal bond, and society itself: a behaviour problem
in an otherwise healthy animal may result in re-
homing or euthanasia of the dog, social stress for
owners, or even injury to third parties. It is important
for the practitioner to realize that giving advice about
behavioural problems has broad consequences
beyond the patient itself.

Behavioural complaints may appear simple ("My
dog is just pulling on the lead") and are coloured
by the owner’s interpretation ("It is just a disobedient
dog"). Owners may ask for a quick fix, such as a
drug to calm the dog down or a few tips and tricks.
However, as for signs of any disease, behavioural signs
deserve a full clinical and behavioural examin
ation; a symptomatic approach should be avoided at all times.
If no in-house expertise is available, referral to a spe-
cialist in behavioural medicine should be considered.

A detailed discussion of multiple behavioural con
ditions is beyond the scope of this chapter. Brief guide-
lines are given concerning a range of topics that are
frequently presented as problems in general practice
(see BSAVA Manual of Canine and Feline Behavioural
Medicine for more details).

Canine body language
Humans and dogs are both social species, which
means that not only do they enjoy the presence of a
companion, but they also exhibit decreased function-
ing in isolation and may experience reduced welfare.
Optimal functioning is dependent upon social relation-
ships with other members of society, and this requires
effective communication and a mutual understanding
of species-specific signalling, social gestures and
interactions.

Important concepts in canine communication
Perception
Perception is the process by which individuals regis-
ter and evaluate information detected from the internal
and external environment, consciously or uncon-
sciously (Burn, 2009). The quality and quantity of
stimuli that can be perceived depends on the sensory
apparatus of the animal, whilst the complexity of per-
ception depends on the cognitive abilities and previ-
ous experiences of the individual. When dealing with
dogs, it is important to understand that some actions,
which are perceived as benign by humans, can be
perceived as threatening by dogs (Figure 12.1).

Cognition
Cognition refers to the mechanism by which animals
acquire, process, store and act on information from
the environment (Shettleworth, 2001). For veterinary
surgeons, it is important to be aware that health or
age-related factors influencing information retrieval
(sensory function), information processing (central
nervous system, CNS) or executive functioning (cardio-
vascular, musculoskeletal or neurological systems)
may affect the cognitive and communicative function-
ing of the dog (Figure 12.2).

Arousal
Arousal is a state of psycho-physiological activation
that determines the responsiveness of an individual to
environmental stimuli. From a behavioural point of
view, arousal is characterized by increased alertness,
sensory sensitivity and readiness to respond to
stimulation through faster cognitive processing and more response (Ligout, 2009). However, when arousal is too high it interferes with the acquisition and assimilation of information and consequently with proper cognitive processing (Overall, 2013).

Stress
Stress is the biological response elicited when an individual perceives a threat to its homeostasis (Moberg, 2000). Previous research has indicated that an individual’s perception of the stressor (through predictability and control) plays an important role in the effects of stress (Weiss, 1972; Yang et al., 2011), even more so than the physical characteristics of the stressor (such as intensity or duration).

How dogs react in social stress situations: The way a dog copes with a perceived social threat in a specific context (e.g. veterinary examination) depends on dog-related factors (physical health, emotional state) influenced by actual context (owner present or absent, previous experience of the car ride, waiting room or clinic). When a perceived threat cannot be resolved by emitting conflict avoiding signalling, the dog will try strategies higher up the ‘ladder of aggression’ (see Figures 12.3, 12.4 and 12.14).

How dogs communicate
Communication is the transfer of information between a sender and a receiver, where both the sender and the receiver map a signal to a particular meaning. When signal-to-meaning mapping involves a syntax (a formal structuring of the signals in relation to each other), the type of communication is called language (van der Zee, 2009). As dogs have no spoken language, their communication mainly relies on body language combined with odour signalling and vocalization (Figures 12.5 and 12.6).
In contrast to belief, studies have found no relation -

How well are dogs able to understand human language?

It is thought that ten thousand years of cohabitation between humans and dogs may have enabled dogs to understand quite a lot of human communication. However, it is important to understand what dogs are actually responding to.

The meaning of words

According to a recent study, attempts to teach dogs words outside an associative context (e.g. by human referential actions only) were not successful. However, dogs can learn words by association (through classical conditioning) (Tempelmann et al., 2014; see also Puppy development and behaviour, below).

Feelings of guilt

In contrast to belief, studies have found no relationship between the ‘guilty look’ on a dog’s face and the fact that it had engaged in disobedient behaviour. However, researchers did find that the dog’s ‘guilt admitting’ behaviour occurred in response to owner cues (e.g. scolding) (Horowitz, 2009).

Human non-verbal cues

Research has shown that ‘what’ we say is highly influenced by ‘how’ we say it, i.e. the role of non-verbal communication is unmistakable and it is likely that this influences our communication with dogs. Dogs are able to comprehend a variety of human non-verbal cues, such as pointing and gazing, which makes them more able than primates to read human non-verbal gestures (Kaminski et al., 2012; Kirchhofer et al., 2012).

Understanding human intentions

Dogs are able to treat human communication in a flexible way and can discriminate between communication that is intended towards them and that intended towards third parties. Dogs do not need eye contact to know if a human gesture is intended for them. These characteristics of understanding human communication have been demonstrated in puppies as young as 6–10 weeks old (Kaminski et al., 2012).

Potential pitfalls

As humans are largely unaware of their own body language, and unaware that dogs pick up the non-verbal cues they emit, this could lead to misunderstanding.

For veterinary professionals, it is important to look at these human gestures from the dog’s perspective: do dogs meet and greet in the same way, how are ‘human gestures’ like extending a hand or hugging perceived, how could problems arise and how should they be dealt with?

How well are humans able to understand dog language?

Importance of dispelling myths

Dogs that cohabit with humans are capable of bonding with other dogs and species within the family and forming stable, lifelong attachments. Unfortunately, for more than half a century, human vision of dog behaviour has been influenced by our own social constructs. For example, dominance has been (incorrectly) perceived as an individual dog trait and the interpretation of certain types of canine signalling has been (incorrectly) linked to status (i.e. ‘dogs with their tail up and ears forward have been thought to be ‘dominant’ and dogs with their tail tucked under and ears back have been thought to be ‘submissive’) (Bradshaw et al., 2009). Such associations have not been helpful in promoting safe and animal-friendly interactions between humans and dogs. For veterinary professionals working with dogs, it is therefore crucial to dispel myths and adopt a scientific approach.

Breed differences

In addition to the differences between individual dogs in terms of reaction to stimuli, the selection and breeding of dogs for certain characteristics has resulted in a range of phenotypes for head and body size, hair coat, skin folds, ear and tail position and tail length, which influence the way emotions and motivations are expressed by dogs and are observed by humans (Rimbault and Ostrander, 2012). For example, some breeds (e.g. Beagles) spontaneously hold the tail in an elevated position, whilst others (e.g. Chow Chow) hold the tail in an upright curved position. However, some breeds may only raise the tail in response to a (pleasant or unpleasant) stimulus. In addition, some breeds may have no discernible facial expressions because of the presence of skin folds or overlapping hairs surrounding the eyes and face (e.g. Bull Terriers, Cavalier King Charles Spaniels). Thus, veterinary professionals should remember that just looking at a few body parts is not an

### Table: Communication, Emotion/motivation, Message(s), and Sensory organs picking up the message

<table>
<thead>
<tr>
<th>Communication</th>
<th>Emotion/motivation</th>
<th>Message(s)</th>
<th>Sensory organs picking up the message</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body language:</td>
<td>Positive or negative emotion</td>
<td>Social approach</td>
<td>Visual system – note that a dog’s eyes are very sensitive to movement, even when far away</td>
</tr>
<tr>
<td>Face</td>
<td>Positive or negative arousal</td>
<td>Social distancing</td>
<td>Tactile system</td>
</tr>
<tr>
<td>Body</td>
<td>Perceived threat</td>
<td>Play</td>
<td></td>
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<tr>
<td>Skin</td>
<td>Perceived conflict</td>
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<tr>
<td>Posture</td>
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<td></td>
</tr>
<tr>
<td>Action</td>
<td></td>
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<tr>
<td>Vocalizations:</td>
<td>Positive sexual arousal</td>
<td>Destrus</td>
<td>Auditory system – harsh low frequency, unmodulated barks are more commonly the response to a perceived threat. The more tonal, higher pitched, modulated barks are more commonly seen during play and isolation</td>
</tr>
<tr>
<td>Bark</td>
<td>Negative stress arousal</td>
<td>Perceived competition</td>
<td></td>
</tr>
<tr>
<td>Growl</td>
<td></td>
<td>Perceived threat</td>
<td></td>
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<tr>
<td>Howl</td>
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<td></td>
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<tr>
<td>Yelp</td>
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<tr>
<td>Scream</td>
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<tr>
<td>Odour signalling:</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Urine</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Anal glands</td>
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</table>

It is important to realize that most signals used in canine body language have more than one meaning, depending upon the situation. Hence, the importance of observing the behaviour of the dog in the relevant context.
accurate way to assess a dog’s emotion or motivation; it is important to interpret dog language by looking at the entire dog (face, eyes, ears, skin, hairs, posture, sounds, smells and movement) within a given context.

Dog barking
Barking in dogs appears to be characterized by acoustic parameters specific for the context and animal’s emotional state (tonality, peak frequency and inter-bark intervals). Consequently, barking has more than one meaning. For example, when dogs bark they can be aroused or excited in a positive (i.e. during play) or a negative (i.e. when isolated or feeling threatened during exposure to visual or auditory stimuli) way. Research indicates that humans, in general, are quite skilled at recognizing different types of bark and underlying emotional state (Pongrácz et al., 2005, 2011). Unfortunately, human society in general does not take kindly to barking by dogs and this kind of canine vocalization may lead to serious conflicts between neighbours, the filing of official complaints and could potentially result in relinquishment or euthanasia of the dog. For further information on barking, see the BSAVA Manual of Canine and Feline Behavioural Medicine.

Prevention is key
Be aware of human pitfalls
- Human social gestures, such as sitting close to show affiliation, putting one’s arm around someone’s shoulders and restraining someone in a friendly hug, are positive signals from a human perspective. Young children, especially, like to pet dogs as a sign of their friendship, not realizing that their (benign) actions might intimidate a dog and induce fear. The fact that the dog freezes and does not move, may lead parents and/or teachers to think that the dog feels happy with the well-intended attention.
- Humans might interpret subtle signs such as yawning as the dog being ‘bored’ or ‘tired’. However, it should be explained to owners that this may, in fact, be a subtle sign relating to conflict avoidance.
- It is important to be aware of why an unfamiliar dog might approach you in the veterinary practice. When an unknown dog approaches you and sniffs (e.g. your hand), this is most likely not a request to be petted; it only means that the dog is exploring you.

Be aware of dog language pitfalls
- When dogs meet humans or other dogs, they are not trying to sort out who is the boss; they just want to investigate and pick up information. Problems may arise when dogs are restricted in their movement (e.g. when they are on a lead) or when owners with a dog on a lead approach the other dog from the front and stand still. Dogs may interpret this encounter as a potential threat (Figure 12.7).
- When a dog raises its tail and bristles, this does not signal status. Instead, it relates to arousal and, perhaps, threat perception.
- When a dog wags its tail, this does not necessarily mean it is friendly and wants to be petted. Tail wagging represents a state of arousal that might be pleasant (play, greeting) or unpleasant (threat, incentive for attack). Translating dog language based on tail movements is not helpful.

Always interpret behaviour within a context (Figure 12.8). The way a dog reacts to environmental and social stimuli depends on its perception, cognition, threshold for arousal and the type of emotional response that is triggered in the brain. The individual behavioural strategy (i.e. signalling of the response) depends on several factors such as genetic predisposition, behavioural development, health status, past learning experiences and context.

Important note: aggression is not a trait or characteristic inherent to an individual. Aggression is a strategy that dogs use when conflict avoiding signalling does not have the desired outcome from the dog’s point of view (Figure 12.9).

Meeting an unknown dog when on a lead and standing still may change the dynamics of communication between the dogs. (© J Monteny)
Puppy development and behaviour

A puppy’s development is influenced by its genetic makeup, its environment and learning experiences. Lack of exposure to social and environmental stimuli, or exposure to stimuli that overtaxes the puppy’s ability to cope, may induce chronic stress and lead to developmental disorders (Weiss, 1972). The socialization period (between 3 and 14 weeks of age) is a particularly sensitive time during which puppies develop strategies to cohabit with conspecifics or other species (socialization) and learn how to respond to environmental stimuli (environmental learning). Both socialization and environmental learning should be continued throughout a dog’s life and owners should be informed correctly by trained professionals (McBride, 2009).

Owners should speak to experts before and after buying a puppy to avoid unrealistic expectations and maximize the chances of a successful adoption (Hettis et al., 2004; Gazzano et al., 2006; Marder and Duxbury, 2008). The role of the veterinary practice is to provide animal health care and to support the owner in ensuring good pet welfare. For the latter, the role of the veterinary practice is to educate owners about everyday life of a puppy within a household, the importance of puppy socialization classes and the need for using training methods conducive to good welfare. Attending puppy classes has been found to be associated with less behavioural problems later in life (Sterry et al., 2005; Blackwell et al., 2008) and a lower chance of relinquishment (Duxbury et al., 2003).

Organizing puppy classes entails a responsibility towards dogs and their owners, and strongly influences the functionality of the human–dog relationship within society. Puppy classes, therefore, should be run by professionals with a number of theoretical and practical skills related to learning theory, dog training, observation and awareness of dog language, as well as sufficient interpersonal skills to provide smooth and friendly owner guidance (ABTC, 2012).

When setting up puppy classes in veterinary practice, or when referring clients to puppy classes, it is important for the veterinary team to be aware of what a ‘good’ puppy class is and how to screen for it.

Puppy welfare

According to the Animal Welfare Act 2006 (which applies in England and Wales), the Animal Health and Welfare (Scotland) Act 2006 and the Welfare of Animals (Northern Ireland) Act 2011, the person responsible for the animal has a duty to meet its welfare needs, which are for a suitable environment, a suitable diet, to exhibit normal behaviour patterns, to be housed with or apart from other animals (if applicable) and to be protected from pain, suffering, injury and disease. Whilst veterinary surgeons are trained to monitor the physically-related needs, there is a lack of information about what constitutes appropriate canine (social) behaviour and how to offer preventive care related to puppy fear and anxiety.

When thinking about raising puppies to balanced adults, veterinary surgeons must not only promote techniques conducive to welfare, but also inform owners about their individual puppy’s developmental needs and limitations due to genetic background (e.g. dogs will react differently when bred as companion animals versus when bred selectively from a working line or a ‘show’ line). The expectations of the owner and the needs of the puppy should both be taken into account.

What types of tools can my practice recommend to help owners achieve a minimum set of expectations in their puppy?

1. Prevention

Although the exact minimum set of expectations may depend on the specific household, in general, owners will expect a puppy to be house-trained, to be able to be left home alone, to allow human contact, to discriminate human objects from toys, and to be friendly to people without jumping and biting. As neurological and physical development is ongoing, most of these behaviours will take time for a puppy to learn. The owner needs to be aware that the puppy cannot be perfectly educated and well behaved from day one.

For example, puppies explore the world by taking random objects in their mouth, chewing on them and sometimes even ingesting them. A puppy will not initially discriminate between objects and toys. This chewing behaviour is nonetheless part of normal behavioural development, but problems can arise, including:

- Health problems when the puppy ingests harmful items (sharp objects, toxic plants or substances, irritating liquids)
- Dissatisfaction in the owner when the puppy chews a valuable object (mobile phone, tablet, clothes/shoes).

Action points:

- Avoid situations where puppies can perform unwanted behaviour.
- Plan ahead, prepare the environment and make it puppy-proof.
- Use appropriate tools (puppy safety gates, puppy kennels).
- Teach owners the correct way to introduce these tools (associate with something rewarding).

2. Positive reinforcement

Reinforcing desirable behaviours is a puppy-friendly way to learn, and will increase the odds that they
happen. In addition to the minimum set of skills, there are others that may be useful and many of these can be taught during puppy classes: coming when called (recall), going to a dog bed or crate when requested, performing behaviours such as sitting or lying down on cue, loose lead walking, greeting humans and dogs on walks, getting along with other dogs, going on car journeys, going to the vet, and anything else that is physically possible for the puppy and that the owner requires. The rationale for using positive reinforcement should be clarified to the owner along with an explanation about how it should be applied (see Figure 12.10). In addition, a reinforcing stimulus can be primary (inherently rewarding, such as food or play) or secondary (associated with a primary stimulus such as a clicker).

**Action points:**

- List desirable behaviours according to the owner’s viewpoint. Some behaviours owners will readily list, such as “we want him to be house-trained” and “we want him to greet people in a friendly way”. Other behaviours are taken for granted by the owner and may not be mentioned, such as “lying quietly on his bed” or “playing with his own toys”.
- Avoid the pitfall of wording such as “we want him to stop jumping”, as reinforcement is not about stopping, but encouraging behaviour.
- Explain the importance of timing. Reinforcing the action needs to be done immediately and before the puppy engages in a new action (or shows the intention to).
- Explain the importance of being consistent. A puppy will learn faster if the desired behaviour is initially followed by a reward every time.
- A reward is not necessarily what humans find rewarding – it is something that the puppy finds worthwhile at that moment. The value of the reward can change: the perception of a treat may be different in terms of quantity (being hungry or not), quality (bread versus chicken) and variation (always the same treat may reduce motivation).
- Some behaviours may be self-rewarding for the puppy, such as chewing, destructive behaviour, digging or barking. Preventing eliciting situations is important (see above). In addition, when observing such behaviours, consider that they may be coping mechanisms due to the lack of environmental stimulation.

3. **Why, how and what to ignore**

Ignoring unwanted puppy behaviour may be tough for owners. Good preventive behavioural practice requires that the veterinary team explains why ignoring certain behaviours is important, how to do it, and what situations can or cannot be ignored.

**Action points:**

- Why. Puppies learn by trial and error. The puppy may feel rewarded for actions that trigger a response. When an owner tells a puppy off (e.g. “stop doing that”), the puppy does not understand the content of what is being said (Horowitz, 2009). Instead it may experience the ‘talking to’ as rewarding attention and not as a punishment.
- How. To ignore a puppy’s undesirable behaviour means continuing to do what you were doing and not performing any action related to the puppy’s behaviour. Interaction with the puppy (talking to, looking at, touching, moving towards) must be avoided. Leaving the room to give the puppy a ‘time-out’ is not the same as ignoring the puppy’s behaviour.
- What can be ignored. Ignoring a puppy’s behaviour should be limited to those behaviours that are harmless for the puppy and the environment. For example, stealing a towel or a newspaper are actions that might be better ignored to avoid the risk of inadvertently rewarding the stealing behaviour. Preventing eliciting situations (see above) is also important.
- What cannot be ignored. Other actions cannot be ignored and require immediate intervention (interrupt the puppy and remove it from the situation), including:
  - Actions that may be harmful to the puppy’s health (e.g. swallowing a handkerchief or chewing sharp, toxic or hazardous objects)
  - Painful or potentially harmful actions towards humans or other animals (e.g. biting a person or clothes).

4. **Anticipate and redirect unwanted behaviour**

Teach owners to observe their puppy’s behaviour and recognize signs of imminent undesirable behaviour. For example, an owner anticipates a puppy taking a towel from a rack because it approaches the towel. It is important to intervene before the puppy actually takes the towel by redirecting the puppy’s interest to another target. When owner intervention occurs after the towel has been removed, a puppy can learn that stealing towels (and other objects) is a good way to elicit (rewarding) attention from the owner.

**Action points:**

- Observe early signs of imminent undesirable behaviour and redirect the puppy’s interest.
- Ensure redirecting occurs in a positive and encouraging way.
- Be aware of the fact that dogs are able to differentiate between positive and negative emotional messages. The latter may lead to stress and conflict between the owner and the puppy.

5. **Encourage and guide alternative behaviour**

Puppy owners often want to stop a particular behaviour. However, teaching a puppy what not to do is not very useful, since the dog still does not know what it can do. It is better to focus on teaching the dog desirable behaviours, preferably those that are incompatible with undesirable ones.

**Action points:**

- Be patient. Wait for the puppy to spontaneously perform behaviour that is on the list of desirable
behaviours. For a puppy that jumps up against people while greeting them, the desired behaviour could be standing with all four feet on the floor.

- Be aware of timing (see above).
- Prepare a reward. Choose a type of reward in advance (primary and/or secondary) and make sure the puppy understands it (the secondary reward has been associated with the primary). When using a secondary reward, always present it before the primary one, not after. For the primary reward, choose something you know will be rewarding and that you can reach quickly.

6. Understand the puppy’s perspective
In order for a puppy to function as part of a family, it is not only important that it understands the owner, but also that the owner understands the puppy. Understanding the puppy’s perspective means learning how the puppy experiences the world around it and to be aware of dog language (see above). This will help an owner to interpret whether a puppy has understood what is required of it, what a puppy is signalling and how the puppy responds emotionally to certain events (getting upset/stressed, becoming over enthusiastic).

7. Clarify the role of punishment
While punishment is perceived as an acceptable regulator in human society (e.g. not stopping at a red traffic light may result in a fine), in dog training it is rather a loaded term. Dog owners and dog professionals often engage in emotional disputes about the usefulness, or abusiveness, of punishment. When teaching puppy classes it is important to clarify the meaning (see Figure 12.10).

Action points:
- Clarify that punishment is only about suppressing behaviour or reducing the chance that the behaviour may be performed in the future. If something does not suppress the behaviour, it is not a true punishment. Instead, it will only be something annoying for the puppy.
- Merely trying to suppress an undesirable behaviour without indicating to the dog what is expected instead does not provide a long-term solution.
- Be aware of different types of punishment.
- The use of physical punishment needs to be restricted to emergency situations. There are too many welfare risks involved when applying it.
- Negative punishment techniques can be very useful (be aware of pitfalls), whereas positive punishment has many risks (see Figure 12.10).
- Try to avoid being judgemental when owners speak of punishment. Instead, try to listen critically – analyse and reflect what they are telling you in terms of learning principles.

Frequently asked questions
Q: Are puppies sensitive to stress?
A: Recent research indicates that the Stress Hypo Responsive Period (SHRP) ends at 4 weeks of age, and that from the age of 5 weeks the impact of behavioural and emotional responses to external stressors needs to be taken into account in puppies (Nagasawa et al., 2013).

Q: At what age should puppies attend socialization classes?
A: Healthy puppies can start socialization classes 1 week after their primary vaccination as the benefits of early socialization on reducing behavioural problems outweigh the risk of infection in most cases.

Q: When should socialization start?
A: Socialization in the broad sense of social contact with conspecifics (littermates and the dam) or humans, starts at the breeder’s facility right after birth. Even when the puppy still has closed eyes and ear canals, the olfactory and tactile perception is functional and will influence brain development. When referring to real social interaction, this starts between week 2 and week 3 after birth when the eyes and ear canals open, so the early experiences at the breeder’s premises are very important. According to Howell and Bennett (2011), breeders would benefit from starting to exercise puppies as young as 3 weeks of age. Breeders can also help with environmental learning by habituating puppies to different environmental stimuli (smells, surfaces, materials, human social contact).

Q: What are the key learning principles a puppy class instructor should know?
A: The ABTC (Animal Behaviour Training Council) published a set of standards in 2012 listing the knowledge and skills required for different types of animal behaviour and training professionals (www.abtcouncil.org.uk), including for people who teach animal (puppy) training classes.

Q: What skills and knowledge should a puppy class instructor possess?
A: An overview is provided in Figure 12.10. (For more detailed information, the reader is referred to the BSAVA Manual of Canine and Feline Behavioural Medicine.)

Q: What clinical signs should be screened for in a puppy socialization class and what action(s) should be taken?
A: An overview is provided in Figure 12.11.

Q: What is the problem with the use of aversive training methods to stop problem behaviour?
A: When looking at problem behaviours frequently encountered in puppies, such as chewing household objects or stealing objects/food, 78% and 93%, respectively, of dog owners in a UK-based study mentioned using techniques based on physical or verbal punishment to stop the behaviour (Hiby et al., 2004). In addition, results showed that the use of training methods based on physical punishment were correlated with a higher incidence of problem behaviours. Problem behaviours need to be considered as a welfare issue for the animal, as they may result in relinquishment or euthanasia of the dog at some point in life.
Chapter 12  Behaviour problems: a brief guide

Non-associative learning

Habitation
Repeated or prolonged exposure to a non-harmful stimulus (or set of stimuli) that results in cessation or decrease in the response to the stimulus (Meunier, 2006)
Benefits of the technique:
- Very important in puppy training and education
- Recommended for normal attenuation of a response to something novel in the environment
- Easy technique (does not require timing and consistency)
- Requires frequent exposure to mild stimuli in multiple contexts (below the threshold of arousal)
Examples:
- Surfaces – a puppy is exploring a novel surface (e.g. grass in the garden). After a short while, the brain will habituate and the surface becomes a stimulus without meaning
- Household noises – a puppy habituates to everyday mild household sounds (washing machine, refrigerator, radio) and they soon become background noises
- Objects – an item introduced to the house (e.g. large plant) will be novel in the beginning, but after a short while the object in this context will be ignored
- Social cues – a puppy habituates to the movement of the owner and this becomes background information
Risks of the technique:
- Habitation is context-specific
  - A change in the stimulus or environment in which it is presented may undo the process. Example: moving a large plant from the living room to the kitchen may require another period of habituation
- Habituation requires frequent exposure to mild stimuli
  - When stimuli are presented above the threshold for arousal/stress, the brain may not be able to attenuate the importance of the stimulus. Example: an owner is walking the puppy down the street, when a passing truck makes a sudden and loud noise. The puppy is startled and reacts with a fear response. This experience will not be helpful to habituate the puppy to the sound of trucks as the noise was above the puppy’s threshold for stress
- When stimuli are presented above the threshold for stress, sensitization may occur
  - Example: a puppy that reacts with a fear response to the loud noise of a truck may respond more fearfully with repeated exposure to truck noise, and even start responding fearfully to milder noises such as cars
- Associative learning may still occur
  - In the long-term, habituation may induce a conditioning process whereby a puppy comes to expect certain stimuli in specific contexts. Example: a puppy is habituated to the owner moving around the kitchen. In the long-term, the puppy may learn that at a specific time of day, the movement of the owner (e.g. towards the refrigerator) has a pleasant outcome (e.g. opening the refrigerator and preparing the puppy’s meal). In this instance, habituating to the owner’s movement may be replaced by associative learning (expecting food)

Flooding
Flooding involves prolonged exposure to a worrisome stimulus that provokes a response. The aim of flooding is that, with exposure, the puppy will stop reacting to the stimulus.
- Flooding techniques represent a welfare issue and should never be used in puppy training. The inability to escape (whether from a cage or a stimulus that the puppy views as fearful) can cripple the animal behaviourally for life because they experience a condition called learned helplessness (Overall, 2013)
- Example: a puppy that has been living in a kennel environment for 5 months behaves extremely fearfully towards all outside stimuli. Once adopted, the owners try to help the puppy by taking it for a walk in a busy street and sitting down on a bench for a few hours. Although the owner’s intention is for the puppy to get used (habituate) to the noise and movement, it is unavoidable that the overload of stimuli at high intensity (vehicles and people) terrifies the puppy and the flooding will lead to a state of learned helplessness

Associative learning

Classical conditioning
Pairing of two stimuli. Usually it is a neutral stimulus that is timely and consistently followed by a meaningful stimulus. As a result, the neutral stimulus acquires the same meaning and becomes a ‘conditioned’ stimulus (Pavlov, 2003)
Benefits of the technique:
- Very important in puppy education and training
- Acquisition of associations is a passive process for the puppy (no action is required)
  - Example: a leash originally has no meaning for a puppy. In this case attaching the leash is followed each time by ‘going out for a walk’. The original neutral stimulus (the leash) becomes the predictor of ‘expecting a walk’
- Strong and lasting associations are made. Once classical conditioning is installed, extinction is difficult and eradication of the association is impossible
- Emotions can be conditioned along with the stimulus
  - On its first visit to the veterinary practice, the puppy is placed on the examination table and given treats. Consequently, the examination table will become associated with a pleasant emotion (i.e. the anticipation of food). Note: The effect of the examination table being conditioned to something pleasant will also have a protective effect towards a third (potentially unpleasant) stimulus. When the vet gives the puppy on the examination table an injection (unpleasant), the chance that the puppy now associates the table with something unpleasant is much less likely
Risks of the technique:
- Long lasting and strong associations. Humans may accidentally create associations or chains of associations that are undesirable
  - Example: the owner uses a can opener to open the puppy’s canned food. Every time the puppy hears the owner enter the kitchen, open the cupboard and take out the can opener, the puppy expects the owner to prepare its food; the puppy gets aroused and starts salivating
- Unpleasant emotions can be conditioned along with the stimuli
  - When specific stimuli are followed by a significant unpleasant event and/or stress, they can become associated with an unpleasant emotional reaction. Therefore, it is crucial to look at the puppy’s threshold for arousal and/or stress and evaluate learning from the puppy’s perspective
Example: the sound of the doorbell predicts the entering of visitors. A puppy that feels stressed when visitors enter the home will soon become stressed at the sound of the doorbell (as this predicts the sight of visitors)

12.10 Review of non-associative and associative learning techniques. (continues)
Operant conditioning

The behaviour results in something unpleasant for the puppy (unpleasant outcome)

Positive punishment (P+ = adding something unpleasant)

Benefits of the technique:

- Very important tool in puppy training and education
- Proven positive effect on welfare when applied correctly. Enhances the relationship between the puppy and the owner (focuses on desired behaviour)
- Focuses on desired behaviour. Teaching the puppy ‘what to do’ instead of ‘what not to do’
- Owners learn to observe behaviour and assess the motivation of the puppy (i.e. the likelihood of the desired behaviour occurring)
- No risk of the owner doing anything unpleasant that the puppy might associate with the owner rather than its own behaviour

Examples:

- Learning to sit and wait at the door – a puppy is outside and only when it is sitting quietly and relaxed at the door does the owner open it. The puppy has now learned that the behaviour (sitting at the door) has a positive outcome (the door opens)
- Playing with dog toys – when the puppy takes its toy and starts chewing it, the owner pays attention to the puppy and praises it. The puppy learns that chewing its toys has a positive outcome. In combination with prevention (see text), puppies can be easily taught to increasingly chew on their own toys instead of the owner’s objects or furniture

Risks of the technique:

- Owners need to think about and focus on desired (rather than undesired) behaviours
- Implementation of positive reinforcement requires skill and practice in order for the owner to perform this correctly (timing and being consistent). Lack of timing and consistency may induce frustration in puppies
- Unwanted behaviour may be unintentionally reinforced (by the owner or in the owner’s absence)
  - Example: chewing on inappropriate objects – a puppy plays with its toys but nobody is paying attention. However, as soon as the puppy starts chewing on the owner’s shoe, the owner reacts, talks to the puppy and tries to recover the shoe. From the puppy’s point of view, stealing and chewing a shoe has a favourable outcome and such behaviour is likely to occur more often
  - Learning to scratch at the door – a puppy is outside and wants to come indoors. It paws at the kitchen door. Because the owner is worried about damage to the door, it is opened for the puppy to enter. From the puppy’s point of view, scratching at the door had a favourable outcome and it is likely the puppy will repeat this behaviour when wanting to come inside
- If the puppy’s threshold for arousal is exceeded, then it may not be able to perform the desired behaviour (and using positive reinforcement may not be possible)
  - Example: a puppy reacts with arousal when watching a cat and starts a pursuit. As watching the cat induces a state of arousal in the puppy, the chances that the puppy will perform a calm behaviour that can be reinforced are low. In these cases, the owners often fall into the trap of performing positive punishment (shouting, reprimanding the puppy). The key is to prevent the situation from happening in the first place (see text)

Negative reinforcement (R– = removing something unpleasant)

The behaviour results in something unpleasant being taken away (pleasant consequence)

Benefits of the technique:

- Easy technique to perform, at least from a human perspective
- Can be useful in rare cases during puppy upbringing. Providing the unpleasant stimulus is mild and not perceived by the puppy as painful/harmful or fear/anxiety-inducing
  - Example: learning to walk on a loose lead – an owner is walking a puppy and the puppy has reached the end of the leash. The moment the puppy wants to walk further away, the owner stops (resulting in more tension on the leash). As soon as the puppy stops pulling, the owner starts walking again. Note: This type of exercise can only be performed with puppies that have a normal threshold of arousal/frustration and have already learned a range of strategies to ‘solve’ these situations

Risks of the technique:

- Not a good instrument in puppy training and education
- Difficult to carry out without stressing the puppy
- Negative reinforcement has to be used with caution, as taking away something unpleasant means that something pleasant was administered previously. Examples that should be considered harmful include:
  - Learning to sit – an owner wants to make a standing puppy sit and pushes on the hindquarters. When the puppy sits, the pressure on the hindquarters is removed
  - Learning to lie down – an owner wants a puppy to lie down and therefore places their foot on the leash (putting tension on the puppy’s neck). Once the puppy lies down, the foot is removed from the leash

Positive punishment (P+ = adding something unpleasant)

The behaviour results in something unpleasant for the puppy (unpleasant outcome)

Benefits of the technique:

- Can be effective in an emergency situation or for self-preservation
  - Emergency situation – a puppy is walking on the pavement and jumps towards the street where a motorbike is approaching. The owner pulls the lead with a firm jerk, preventing the animal from being hit by the vehicle. Similar situations are conceivable where an owner provides an unpleasant action (shouting, grabbing, pulling, pushing) in situations associated with danger around stairs, windows or swimming pools, or in situations with children. It is important to note that none of these represents a training situation, all are emergency situations
  - Self-preservation – a puppy spots a hedgehog and tries to bite it, but biting the hedgehog results in painful contact with the spikes and the puppy no longer bites the hedgehog. In future encounters, the puppy may have learned to avoid hedgehogs
### Associative learning continued

#### Risks of the technique:
- **Not a good instrument** in puppy training and education.
  - It is difficult to apply correctly and without causing harm to the puppy. There is evidence of inducing fear, anxiety, and an elevated risk of aggression towards the owners (Herron et al., 2008). Teaching a puppy what it cannot do also does not help it understand what it should do.
  - Applying positive punishment (particularly with aversive stimuli) in training is likely to induce reduced reactivity during play and lower levels of interaction with new people (Rooney and Cowen, 2011).
  - The puppy may associate the unpleasant stimulus with the person applying it (owner) or the context in which it is administered.
  - Example: making wrong associations – each time the owner sits on the sofa, the puppy approaches, jumps on their knees and bites their clothing, all with the intention to play. The owner reacts by pushing the puppy away, while telling them off (“no, stop doing it”). For this puppy, the situation (approaching the owner on the sofa) will become associated with an unpleasant outcome (negative message and being pushed away). Because a puppy cannot understand the reason when humans respond unpleasantly to playful interaction, it may not know how to solve the situation, and instead become frustrated and barking.
  - Example: learning the wrong skills – an owner is walking the puppy on a leash. When they meet another dog, the puppy starts pulling towards the dog (out of curiosity and desire to play). The owner responds by giving a firm jerk on the leash. The puppy has now learned that the sight of a dog approaching is associated with something unpleasant happening. In the future, the puppy might anticipate and start barking when it sees a dog while on the leash.
  - There is a risk that the puppy links the aversive stimulus with a different behaviour than the owner had in mind.
  - Example: avoidance conditioning – a 5-month-old puppy while in the garden was barking incessantly at passers-by, and the owners were advised to use an electric shock collar whenever it barked. Instead of associating the shocks with its own barking, the puppy quickly learned that the sight of people passing by was linked to an unpleasant outcome (the shock). Consequently, the sight of people will induce a strong emotional response in the puppy’s brain, enhancing strategies to cope with fear, such as flight (trying to get away) or fight (aggressive response aimed at chasing away the threat). In both scenarios, the puppy’s welfare will be compromised.
  - Positive punishment is no long-term solution for situations in which undesirable behaviour occurs. Prevention is the key (see text).

#### Negative punishment (P− = removing something pleasant)

The behaviour is followed by something pleasant being taken away (unpleasant consequence).

**Benefits of the technique:**
- **Very important tool** in puppy training and education.
- In contrast to positive punishment, there are less risks for harmful consequences for the puppy. Less risk for damage to the relationship between the owner and the puppy.
- Constructive method to use in puppies with normal thresholds of arousal. Can be combined with positive reinforcement once the puppy shows a desired behaviour.
  - Example: puppy education – a puppy is playing with its owner and gets a bit excited; it jumps and starts nipping clothes. Because the owner does not want the puppy to become overexcited, they end the play session by stopping all movements and releasing the play objects. By depriving the puppy of pleasant things (i.e. interaction with the owner), the excited behaviour is ‘punished’ and the puppy stops jumping, barking and nipping.

**Risks of the technique:**
- It takes skill for owners to see whether they are taking away something pleasant or accidentally applying something unpleasant (e.g. putting the puppy in another room, away from people).
- There is a risk of frustration when the puppy cannot obtain success or when the objectives of the owner are too difficult for the puppy.
  - Example: frustration – particularly in puppies with a very low threshold for frustration, in a play setting (as described above), the moment the owner stops the interaction and lets go of the toys, the puppy tends to get frustrated and more aroused. Such puppies will increasingly growl, bite and snap at the owner. (Frustration is a status that may arise when the puppy’s expectation and what is really happening are perceived to be too far away from one another.)
  - Example: stress and conflict – an owner wants to teach a puppy to only start eating on cue, after the bowl has been placed on the floor. However, as the puppy is not aware of the owner’s intentions, it just learns that the outcome of being presented with a food bowl results in a stressful situation. If the owner expresses negative emotion when the puppy does it ‘wrong’, feeding will now also equal conflict. At this point the puppy may start presenting conflict avoidance behaviours (see text).
- Relies on extinction of behaviour and can, in some cases, initially lead to an increase in the undesired behaviour due to frustration. Owners may not be able to persist with negative reinforcement and instead begin to intermittently reward the behaviour or even use positive punishment.

#### (continued) Review of non-associative and associative learning techniques.

<table>
<thead>
<tr>
<th>Social/non-social environmental stimuli above the puppy’s threshold for arousal (can be pleasant)</th>
<th>Clinical signs that may be observed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physiological signs of arousal</td>
<td>Dilated pupils, panting, increased motor actions</td>
</tr>
<tr>
<td>Behavioural signs of arousal</td>
<td>Excitement, jumping, pulling, chewing, scratching, biting</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Social/non-social environmental stimuli above the puppy’s threshold for stress</th>
<th>Clinical signs that may be observed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physiological signs of an acute stress response</td>
<td>Dilated pupils, panting, salivating, trembling, urinating, defecating, stopping eating</td>
</tr>
<tr>
<td>Behavioural signs of an acute stress response</td>
<td>Loud noises and new/moving objects – freezing, sitting, laying down, trying to get away, panic</td>
</tr>
<tr>
<td></td>
<td>Escalation of social conflict – barking, biting, growling, lunging, staring, bearing teeth</td>
</tr>
</tbody>
</table>

### Immediate actions
- Stop the exercise and examine what is happening.
- Depending on the intensity, duration and frequency of the behaviour, ignore the behaviour or stop lesson and give the puppy a break.
- Adapt solution according to the core problem (was the exercise above the threshold? Or is it a fearful puppy with a lowered threshold?)
- In the case of a noise context, instantly remove the puppy from the situation and provide a quiet environment where the puppy is able to calm down.
- In all cases where the puppy is not immediately recovering and presenting functional behaviour, it should be seen by a veterinary surgeon for a clinical and behavioural health check.

#### 12.11 Clinical signs that may be observed with social/non-social environmental stimuli above a puppy’s physiological threshold for arousal and stress.
A clinical approach to behaviour problems

Dealing with behaviour cases is comparable to dealing with veterinary internal medicine, in that the dogs are presented with signs observed by the owner that do not necessarily present during the clinical examination: a coughing dog might cough, but a vomiting dog will not necessarily vomit in the surgery. As with other conditions, to interpret behavioural signs in context, owners should be questioned and asked to describe their observations.

Behavioural examination

The consultation for a behavioural problem will take the following course. Often, considerable time is required for a behavioural consultation and it may be necessary to schedule an additional appointment to allow a full investigation.

1. The complaint

This is essentially the signs displayed – as perceived by the owner. Owners should be encouraged to describe the behavioural signs but it is important to distinguish these from an owner’s interpretation of them (e.g. “We think he is jealous”). Open questions (see Chapter 2) should be used to guide the conversation: What happened? With whom? What happened next? How did you solve it?

At this stage of the consultation it may be appropriate to screen the information for the degree of emergency or for potential harm to people or pets, e.g. a dog bite might happen again and harm people or other pets. Behaviour problems might be so extreme (e.g. destruction, aggression, house soiling) that they could be a reason for relinquishment or even euthanasia at this stage.

It is important to respond in a client-centred way (e.g. “I understand that you feel upset about Bono destroying the new sofa, and our team is happy to help you solve Bono’s problem”). Communication techniques such as rephrasing, emphatic listening and summarizing might be helpful (Cornell and Kopcha, 2007; see also Chapter 2).

2. History-taking

Open-ended questions should be used with the client. It is important to investigate the incidence, frequency, extent and evolution of the problem signs over time, together with details of how the owners have reacted and what therapeutic steps have already been tried. An example of a canine behaviour questionnaire can be found at the end of the chapter.

It can be helpful to draw a timeline (letting the owner participate), using colours when necessary to indicate problem-free periods (green) and problem situations (red) (Figure 12.12).

3. Observation

It is of critical importance to spend time observing the dog, both for the signs it displays and also to see its interaction with its owner.

- What behaviour triggers a response from the owner?
  - Dog being relaxed and calm (owner is reinforcing relaxed behaviour).
  - Dog showing signs of arousal (e.g. jumping up, pacing; owner is reinforcing arousal/excitement).

- How does the owner respond?
  - Does the owner respond verbally or with physical restraint?
  - Is the owner’s response calm or angry?
  - Is the response consistent with what the owner described during the history-taking process?

![Timeline example](image)

A timeline can be helpful. In this example, green periods are problem-free and red indicates when problems occurred. The problem contexts are explored.
The context is important, as behaviour is context-dependent: a dog behaving calmly in the clinic might behave differently at home or on walks. Never rely on behaviour observed in only one context. It can be useful to observe the dog–owner interaction in the home setting. If a home visit is not possible (or safe), the owner should be asked to provide video footage a few days before an appointment, so that the veterinary team can review it prior to the consultation. Both relaxed and problem situations should be observed, noting the response of the owner (and other family members) in each case and the outcome. Careful note should be taken of how the dog behaves in the owner’s absence.

4. Differential diagnosis
It is essential to investigate any potential underlying disease, pain or physical impairment, and to consider the potential side effects of any medication that might produce behavioural signs (e.g. metoclopramide, phenytoin/propylamine). It is also helpful to define any underlying motivation (e.g. play, solving conflict, avoiding threat, competition, frustration) and any underlying emotion (positive or pleasant – negative or unpleasant). Factors pertaining to the dog or its environment that elicit the behaviour should be differentiated from those that maintain it.

5. Diagnosis
Whereas diagnosing the cause of a physical disease is commonly based on laboratory and clinical evidence, a diagnosis of the cause of a behavioural problem should be considered more as a working hypothesis, to be checked and rechecked. It may be helpful to consider this in terms of functional and contextual diagnosis.

- **Functional diagnosis** relates to the motivation for the behaviour and any underlying emotion.
- **Contextual diagnosis** relates to the factors that elicit and/or maintain the behaviour. These can be:
  - Dog-related (e.g. the dog lacks self-control and reacts to low-level stimuli)
  - Owner-related (e.g. age group, socioeconomic situation)
  - Environmental (e.g. home location, neighbours).

6. Risk assessment
A risk assessment should be performed in every situation where the dog’s behaviour may result in harm to people or other animals. The risk assessment investigates the risk a dog may represent within a given context (De Messter et al., 2011).

i. **Identify the hazards.** Investigate how often, when and where a dog might be exposed to the threatening triggers (sounds, social stimuli, situations). This should include not only an assessment of the animal’s physical and behavioural characteristics but also its physical and social environment.

ii. **Decide who might be harmed or at risk and how.** Identify people or other pets that might potentially interact with the dog and, for each of them, identify: contexts (action, time, place, frequency, who will be present); the most likely strategy the dog will adopt; and the likely consequence in terms of injury or trauma.

iii. **Evaluate the risks and decide on precautions.**
- What are the safety measures necessary to make sure the dog can find safety and comfort and will NOT be exposed to EACH of the risk situations?
- What is necessary to prevent injury or trauma?
- What are the options/limitations for implementation of each of the safety measures in the dog’s living environment in the short term (human-, dog- and context-related factors).

iv. **Record your findings and implement them.**
- Write down the findings and proposed safety measures.
- Check that the clients have fully understood, and determine what further help they may need for implementation.
- In most cases a safety protocol is part of a behaviour modification therapy (BMT) plan (see later); talk to the client and check how they see the plan (practically, financially and in terms of follow-up).

7. Prognosis
Owners will hope to hear a prediction on future developments. However, this will not be possible at the outset, as the prognosis depends on assessment of all the diagnostic factors (dog, human and environmental) and is influenced by the owner’s willingness, compliance and the response to therapy.

8. Treatment options
- **Treat underlying or concomitant physical disease.** Be aware that some conditions (e.g. chronic pain conditions, sensory impairment, cognitive decline) might need a continuous follow-up and communication with colleagues treating that part of the dog’s condition.
- **Management.** Provide comfort and safety zones for the dog; suggest immediate measures such that the dog is no longer exposed to threatening stimuli. Make sure management tips are applicable and understood by the owners (explain to owners what to do and how to do it) and refer to a behavioural counsellor when necessary.
- **Cognitive approach.** Owner misconceptions and beliefs must be identified and addressed. This must not be judgemental, as owners may be distressed and react defensively to the ongoing behavioural problem of their dog. It is important to use appropriate communication techniques to put the dog’s behavioural condition into the correct context. These techniques can be learned (see Cornell and Kopcha (2007) and Chapter 2).
- **Behaviour modification therapy (BMT).**
  - **Communication** – whilst clients may focus on stopping the dog’s unwanted behaviours, it is advisable to investigate thoroughly how far the BMT plan that you have in mind for the dog fits in with the owners expectations in terms of:
    - Type of behavioural improvement (e.g. “we want our dog to be sociable with children of all ages” or “we want our dog to stay home alone for 5 hours a day”)
Owner engagement (e.g. “we would like to solve the noise problem by Christmas, but our working schedule will not allow us to put a lot of effort into rehabilitation training”)

The extent of professional help the owners are willing to accept (e.g. “we are happy to have a rehabilitation trainer helping us” or “we would prefer you to write it down and we will do it ourselves”)

The cost of the therapy

The duration of the BMT plan (e.g. weeks, months, years).

**Plan:**

- Identify comfort zones (increases the dog’s perception of predictability and control)
- Explore the type and number of functional behaviours (e.g. relaxed behaviour)
- List new behavioural strategies for the dog to achieve in terms of progress
- Plan how these strategies can be implemented (protocols should be based on learning theory)
- Check feasibility of the rehabilitation training in terms of the dog’s threshold to arousal/stress
- Check the owner’s understanding and skills in relation to the plan
- Determine whether psychotropic drugs are required (which drug(s), for what purpose, at what dosage and for how long)
- Recheck and follow up how implementation of the plan can be maximized (owner agreement in terms of training goals and the use of drugs, as well as the role of the owner, the skills they need for implementation of the plan and the engagement required in the short and long term).

**Psychotropic drugs** – Psychotropic drugs can be used to achieve different goals:

- Strategic administration – for the treatment of profound anxiety or panic associated with sporadic events
- Long-term administration – with the aim of influencing reactivity, self-control, emotional responses and cognitive function in order to raise the threshold for arousal and stress, and allow the dog to respond in a more functional manner to adverse stimuli
- The psychotropic drugs most commonly used include benzodiazepines (diazepam, midazolam, lorazepam and temazepam) for short-term use and antidepressants (tricyclic antidepressants, e.g. clomipramine; selective serotonin reuptake inhibitors, e.g. fluoxetine, fluvoxamine, sertraline; monoamine oxidase inhibitors, e.g. selegiline) for long-term use. For specific indications, administration, side effects and potential risks, see the **BSAVA Small Animal Formulary**.
- Before prescribing a psychoactive substance for a behaviour problem, it is important to consider the following:
  - The functional and contextual behaviour diagnosis
  - Is the psychotropic agent authorized for use in dogs? If not, then written informed consent for off-label drug use should be obtained from the owner
  - Evidence-based medicine – what is known about the indications, effects and side effects of the drug from the veterinary literature?
  - How experienced is the veterinary team with using the drug?
  - What are the expected side effects in this patient and how could they affect the dog’s welfare?
  - Is the veterinary team aware of any medical contraindications for use of the drug?
  - What psychotropic drugs have been used in this dog previously (relating to the actual problem), when were they used and what were the results?
  - What is the cost of the drug and how does it relate to owner compliance to complete the entire treatment course?
  - How will the owner administer the drug to the dog and who should they contact in the event of problems?
  - What is the risk to family members (including children) from accidental/abusive ingestion of this drug?

**Nutraceuticals:**

- The use of diets, nutraceuticals and supplements may appeal to clients and be preferred to the use of medicines, as they are felt to affect behaviour in a more ‘natural’ way
- Although nutraceuticals offer tremendous promise for favourably influencing behaviours at the molecular level in the brain in a way that may have fewer side effects than traditional psychotropic drugs (Overall, 2013), more research is needed regarding the underlying mechanisms of action (Galan et al., 2014; Dodd et al., 2015)
- Supplements such as alpha-casozepine and L-theanine have been studied for use in animals with anxiety disorders (Beata et al., 2007; Arauyo et al., 2010)
- The strongest evidence for the use of nutraceuticals has been shown in age-related brain neurodegenerative changes. Diets enriched with neuroprotectives/antioxidants (Cotman, 2002) or nutraceuticals containing a combination of phosphatidylserine, a standardized extract of Ginkgo biloba, α-tocopherol and pyridoxine have been shown to be effective in canine cognitive dysfunction syndrome (Osella et al., 2007).

**Tranquilizers** (e.g. butyrophenones and phenothiazines) are not useful for BMT because they decrease spontaneous activity, resulting in a decreased response to external and social stimuli and thus interfere profoundly with any behaviour modification.
Chapter 12

Referral to a behaviour specialist. Modifying dog behaviour requires different skills such as insight (what needs to be changed and why) and theoretical understanding (what is the problem and how can it be changed), as well as practical and professional skills (what methods to apply in order to maximize the animal’s comfort and progress). For veterinary practices that offer behavioural services in-house, it may be constructive to collaborate with professional rehabilitation trainers in order to maximize therapy implementation. Whenever the veterinary team feels that the professional skills to achieve these goals are not present in-house, referral to a veterinary behaviour specialist is advised.

Clinical approach to some common presentations

The following discussion of presenting signs is arranged in alphabetical order, which does not reflect commonness or severity. The reader is referred to the BSAVA Manual of Canine and Feline Behavioural Medicine for further details of the conditions and their management. A range of client handouts is available on a CD that accompanies that Manual and also at www.bsava.com for members of BSAVA.

It is important first to exclude medical problems that might contribute to the problem. For the purposes of this chapter, it is assumed that any underlying medical problems have been addressed.

Aggression

Aggression against familiar people or pets

- **Triggers:** There is often a perceived conflict over ‘resources’ (food, bones (Figure 12.13), toys, objects, resting places, human attention). This perceived threat may be triggered by various interactions:
  - Benign – approaching, walking by, petting, talking, gazing
  - Aversive – pulling, pushing, picking up
  - Aversive painful – inflicting pain.

The British Small Animal Veterinary Association (BSAVA) recommends against the use of electronic shock collars and other aversive methods for the training and containment of animals. Shocks and other aversive stimuli received during training may not only be acutely stressful, painful and frightening for the animals, but may also produce long-term adverse effects on behavioural and emotional responses.

The Association recognizes that all electronic devices that employ shock as a form of punishing or controlling behaviours and other means that rely on aversive stimuli are open to potential abuse and that incorrect use of such training aids has the potential to cause welfare problems.

Apart from the potentially detrimental effect on the animal receiving shocks, there is also anecdotal evidence that there is a risk to public safety from the use of shock systems, as they evoke aggression in dogs under certain circumstances.

The BSAVA strongly recommends the use of positive reinforcement training methods that could replace those using aversive stimuli.

Euthanasia is a valid outcome in cases where treatment options are incompatible with basic welfare issues: i.e. the dog’s quality of life cannot be restored, or the safety of people, pets or the environment cannot be ensured (due to risk factors relating to the dog, owners and/or the environment itself).

Competition over resources, such as a bone, can be perceived as a threat and may lead to aggression. (© B Boerner)

The primary aim of veterinary intervention should be to prevent aggression occurring.

**Aggression against unfamiliar people or pets**

- **Triggers:** A perceived threat following mostly benign actions, such as movement (walking, cycling, jogging, approaching; see Figure 12.3) of a social stimulus (people, pets). Dogs may be triggered to react aggressively by subtle cues predicting a potential action from the social stimulus (e.g. gazing, reaching out) before it moves.

- **Features:** The behavioural features depend on the context.
  - In public places this is commonly directed at chasing people or pets, or attacking whilst the person or pet is moving or just passing by.
  - Dogs behind a fence will usually bark or perform threatening postures and attack.
  - Dogs that feel threatened if approached while walking on a lead may use the strategies on the ‘ladder of aggression’ (see Figure 12.14) and/or immediately bark, launch and attack, as the behavioural response is modified over time (operant learning).

- **Comments:** The negative emotion associated with an unpleasant event is triggered by the appearance of a person or pet. The fact that the dog feels threatened by benign actions, such as people walking, cycling or running, is difficult to understand from the human perspective. This is the typical setting for attacks in public places and may be compounded by predation (Figure 12.16).

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### Types of factors contributing to aggression in dogs

<table>
<thead>
<tr>
<th>Elements</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical problems</td>
<td>Disease, Pain, Sensory impairment, Drugs</td>
</tr>
<tr>
<td>Behavioural disturbances</td>
<td>Emotional disorders, Reduced threshold of self-control, Reduced control of bite response</td>
</tr>
<tr>
<td>Genetic predisposition</td>
<td>Cocker Spaniel, Bernese Mountain Dog</td>
</tr>
<tr>
<td>Early life experience</td>
<td>Sensory deprivation, Social deprivation</td>
</tr>
<tr>
<td>Training</td>
<td>Use of physical punishment</td>
</tr>
<tr>
<td>Human factors</td>
<td>Children (unpredictable behaviour), Owner beliefs, Miscommunication</td>
</tr>
<tr>
<td>Sociocultural environment</td>
<td>Poor housing conditions, Overcrowded housing (people), Other pets</td>
</tr>
</tbody>
</table>

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**12.14** The canine ‘Ladder of Aggression’: how a dog reacts to stress or threat. It is important to note that dogs may not follow all steps on the ladder in a consecutive manner. The strategies employed depend on the individual animal and the context. (Reproduced from the *BSAVA Manual of Canine and Feline Behavioural Medicine, 2nd edn*)

**12.15** Factors contributing to aggression in dogs.

**12.16** A comparison of motivation and behaviour associated with aggression, play and predation.
Clinical approach and management:
• Explore contexts, eliciting trigger(s) and outcomes
• Perform a risk assessment. Public safety is paramount
• It is important that the owner develops the correct attitudes, being able to exert control over the dog without physical force and can understand and implement appropriate safety measures, such as confinement of the dog (garden, lead).

Biting
Bites resulting from aggression

Triggers: A perceived threat or social conflict.
Features: Dogs use a range of strategies (see Figure 12.14) to avert threats and solve conflicts. The goal of these behavioural sequences is to deflect the threat and to restore harmony. A bite represents the last resort for a dog that is trying to solve a conflict or avert a threat.

Comments: When bites are directed toward familiar people after no apparent trigger, or after a benign trigger, it is always important to look for signs of physical disease (e.g. abnormalities or reduction in general activity, exploratory behaviour, food and water intake, wakefulness, play or social interaction) as well as signs of behavioural problems (e.g. anxiety, social fear, hyperactivity/hyper-reactivity).

Clinical approach and management:
• See Aggression, above. Behavioural investigation should include a full behavioural consultation and risk assessment
• Perform a standard medical investigation. Consider rabies in a dog that has recently travelled abroad
• When considering biting in puppies, it is essential to differentiate aggression from play biting (see below). Aggression in puppies should always be considered an emergency and necessitates investigation of underlying physical or emotional disorders.

Bites resulting from frustration
Preventing access to motivating stimuli results in a negative emotion and can lead to a bite. Frustration can also arise when using ‘negative’ punishments, such as the removal of something pleasant.

Bites resulting from play

Triggers: Arousal and movement.
Features:
• Excitement, jumping and snapping
• No threatening postures.

Comments: Play biting in puppies is a normal behaviour within the development of social and predatory skills.

Clinical approach and management:
• Avoid triggering contexts (movement) and reinforce more controlled play
• Avoid the pitfall of physical punishment as it will eventually lead to conflicts
• Play biters that persist and/or cause injury to the owners should be given a behavioural consultation.

Biting linked to predation

Triggers: Moving potential prey or non-socialized species.

Features:
• Chasing, stalking, launching, biting and killing
• No threatening body postures, growling or baring of teeth
• The goal of the dog’s behaviour is catching and killing prey.

Comments:
• Predation stimulates a positive emotion in the dog and there is no threat or conflict involved
• Selective breeding for specific aspects of predation (e.g. hunting behaviour) may intensify different elements of these responses (e.g. chasing, stalking, rounding up)
• Be aware of the differences between dogs that chase potential prey (predation) and dogs that chase people or animals in the context of a perceived threat (aggression).

Clinical approach and management:
• Lifelong safety measures – there is no curative BMT
• Prevention is the key (i.e. socializing dogs with different species; Figure 12.17).

Redirected biting

Triggers: Physical restraint or control in a highly aroused or excited dog.

Early exposure to prey species helps to prevent predatory behaviour later in life and may even encourage social behaviour toward these individuals. (Courtesy of H Blancke and reproduced from the BSAVA Manual of Canine and Feline Behavioural Medicine, 2nd edn)
Compulsive behaviours

Compulsive behaviours include:

- Locomotion – spinning, tail chasing, pacing, jumping in place, digging and scratching
- Oral – self-licking, self-chewing and flank sucking
- Vocalization – repetitive barking, whining and howling
- Hallucinatory – shadow chasing and fly snapping
- Aggressive – self-directed growling, biting and attacking.

The following breed predispositions have been noted:

- Dobermann – flank sucking
- English Bull Terrier – spinning in circles, sticking head between objects and freezing
- Staffordshire Bull Terrier – spinning in circles
- German Shepherd Dog – tail chasing
- Australian Cattle Dog – tail chasing
- Miniature Schnauzer – checking hind end
- Border Collie – shadow chasing
- Large-breed dogs – persistent licking.

Causes may be behavioural or medical.

- Normal behaviour in acute conflict/frustration – the behaviour is shown in situations with motivational conflict or resulting from frustration, or another situation in which a dog does not have an appropriate response for reducing arousal
- Attention-seeking – owner attention may condition normal conflict behaviours or reinforce existing compulsive behaviours
- Medical disorder – central nervous system (CNS) disease, skin disease, degenerative disease, toxin exposure or trauma.

Coprophagia

Puppy behaviour

- Triggers: Often simply a puppy picking up faeces amongst other objects and chewing on it or ingesting it.
- Features:
  - Puppy exploring its environment and picking up objects (faeces)
  - Owner may be present or absent.

- Comments:
  - Normal exploratory behaviour in puppies, but generally considered repulsive to owners
  - Some dogs may develop a dietary preference for faeces and may find ingestion of animal faeces rewarding due to smell, flavour and texture (frozen in winter).

Clinical approach and management:

- Exclude underlying disease or anomaly (e.g. hydrocephalus)
- Control defecation setting (supervise puppy when toileting)
- Reinforce acceptable behaviours (retrieving treats instead of faeces)
- Clean up in the absence of the puppy using appropriate cleaning products.

Attention-seeking or learned behaviour

- Triggers:
  - Owner presence or intervention
  - Anticipation of owner intervention.

- Features:
  - With the owner present, the dog defecates and ingests its faeces; this is followed by a negative response from the owner
  - Or, to avoid a negative reaction, the dog defecates and ingests the faeces immediately, before the owner can respond.

- Comments: Dogs may use several behaviours at random while seeking attention from the owner. Dogs will learn from the outcome (operant learning), so faeces-eating can be involuntarily reinforced by owner attention (whether positive or negative) and the dog usually eats faeces in the owner’s presence.

Clinical approach and management: Owner education:

- Clarify the difference between anthropomorphism and the dog’s perspective
- Explain operant learning (how the dog learns from the outcome of the situation)
- Explain why owner attention reinforces the behaviour (initiating factor) and why it is maintained (positive and negative attention will both reinforce the coprophagia).

As part of a behavioural disorder

- Triggers: May have unapparent triggers or can be secondary to anxiety or part of a compulsive disorder.

- Features:
  - Dog spends time scavenging for faeces instead of exhibiting adaptive behaviour (sniffing, exploring, playing)
  - Owner may be present or absent.

- Comments: Absence of normal sniffing, with coprophagia or pica instead, can be a coping strategy to divert stress in hyperactivity, compulsive disorders and emotional disorders.

Clinical approach and management:

- Inform the owner that coprophagia is a coping mechanism for an underlying behavioural disorder
- It is important to stress the detrimental effects of physical punishment on the problem
- Treat the underlying behavioural disorder and use psychotropic drugs when indicated.
Secondary to a medical condition

- **Triggers:**
  - Hunger (polyphagia, malabsorption, exocrine pancreatic insufficiency, inadequate diet)
  - CNS disease.
- **Features:**
  - Dog scavenges for faeces (and/or other abnormal food items – pica)
  - Owner may be present or absent.
- **Comments:**
  - Polyphagia can be iatrogenic (e.g. corticosteroid therapy, over-supplementation of thyroxine)
  - In senior pets always consider canine cognitive function.
- **Clinical approach and management:** Treat the underlying medical condition.

Destructive behaviour

Puppy behaviour

- **Triggers:** Normal puppy behaviour (puppies have a high propensity to chew on anything they find).
- **Features:** Exploring, chewing on objects (sometimes ingesting).
- **Comments:** An active under-stimulated puppy is more likely to destroy objects and furniture.
- **Clinical approach and management:** Prevention is key! Provide environmental diversity, mental and physical stimulation and a safe environment with appropriate objects to chew on. Pay special attention to puppies from working breeds.

Attention-seeking or learned behaviour
See Coprophagia: attention-seeking behaviour, above.

As part of a behavioural disorder

- **Triggers:**
  - There is often a specific external trigger, such as a sound or visual or social stimulus
  - The stimulus may occur in the presence or absence of the owner.
- **Features:**
  - Chaotic destruction, selection of objects, only destroying doors and windows blocking the way out
  - May occur with owner present or absent
  - Video monitoring is crucial for differentiating types of activity and stimuli.
- **Comments:** The type of destruction will reflect the underlying motivation/emotion. For example:
  - Points of egress, small items: sound sensitivity
  - Objects in reach, random, chaotic: self-control problems (Figure 12.18a)
  - Selective to chaotic destruction when owner absent: separation-related behaviour (Figure 12.18b)
  - Near point of exposure to moving social stimuli: perception of unsolvable stress/threat (territorial behaviour).
- **Clinical approach and management:**
  - Avoid eliciting triggers
  - Treat any underlying behavioural disorder and provide comfort zones
  - Consider BMT
  - Use psychotropic drugs when indicated.

Digging

Normal behaviour

- **Triggers:**
  - Lack of appropriate outlet for exercise
  - Opportunity to dig (soft ground) and the presence of potential prey (such as rats or mice)
  - Some working breeds might dig as part of hunting behaviour (terriers, Dachshunds)
  - Dogs may bury items and dig them up again
  - Inside the home digging may be targeted; for example, at carpets and floors (see Destructive behaviour, above).
- **Features:** Digging in the garden, furniture (e.g. sofa, bed), floors and carpets.
- **Comments:** Normal canine behaviour (Figure 12.19), but may be unacceptable to owners. Normal digging is inherently rewarding! Search for the motivation.
- **Clinical approach and management:** Owner education.
Attention-seeking or learned behaviour

- **Triggers:** Owner presence at first, but then owner absence in the long term.
- **Features:** Dog is digging and behaviour is reinforced by the owner’s response, whether positive or negative.
- **Comments:**
  - Owner intervention will result in increased digging and, eventually, in digging in the owner’s absence only
  - Differentiate from dogs that perform digging because they wish to escape or roam.
- **Clinical approach and management:**
  - Address the underlying problem
  - Provide suitable environmental enrichment
  - Educate the owner
  - Physical punishment must be avoided as it may lead to conflict, human-directed aggression and jeopardy of the human–animal bond.

As part of a behavioural disorder

- **Triggers:** May be unapparent or specific (e.g. sound, visual, social stimulus, presence or absence of the owner).
- **Features:** Digging may be an attempt to hide or seek comfort zones, or performed selectively at barriers blocking the exit. Video monitoring is crucial for differentiation.
- **Comments:** The context/place of digging will reflect the underlying motivation/emotion:
  - Aim to escape or to access comfort zone: sound sensitivity
  - Random, chaotic: hyperactivity, self-control problems
  - Search for comfort zone: separation-anxiety.
- **Clinical approach and management:**
  - Avoid eliciting triggers
  - Treat underlying behavioural disorder and provide comfort zones
  - BMT
  - Use of psychotropic drugs when indicated.

Fear of objects, places or people

**Fear due to limited experience**

- **Triggers:** Unapparent, usually casual benign triggers.
- **Features:** The dog displays acute stress signalling, including withdrawal, avoidance, turning the body away and trying to escape (Figure 12.20). When escape is not possible, other strategies may be used (e.g. aggression, self-directed behaviours and compulsive behaviours).

<table>
<thead>
<tr>
<th>Urination and defecation/diarrhoea</th>
<th>Increased motor activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vocalizations</td>
<td>Salvation</td>
</tr>
<tr>
<td>Piloerection</td>
<td>Trembling</td>
</tr>
<tr>
<td>Polyphonia/panting</td>
<td>Looking away</td>
</tr>
<tr>
<td>Protrusion of the tongue</td>
<td>Muzzle licking</td>
</tr>
<tr>
<td>Yawning</td>
<td>Paw lifting (front paw held at 45 degrees)</td>
</tr>
</tbody>
</table>

**Comments:**
- There may be a genetic predisposition (selective breeding for certain characteristics/abilities)
- There has often been regular exposure to stimuli during the key developmental period
- Fearful responses towards people are usually misinterpreted by owners and thought to be linked to a ‘traumatic event’ (dog has been abused by someone): owner education is the key.
- **Clinical approach and management:**
  - Provide a safe environment for the dog (Figure 12.21)
  - Make use of BMT. Introduce environmental stimuli gradually whilst monitoring, to allow the dog to stay in its comfort zone (a comfort zone is a place where the dog perceives predictability and control over its environment, i.e. a place without threatening stimuli).

12.19 Digging is normal canine behaviour, but may be unacceptable to the owner. (© J Monsieur)

12.19 Behavioural and somatic signs of acute stress in dogs.

12.20 Comfort zone for a dog presenting with aggression towards unknown people entering the home. Visual protection prevents the dog from seeing visitors entering the home. (© T De Keuster)
Fear due to trauma

- **Triggers:** Often physical trauma and/or loud noises.
- **Features:** Behavioural responses within the normal range that have abruptly changed following the traumatic event.
- **Comments:** Genetic predisposition will determine the emotional response and related emotional reactions (dogs without a genetic predisposition may have no negative consequences following the same trauma).

**Clinical approach and management:**
- Provide a safe environment for the dog
- Make use of BMT
- Use of psychotropic drugs when indicated.

As part of a behavioural disorder

- **Triggers:** May be unapparent or specific (sound, visual, social stimulus, presence or absence of owner).
- **Features:** Video monitoring is crucial for differentiation.
- **Comments:** Explore the underlying motivation/emotion:
  - Social fear (withdrawal or aggressive response)
  - Sound sensitivity (trying to escape or move into comfort zone)
  - Separation-related (search for comfort zone).

**Clinical approach and management:**
- Treatment goals are to make the dog’s behaviour functional and will not necessarily lead to normal behaviour
- Avoid eliciting triggers
- Treat any underlying behavioural disorder
- Always provide comfort zones (Figure 12.22)
- Consider BMT and the use of psychotropic drugs when indicated.

Secondary to a medical condition

- **Triggers:** Any disorder that alters sensory function, stimulus interpretation or behavioural response.
- **Features:** Head down, trembling, backing away, acute stress signalling or active escape behaviours.
- **Comments:** Think of cognitive dysfunction in senior dogs
- Consider possible drug effects.

**Clinical approach and management:** Treat the underlying medical condition.

House soiling

Secondary to a medical condition

- **Triggers:**
  - Urge to eliminate
  - Inadequate cleaning after a previous episode
  - Problems influencing control.
- **Features:** Inappropriate urination or defecation.
- **Comments:** Investigate for the underlying medical disorder.

**Clinical approach and management:** Treat the underlying medical condition.

Incomplete housetraining

- **Triggers:**
  - Urge to eliminate
  - Inadequate cleaning after a previous episode
  - Problems influencing control.
- **Features:** Inappropriate urination or defecation.
- **Comments:** There are often owner misconceptions and physical punishment may exacerbate the problem so that the dog will urinate or defecate only in the owner’s absence
  - Some dogs have ‘learned’ to soil indoors for various reasons (e.g. poor supervision, lack of access to outdoors). Dogs with learned preferences may not eliminate outdoors and show preferential elimination on arrival in the home environment.

**Clinical approach and management:** Owner education and application of learning principles.

As part of a behavioural disorder

- **Triggers:** There may be unapparent or specific triggers (sound, visual, social stimulus, presence or absence of the owner).
Features: Inappropriate urination/defecation due to various scenarios:
- Separation-related problems (urination/defecation occurs in the absence of the owner)
- Hyperactivity (elimination following arousal or a greeting)
- Sound sensitivity (in the absence of the owner the dog will eliminate following fear-inducing noise stimuli; outdoors the dog may refuse to eliminate in the presence of a fear-inducing noise stimuli)
- Fear of places (fearful animals may wait rather than eliminate outdoors, and may eliminate in an appeasing environment, often at home – indoors).

Comments: Differential diagnosis is key.

Clinical approach and management:
- Owner education
- Treat any underlying behavioural disorder and use psychotropic drugs when indicated.

Urine marking

Features:
- A normal behaviour in canine communication, triggered by odours (urine) or context (vertical objects)
- May also be stress-related or conflict-related (social stress, either visual or olfactory) and a sign of an underlying behavioural problem.

Comments: Marking indoors may be considered to be ’naughty’ behaviour by owners and may lead to physical punishment.

Clinical approach and management:
- Owner education
- Appropriate cleaning of urine indoors
- Treat any underlying behavioural disorder and use psychotropic drugs when indicated.

Hyperactivity

As learned behaviour

Features:
- Dog behaves in a hyperactive way (jumping, panting, vocalizing, destructive behaviour, stealing, inability to be trained or walked) in different contexts but always in the presence of the owner.

Comments:
- Owners may not be aware of learning principles and may involuntarily reinforce unwanted behaviours in a normally active dog
- Inexperienced owners may be more prone to bad timing, involuntarily reinforcing wrong behaviours
- Dogs from selective working breeding lines may be more at risk
- Over time this may result in conflicts or physical punishment and risk escalation towards aggression.

Clinical approach and management:
- Owner education.

As part of a behavioural disorder

Features:
- Dog appears agitated and unable to settle, displaying signs including jumping, panting, vocalizing, destructive behaviour, coprophagia, stealing and an inability to be trained
- This may be in the presence or absence of the owner.

Comments:
- Dogs present with a lack of focus and are easily distracted
- It is difficult to reinforce desired behaviours.

Clinical approach and management:
- Differentiate from a normal dog with a lack of physical activity and stimulation, or inexperienced owners reinforcing unacceptable behaviours
- Be aware of risk of escalation if physical punishment is used. Implement safety management (BMT)
- The support of psychotropic drugs is indicated.

Redirected behaviour

See Biting, above.

Resource guarding

See Aggression, Biting, above.

Sound sensitivity

Sensitive breeds may include shepherds, collies and other herding dogs. Certain lines may be considered ‘noise-sensitive’ or ‘noise-stable’

Resulting from a lack of exposure early in life

Features:
- Noise not previously experienced.

Comments:
- Owners may not be aware of learning principles and may involuntarily reinforce unwanted behaviours in a normally active dog
- Inexperienced owners may be more prone to bad timing, involuntarily reinforcing wrong behaviours
- Dogs from selective working breeding lines may be more at risk
- Over time this may result in conflicts or physical punishment and risk escalation towards aggression.

Clinical approach and management:
- Owner education.
Comments: A high variability of signs can occur between individuals.

Clinical approach and management:
- BMT, taking into account reserved prognosis
- Aim is for functional behaviour, not necessarily ‘perfect’ behaviour.

Resulting from sensitization

Triggers: Repeated exposure to noise (e.g. fireworks) (Figure 12.24).
Features: Increasing signs of inability to cope with stimulus.
Comments: May be induced following the misconception that the dog should eventually habituate to the sound when exposed on a regular basis. In reality, the opposite will happen in a noise-sensitive dog – the animal will become sensitized to minimal intensity of the presented noise.

Separation-related problems

As part of a medical problem

Triggers: Painful process or CNS disease (i.e. cognitive decline).
Features: Vocalizing, salivating, panting, house soiling, destruction and escape attempts. As these features are signs of emotional arousal and distress (and not necessarily linked to the physical disease itself), the dog may initially present them only in the owner’s absence and behave ‘normally’ when the owner is present. With progressing CNS decline, arousal and distress may become chronic and signs may be present with or without the owner.
Comments: Use of video footage is recommended to investigate behaviour.

Clinical approach and management:
- Treat the underlying medical condition
- Provide comfort zones
- A BMT plan may be indicated in order to create predictable routines and comfort zones for the dog, which reduce stress and improve wellbeing.

As part of a behavioural disorder

Triggers: Varied and may be linked to anxiety of being separated from attachment figure (human/dog). Can also occur in dogs that suffer from different anxiety problems, such as sound (e.g. fireworks, thunderstorms) or visual cues (e.g. humans, other animals or vehicles passing by). These animals might behave in a functional way when the owners are present (due to no exposure or the comfort of owner presence) and in a dysfunctional way when the owner is absent (a dog in a garden or behind a window exposed to visual and auditory cues). Dogs with low arousal thresholds and lack of self-control (hyperactivity) may be presented for ‘separation-related problems’. As these dogs might be physically managed and/or reprimanded in the owner’s presence, absence of owner control may lead to destruction and vocalization.

Features: Destruction, vocalization, house soiling, self-trauma and licking behaviours when separated from the owner.
Comments: Destructive behaviour, soiling and vocalization reflect the underlying motivation/emotion:
- Destruction of points of egress and small items – sound sensitivity
- Destruction of objects at reach, at random and chaotic – hyperactivity
- Problems only in the absence of an attachment figure (human/animal) – separation anxiety
- Target is near point of exposure to social stimuli – territorial
- Video monitoring is crucial to differentiate the type of destruction and behaviour.

Clinical approach and management:
- Avoid eliciting triggers and/or contexts
- Treat any underlying behavioural disorder and provide comfort zones
- BMT
- Use psychotropic drugs when indicated
- Barking.

As a result of a traumatic experience

Triggers: Physical trauma associated with loud noises (e.g. shotgun, heavy thunderstorms).
Features: Behavioural responses were within the normal range, but abruptly changed following the traumatic event.
Comments: Genetic predisposition will determine the emotional response and related emotional reaction. Dogs without a genetic predisposition may have no negative consequences following the same traumatic events.

Clinical approach and management:
- Address the underlying emotional disturbance
- BMT
- May need the support of psychotropic drugs.
Normal behaviour linked to arousal

- **Triggers:** Visual or auditory external stimulus.
- **Features:** Barking can be seen as a normal response in a context of arousal, excitement, distress or threat.
- **Comments:**
  - Positive or negative emotion possible. The emotional state is not always easy to distinguish from the owner’s description and use of video is recommended
  - Dogs will learn from the outcome of a situation and the owner’s reaction (whether verbal or physical) to the dog’s barking will intensify the problem (operant learning).
- **Clinical approach and management:** Owner education.

As attention-seeking behaviour

- **Triggers:** Dog wants to be with the owner.
- **Features:** Repetitive high-pitched barking.
- **Comments:** Dogs may use several behaviours at random while seeking attention from the owner.
- **Clinical approach and management:** Owner education.

As sign of hyperactivity

- **Triggers:** Occurs with minimal environmental or social stimuli.
- **Features:** There is high arousal and an excessive vocal and motor/social response to minimal stimuli.
- **Comments:**
  - Dog appears agitated and unable to settle
  - Must be differentiated from learned/conditioned hyperactivity (see above).
- **Clinical approach and management:**
  - Treat the underlying behavioural disorder
  - Be aware of the consequences of physical punishment (evolution towards an aggressive response).

While hunting or chasing prey

- **Triggers:** Moving prey.
- **Features:**
  - Positive emotion
  - Chasing and stalking.
- **Comments:**
  - High state of arousal
  - Positive emotion
  - Desired behaviour in hunting breeds – bark when they locate prey but do not proceed to eating it.
- **Clinical approach and management:** No curative treatment. Avoidance is the best strategy (e.g. keep away from prey species and provide alternative exercise).

As a sign of frustration

- **Triggers:** Discordance between the expected outcome of a situation versus reality.
- **Features:**
  - High arousal
  - Repetitive high-pitched bark.
- **Comments:**
  - High arousal, negative emotion
  - Frustration may lead to conflict and aggressive strategies from the animal.
- **Clinical approach and management:**
  - Owner education
  - Avoiding frustrating situations
  - BMT.

As learned behaviour

- **Triggers:** External triggers, visual or auditory.
- **Features:** Barking occurs following external trigger and is involuntarily reinforced by owners, by reacting each time the dog barks.
- **Comments:** Very popular miscommunication, and perhaps the most difficult to treat, as owner intervention often stops the barking in the short term.
- **Clinical approach and management:**
  - Trigger identification (e.g. social, noise, doorbell) and counter-conditioning
  - Provide safe environment from the dog’s perspective
  - Owner education.

During play

- **Triggers:** Arousal and movement.
- **Features:**
  - Play bow, play face
  - Other behavioural elements may include growling, biting and jumping.
- **Comments:**
  - Barking may be more common in certain breeds (e.g. herding dogs).
- **Clinical approach and management:**
  - Advise owners to focus on playing games with a lower degree of arousal (e.g. search games or intelligence games)
  - Note that punishment of the aroused dog might induce redirected behaviours of conflict.

As territorial or fear-based behaviour

- **Triggers:**
  - External trigger (exposure to moving stimuli – social (people, pets) or non-social (vehicles))
  - Dogs bred for guarding and territorial behaviours might be presented more often for barking in this context.
- **Features:**
  - Barking is used as a distance-increasing signal (rising frequency and ferocity of bark)
  - Other body signalling may be present (tense body posture).
- **Comments:**
  - The visual or auditory stimulus is perceived as a threat or conflict, resulting in high arousal, negative emotion and distress
  - Owners may not be aware of the dog’s emotion and/or motivation for the response. This is especially so in relation to barking in social situations
  - There is no such thing as the standard, and different dogs will react in different ways
  - Social conflicts can arise in the context of resources (competition) or interactions (benign, aversive, painful)
• Other aggressive signalling may be present (see Figure 12.14).

Clinical approach and management:
• Owner education (conflict solving, threat-averting signalling)
• Provide a safe environment for the dog (e.g. fencing)
• Address any underlying behavioural disorder.

As separation-related behaviour

• Triggers: Absence of owner or attachment figure
• Features:
  - Negative emotion
  - Vocalization indicating distress (howling, distress barking).
• Comments: Differentiate from vocalizing related to sound sensitivity and hyperactivity (video footage may be helpful).

Clinical approach and management:
• Avoid eliciting triggers and contexts
• Treat any underlying behavioural disorder
• Provide comfort zones
• Use BMT
• Use psychotropic drugs when indicated.

Reflecting a medical problem

• Triggers: Medical condition and an inability to respond appropriately (e.g. pain or cognitive decline)
• Features:
  - Besides vocalizing, other signs may be present (e.g. salivating, panting, house soiling, destruction or escape attempts)
  - Older dogs suffering from cognitive decline often display monotonous barking at night, in the owner’s absence or in the owner’s presence.
• Comments: Use of video footage is recommended to investigate further.

Clinical approach and management:
• Treat the underlying medical condition
• Provide comfort zones
• A BMT plan may be indicated.

References and further reading


Galán A, Carletti BE, Morgaz J, Granados MM, Mesa I et al. (2014) Comparative study of select biochemical markers in cerebrospinal fluid of healthy dogs before and after treatment with nutraceuticals. Veterinary Clinical Pathology 43(1), 72–77


Horwitz DF and Mills DS (2009) BSAVA Manual of Canine and Feline Behavioural Medicine, 2nd edn. BSAVA Publications, Gloucester [contains CD of client handouts; these handouts are also available to members of BSAVA at www.bsava.com]

Howell T and Bennett P (2011) Puppy power! Using social cognition research tasks to improve socialization practices for domestic dogs (Canis familiaris). Journal of Veterinary Behavior 6, 196–204


Meurier LD (2006) Selection, acclimation, training and preparation of dogs for the research setting. ILAR Journal 47, 326–347


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Ramsey IJ (2014) BSAVA Small Animal Formulary, 8th edn. BSAVA Publications, Gloucester
Skinner BF (1951) How to teach animals. Scientific American 185, 26–29

Weiss JM (1972) Psychological factors in stress and disease. Scientific American 226, 104–113
Yang L, Welfman LL, Ambrosewicz MA and Sanford LD (2011) Effects of stressor predictability and controllability on sleep, temperature and fear behavior in mice. Sleep 34(6), 759–771

Useful websites
Association of Pet Behaviour Counsellors (APBC) www.apbc.org.uk/apbc
Association of Pet Dog Trainers (APDT) www.apdt.co.uk/dog-trainers
British Small Animal Veterinary Association (BSAVA) – Aversive training methods – https://www.bsava.com/Resources/Positionstatements/Aversivetrainingmethods.aspx
British Veterinary Behaviour Association (BVBA) www.bvba.org.uk
European College of Animal Welfare and Behavioural Medicine (ECAWBM) www.ecawbm.com
BSAVA CLIENT QUESTIONNAIRES: BEHAVIOUR SERIES

Canine behaviour questionnaire

Date __________________________

Owner details

(Mr/Mrs/Miss/Ms) Surname/Family name __________________________ First name or Initials __________

Address ___________________________________________________________________________________

Postcode __________________________

Phone (day) __________________________ (evening) __________________________ (mobile) __________________________ Fax __________________________

Email ___________________________________________________________________________

Please include as much information as possible. The more detail available, the more accurate our assessment of the case can be. Please use additional sheets where necessary.

Have you owned a dog before? [ ] Yes [ ] No
Have you owned this breed of dog before? [ ] Yes [ ] No
Have you owned other pets previously? [ ] Yes [ ] No

Please list other current household pets

<table>
<thead>
<tr>
<th>Type and breed</th>
<th>Name</th>
<th>Age</th>
<th>Spayed/neutered?</th>
<th>Relationship with dog (e.g. avoids, plays, fights)</th>
</tr>
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Please list the names, ages and occupations of other family members who live at home

<table>
<thead>
<tr>
<th>Name</th>
<th>Age</th>
<th>Occupation</th>
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</table>
BSAVA CLIENT QUESTIONNAIRES: BEHAVIOUR SERIES

**Patient details**

Name ___________________________________________ Breed ____________________________

Sex [ ] Male  [ ] Female  [ ] Male neutered  [ ] Female spayed

Date of birth __________________________ Age when obtained (if known) __________________

Date first acquired __________________________ Source ____________________________

Reason(s) for obtaining this dog
____________________________________________________________________________________________
____________________________________________________________________________________________
____________________________________________________________________________________________

Has the dog ever been used for breeding? [ ] Yes  [ ] No
If yes, at what age? ____________

How would you describe your dog's personality?
____________________________________________________________________________________________

Do you consider your dog to be:

[ ] Aggressive? (growling, snarling, snapping, nipping or biting in any circumstances)
[ ] Destructive?
[ ] Hyperactive/restless?
[ ] Disobedient?
[ ] Housetrained?
[ ] Nervous?
[ ] Excitable?
[ ] Noisy/excessive vocalization?
[ ] Depressed?
[ ] Demanding attention?
[ ] Playful?

**A Medical history**

1. Please give a brief medical history, especially recurrent problems and treatment.
   Use an extra sheet if necessary
   __________________________________________________________________________________________
   __________________________________________________________________________________________
   __________________________________________________________________________________________

2. Vaccination status __________________________

3. Date last wormed __________________________

4. Is your dog currently on any regular medications (such as allergy medication, heartworm treatment, herbal or homeopathic remedies)?

<table>
<thead>
<tr>
<th>Drug/remedy</th>
<th>Dose</th>
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</table>
BSAVA CLIENT QUESTIONNAIRES: BEHAVIOUR SERIES

5. Has your dog been on medication for his/her behaviour in the past?  
   If yes, please list name and dosage (include herbals and homeopathics)

<table>
<thead>
<tr>
<th>Drug/remedy</th>
<th>Dose</th>
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</table>

6. Is your dog on any medication for his/her behaviour now?  
   If yes, please list name and dosage (include herbals and homeopathics)

<table>
<thead>
<tr>
<th>Drug/remedy</th>
<th>Dose</th>
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</table>

**B Early history**

1. Please give details of the dog’s early life, if known, including litter size, age of weaning, age when obtained, whether raised outside or indoors, if orphan or stray, whether hand-reared, etc.

_______________________________________________________________________________________
_______________________________________________________________________________________
_______________________________________________________________________________________

2. How much interaction did the puppy have with people in the first year of his/her life?

_______________________________________________________________________________________

3. What method of housetraining was used?

_______________________________________________________________________________________

4. How did you react to any mistakes during housetraining?

_______________________________________________________________________________________

5. Did your puppy attend puppy ‘parties’ or classes? If so, please give details

_______________________________________________________________________________________

**C Training and obedience**

1. Has your dog ever attended training classes?  
   [ ] Yes  [ ] No

2. If Yes, please give details (when, where, age of dog, who took it to the class)

_______________________________________________________________________________________

3. What types of training techniques were used in the class?

_______________________________________________________________________________________

4. What training methods have you used?

_______________________________________________________________________________________

5. How well did your dog do in the class?  
   [ ] Very well  [ ] Average  
   [ ] Poor  [ ] Was asked to leave

If asked to leave, please say why ____________________________________________________________________
### BSAVA CLIENT QUESTIONNAIRES: BEHAVIOUR SERIES

6. Do you think your dog is Good, Average or Poor at learning?  [ ] Good [ ] Average [ ] Poor

7. What tasks will the dog reliably perform for you on command?  
   [ ] Sit [ ] Stay [ ] Down [ ] Fetch [ ] Other ________________________________

8. Does your dog do 'tricks' (such as shake, rollover)? ________________________________

9. Does your dog pull when on the lead? [ ] Yes [ ] No

10. Is your dog more obedient in some places than in others? [ ] Yes [ ] No
    If Yes, please give details: ____________________________________________________

11. Is your dog more obedient with some people than with others? [ ] Yes [ ] No
    If Yes, please give details: ____________________________________________________

12. How do you correct your dog when he/she misbehaves? ________________________________

### D Diet and feeding

1. What types of food (and brands) do you give your dog? ________________________________

2. How much does he/she eat a day?____________________________________________________

3. When and where is the dog fed? (how often and at what time) __________________________

4. If there is more than one dog in the home, how many food bowls are provided? ___________
   Where are the food bowls situated?____________________________________________________

5. Who feeds the dog?_________________________________________________________________

6. Is the dog protective (stiffening, growling, snapping or biting) around the food? [ ] Yes [ ] No
   Details ________________________________________________________________

7. Is his/her appetite Good or Poor? [ ] Good [ ] Poor

8. Does your dog eat Quickly or Slowly? [ ] Quickly [ ] Slowly

9. What are his/her favourite foods? ______________________________________________________

10. Do you have to be present for him/her to eat? [ ] Yes [ ] No

11. How much does your dog drink each day (in pints or litres)? __________________________

12. Do you add supplements or titbits to the diet? [ ] Yes [ ] No
    If yes, what and why? ____________________________________________________________

13. Is he/she given bones or chews?_____________________________________________________
    Is he/she possessive with these? _________________________________________________

14. Do you consider your dog to be at the correct weight? [ ] Yes [ ] No
    Please fill in your dog’s weight ____________________________________________________
BSAVA CLIENT QUESTIONNAIRES: BEHAVIOUR SERIES

E  Daily activities

Sleeping and waking
1. Where does your dog sleep? ________________________________

2. If your dog sleeps on the bed, who invites him/her up? ________________________________

3. When does the dog get up in the morning? ________________________________

4. Does your dog ever wake you at night?  [ ] Yes  [ ] No
   If yes, how often and why? ________________________________

Going outside
5. When does your dog go outside and for how long? ________________________________

6. How does your dog ask to go outside? ________________________________

7. Does he/she roam free in a garden or yard? ________________________________

8. What type of fencing is used to restrain the dog? ________________________________

9. Is your dog keen to explore when on its own? ________________________________

Toileting
10. Where does your dog tend to go to the toilet? ________________________________

11. Does your dog spot mark with small amounts of urine?  [ ] Yes  [ ] No
   If so, where? ________________________________

12. How often does he/she empty his/her bladder in a day? ________________________________

13. How frequently does he/she empty his/her bowels? ________________________________

Exercise
14. What sort of exercise (e.g. walking on/off lead, running off lead, agility training) does your dog receive and how much?

<table>
<thead>
<tr>
<th>Type</th>
<th>Purpose</th>
<th>Amount</th>
<th>Frequency</th>
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</thead>
<tbody>
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</table>

15. Who takes the dog for exercise?

Play/training
16. Is there any specific time devoted to play and/or training on a daily basis?  [ ] Yes  [ ] No

17. Does your dog play games with you or other family members?  [ ] Yes  [ ] No
   Details ________________________________

18. Who initiates play: people or the pet? ________________________________

19. What types of toys does your dog play with? ________________________________
BSAVA CLIENT QUESTIONNAIRES: BEHAVIOUR SERIES

‘Home alone’
20. Is your dog left home alone in the house?
__________________________________________________________
21. Where does the dog stay during the day when no one is home?
__________________________________________________________
22. What does he/she do as you prepare to depart?
__________________________________________________________
23. Does your dog ever bark or whine when you leave? [ ] Yes [ ] No
24. Does your dog ever [ ] vocalize, [ ] toilet, or [ ] engage in destructive behaviour while you are gone?
25. Typically, how long is your dog alone without people on any given day?
__________________________________________________________
26. What arrangements are made for your dog when you go on holiday?
__________________________________________________________

Family routine
27. What does he/she do during family meals?
__________________________________________________________
28. Has there been a change in your household routine (e.g. new work hours, new baby, moving, new roommate or visitors, boarding, diet change)? [ ] Yes [ ] No

Details ______________________________________________________________________________________

Favourite things
Please list 5 things your dog enjoys most; these may be foods, toys or activities
__________________________________________________________
__________________________________________________________
__________________________________________________________
__________________________________________________________
__________________________________________________________

F Interaction with family members

The home environment
1. What type of home do you have (e.g. flat/apartment, house)
__________________________________________________________
2. What areas of the house does your dog have access to?
__________________________________________________________
3. Where does your dog sleep at night?
__________________________________________________________
4. Does he/she have their own bed?
__________________________________________________________

Reaction to handling by family members
5. Is there aggression in the following circumstances? This can include growling, snarling (showing teeth), lunging, nipping, snapping or biting. Please fill in the chart: (Y=Yes, N=No, N/A=doesn’t apply). If biting has occurred in any of these circumstances, please describe the wound (tear, puncture, bruising)

<table>
<thead>
<tr>
<th></th>
<th>Adult owner (female)</th>
<th>Adult owner (male)</th>
<th>Children</th>
<th>Any specific individual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Handling/grooming</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Petting or hugging</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disturbed when resting</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discipling</td>
<td></td>
<td></td>
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<tr>
<td>Walking on the lead</td>
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<tr>
<td>Taking food away</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Taking other objects</td>
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</table>
### Interaction with others

#### Reaction to visitors

1. How does your dog behave when visitors come to the house (e.g. barking, door charging)?

2. Is the behaviour different toward familiar and unfamiliar people? [ ] Yes [ ] No
   - If yes, describe

3. Is the behaviour different toward people outside the house and people inside the house? [ ] Yes [ ] No
   - If yes, describe

4. Does your dog display aggression (growling, snarling, snapping or biting) to visitors to your home? [ ] Yes [ ] No
   - If yes, describe

5. Has your dog ever bitten or attacked anyone? [ ] Yes [ ] No

6. Please fill in details of any regular visitors to the home

<table>
<thead>
<tr>
<th>Name (if known)</th>
<th>Purpose</th>
<th>Time &amp; Days</th>
<th>Dog’s reaction</th>
</tr>
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<tbody>
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</table>

7. What is the dog’s response to other visitors?

<table>
<thead>
<tr>
<th>Frequent visitors</th>
<th>Occasional visitors</th>
<th>Rare visitors</th>
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#### Reactions to other people

8. Please describe your dog’s reaction to each of the following:

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<tr>
<th></th>
<th>In the home</th>
<th>Out of the home</th>
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<tbody>
<tr>
<td>Familiar men</td>
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<tr>
<td>Familiar women</td>
<td></td>
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<tr>
<td>Familiar children</td>
<td></td>
<td></td>
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<tr>
<td>Unknown men</td>
<td></td>
<td></td>
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<tr>
<td>Unknown women</td>
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<tr>
<td>Unknown children</td>
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<tr>
<td>Familiar dogs</td>
<td></td>
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<tr>
<td>Unknown dogs</td>
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<td></td>
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<tr>
<td>Other animals</td>
<td></td>
<td></td>
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<tr>
<td>Crowds/busy areas</td>
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BSAVA CLIENT QUESTIONNAIRES: BEHAVIOUR SERIES

Reactions to other animals
9. What is the reaction to other dogs when out at exercise? 
   On a lead ________________________________
   Free exercise ________________________________

10. What is the reaction to other animals, e.g. squirrels, unfamiliar cats? ________________________________

H Other behaviours
1. Does your dog ever show inappropriate mounting or other sexual activity? [ ] Yes [ ] No
   If so, to whom or what? ________________________________

2. Is your dog ever protective over parts of his/her body (especially ears and feet)? [ ] Yes [ ] No
   If yes, which regions? ________________________________

3. Does your dog lick or chew on themselves more than you would expect? [ ] Yes [ ] No

I The current problem
1. What is the current problem(s) you are having with your dog? Please describe it briefly
   ________________________________

2. When did it begin? ________________________________

3. How long has it been present? ________________________________

4. How old was the dog when it began? ________________________________

5. Where does the problem when it began? ________________________________

6. With whom? ________________________________

7. How often? ________________________________

8. Other details ________________________________

J Aggression

Please answer the questions below if the problem is aggression:

1. Describe the most recent incident and the setting it occurred in (try to be very precise, as if you were drawing a picture):
   a) Where was the dog? ________________________________
   b) Where was everyone in relation to the dog? ________________________________
   c) What was everyone doing before the incident? ________________________________
   d) What did the dog do? ________________________________
   e) What was the dog’s body posture? Describe the position of ears, tail, face, hair on back, or draw a picture if necessary ________________________________
BSAVA CLIENT QUESTIONNAIRES: BEHAVIOUR SERIES

2. What was your reaction to the behaviour?

3. How did the dog react to your reaction?

4. Was there any punishment?

5. If there was a bite wound was it a puncture wound or a tear?

6. Going back in time, describe the 3 most recent incidents of the behaviour. Please use additional pages for this.


8. When does the problem occur?
   When left alone?  [ ] Always  [ ] Rarely  [ ] Usually  [ ] Never
   When family members are present?  [ ] Always  [ ] Rarely  [ ] Usually  [ ] Never

9. What has been done to correct the problem?

10. Is the problem getting:  [ ] Better  [ ] Worse  [ ] No change?

11. Do you suspect any cause?

K  House soiling
   If the problem is house soiling, does it take place:
   When you are not present?  [ ] Yes  [ ] No
   When someone is home?  [ ] Yes  [ ] No

L  Destruction
   If the problem is destruction, does it take place:
   When you are not present?  [ ] Yes  [ ] No
   When you are home?  [ ] Yes  [ ] No

M  Other problems
   What other behaviours does your dog engage in that are objectionable to you?
   __________________________________________
   __________________________________________

   Does his/her behaviour cause arguments at home?
   __________________________________________
   __________________________________________

N  You and your dog

1. How would you describe your relationship with this dog?
   Adult owners (female)  ______________________
   Adult owners (male)  ______________________
   Children  ______________________

Canine behaviour questionnaire
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BSAVA Manual of Canine and Feline Behavioural Medicine, 2nd edition
2. **What are your feelings about the dog’s present behaviour?**
   - Adult owners (female)
   - Adult owners (male)
   - Children

3. **How would you ideally like your dog to be?**

4. **Under what circumstances would you consider euthanasia?**

5. **What is your expectation for change?**

6. **Is there anything else you would like to add about your dog and its behaviour?**
   - Please give any other information you think is relevant to the case

---

Questionnaire completed by (print) ____________________________

Signature ____________________________ Date ________________
Regurgitation, vomiting and diarrhoea

Sara Gould

Vomiting and diarrhoea are extremely common reasons for owners to present their dogs at veterinary clinics. A logical systematic approach, beginning with a full history and thorough physical examination, is necessary to ensure that appropriate further investigations and treatments are instigated.

The majority of acute vomiting/diarrhoea cases are self-limiting. However, a small but significant minority have potentially life-threatening problems. Severe vomiting itself can result in fluid and electrolyte depletion and occasionally aspiration pneumonia. Care of emergency patients is discussed in Chapter 8.

Presenting signs and causes

Regurgitation

Regurgitation is the passive expulsion of undigested saliva-covered food from the oesophagus, and is the most important clinical sign of oesophageal disease. It is essential to differentiate clearly between vomiting and regurgitation (Figure 13.1), as a failure to make this distinction will invariably lead to a misdiagnosis.

The severity of the clinical signs depends on the underlying cause. Retching and dysphagia suggest oropharyngeal disease (see Chapters 20 and 23). Severe regurgitation can result in aspiration pneumonia; these patients will present with a cough, fever and harsh lung sounds (see Chapter 24). Common causes of regurgitation are listed in Figure 13.2.

- **Megaesophagus** (Figure 13.3) is probably the most common cause of regurgitation in the dog, although in the majority of adult-onset cases no cause is identified (idiopathic). Megaesophagus may be secondary to myasthenia gravis, hypoadrenocorticism, polymyositis or thymoma.

<table>
<thead>
<tr>
<th>Cause of regurgitation</th>
<th>Presentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oesophageal foreign body</td>
<td>Often in small terrier breeds. Radiodense foreign body (FB) visible on thoracic radiography</td>
</tr>
<tr>
<td>Oesophagitis</td>
<td>Secondary to physical damage (FB), chemical injury or gastro-oesophageal reflux</td>
</tr>
<tr>
<td>Megaesophagus</td>
<td>Dilated air-filled oesophagus often visible on plain thoracic radiographs. Congenital or acquired disease</td>
</tr>
<tr>
<td>Oesophageal stricture</td>
<td>Secondary to FB or following gastro-oesophageal reflux under general anaesthesia</td>
</tr>
<tr>
<td>Hiatal hernia</td>
<td>Congenital hiatal hernia seen in Shar Pei, Chow Chow, French Bulldog, Bulldog</td>
</tr>
<tr>
<td>Congenital vascular ring anomalies</td>
<td>Young puppies often regurgitate from the time of weaning</td>
</tr>
</tbody>
</table>

13.1 Differentiation of regurgitation and vomiting.

13.2 Common causes of regurgitation.

13.3 A lateral thoracic radiograph of a 7-year-old Whippet with regurgitation, pyrexia and a soft cough. A large gas-filled megaesophagus is visible, and there is patchy increased opacity in the cranioventral lung lobes consistent with aspiration pneumonia.
- **Oesophageal foreign bodies** (FBs) occur frequently in small terriers, although any breed can be affected. The commonest oesophageal FBs are bones. Dogs with complete oesophageal obstruction present with acute signs, whereas those with partial obstruction may have a chronic history of regurgitation. FBs lodged in the cervical oesophagus may be palpable. Survey radiography will identify a radiodense FB. Radiolucent FB identification may require contrast studies or direct visualization using endoscopy.

- **Oesophagitis** may be a result of ingestion of irritants, or secondary to an oesophageal FB (Figure 13.4), or may follow gastro-oesophageal reflux. Chronic vomiting, hiatal hernia, gastric motility disorders and anaesthesia are all potential causes of gastro-oesophageal reflux. If damage to the oesophagus is severe, scarring and fibrosis can result in an oesophageal stricture.

**Vomiting**

Vomiting is defined as the forceful ejection of stomach contents, and involves three stages:

1. Nausea.
2. Retching.
3. Vomition.

It is essential to differentiate clearly between vomiting and regurgitation (see Figure 13.1), as a failure to make this distinction will invariably lead to a misdiagnosis. The onus is on the clinician to obtain sufficient historical information to make the distinction. Occasionally it may not be clear from the history obtained and it may be necessary to observe the patient. Occasionally patients may regurgitate and vomit concurrently.

Vomiting is initiated by the vomiting centre in the medulla oblongata that can be triggered either directly or indirectly (via the chemoreceptor trigger zone, CRTZ) (Figure 13.5).

**PRACTICAL TIP**

Whilst the majority of cases of vomiting are linked to gastrointestinal disorders, it is important not to forget non-gastrointestinal causes (e.g. pyometra, prostatitis) when compiling lists of differential diagnoses (see Figure 13.6).
Diarrhoea

If the predominant sign is diarrhoea attempts should be made to distinguish between small intestinal (SI) and large intestinal (LI) diarrhoea. This distinction is most relevant in chronic diarrhoea.

- Small intestinal diarrhoea results in increased faecal volume, usually without urgency. Melaena may be evident.
- Large intestinal diarrhoea usually results in urgency, mucus, tenesmus and, occasionally, fresh blood and increased faecal frequency. Tenesmus is often associated with diseases of the rectum and the anus (see Chapter 30).

It is beyond the scope of this chapter to list every known cause of vomiting/diarrhoea; the common differential diagnoses seen in practice will be considered. With the aid of historical and clinical information, an appropriate differential list can be formulated (Figure 13.6).

### Gastric disorders
- Dietary indiscretion/intolerance/allergy
- Gastritis
- Haemorrhagic gastroenteritis (HGE)
- Foreign body
- Gastric ulceration (e.g. non-steroidal anti-inflammatory drugs (NSAIDs), steroids)
- Neoplasia

### Intestinal disorders
- Foreign body
- Inflammatory bowel disease
- Antibiotic-responsive enteropathy
- Intussusception
- Ulceration
- Neoplasia
- Exocrine pancreatic insufficiency

### Extra-gastrointestinal abdominal disorders
- Pancreatitis
- Liver disease
- Pyometra
- Prostatitis
- Peritonitis
- Nephritis

### Metabolic/endocrine disorders
- Renal failure
- Diabetic ketoacidosis
- Hypercalcaemia
- Hypoadrenocorticism

### Infections
- Parvovirus
- Leptospirosis
- Campylobacter
- Salmonella
- Clostridium
- Giardia

### Drug/toxin-induced
- Examples: ethylene glycol; morphine; chemotherapy drugs; erythromycin

### Neurological disorders
- Vestibular disease
- Neoplasia

**13.6** Common differential diagnoses of vomiting and/or diarrhoea.

---

### Diagnostic approach

#### History

Signalment may allow the clinician to consider specific conditions or breed predispositions to certain gastrointestinal (GI) diseases: young dogs are more likely to have infectious, congenital or hereditary causes; older dogs are more likely to have acquired disease or neoplasia. The dog’s previous medical history should be obtained, with particular reference to previous GI problems, vaccination status, worming history, diet and environment.

Key information to obtain is:

- Signalment and medical history
- Vaccination status, worming history and current medications
- Duration, nature and severity of signs
- Time in relation to eating (ensure clear differentiation from regurgitation)
- Environment and diet: is the dog a scavenger?, have there been changes in diet or appetite?
- Content of vomitus: food, bile, blood, foreign material
- Appearance of diarrhoea: melaena, mucus, blood, steatorrhoea; small intestinal versus large intestinal
- Other systemic signs: e.g. polyuria/polydipsia (PU/PD), fever.

**PRACTICAL TIP**

It is important to consider all body systems, as many systemic diseases have gastrointestinal signs. For example, if PU/PD is identified prior to the onset of vomiting, then metabolic/endocrine disorders are likely differentials.

#### Physical examination

A careful and thorough clinical examination may help identify the underlying cause (Figure 13.7), as well as assessing the severity of the vomiting and/or diarrhoea.

- Careful attention should be paid to the hydration status of the patient (pulse rate, quality, skin tenting, mucous membrane colour) and abdominal palpation.

**13.7** Physical examination findings and possible causes of vomiting and/or diarrhoea.

<table>
<thead>
<tr>
<th>Physical examination finding</th>
<th>Possible causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tympanic abdomen and unproductive retching</td>
<td>Gastric dilatation–volvulus</td>
</tr>
<tr>
<td>Abdominal pain</td>
<td>Pancreatitis, hepatitis, peritonitis, prostatitis, nephritis</td>
</tr>
<tr>
<td>Abdominal mass</td>
<td>Foreign body, neoplasia, intussusception, lymph nodes</td>
</tr>
<tr>
<td>Jaundice</td>
<td>Pancreatitis, liver disease</td>
</tr>
<tr>
<td>Vaginal discharge</td>
<td>Pyometra</td>
</tr>
<tr>
<td>Uraemia/stomatitis</td>
<td>Chronic renal failure</td>
</tr>
<tr>
<td>Enlarged peripheral lymph nodes</td>
<td>Lymphoma (and hypercalcaemia)</td>
</tr>
</tbody>
</table>
Abdominal palpation should be performed in a methodical way, considering the abdomen in four quadrants and carefully assessing the abdominal organs. Pain, if present, should be reproducible. Excessive force applied suddenly to the abdomen can result in abdominal guarding.

In some individuals abdominal palpation may be made difficult due to temperament, physical size and/or abdominal guarding. In these cases the possibility of abdominal pain/masses should not be excluded.

Rectal examination should be performed to assess the prostate gland in male dogs, and may assist in the identification of melaena and rectal abnormalities. Further discussion of rectal disorders can be found in Chapter 30.

**Further investigation**
The further investigations that are most appropriate are usually dictated by the historical and clinical findings. If self-limiting disease is suspected, further investigations may not be necessary (Figure 13.8). Dogs with severe vomiting/diarrhoea that are systemically unwell, or those with chronic relapsing gastrointestinal signs, warrant further investigation (Figure 13.9).

![Diagram of acute vomiting and/or diarrhoea](image)

![Diagram of chronic vomiting and/or diarrhoea](image)

**Figure 13.8** A suggested approach to acute vomiting and/or diarrhoea. MDB = minimum database.

**Figure 13.9** A suggested approach to chronic vomiting and/or diarrhoea. EPI = exocrine pancreatic insufficiency; GI = gastrointestinal; IBD = inflammatory bowel disease; SI = small intestinal; TLI = trypsin-like immunoreactivity.
It is important to remember that animals that are significantly dehydrated or are suspected of having significant life-threatening GI or systemic disease, need to have their fluid and electrolyte deficits corrected whilst further investigations are undertaken. Failure to correct fluid and electrolyte abnormalities before general anaesthesia, for example, is likely to lead to increased patient morbidity and mortality.

**Laboratory tests**

**Minimum database:** Basic information can be obtained rapidly and for relatively little expense. Packed cell volume (PCV) and plasma protein can easily be determined from a microhaematocrit. Additionally, a crude assessment of white cell numbers can be obtained by examining the buffy coat, and the appearance of the plasma may give clues as to the cause of the vomiting (i.e. icteric plasma). A blood glucose measurement can also be obtained easily. Urine dipstick tests and urine specific gravity (USG) can give additional information about renal function and help establish whether any azotaemia is caused by renal (increased urea and creatinine; USG >1.030) or prerenal (increased urea and creatinine; USG <1.030) disease.

**Biochemistry and complete blood count:** Serum biochemistry (Figure 13.10) and complete blood count (CBC) (Figure 13.11) are useful to identify non-GI causes of vomiting/diarrhoea and to assess the effects of profuse vomiting/diarrhoea. Even if the signalment, history and clinical examination are suggestive of an underlying cause, further testing can confirm suspicion and also check for concurrent disease.

**Blood gas analysis:** If facilities exist to determine acid–base status, then this can assist the management of acutely unwell patients. Metabolic acidosis is generally more common than metabolic alkalosis in dogs with GI disease. However, abnormalities in acid–base status rarely require addressing in their own right, and the focus should remain on treating the underlying cause and correcting fluid deficits and electrolyte abnormalities.

**Faecal analysis:** Full faecal analysis including culture is one of the first tests that should be performed, especially in young animals with vomiting/diarrhoea. Faecal PCR tests are now available for *Giardia, Salmonella, Clostridium perfringens* and parovirus. A parvo virus ELISA is also available.

<table>
<thead>
<tr>
<th>Abnormality</th>
<th>Possible causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypoglycaemia</td>
<td>Sepsis. Severe liver disease. Hypoadrenocorticism</td>
</tr>
<tr>
<td>Hyperglycaemia</td>
<td>Diabetes mellitus/diabetic ketoacidosis</td>
</tr>
<tr>
<td>Elevated urea and creatinine</td>
<td>Prerenal (dehydration). Renal failure Postrenal obstruction</td>
</tr>
<tr>
<td>Hyperkalaemia ± hyponatraemia</td>
<td>Hypoadrenocorticism</td>
</tr>
<tr>
<td>Hypokalaemia ± hyponatraemia</td>
<td>GI fluid and electrolyte losses</td>
</tr>
<tr>
<td>Hypoalbuminaemia</td>
<td>GI loss (chronic). Liver disease (chronic). GI blood loss</td>
</tr>
<tr>
<td>Hypercalcaemia ± azotaemia</td>
<td>Hypercalcaemia of malignancy. Hypoadrenocorticism</td>
</tr>
<tr>
<td>Elevated bilirubin</td>
<td>Liver disease. Pancreatitis</td>
</tr>
<tr>
<td>Hypocholesterolaemia</td>
<td>GI loss. Chronic liver disease</td>
</tr>
<tr>
<td>Hypercholesterolaemia</td>
<td>Acute obstructive liver disease. Pancreatitis</td>
</tr>
<tr>
<td>Increased liver enzymes</td>
<td>Acute liver disease (massive increases expected). Mild to moderate increases in chronic liver disease, secondary to other inflammatory/infectious diseases</td>
</tr>
<tr>
<td>Elevations in amylase/ lipase</td>
<td>Mild elevations suggest decreased renal clearance or are a non-specific finding. Massive elevations may suggest pancreatitis, so testing for specific canine pancreatic lipase is recommended (see text)</td>
</tr>
</tbody>
</table>

**Tests for pancreatitis:** Pancreatitis is probably an underdiagnosed disease in general practice. Whilst it may be relatively easy to diagnose severe acute pancreatitis, many more dogs suffer from chronic pancreatitis that may be harder to diagnose. Any dog can get pancreatitis, but certain breeds including Cocker Spaniels, Miniature Schnauzers, Boxers and Cavalier King Charles Spaniels appear to be over-represented (Watson *et al.*, 2007). A presumptive diagnosis of pancreatitis should be made on the basis of a combination of historical, clinical and laboratory testing (see Figures 13.10 and 13.11). The lack of sensitivity of amylase and lipase is well known, but even newer tests including canine pancreatic lipase immunoreactivity (cPLI) and SNAP cPL and Spec cPL have the advantage of improved sensitivity and specificity compared with amylase or lipase, but results should always be interpreted in light of clinical, biochemical

---

**WARNING**

- Campylobacter, Salmonella and Giardia are zoonotic infections

---

13.10 Some differential diagnoses for commonly identified abnormalities seen on biochemistry in dogs with vomiting and/or diarrhoea.
and imaging results (McCord et al., 2012). The gold standard diagnostic test is pancreatic biopsy, though this is rarely performed.

**Tests of exocrine pancreatic function:** Inadequate production of digestive enzymes by the pancreatic acinar cells, due to atrophy, leads to malabsorption of nutrients. The persistence of undigested food within the small intestine often results in bacterial overgrowth. Voluminous, pale, often malodorous, small intestinal diarrhoea is present and many dogs are clinically malnourished. Exocrine pancreatic insufficiency (EPI) can affect any breed, but German Shepherd Dogs are over-represented. EPI can also develop as a consequence of chronic pancreatitis. Dogs with EPI have low trypsin–like immunoreactivity (TLI) and will often have cobalamin and folate abnormalities (see Tests of intestinal absorption, below).

**Tests of liver function:** Many dogs with severe GI disease have abnormalities of liver enzymes, but it may not be easy to decide whether the changes are due to a primary liver disease or reflect a secondary hepatopathy. For example, dogs with severe inflammatory bowel disease will have changes in liver enzymes as a consequence of increased metabolic demand and increased toxins/bacteria in the portal blood. Successful treatment of the primary disease should resolve the changes in liver enzymes. Dogs with both acute and chronic liver disease can present with vomiting and diarrhoea, and recognizing patterns that are suggestive of acute liver disease, chronic liver disease and secondary hepatopathies requires evaluation of liver enzymes and liver function tests (Figure 13.12), together with historical and clinical information. Dogs with significant inflammatory diseases such as pancreatitis, inflammatory bowel disease, pyometra or prostatitis could all have biochemical changes consistent with a secondary hepatopathy.

![Biochemical changes in acute, chronic and secondary hepatopathies](image)

**Bile acids**
- A serum bile acids concentration of <40 μmol/l is typical in secondary hepatopathies.
- Dogs with primary liver disease, either acute or chronic, would be expected to have bile acids >60 μmol/l, and levels can be >100 μmol/l.

**Testing for hypoadrenocorticism:** Hypoadrenocorticism is an uncommon cause of vomiting and/or diarrhoea. Many cases are presented in acute crisis; others can have a more chronic, waxing and waning disease, making diagnosis a challenge. Hypoadrenocorticism is most common in young to middle-aged dogs and certain breeds are over-represented (e.g. poodles, West Highland White Terrier, Bearded Collie, Nova Scotia Duck Tolling Retriever). Most dogs with hypoadrenocorticism have classical electrolyte abnormalities (hyperkalaemia, hyponatraemia, with sodium:potassium ratios <27:1, and hypochloraemia) but these electrolyte abnormalities are not pathognomonic for hypoadrenocorticism and many dogs with acute vomiting/diarrhoea have electrolyte disturbances. Other abnormalities include azotaemia and a relatively dilute USG. Hypercalcaemia and hypoglycaemia may also be seen.

Diagnosis of hypoadrenocorticism is made using the adrenocorticotrophic hormone (ACTH) stimulation test, confirming suboptimal cortisol before and after stimulation:
- In hypoadrenocorticism cortisol levels are typically <20 nmol/l both pre- and post-stimulation.
- It is important to remember that pretreatment with steroids can blunt the adrenocortical response.
- Measuring resting cortisol levels may be useful to exclude hypoadrenocorticism: if cortisol is >55 nmol/l hypoadrenocorticism is unlikely (Lennon et al., 2007).

**Tests of intestinal absorption:** Foliate/B12 (cobalamin) tests are most often utilized in cases of chronic vomiting and/or diarrhoea, to assess intestinal absorptive function. They can be helpful in confirming a suspicion of inflammatory bowel disease or bacterial overgrowth. The tests should be interpreted in the context of known exocrine pancreatic function. Deficiencies in cobalamin can be supplemented parenterally.

**Coagulation profiles:** Testing coagulation by activated partial thromboplastin time (APTT) and prothrombin time (PT) is indicated in patients with haematemesis or melaena, or in systemically unwell dogs with an acute abdomen, in order to detect disseminated intravascular coagulation (DIC). Platelet counts should be verified by checking a blood film prior to undertaking coagulation profile testing. Animals with severe thrombocytopenia (<50 x 10⁹/l) can bleed spontaneously.

**Diagnostic imaging**
A structured examination of all abdominal contents is essential to avoid missing abnormalities that were not anticipated.

**Survey abdominal radiography:** Abdominal radiography can assist in the diagnosis of many GI diseases, such as gastric dilatation–volvulus (GDV), and is a priority in suspected cases of intestinal obstruction. Classic signs of GDV are: dilatation of the stomach with gas ± food/fluid; and malposition of the fundus and pylorus. The pylorus rotates to the left and becomes more cranial and dorsal relative to the fundus (Figure 13.13).
Chapter 13  Regurgitation, vomiting and diarrhoea

160

Small intestinal obstruction may be evident on plain abdominal radiographs. Dilated loops of small intestine may be seen in association with obstruction caused by a foreign body (Figure 13.14), neoplasia or intussusception. The exact criteria upon which dilatation is diagnosed is variable, though most authors agree that a small intestinal width greater than the height of the vertebral endplate of L2 is significant. (The measurement of intestinal wall thickness cannot be reliably assessed on plain abdominal radiographs, and can only be measured during contrast studies or ultrasonographically.) Linear foreign bodies may be suspected on the basis of clumping of intestines, tight bends or C-shaped loops and avoid gas pockets. Not all foreign bodies are radiodense.

A loss of serosal detail may suggest free abdominal fluid and direct further investigations such as ultrasonography to establish a diagnosis and obtain fluid samples (see Chapter 25). The best determination of liver size is based on the appearance of the gastric axis and the extent beyond the costal arch on plain abdominal radiographs. Abnormalities in organ size and shape can be further investigated by ultrasonography.

PRACTICAL TIP

It is important to remember that not all foreign bodies are visible on plain radiographs and that a normal abdominal radiograph does not exclude the possibility of gastrointestinal or systemic disease.

Abdominal ultrasonography: Image quality is dependent on machine-related factors and also on the skill and experience of the operator. Large amounts of gas, food and faeces can also make abdominal imaging difficult. A methodical assessment of the GI tract and other intra-abdominal organs is essential. Readers are directed to specific imaging texts (e.g. BSAVA Manual of Canine and Feline Ultrasonography) for detailed information; a guide to some of the more common abnormalities that might be seen in cases of acute vomiting and diarrhoea, that may not have significant abnormalities on clinical examination, is given in Figure 13.15.

<table>
<thead>
<tr>
<th>Ultrasonographic finding</th>
<th>Possible causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>GI wall thickening with no loss of layering</td>
<td>Inflammatory disease</td>
</tr>
<tr>
<td>GI wall thickening with loss of layering</td>
<td>Neoplasia more likely</td>
</tr>
<tr>
<td>Enlarged abdominal lymph nodes</td>
<td>Mild increases: reactive lymph node. Moderate/marked increases: diffuse or metastatic neoplasia</td>
</tr>
<tr>
<td>Free abdominal fluid</td>
<td>Peritonitis</td>
</tr>
<tr>
<td></td>
<td>Liver disease</td>
</tr>
<tr>
<td>Microhepatica</td>
<td>Chronic end-stage liver disease. Portosystemic shunts</td>
</tr>
<tr>
<td>Hepatomegaly</td>
<td>Acute hepatitis or cholangiohepatitis. Neoplasia</td>
</tr>
<tr>
<td>Enlarged hyperechoic hypoechoic pancreas (often painful)</td>
<td>Acute pancreatitis. Pancreatic tumour</td>
</tr>
</tbody>
</table>

13.15 Possible causes of some ultrasonographic abnormalities in patients with vomiting and/or diarrhoea.

PRACTICAL TIPS

- Not all causes of vomiting and/or diarrhoea will result in obvious ultrasonographic changes
- Gastric foreign bodies can easily be missed if there is a lot of gas present in the stomach...
Regurgitation, vomiting and diarrhoea

Chapter 13

Ultrasonography can also be used to confirm the nature of abnormalities identified on clinical examination, in assessing the nature of abdominal masses (e.g. foreign body, neoplasia, intussusception; Figure 13.16), or in screening to exclude potential differential diagnoses. If neoplasia is suspected it is important to evaluate the abdomen thoroughly for evidence of metastatic spread, but to remember that ultrasonography cannot be used to diagnose a particular tumour type and that not all ‘nodules’ or ‘masses’ are neoplastic. Thoracic radiographs (ideally two inflated views) should be obtained to assess for pulmonary metastases if neoplasia is suspected.

Biopsy samples should be taken from both the stomach and small intestine when investigating vomiting or small intestinal diarrhoea. Large amounts of food or fluid in the stomach, despite adequate starving, can hamper gastroduodenoscopy, and is suggestive of a gastric motility disorder.

**WARNING**

Care should be taken if gastroduodenal ulcers are seen. Biopsy samples should not be taken from the centre of ulcers, to avoid the risk of perforation.

Colonoscopy is indicated for dogs with large bowel diarrhoea, tenesmus and haematochezia. Patients need to be adequately prepared with 24 hours’ starvation, oral cleansing solutions and warm water enemas.

**Pros and cons of endoscopy**

- **Benefits:**
  - Potentially reduced morbidity and mortality compared with surgery

- **Limitations:**
  - Operator skills
  - Biopsy samples often small
  - Can only identify mucosal disease
  - Not all portions of the GI tract can be visualized/sampled

**Exploratory laparotomy**

Laparotomy to obtain full-thickness biopsy samples as part of a thorough examination of the abdominal cavity still has a useful role in general practice, though surgeons should be adequately prepared for such procedures (see *BSAVA Manual of Canine and Feline Abdominal Surgery*). Exploratory surgery is part of the treatment process for GDV (Figure 13.17), intestinal foreign bodies (Figure 13.18), intussusceptions, most discrete intestinal tumours and perforated ulcers (Figure 13.19).

It is important to remember that chronic inflammatory GI disease may not be visible to the surgeon.

Endoscopy

In the acute setting endoscopy may be used to investigate haematemesis, to look for gastroduodenal ulceration or neoplasia, or occasionally to retrieve gastric foreign bodies. It is essential to ensure that patients are haemodynamically stable before being anaesthetized for endoscopic procedures.

Endoscopy is mainly used for biopsy in chronic inflammatory GI conditions, after many other potential differential diagnoses have been excluded. Multiple
Only histopathology can confirm that disease is present, so gut biopsy samples should be taken even if the bowel looks ‘normal’. A thorough assessment of the entire GI tract should be performed in a logical manner, ensuring that all loops of intestine have been palpated, as foreign bodies and small intraluminal lesions can be missed. Any enlarged lymph nodes can be sampled, as can other abdominal organs. Full-thickness gut biopsy carries a slightly increased risk of complications, and owners should be made aware of the risks. The likelihood of wound breakdown is increased in patients with significant hypoalbuminaemia, in those that are profoundly anorexic, and with poor surgical technique. Most dehiscence occurs within 72 hours of surgery.

Principles of treatment

Dogs that are systemically well and suspected to have self-limiting disease can be treated symptomatically.

Systemically well patients

The dog should be starved for 12–24 hours, followed by the introduction of small quantities of a low-fat, highly digestible diet. Veterinary prescription diets can be used, but home-cooked diets (chicken/cottage cheese/egg and rice) are also suitable. If the clinical signs resolve, the dog can then be gradually reintroduced to its normal diet over several days. Water should be offered little and often, and oral electrolyte solutions can be offered in addition to water.

In addition:

- Anti-emetics can be used, provided GI obstruction has been excluded
- Antibiotics are not indicated in acute vomiting or diarrhoea, unless a specific infection has been identified (e.g. Campylobacter)
- Anthelmintics should be considered in puppies
- If haematemesis is a clinical feature, gastroprotectants such as sucralfate, omeprazole or H2 blockers (e.g. cimetidine, ranitidine) can be used
- Products such as prebiotics, probiotics and clay based medications are often used to treat diarrhoea but there is limited published evidence of efficacy.

Systemically unwell patients

Patients that are significantly dehydrated, or have suspected systemic or severe GI disease will benefit from correction of fluid deficits and electrolyte abnormalities. Assessing hydration status should be part of the clinical assessment.

The choice of fluid depends on the underlying disease and the type of fluids available. The priority is always to correct dehydration and electrolyte imbalances and the commonest error in practice is failure to give sufficient fluids, rather than giving the ‘wrong’ fluids.

- For dogs with hypercalcaemia, hyperkalaemia (suspected hypoadrenocorticism) and pyloric/jejunal obstruction, the crystalloid of choice would be 0.9% NaCl.
- In the majority of other causes of acute vomiting/diarrhoea, Hartmann’s solution would be appropriate.
- Colloids (10–20 ml/kg) or plasma may be useful in markedly hypoalbuminaemic patients.
- Blood transfusion is indicated in cases of severe GI blood loss.
Fluid rates are calculated based on the level of dehydration and the underlying disease. Crystalloid fluid rates can be calculated based on deficits, sensible and insensible losses. Many clinicians use multiples of maintenance requirements to guide fluid rates (Figure 13.20). These guide rates are then modified based on clinical response. Wherever possible, fluids – especially those with added potassium – should be given using fluid pumps/syringe drivers to ensure accurate delivery of fluids.

Whatever the fluid type or rate of administration, frequent monitoring of the patient should be undertaken, with particular reference to urine output, heart rate, pulse quality and hydration status.

In addition to fluid therapy:

- Anti-emetics can be used to reduce fluid and electrolyte losses, but should not be used in cases of GI obstruction, or for prolonged periods without a diagnosis
- Gastroprotectants can also be given
- Antibiotics should be reserved for cases with identified infections, or those at risk of sepsis.

Details of specific treatments for specific conditions can be found in appropriate BSAVA manuals.

### Potassium supplementation

Many animals with vomiting and diarrhoea are hypokalaemic, and additional potassium supplementation should be given. Clinicians are often concerned about the risks of potassium supplementation in practice, but it can be undertaken safely if the following guidelines are followed:

- Wherever possible, adjust potassium supplementation based on plasma potassium levels
- Always ensure potassium is well mixed in the fluid bag
- Ensure the bag is labelled appropriately with the amount of potassium added
- Use a fluid pump/syringe driver
- Do not exceed infusion rates of 0.5 mmol K⁺ per kg per hour

<table>
<thead>
<tr>
<th>Condition</th>
<th>Suggested initial fluid therapy rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild vomiting ± diarrhoea with no obvious evidence of dehydration</td>
<td>1-1.5 x maintenance</td>
</tr>
<tr>
<td>Moderate vomiting ± diarrhoea with clinical evidence of dehydration</td>
<td>2-2.5 x maintenance</td>
</tr>
<tr>
<td>Severe vomiting ± diarrhoea with marked dehydration</td>
<td>2-3 x maintenance ± bolus fluids (20–30 ml/kg over 15–20 minutes)</td>
</tr>
<tr>
<td>Gastric dilatation-volvulus</td>
<td>Bolus fluids; shock rate 90 ml/kg/h</td>
</tr>
</tbody>
</table>

13.20 Suggested crystalloid fluid therapy rates in dogs with vomiting ± diarrhoea. Maintenance rate = 2–4 ml/kg/h.

### References and further reading

Abnormalities of eating and drinking

Nick Bexfield

Dogs presenting with polydipsia, polyuria, polyphagia or weight loss are seen relatively commonly in clinical practice. There are multiple causes for each of these problems, and it is important that the clinician formulates a complete list of differential diagnoses prior to undertaking diagnostic investigations. It is very unusual for patients with these clinical signs to present as an emergency, so there is time for a methodological work-up. However, the investigation can be challenging, and it is vital that a logical approach to each case is employed. This chapter will provide an overview of the causes of each of these clinical signs and cover the diagnostic approach, including how the signalment, history and results of the physical examination can be helpful, and how to interpret results of routine and more specific laboratory tests and diagnostic imaging. Helpful practical tips and warnings related to case investigation are also included.

Polydipsia and polyuria

Drinking and the renal control of salt and water excretion are the main mechanisms for balancing water intake with water loss.

Definitions

- A healthy dog drinks approximately 20–90 ml/kg/day, depending on the moisture content of its diet.
- Normal urine output varies between 20 and 45 ml/kg/day.
- Polydipsia (PD) in dogs is defined as a fluid intake of >100 ml/kg/day.
- Polyuria (PU) in dogs is defined as a urine output of >50 ml/kg/day.

The causes of PU/PD (Figure 14.1) can be divided into:

- Those that cause primary polydipsia (with secondary polyuria).
- Those that cause primary polyuria (with a compensatory polydipsia).

Primary polydipsia is very uncommon and is usually psychogenic. Psychogenic polydipsia, or compulsive water drinking, is usually a manifestation of a behavioural problem triggered by an environmental or emotional stimulus (see Chapter 12).

In contrast, the causes of primary polyuria are much more numerous. The more common causes of PU/PD in dogs (including chronic renal failure, hyperadrenocorticism, hypercalcaemia, hyperthyroidism, liver failure and pyometra) are those that induce secondary nephrogenic diabetes insipidus (NDI), in which the renal tubules are insensitive to antidiuretic hormone (ADH). It should be noted that central diabetes insipidus (CDI) and primary NDI are uncommon but should always be considered as differential diagnoses in cases of PU/PD.

Osmotic diuresis

Osmotic diuresis occurs when the concentration of an osmotic solute, such as glucose present in the glomerular filtrate, exceeds the proximal tubular capacity for reabsorption. This impairs the passive reabsorption of water and results in increased obligatory water loss. By far the most common cause of osmotic diuresis leading to PU/PD is diabetes mellitus. Other causes include primary renal glycosuria, seen in the Norwegian Elkhound and Basenji, and the diuresis that follows relief of a postrenal obstruction (e.g. following urethral catheterization in an animal with urethral obstruction).
Diagnostic approach

The first step for any dog suspected of having PU/PD is to establish that the problem truly exists, preferably by home measurement of daily water consumption over 2–3 days and random urine specific gravity (USG) measurements on submitted samples.

Sometimes the signalment, history and physical examination findings are very suggestive of a cause for the PU/PD, but it is often necessary to perform additional diagnostic tests. Figure 14.2 shows the general diagnostic approach to the patient with PU/PD.

History

Signalment: Some disorders that cause PU/PD develop more commonly in certain breeds or age groups of dog. For example:

- Hyperadrenocorticism (see Chapter 17) typically develops in middle-aged to older small breeds, such as the Miniature Poodle, Dachshund, West Highland White Terrier and Yorkshire Terrier
- The Standard Poodle, Bearded Collie, Rottweiler and Great Dane appear to be predisposed to developing hypoadrenocorticism (see Chapter 17); whilst this is a much less common condition, it should be considered in such a breed presenting with vague but consistent clinical signs

A general diagnostic approach to a dog with polyuria (PU) and polydipsia (PD).

### Confirming PU/PD

- If daily water intake is normal, or if a random USG determination is >1.030, additional history should be obtained to rule out other urinary tract disorders (e.g. urinary incontinence or dysuria; see Chapter 26) that are commonly confused with polyuria
- If random USG measurements are consistently <1.030 and daily water consumption is >100 ml/kg, PU/PD is deemed to be present, and a diagnostic work-up to determine the cause is warranted

### Polyuria/polydipsia

- Quantify water intake and measure urine specific gravity (USG)

- Daily water consumption >100 mg/kg
  - USG <1.030
    - Investigate cause of PU/PD
    - Rule out diet, drugs and environmental factors
    - Is the animal’s signalment suggestive of a particular cause?
    - Are there other clinical signs which suggest a cause (see Figure 14.3)?
    - Does the clinical examination suggest a cause to the PU/PD (see Figure 14.4)?
    - Perform a complete blood count and serum biochemistry
    - Perform urinalysis (USG, dipstick and sediment evaluation)
    - Have all causes of PU/PD except central or nephrogenic diabetes insipidus and psychogenic polydipsia been ruled out?

- Daily water consumption <100 mg/kg
  - USG <1.030
    - Obtain additional history to rule out other disorders (e.g. urinary incontinence or dysuria) that are commonly confused with polyuria
    - Perform a water deprivation test
    - Are there any changes suggestive of a particular cause to the PD/PU? (see Figure 14.5)
    - Perform further testing
    - What is the USG? See Figure 14.7 for differential diagnoses
Many of the other common causes of PU/PD (e.g. diabetes mellitus, chronic renal failure, liver failure and pyometra) are often found in older animals

Psychogenic polydipsia occurs more frequently in young, hyperexcitable, large-breed dogs

Pyometra should be high on the list of differential diagnoses in an intact bitch developing PU/PD during or immediately after the dioestrous phase of the oestrous cycle.

**Diet:** When evaluating an animal with PU/PD, the nature and composition of the diet should be taken into account, especially if clinical signs develop around the time of a dietary change. Food is an important source of water, and dogs fed on dry food invariably drink more water than those fed on moist food.

**Drugs:** Current or recent drug administration should also be ruled out as a cause of PU/PD. Medications that are frequently associated with PU/PD include glucocorticoids, phenobarbital and diuretics. Chronic administration of progestogens to intact bitches for oestrous suppression can lead to acromegaly (growth hormone excess), which can cause secondary diabetes mellitus.

**Environmental factors:** Environmental factors can trigger PU/PD in some animals. In dogs with psychogenic polydipsia it may be possible to identify a stressful environmental change that preceded the onset of clinical signs; examples include the arrival of a new baby or pet, or moving house. PU/PD that develops after head trauma could suggest damage to the ADH-secreting neurons or disruption to the pituitary stalk, resulting in CDI.

**Clinical history:** The presence of other clinical signs in the history may be helpful in determining the cause of PU/PD. Clinical signs more commonly associated with the different causes of PU/PD are listed in Figure 14.3.

---

### Physical examination

A careful clinical examination can help to identify many of the more common causes of PU/PD (Figure 14.4).

**PRACTICAL TIP**

Dogs with psychogenic polydipsia, CDI or primary NDI are typically alert and active, and seldom show any abnormalities on physical examination.

<table>
<thead>
<tr>
<th>Physical examination findings</th>
<th>Possible causes of PU/PD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small or irregular kidneys</td>
<td>Chronic renal failure, protein-losing nephropathy</td>
</tr>
<tr>
<td>Large kidneys</td>
<td>Pyelonephritis, lymphoma (with hypercalcaemia)</td>
</tr>
<tr>
<td>Painful kidneys/sublumbar pain</td>
<td>Pyelonephritis</td>
</tr>
<tr>
<td>Hepatomegaly</td>
<td>Hyperadrenocorticism, diabetes mellitus</td>
</tr>
<tr>
<td>Alopecia, pot belly</td>
<td>Hyperadrenocorticism</td>
</tr>
<tr>
<td>Cataracts</td>
<td>Diabetes mellitus</td>
</tr>
<tr>
<td>Abdominal distension</td>
<td>Liver failure, hyperadrenocorticism, pyometra</td>
</tr>
<tr>
<td>Peripheral lymphadenopathy</td>
<td>Lymphoma (with hypercalcaemia)</td>
</tr>
<tr>
<td>Perianal inss</td>
<td>Anal sac adenocarcinoma (with hypercalcaemia)</td>
</tr>
<tr>
<td>Vaginal discharge</td>
<td>Pyometra</td>
</tr>
<tr>
<td>Fever, peri-renal pain</td>
<td>Pyelonephritis</td>
</tr>
<tr>
<td>Uraemic breath or stomatitis</td>
<td>Chronic renal failure</td>
</tr>
</tbody>
</table>

### Laboratory tests

Even if the signalment, history and physical examination findings are suggestive of an underlying cause, it is usually prudent to perform further testing to confirm the suspicion or evaluate for concurrent disease. This is most important in older animals, as these patients may have more than one disease process present (e.g. the elderly dog with chronic renal failure and liver failure).

**Complete blood count and serum biochemistry:** A complete blood count (CBC) and serum biochemistry are the most useful initial screening tests when investigating dogs with PU/PD. These baseline tests often allow a diagnosis immediately; or they may offer clues as to the underlying cause of the PU/PD. Figure 14.5 shows differential diagnoses for some of the more commonly identified abnormalities on CBC and serum biochemistry, and suggests further tests. For example, dogs with hyperadrenocorticism commonly have elevated alkaline phosphatase (>90% cases), hypercholesterolaemia (>50% cases) and a stress leucogram (neutrophilia, lymphopenia ± eosinopenia).

**Urinalysis:** Urinalysis is a vital test when investigating the patient with PU/PD. The most important features are: USG; presence or absence of glucose, protein or bacteria; and the cellularity of the sample. Urine collection techniques are described in Chapter 26.
Abnormalities of eating and drinking

Parameter | Possible causes of PUPD | Suggested further tests
---|---|---
Elevated urea and creatinine | Chronic renal failure, pyelonephritis, (protein-losing nephropathy) | Urinalysis, ultrasound evaluation of the kidneys
Decreased BUN | Liver failure (can be non-specific sign) | Measure bile acids
Hypercalcaemia (total and ionized) | Hypercalcemia of malignancy, hypervitaminosis D, primary hyperparathyroidism, granulomatous disease, idiopathic, chronic renal failure, skeletal lesions | Identify source of hypercalcaemia with: thorough clinical examination, thoracic and abdominal imaging; ± measurement of PTH; ± measurement of PTHrP
Elevated liver enzymes | Liver failure | Measure bile acids
Hyperglycaemia | Diabetes mellitus | Measure blood glucose
Hyperkalaemia + hyponatraemia | Hypoadrenocorticism | ACTH stimulation test
Hypercholesterolaemia | Hypoadrenocorticism | ACTH stimulation tests ± LDDS test, abdominal imaging
Diabetes mellitus | Measure blood and urine glucose
Protein-losing nephropathy | Quantify urine protein loss
Liver failure | Measure bile acids
Hypalbuminaemia | Liver disease | Measure bile acids
Protein-losing nephropathy | Quantify urine protein loss
Stress leucogram (neutrophilia, lymphopenia ± eosinopenia) | Hypoadrenocorticism | ACTH stimulation tests ± LDDS test, abdominal imaging
Any 'stressful' disease | Tests specific to the disease suspected

**14.5 Abnormalities that may be identified on CBC and serum biochemistry, the diseases they are associated with, and suggested further tests.**

- ACTH = adrenocorticotrophic hormone
- ALP = alkaline phosphatase
- ALT = alanine aminotransferase
- BUN = blood urea nitrogen
- LDDS = low-dose dexamethasone suppression
- PTH = parathyroid hormone
- PTHrP = PTH-related protein.

**PRACTICAL TIP**

Analysis of a urine sample should ideally be performed within 30 minutes of collection. Delayed analysis will allow any bacteria within the sample to proliferate, and the urine pH then becomes alkaline. Casts and cells may degrade as the urine ‘ages’, and crystals may either sediment out of solution or dissolve.

- A drop of urine is placed on a slide and can be examined stained or unstained

  - **± Culture:** for bacteriology and sensitivity testing (samples should be obtained by cystocentesis)
  - **± Urine protein:creatinine (UPC) ratio:** for diagnosis of protein-losing nephropathies.

Urinalysis should include:

- **Specific gravity:** must be done using a refractometer, as dipstick measurement of USG is unreliable
- **Dipstick evaluation:** for pH, protein, glucose, ketones, urobilinogen, bilirubin, blood, etc. (Figure 14.6)
- **Sediment examination:** for casts, erythrocytes, leucocytes, bacteria, yeast, crystals, abnormal cells, etc.
  - The sediment should be prepared by centrifuging a standardized volume of urine (1–5 ml) at 2000 rpm for 5 minutes. The supernatant is decanted and the remaining sediment resuspended in about 0.5 ml of supernatant or water

An example of a commercial dipstick testing kit.

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Urine specific gravity:

- A USG of <1.030 suggests a concentrating defect and is consistent with PU/PD. The direction of further work-up can often be based on the USG (Figure 14.7). Note that glucosuria increases the measured USG; therefore, the value will not be entirely representative of renal tubular concentrating function.
- A USG consistently 1.001–1.007 in a middle-aged to older dog is usually associated with hyperadrenocorticism, or less commonly with CDI (complete or partial), primary NDI or psychogenic polydipsia. It is important to remember that not all dogs with hyperadrenocorticism show ‘classic’ signs of disease, and PU/PD may be the only abnormality present. Moreover, these animals may lack the serum biochemistry abnormalities commonly associated with hyperadrenocorticism (see Figure 14.5). In a dog with a USG 1.001–1.007, hyperadrenocorticism should be ruled out before testing for CDI, primary NDI and psychogenic polydipsia. This should be done by performing tests including an adrenocorticotropic hormone (ACTH) stimulation test and low-dose dexamethasone suppression (LDDS) test, in combination with other investigations such as abdominal ultrasonography (see QRG 14.1).
- A USG of 1.008–1.029 can be associated with hyperadrenocorticism, chronic renal failure, hypercalcaemia, protein-losing nephropathies or pyelonephritis, as well as psychogenic polydipsia. Hyperadrenocorticism, chronic renal failure, hypercalcaemia and protein-losing nephropathies should be ruled out first (see Figure 14.5), followed by pyelonephritis, before evaluating the patient for psychogenic polydipsia.

PRACTICAL TIP

Pyelonephritis can sometimes be difficult to diagnose, but a positive bacterial culture, active urine sediment (red and white blood cells, casts, protein) and a dilated renal pelvis on ultrasonography are supportive of this diagnosis. If these changes are not present, a therapeutic trial with an appropriate antibiotic (e.g. potentiated amoxicillin, fluoroquinolone) could be instigated.

Water deprivation test

The water deprivation test is used for the final evaluation of the patient with PU/PD. Its only indication is to distinguish between CDI, primary NDI and psychogenic polydipsia. In theory, urine will become concentrated in animals with psychogenic polydipsia but will remain dilute in animals with CDI and primary NDI.

WARNING

- The water deprivation test should be performed only after all other causes of PU/PD have been ruled out, limiting the differential diagnoses to CDI, primary NDI and psychogenic polydipsia.
- Dogs with many of the more common causes of PU/PD may respond to a water deprivation test in a similar manner to a dog with CDI, primary NDI or psychogenic polydipsia. Even importantly, use of the water deprivation test in such patients may be dangerous.
- The test should be performed with great care, as it can result in rapid alterations of water and electrolyte balance that can be life-threatening.
- It is contraindicated in azotaemic and/or dehydrated patients and in patients with known renal disease. Patients that are dehydrated have, by definition, already failed the test.

Because use of the water deprivation test is limited to differentiating between some of the less common causes of PU/PD it is beyond the scope of this chapter and readers are referred to the BSAVA Manual of Canine and Feline Nephrology and Urology and the BSAVA Guide to Procedures in Small Animal Practice.
Abnormalities of eating and drinking

Notes on treatment
The treatment of every disorder causing PU/PD is beyond the scope of this chapter (the reader is referred to the relevant BSAVA Manuals), but some general points should be noted.

- Until the mechanism of PU/PD is understood, water intake should not be restricted.
- Dogs with PU/PD should be provided with free access to water unless they are vomiting. In the vomiting patient, parenteral fluids should be administered along with other supportive therapies.
- Parenteral fluids should also be provided when other conditions limit oral intake or the dog appears to be dehydrated despite oral intake.
- The hypercalcaemic animal may require additional parenteral fluid therapy and other measures (e.g. furosemide) to reduce serum calcium. Prolonged hypercalcaemia can lead to irreversible renal damage and other detrimental effects.
- In most cases, directly treating the underlying cause will improve or resolve the PU/PD.
- PU/PD will likely continue in a dog with chronic renal failure, and some animals benefit from additional fluid therapy via subcutaneous administration.
- Treat psychogenic polydipsia by gradually limiting water intake to a normal daily volume (20–90 ml/kg/day). Animals should probably have their water intake reduced over days to weeks to avoid undesirable behavioural side effects that could occur.

Diabetes mellitus: treatment overview
For more details see the BSAVA Manual of Canine and Feline Endocrinology and the BSAVA Manual of Canine and Feline Rehabilitation, Supportive and Palliative Care. See also Chapter 17

- Once the diagnosis is established, all dogs require insulin. Most dogs respond well to subcutaneous lente insulin administered at a dose of 0.5–1.0 IU/kg q12h. Owners should be instructed on the handling, storage and administration of insulin.
- Commercial diets are available for diabetic dogs; if these are not used, the diet should contain digestible carbohydrates and increased fibre. Feed half the caloric requirement at the time of insulin administration.
- Consider weight reduction in obese dogs.
- Dogs should be exercised at approximately the same time each day and the amount of exercise should be roughly the same each day.
- Assess the control of glycaemia primarily by monitoring clinical signs. Additional testing such as the measurement of fructosamine or serial blood glucose measurements are also required in some dogs.
- Monitor for complications including: blindness and anterior uveitis resulting from cataract formation; hypoglycaemia; recurring infections, especially those of the lower urinary tract; and ketoadiposis.

Chronic renal failure: treatment overview
For more details see the BSAVA Manual of Canine and Feline Nephrology and Urology and the BSAVA Manual of Canine and Feline Rehabilitation, Supportive and Palliative Care

- Once the diagnosis is established, management is supportive.
- Nutrition plays a central role in the management of chronic renal failure, and diet should be tailored to the individual patient.
- It is vital that dogs are encouraged to eat.
- If blood phosphate is elevated, consider a phosphate-restricted diet.
- If blood phosphate is still elevated after starting a phosphate-restricted diet, consider phosphate binders.
- Encourage water intake.
- Monitor for proteinuria and treat if present (e.g. an angiotensin-converting enzyme (ACE) inhibitor, protein-restricted diet, omega-3 fatty acid supplementation).
- Monitor for hypertension and treat if present (e.g. ACE inhibitor, calcium channel blocker).

Polyphagia
Polyphagia is an increased food intake, which can be manifested by the dog eating either more frequently and/or consuming a greater quantity than normal. Some animals that are polyphagic may also show signs of excessive food-seeking and food-stealing behaviour.

Polyphagia may be prompted by:

- Failure to assimilate nutrients or an increased loss of nutrients (e.g. exocrine pancreatic insufficiency).
- Inability to use nutrients (e.g. diabetes mellitus, gastrointestinal parasites, poor-quality diet).
- Hypoglycaemia (e.g. insulinoma, insulin overdose).
- Increased metabolic rate or demand (e.g. cold environment, pregnancy, lactation).
- Psychological or learned behaviour (e.g. palatable diets, competition with others for food).
- Endogenous or exogenous glucocorticoids or other drugs (e.g. anticonvulsants).

The causes of polyphagia are listed in Figure 14.8.

Diagnostic approach

History
A complete history should be obtained for the polyphagic patient, with particular attention to the type and quantity of food fed.

Signalment: Some disorders causing polyphagia develop more commonly in certain breeds or age groups. For example:

- Hyperadrenocorticism typically occurs in middle-aged to older small breeds.
- In an entire bitch, pregnancy or lactation should be considered as possible causes of polyphagia.

169
Pathological
- Diabetes mellitus
- Hyperadrenocorticism
- Gastrointestinal parasites
- Exocrine pancreatic insufficiency
- Inflammatory bowel disease
- Lymphangectasia
- Insulina

Physical examination
Findings on physical examination may be helpful when investigating the patient with polyphagia (Figure 14.9). Particular attention should be paid to the dog's body condition, quality of the hair coat, presence of organomegaly or abdominal enlargement.

<table>
<thead>
<tr>
<th>Physical examination findings</th>
<th>Possible causes of polyphagia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor body condition (&lt;2 on a 5-point scale)</td>
<td>Gastrointestinal parasites, diabetes mellitus, exocrine pancreatic insufficiency, lymphangiectasia, inflammatory bowel disease, pregnancy, lactation</td>
</tr>
<tr>
<td>Excessive body fat</td>
<td>Does not suggest a particular underlying medical condition. Consider: overfeeding, drug administration, hyperadrenocorticism, insulina</td>
</tr>
<tr>
<td>Hepatomegaly</td>
<td>Hyperadrenocorticism, diabetes mellitus</td>
</tr>
<tr>
<td>Alopecia, pot belly</td>
<td>Hyperadrenocorticism</td>
</tr>
<tr>
<td>Poor-quality hair coat</td>
<td>Hyperadrenocorticism, exocrine pancreatic insufficiency</td>
</tr>
<tr>
<td>Abdominal enlargement</td>
<td>Pregnancy, hyperadrenocorticism</td>
</tr>
<tr>
<td>Cataracts</td>
<td>Diabetes mellitus</td>
</tr>
</tbody>
</table>

14.8 Causes of polyphagia in dogs. Those more commonly identified in small animal practice are shown in bold.

- The young German Shepherd Dog or Rough-Coated Collie with polyphagia should raise the suspicion of exocrine pancreatic insufficiency (EPI)
- Diabetes mellitus is often found in older dogs
- Gastrointestinal parasites are more common in young animals
- Inflammatory bowel disease and lymphangectasia can occur in animals of any age.

Diet: It is advisable to ask owners to bring in the dog's normal food and for them to show the quantity fed per day. To determine whether sufficient food is being given, the caloric value of the diet should be noted from the container, and the dog's resting energy requirement (RER) calculated (see Chapter 4). The amount of exercise the dog receives should be considered in light of the amount of food fed. Questions should also be asked about the dog's environment, with particular reference to competition for food in a multi-animal household.

Other considerations:
- Current or recent drugs should be ruled out as a cause of polyphagia, especially corticosteroids, anticonvulsants, benzodiazepines and progestins.
- A history of weight loss suggests the presence of a concurrent disease, whereas weight gain, or a change in body shape, may suggest hyperadrenocorticism.
- A concurrent history of PU/PD (see above) suggests diabetes mellitus or hyperadrenocorticism.
- Chronic vomiting, diarrhoea and weight loss raise the suspicion of gastrointestinal parasites (in puppies and adolescent dogs), lymphangectasia or inflammatory bowel disease.
- The presence of voluminous faeces and steatorrhoea supports the diagnosis of EPI, although it should be noted that this is not a consistent finding in all cases.

Laboratory tests
When the cause of polyphagia is not apparent from the signalment, history or physical examination findings, a CBC and serum biochemistry can offer clues as to the underlying cause (Figure 14.10).

Additional tests may include:
- Faecal analysis to rule out gastrointestinal parasites. Alternatively, a therapeutic trial with a suitable anthelminthic could be performed
- Measurement of trypsin-like immunoreactivity (TLI) for the diagnosis of EPI. As noted earlier, the young German Shepherd Dog or Rough-Coated Collie with voluminous faeces, diarrhoea, weight loss and polyphagia should prompt the suspicion of EPI. However, not all dogs with EPI develop voluminous faeces or diarrhoea. Older dogs of any breed can sometimes also develop EPI, usually a result of end-stage chronic pancreatitis.

Notes on treatment
The treatment of every disorder causing polyphagia is beyond the scope of this chapter (see relevant BSAVA Manuals), but some general points should be noted.

- Animals without weight gain, or with weight loss, should not have food restricted, as an underlying disorder is likely.
- In dogs with a pathological cause of polyphagia, treatment of the underlying disease usually resolves or significantly reduces the polyphagia.
- In dogs with a physiological cause of polyphagia, increasing their energy intake is usually all that is required. Consideration should also be given to using a diet with a higher energy density, especially if the volume of food becomes excessive.
Owners should measure food given, to assess intake accurately.

Some dogs may benefit from the addition of low-calorie bulking foods to the diet.

Feeding smaller meals several times per day may be beneficial in some animals.

Polyphagia as a result of drug administration may decrease if a dose alteration is made. Alternatively, different therapy protocols can be considered.

Inappetence refers to a loss or lack of appetite and the term is often used interchangeably with anorexia.

Inappetence is a common but usually non-specific complaint in small animal practice and is often associated with a systemic disease process (Figure 14.11). The pathophysiology is complex. For example, in part, inflammatory, immune-mediated and neoplastic diseases cause inappetence due to the release of pro-inflammatory cytokines such as interleukin-1 and tumour necrosis factor; endogenous toxins contribute to the decreased appetite seen in renal, liver and other diseases; altered gastrointestinal tract motility associated with metabolic disorders, gastrointestinal tract disease and neoplasia contribute to inappetence; fear, pain and stress may also decrease appetite in some patients; decreased appetite has also been associated with aging, and is thought to be mediated in part by cholecystokinin released from the gastrointestinal tract and an enhanced satiating effect of intestinal carbohydrates.

Inappetence can also occur in dogs that have any disease causing painful or dysfunctional prehension, mastication and swallowing (Figure 14.12); these animals may display an interest in food but be unwilling to eat.

Stomatitis/gingivitis/glossitis/pharyngitis

Retropharyngeal abscess/haematoma/lymphadenopathy

Dental or periodontal disease

Retrobulbar disease

Salivary gland inflammation or neoplasia

Masticatory myositis

Fractures of the jaw

Diseases of the temporomandibular joint

Oesophagitis

Cranial nerve V, VII, IX and X neuropathies

Central nervous system diseases

Diagnostic approach

History

It is important first to determine whether the dog has an interest in food and the ability to prehend, masticate and swallow. Patients with disorders causing dysphonia or pain of the oral cavity, oropharynx, other regions of the head or the oesophagus, may show interest in food but cannot eat. These patients commonly display weight loss with halitosis and excessive salivation. Conversely, animals with systemic disease usually have little interest in food.

A thorough general history should be obtained to evaluate for clinical signs that may be associated with diseases leading to inappetence. In order to identify any psychological causes, details about the dog’s environment, diet, other pets and people should be obtained. Current or recent drug administration should also be ruled out as a cause.

Abnormalities of inappetence

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Possible cause of polyphagia</th>
<th>Suggested further tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elevated liver enzymes</td>
<td>Hyperadrenocorticism (especially if ALP&gt;ALT)</td>
<td>ACTH stimulation tests ± LDDS test, abdominal imaging</td>
</tr>
<tr>
<td></td>
<td>Diabetes mellitus</td>
<td>Measure blood and urine glucose</td>
</tr>
<tr>
<td></td>
<td>Corticosteroid administration (ALP&gt;ALT)</td>
<td>Measure blood and urine glucose</td>
</tr>
<tr>
<td></td>
<td>Anticonvulsants (phenobarbital) (ALP&gt;ALT)</td>
<td>Measure urine glucose</td>
</tr>
<tr>
<td>Hyperglycaemia</td>
<td>Diabetes mellitus</td>
<td>Measure urine glucose</td>
</tr>
<tr>
<td></td>
<td>Hyperadrenocorticism (very mild increase)</td>
<td>ACTH stimulation tests ± LDDS test, abdominal imaging</td>
</tr>
<tr>
<td>Hypoglycaemia</td>
<td>Insulinoma</td>
<td>Measure serum insulin, abdominal ultrasonography, exploratory laparotomy</td>
</tr>
<tr>
<td></td>
<td>Insulin overdose</td>
<td></td>
</tr>
<tr>
<td>Hypercholesterolaemia</td>
<td>Hyperadrenocorticism</td>
<td>ACTH stimulation tests ± LDDS test, abdominal imaging</td>
</tr>
<tr>
<td></td>
<td>Diabetes mellitus</td>
<td>Measure blood and urine glucose</td>
</tr>
<tr>
<td>Hypoalbuminaemia ± hypoglobulinaemia</td>
<td>Lymphangiectasia, inflammatory bowel disease</td>
<td>Ultrasonography and biopsy of the gastrointestinal tract</td>
</tr>
<tr>
<td>Stress leucogram (neutrophilia, lymphopenia ± eosinopenia)</td>
<td>Hyperadrenocorticism</td>
<td>ACTH stimulation tests ± LDDS test, abdominal imaging</td>
</tr>
<tr>
<td></td>
<td>Any ‘stressful’ disease</td>
<td>Tests specific to the disease suspected</td>
</tr>
</tbody>
</table>

Major causes of inappetence in dogs.

- Gastrointestinal disease
- Renal disease
- Liver disease
- Neoplasia
- Cardiac disease
- Respiratory disease
- Endocrine disease
- Metabolic disease
- Infectious disease
- Neurological disease
- Toxicities and drugs
- Motion sickness
- Pain, fear, stress
- Anorexia of aging

Abnormalities of eating and drinking
Physical examination
A multitude of physical examination findings may be present in the inappetent patient and these vary with the underlying cause. A complete physical examination is therefore required to determine the presence of systemic disease leading to inappetence. Findings may include fever, icterus, pain, changes in organ size, abdominal distension, masses and abnormal heart or lung sounds.

A thorough ophthalmic, dental, oropharyngeal, facial and cervical examination is required to identify diseases causing painful or dysfunctional prehension, mastication and swallowing (see Chapter 20). Sedation or general anaesthesia may be necessary. The patient can also be observed while feeding, noting signs of pain or dysfunction.

Laboratory tests

**Complete blood count, biochemistry, urinalysis:** If the dog has a lack of interest in food and therefore a systemic disease is suspected, a CBC, serum biochemistry and urinalysis are the most useful initial screening tests. Abnormalities will vary with the different underlying diseases.

A thorough ophthalmic, dental, oropharyngeal, facial and cervical examination is required to identify diseases causing painful or dysfunctional prehension, mastication and swallowing (see Chapter 20). Sedation or general anaesthesia may be necessary.

**PRACTICAL TIP**
Test results can sometimes be normal, especially in patients with conditions causing painful or dysfunctional prehension, mastication and swallowing.

Other more specific laboratory tests may be required to rule out diseases suggested by the history, physical examination and initial diagnostic tests. For instance, investigating for the presence of liver disease as a cause of inappetence may require the measurement of pre- and post-feeding bile acids.

**Diagnostic imaging:** Radiography and ultrasonography are often required to detect thoracic and abdominal pathology. More advanced imaging modalities such as computed tomography (CT) or magnetic resonance imaging (MRI) may be performed if there is a suspicion of central nervous system (CNS) disease. Fluoroscopy is useful when evaluating the ability of a patient to prehend, masticate and swallow food. Additional diagnostic procedures such as endoscopy to investigate gastrointestinal disease or biopsy of abdominal organs may also be required.

**Notes on treatment**
The mainstay of treatment is aimed at identifying and correcting the underlying disease causing the inappetence. Some general rules in the management of the inappetent dog can be noted. More detail can be found in the *BSAVA Manual of Canine and Feline Rehabilitation, Palliative and Supportive Care: Case Studies in Patient Management.*

- Modification of the diet may improve palatability. Consider warming food to body temperature, adding flavoured toppings and increasing the fat content.
- As a general rule, animals should not remain inappetent or anorexic for longer than 3–5 days before alternative feeding methods (e.g. a naso-oesophageal tube, Figure 14.13) should be instigated.
- Animals with severe weight loss, hypoproteinaemia or a chronic disease likely to cause continued inappetence should ideally receive supplemental nutrition.
- An appetite stimulant for use in dogs is mirtazapine (0.6 mg/kg orally q24h).
- Analgesics may improve appetite in painful conditions.
- Anti-emetics such as metoclopramide and maropitant are useful to decrease nausea-associated inappetence.

**Weight loss**

**Definitions**
- Weight loss here refers to an unintended loss of bodyweight.
- Cachexia, often considered a state of severe weight loss, is usually secondary to a severe underlying disease.

Weight loss is a non-specific clinical sign in dogs and is caused by a multitude of conditions. Weight loss may occur due to decreased nutrient intake, increased loss of nutrients, increased nutrient use, malabsorption or malassimilation (Figure 14.14). Weight loss of >10% of bodyweight is particularly significant.

**PRACTICAL TIP**
If other problems with a more defined list of differential diagnoses (e.g. PU/PD, polyphagia, jaundice) are also present, they should be investigated first.
History

Figure 14.15 provides an overview of the diagnostic approach to the dog with unintended weight loss. It is vital to determine whether the dog has a history of a normal, increased or decreased appetite. Weight loss despite a good appetite usually indicates maldigestion, malabsorption, increased utilization or physiological factors.

A complete dietary history is required in order to determine nutrient intake, the type and quantity of food consumed and any changes to the diet. The caloric value of the diet should be noted and the dog’s resting energy requirement (RER) calculated (see Chapter 4) to determine whether sufficient food is being fed.

- Questions should also be asked about the dog’s environment, with particular reference to competition for food in a multi-animal household.
- Information on the patient’s activity and environment can help to determine calorie expenditure.
- The dog’s history should be reviewed for evidence of dysphagia, regurgitation, vomiting, or increased use of calories (e.g. pregnancy, lactation, a cold environment, exercise).
- Questions should be asked about the consistency of the faeces to indicate whether malabsorption may be present.

### Decreased nutrient intake
- Anorexia
- Poor-quality diet
- Underfeeding
- Competition for food
- Dysphagia, regurgitation, vomiting

### Increased nutrient loss
- Protein-losing enteropathy
- Protein-losing nephropathy
- Intestinal parasites
- Neoplasia
- Chronic blood loss (epistaxis, haematemesis, haematuria, melaena)
- Diabetes mellitus
- Effusions

### Increased nutrient use
- Neoplasia
- Physiological (e.g. cold environment, exercise, fever, pregnancy, lactation)

### Malassimilation
- Hepatic failure
- Cardiac failure
- Renal disease
- Hypoadrenocorticism
- Neoplasia

### Causes of weight loss in dogs.

#### Decreased nutrient intake
- Anorexia
- Poor-quality diet
- Underfeeding
- Competition for food
- Dysphagia, regurgitation, vomiting

#### Increased nutrient loss
- Protein-losing enteropathy
- Protein-losing nephropathy
- Intestinal parasites
- Neoplasia
- Chronic blood loss (epistaxis, haematemesis, haematuria, melaena)
- Diabetes mellitus
- Effusions

#### Increased nutrient use
- Neoplasia
- Physiological (e.g. cold environment, exercise, fever, pregnancy, lactation)

#### Malassimilation
- Inflammatory and infiltrative small intestinal disease
- Lymphangiectasia
- Severe intestinal parasitism
- Exocrine pancreatic insufficiency

### Diagnostic approach

**History**

- Questions should also be asked about the dog’s environment, with particular reference to competition for food in a multi-animal household.
- Information on the patient’s activity and environment can help to determine calorie expenditure.
- The dog’s history should be reviewed for evidence of dysphagia, regurgitation, vomiting, or increased use of calories (e.g. pregnancy, lactation, a cold environment, exercise).
- Questions should be asked about the consistency of the faeces to indicate whether malabsorption may be present.

#### Causes of weight loss in dogs.

**14.14** Causes of weight loss in dogs.

**14.15** A diagnostic approach to the dog with unintended weight loss. ACTH = adrenocorticotrophic hormone; CBC = complete blood count; CNS = central nervous system; EPI = exocrine pancreatic insufficiency; RER = resting energy requirement; TLI = trypsin-like immunoreactivity.
Other historical findings such as PU/PD, lethargy, vomiting, exercise tolerance, coughing, changes in body size and neurological signs may help to identify an underlying disease.

**Physical examination**

Physical examination should include measurement of bodyweight, body condition score (see Chapter 4) and an assessment of muscle wasting. Bodyweight can be compared against historical data for the dog to determine the exact amount of weight lost. Muscle wasting is assessed by palpating over the skull and scapulae, as well as palpation of the longissimus and gluteal muscles.

A complete physical examination should be performed to identify abnormalities that might help localize the problem to a particular organ or body system. Fever suggests an underlying infectious, inflammatory or immune-mediated disease. Lack of fever is more consistent with metabolic causes of weight loss such as renal, hepatic, cardiac or gastrointestinal disease.

**Diagnostic tests**

A CBC, serum biochemistry and urinalysis are the most useful initial screening tests to identify the presence of an underlying disease such as organ failure or inflammation. Abnormalities will vary with the different underlying diseases causing weight loss.

Test results can sometimes be normal, especially in patients with decreased nutrient intake leading to weight loss.

Other more specific laboratory tests may be required, determined by the most likely differential diagnoses, on the basis of findings on the history, physical examination and initial diagnostic tests. The following is a suggested list of further investigations when considering the dog with weight loss:

- Thoracic and abdominal imaging to detect neoplasia or the presence of systemic disease
- Examination of serial (ideally three) faecal samples, for intestinal parasites
- Measurement of pre- and post-feeding bile acids, to rule out liver dysfunction
- Determination of UPC ratio, to detect protein-losing nephropathy
- ACTH stimulation test in dogs with intermittent lethargy, gastrointestinal signs and/or PU/PD

**Measurement of serum TLI for dogs with polyphagia and/or diarrhoea**

**Gastrointestinal endoscopy and biopsy to identify inflammatory and infiltrative small intestinal disease and lymphangiectasis. The majority, but not all, patients with these disorders will have diarrhoea and/or vomiting**

**Echocardiography in animals with suspected cardiac disease, even if thoracic radiographs are normal**

**Evaluation of the CNS for causes of anorexia or infectious, inflammatory or neoplastic diseases leading to weight loss.**

**PRACTICAL TIPS**

- If the cause of weight loss remains undetermined, daily physical examination should be carried out to localize any disease
- For example, pyrexia may be intermittent in some animals with immune-mediated or inflammatory disease. In the older animal with unexplained and significant weight loss, neoplasia is the major differential diagnosis. In such cases, one may have to wait until the tumour progresses enough to be detectable

**Treatment**

The most important consideration is to treat the underlying cause of the weight loss.

Additionally, appropriate nutritional support should be provided, based on the dog’s RER. If the dog is able to ingest, digest and absorb nutrients, oral nutrition is the preferred route. If the dog is unable or unwilling to ingest food, but can digest and absorb nutrients, enteral nutrition should be provided. Methods for providing enteral nutrition include the use of a naso-oesophageal, oesophageal or gastrostomy feeding tube (see *BSAVA Guide to Procedures in Small Animal Practice* for details).

**References and further reading**


Testing for hyperadrenocorticism: some important considerations

**ACTH stimulation test**
Details of how to perform this test can be found in the *BSAVA Guide to Procedures in Small Animal Practice*.
The ACTH stimulation test only reliably identifies ~50% of dogs with adrenal-dependent disease and ~85% of dogs with pituitary-dependent disease. This means that significant numbers of cases will be missed if only an ACTH stimulation test is performed. Moreover, this test incurs false-positive results relatively frequently. For example, dogs with 'chronic stress' due to the presence of another disease may have adrenal gland hyperplasia and thus an abnormal ACTH test response.

**Low-dose dexamethasone suppression test**
Details of how to perform this test can be found in the *BSAVA Guide to Procedures in Small Animal Practice*.
The LDDS test is more reliable than the ACTH test in confirming hyperadrenocorticism, as the results are diagnostic in the majority of adrenal-dependent cases and in ~90–95% of pituitary-dependent disease. However, the LDDS test is also prone to false-positive results, generally due to stress during the 8-hour period over which the test is performed.

**PRACTICAL TIP**
In a patient that becomes stressed during hospitalization, consideration should be given to sending the animal home during the period between blood sampling.

**Adrenal gland ultrasonography**
Adrenal gland ultrasonography is an important technique to aid the diagnosis of hyperadrenocorticism. The adrenal glands of a dog with pituitary-dependent hyperadrenocorticism (PDHAC) are symmetrically enlarged; a thickness of >7.5 mm for the left adrenal gland is considered to provide the best sensitivity and specificity as a diagnostic test for PDHAC. However, increases in adrenal gland thickness are not specific enough to warrant the use of adrenal ultrasonography as a screening test for hyperadrenocorticism, as there is considerable overlap between normal and hyperplastic adrenal glands.

Adrenal gland hyperplasia can occur in animals with chronic stress, such as in a variety of diseases including diabetes mellitus and pyometra.

If one adrenal gland is enlarged, and the other is hypoplastic, especially if the larger gland is asymmetrical or invasive, this supports a diagnosis of adrenal-dependent hyperadrenocorticism.

Ultrasoundograms of the bilaterally enlarged (a) left and (b) right adrenal glands in a dog with PDHAC. Note that the shape of the glands is bilaterally preserved; however, both glands appear 'plump'. Asterisks indicate the long axis of the gland. Reproduced from the *BSAVA Manual of Canine and Feline Ultrasonography*. 

Ultrasonograms of the bilaterally enlarged (a) left and (b) right adrenal glands in a dog with PDHAC. Note that the shape of the glands is bilaterally preserved; however, both glands appear 'plump'. Asterisks indicate the long axis of the gland. Reproduced from the *BSAVA Manual of Canine and Feline Ultrasonography*. 

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The lame dog is one of the more common presentations to first-opinion vets and any vet working in a busy general practice will be faced with such a case on a daily basis. Rather than a systematic review of all causes of lameness (which is covered elsewhere – especially the BSAVA Manual of Canine and Feline Musculoskeletal Disorders), this chapter will focus on the initial approach to the lame dog, to help the clinician develop a list of the common differential diagnoses for further investigation and treatment. Neurological causes and generalized weaknesses that may present with a gait abnormality are dealt with in Chapters 11 and 17. Lameness associated with acute trauma (such as a road traffic accident) is of secondary concern to the assessment and stabilization of the traumatized patient, which is considered in Chapter 10. Essentially, this chapter will consider the approach to the orthopaedic patient.

The aim of the first-opinion 10-minute consultation should be to work through the following plan:

1. Is the dog lame?
2. Which limb is affected?
3. Gathering baseline data.
4. The seat of pain – which part of the limb is affected?
5. What are the most common differentials?
6. What further investigations or treatment are appropriate?

**Observation**

**Definition of lameness**

For the purposes of this chapter, lameness will be considered to be: reduced or absent use of one or more limbs, associated with discomfort.

With moderate to severe unilateral lameness the affected limb will be readily apparent as the animal hobble into the consulting room. However, observation should begin as early as possible: preferably with the posture of the dog as it sits in the waiting room and how it rises as the client is called. For example, dogs with stifle discomfort will often sit on one haunch with both hindlegs to one side of the body (Figure 15.1) because the full flexion of the stifle required to sit normally will be painful.

Watching how the dog moves (from behind, in front and from the side) in straight lines and turning can be very useful, but should always be on a flat surface. For subtle lameness this may be the best way to identify which leg is affected (this may differ from the owner’s opinion).

With any lameness the dog will be willing to place more weight on the unaffected leg(s):

- For the forelimb, this will mean that as the sound leg contacts the ground the dog’s head will sink, but as the painful leg bears weight the dog’s head will rise.
- For hindlimbs, the gluteal region will lift as the painful leg strikes the ground.
- With bilateral hindlimb lameness, there may be ‘bunny hopping’, which is particularly noticeable with increased speed of movement.
- Young dogs with bilateral forelimb disorders (e.g. medial compartment elbow disease) may have a shuffling gait or seem alternately lame on each limb.
Observation of the moving dog should also note the passage of the affected leg through the swing phase:

- Is it flicked out?
- Is it swung laterally, to avoid flexion of the joints required to maintain normal sagittal movement?

There may also be hints (such as ataxia, weakness or spasticity) that the problem may be something other than orthopaedic (see relevant chapters).

**History: baseline data**

Clinical training in the university environment usually involves extremely thorough history-taking, relating not just to the presenting condition but to all aspects of the animal and its environment. Whilst the importance and value of such a thorough approach should not be underestimated, it is time-consuming beyond the scope of most first-opinion consultations and will often merely duplicate data already in the clinical records. Instead, it is important to establish the key facts relating to the presenting complaint, expanding as required, and reserve a full history for those cases that require significant further investigation. With experience these data may be obtained in tandem with the clinical examination for greater efficiency.

The most important points to be addressed for a lame dog include:

- **Age:** Is the patient:
  - A skeletally immature dog: Raises the suspicion of a developmental disorder:
    - Most developmental disorders will become apparent at 5–8 months
    - Skeletal maturity can be considered to be present at 12 months (up to 15 months in giant breeds)
  - A young adult (typically 1–6 years): Trauma is more likely
  - An older dog: Osteoarthritis is likely
- **Breed:** Certain conditions are more common in specific breeds, which can affect how much weight should be given to a specific differential.
  - For example, hip dysplasia is rife amongst German Shepherd Dogs, but rarely, if ever, seen in Greyhounds
- **Duration:** When did the owner first notice the problem and has it been constant since then?
  - This should be viewed in light of the physical examination, and the degree of muscle atrophy present, which might conflict with the reported onset. For example, a dog with cruciate disease may have been lame for several months, with a marked degree of muscle atrophy, but may only be presented by the owner when that lameness worsens suddenly, as the ligament finally snaps completely or the meniscus tears
- **Was there an obvious inciting cause?**
  - There may be a history of obvious trauma or acute lameness after vigorous exercise
  - An owner may relate the lameness to a less specific insult that resulted in worsening of a previously unnoticed condition

**Is there any history of previous orthopaedic problems (in the affected limb or another limb) or past trauma?**

- Can the owner describe the lameness? For example:
  - Is the lameness worse after rest, but eases with gentle exercise (might be consistent with osteoarthritis)
  - Is the lameness constant and restrictive to exercise (might suggest a muscle problem).

**Physical examination: identifying the seat of pain**

Although time may be limited, and there is a desire to get to the cause of the problem as quickly as possible, rushing straight to the affected limb is never indicated. A lame dog is likely to be in pain and anxious; taking time to ensure that it is relaxed and comfortable in the consulting environment will greatly enhance the results of the physical examination. This time can be used for assessing the general physical state of the dog (see Chapter 3) and gathering data from the owner; it may also give an indication as to whether further restraint (or protection) is required before manipulating a painful area.

The approach taken to the examination of a limb may differ from one clinician to another, but it is vital that whatever approach is adopted, it is systematic, thorough and involves examination of the contralateral limb for comparison. The author’s preference is to work from the distal extremity of the limb proximally, and to split the examination into palpation and manipulation.

**Palpation**

*Without moving the limb,* all aspects are palpated – from the toes to the dorsal midline. This allows the identification of any particularly sensitive areas, which may then modify how the joints are examined and manipulated. For example, if long bone palpation produces a pain response, then to examine the joints at either end of the bone will necessitate manipulation without holding the painful long bone area. Also, if joint pain is identified through palpation alone then it can be predicted that manipulation of the joint will be even more painful, and flexion and extension examinations should be carried out with care.

Pain from palpation of the long bones is unusual in dogs, but is seen relatively commonly in four conditions:

- **Panosteitis** (Figure 15.2): usually affects juvenile dogs; German Shepherd Dogs are over-represented
- **Neoplasia** (Figure 15.3): middle-aged and older larger breeds usually affected; key sites of predilection are the metaphyseal regions close to the stifle and away from the elbow
- **Metaphyseal osteopathy:** metaphyses will be markedly misshapen, hot and painful
- **Physeal injuries:** e.g. Salter–Harris type II fracture (Figure 15.4)

Particular attention should be paid to the feet, as conditions of the feet and digits can be acutely
Panosteitis is one of the few common causes of bone pain. Radiographically it presents as radiodense ‘thumbprint’ lesions on the long bones (arrowed).

Primary bone neoplasia, most commonly osteosarcoma, usually affects the extremities of the long bones away from the elbow and towards the stifle. Unusually, the distal tibia was involved in this case.

Salter–Harris type II fracture of the proximal tibia. On presentation, such fractures are often remarkably stable, but there is marked pain and swelling of the metaphyseal region. Note the small bone fragment below the avulsed tibial tuberosity (white arrow) and the fracture line extending from the physis (red arrow).

Elbow effusions can be voluminous, as in this 6-month-old Golden Retriever with osteochondrosis dissecans (OCD). There is a large distension caudal to the lateral epicondyle.

Stifle effusion is easily palpated as a bulging of the joint capsule to either side of the straight patellar ligament.
Manipulation
Following palpation, examination should proceed to manipulation of the joints. This should be done in such a way as to be able to flex and extend one joint at a time, avoiding direct pressure on any previously identified sensitive regions. Joints should be carefully flexed and extended, noting: the range of motion (again, using the contralateral limb as reference); any evidence of crepitus; and any pain response.

Examining specific joints
Interphalangeal and metacarpo/tarsophalangeal joints
Injuries to the digital joints are common at any age, but especially in very energetic dogs.
- With ligament disruption or fractures there is usually obvious swelling and deformity and a history of acute onset.
- For subtle injuries it is helpful to apply pressure from all angles to each digit separately, for signs of excessive movement.
- Osteoarthritis of the interphalangeal and metacarpo/tarsophalangeal joints is often seen in older animals. The foot tends to collapse, taking on a flatter appearance with splayed digits and joint thickenings. It should not be underestimated as a cause of lameness.

Carpus
Acute trauma to the carpus is usually associated with profound and obvious swelling. Common injuries to the carpus involve hyperextension or damage to the collateral ligaments.
- Hyperextension can be assessed by extending the joint from the elbow (pushing distally on the olecranon) whilst exerting an opposing force on the palmar aspect of the foot with the other hand (Figure 15.7). Note: If there is obvious joint swelling, this is likely to be extremely painful and such examination should be carried out under sedation.
- Laxity in the collateral ligaments can be assessed by holding the foot firmly and moving from side to side; however, the carpus is a very lax joint generally, and any movement must be referenced against the normal limb.
- Carpal bone fractures are commonly seen (and will be accompanied by diffuse joint swelling and acute onset). Fractures to the proximal portions of metacarpals II and V can cause significant joint instability due to the effective avulsion of the collateral ligament.

Elbow
The elbow is a very rewarding joint to examine.
- Effusions are readily palpated, especially caudal to the lateral epicondyle.
- Deposition of new bone associated with chronic disease is easily identified as firm thickenings medially and laterally around the insertions of the joint capsule. This can be so pronounced that it is not possible to feel the fossa between the lateral epicondyle and the olecranon.
- In young dogs with medial compartment disease, the medial aspect of the joint, just distal to the medial epicondyle, can be exquisitely painful as pressure is applied directly over the region of the medial coronoid process. As the elbow is a hinge joint, it is easy to assess objectively the range of motion and the degree of flexion or extension that produces a pain response. In advanced osteoarthritis, where periarticular new bone can produce massive thickening of the joint (Figure 15.8), flexion can be severely restricted. This in turn will lead to a very clumsy gait as the leg is swung away from the body. In early elbow disease where changes may be subtle, it can be useful to flex and extend the joint in varying degrees of pronation and supination, which will affect the pressure through the medial compartment.

Shoulder
The shoulder is an unusual joint, in that movement is often minimal during walking, with the whole limb swinging in a sagittal plane through the actions of the extrinsic shoulder muscles and the majority of limb shortening to permit the swing occurring at the carpus and elbow. Shoulder lameness may therefore be much less obvious than lameness associated with the more distal joints.
- Palpation of both shoulders simultaneously (from the dorsal aspect, standing astride the dog) can be useful to detect muscle atrophy – especially in the supra- and infraspinatus muscle groups.
- Three important manipulations can be used for the shoulder to assess for a pain response:
Chapter 15 Lameness

• Cranial traction of the limb, pulling the leg forward with one hand and pushing back on the shoulder with the opposite hand. Note: This can also produce a pain response in dogs with cervical disc disease due to traction on the nerve roots.

• Caudal traction of the limb, to flex the shoulder and simultaneously palpate around the biceps tendon. In a normal joint there must be reciprocal flexion of the elbow to facilitate shoulder flexion, due to the limiting action of the biceps. With the shoulder flexed, pressure can be exerted to extend the elbow to assess the pain response through the biceps. In cases of biceps tendon rupture or avulsion of the supraglenoid tubercle, extension of the elbow with the shoulder in flexion will be possible.

• Abduction of the shoulder joint, i.e. abduction of the humerus and distal limb with the scapula held flat. This puts strain through the medial glenohumeral ligament, which is a common site of shoulder ligament injury.

Tarsus

■ Tarsal lameness is invariably accompanied by swelling (acute) or thickening (chronic) of the joint, which may significantly reduce the range of movement.

■ Injuries or degeneration of the intertarsal or tarsometatarsal joints will be accompanied by inappropriate movement of these tight joints, dorsoplantar deviation, or thickening around the supporting ligaments. Particular attention should be paid to the Achilles tendon, feeling for areas of thickening. Fractures of the proximal portion of metatarsals II and V will have a destabilizing effect similar to the carpus.

PRACTICAL TIP
The talocrural joint is remarkably mobile, and this mobility can easily be confused with ligament damage

Stifle

The stifle is the single most common joint implicated in orthopaedic lameness in the dog. A thorough examination should include:

■ Palpation for evidence of joint effusion

■ Palpation for thickening of the fibrous soft tissues around the medial collateral ligament (medial buttressing)

■ Assessment of muscle atrophy in the thigh: quadriiceps atrophy is a particular feature of stifle disease

■ Assessment of the mobility of the patella. The patella should be pushed medially and laterally, with the joint in varying degrees of flexion, to assess whether it will luxate and, if so, in which direction and at which stifle position. Patellar luxation is a very common orthopaedic disorder

■ Assessment for anterior cruciate ligament instability, using cranial drawer and tibial thrust (see QRG 15.1)

■ The joint should be flexed and extended fully, to feel for crepitus or any clicks or even clunks, the latter often associated with a tear in the medial meniscal cartilage.

■ In cases of acute lameness, especially in small terrier puppies, palpation around the tibial tuberosity should be performed to detect signs of avulsion (Figure 15.9).

PRACTICAL TIPS
When recording findings in the clinical records it is helpful to be as descriptive as possible. Lameness scales (e.g. 7/10 lame) are subjective and may vary from one observer to another, so describing the lameness may be more useful

■ Be precise about any anatomical landmarks that are associated with pain on palpation and try to quantify the degree of manipulation of a joint that produces a reaction

■ Always double check that the correct limb has been recorded, as some conditions may be bilateral and it is important for future examination to know for certain on which limb the dog was previously lame

PRACTICAL TIPS

Hip

As a true ball and socket joint, the hip should be free to move through a global range without evidence of pain. Palpation for effusion is invariably unrewarding. Pain from hip disease is most frequently encountered with the limb fully extended caudally, or abducted. It is helpful to rest one hand over the hip joint whilst the other manipulates the limb to feel for crepitus and laxity. Young dogs with markedly dysplastic hips may exhibit palpable (and sometimes audible) subluxation as the femoral head slips over the dorsal acetabular rim. In extreme cases this can be apparent by resting the hands over the hips with the dog standing and rocking the hindquarters from side to side. In less severe cases, and especially if painful, hip laxity is best assessed with the dog sedated (see QRG 15.2).

It is worth noting that many young dogs with extremely lax hips may not display overt discomfort, but may present with a “bunny hopping” gait.
**Differential diagnosis**

Common conditions associated with specific joints are listed in Figure 15.10. The suspicion of a particular condition may be raised when a susceptible joint in an over-represented breed is identified as the source of lameness (Figure 15.11).

Because of the frequency of occurrence of developmental orthopaedic disorders, it is helpful to refine the list of the more common differentials with the consideration of juvenile (<1 year old) versus adult dogs.

**Juvenile dogs**

Many young dogs presenting with lameness concurrent with acute inflammation will have an underlying developmental disorder. It is important to detect these at as early an age as possible, as this may significantly affect the outcome. Common conditions include:

<table>
<thead>
<tr>
<th>Condition</th>
<th>Breeds commonly affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medial compartment elbow disease (fragmented coronoid process; osteochondrosis dissecans, OCD)</td>
<td>Retrievers, Bernese Mountain Dog, Rottweiler</td>
</tr>
<tr>
<td>Ununited anconeal process</td>
<td>German Shepherd Dog, giant breeds (especially Great Dane, Mastiff)</td>
</tr>
<tr>
<td>Incomplete ossification of the humeral condyle</td>
<td>Spaniels</td>
</tr>
<tr>
<td>Shoulder OCD</td>
<td>Gundogs (e.g. Vizsla, retrievers)</td>
</tr>
<tr>
<td>Tarsal OCD</td>
<td>Labrador Retriever, Bull Terrier</td>
</tr>
<tr>
<td>Achilles tendinopathies</td>
<td>Can occur in any breed if traumatic; idiopathic in Dobermann</td>
</tr>
<tr>
<td>Plantar ligament disorders</td>
<td>Collies</td>
</tr>
<tr>
<td>Anterior cruciate ligament disease</td>
<td>Can occur in any breed, but very common in retrievers, Rottweiler, Mastiff, Boxer, and in small breeds with overly steep tibial plateau angles</td>
</tr>
<tr>
<td>Luxating patella</td>
<td>Medial luxation: terrier breeds, spaniels, Labrador Retriever</td>
</tr>
<tr>
<td>Tibial tuberosity avulsion</td>
<td>Very common in small terriers, especially West Highland White Terrier</td>
</tr>
<tr>
<td>Hip dysplasia</td>
<td>Found in most breeds except for racing breeds. Over-represented in retrievers, German Shepherd Dogs, spaniels</td>
</tr>
<tr>
<td>Avascular necrosis of the femoral head (Legg–Calvé–Perthes disease)</td>
<td>Small terrier breeds</td>
</tr>
</tbody>
</table>

**Digital joints**

- Fractures
- Luxations
- Ligament damage

**Carpus**

- Hyperextension injuries
- Collateral ligament tears/avulsion
- Metacarpal fractures (proximal fractures of metacarpals II or V may lead to carpal instability)
- Carpal bone fractures

**Elbow**

- Fragmented coronoid process
- Osteochondrosis dissecans (OCD) of medial aspect of humeral condyle
- Ununited anconeal process
- Incongruency
- Luxation
- Incomplete ossification of the humeral condyle

**Shoulder**

- OCD
- Medial glenohumeral ligament tears
- Bicipital tendonitis
- Luxation

**Tarsus**

- OCD
- Achilles tendinopathies
- Plantar ligament disorders
- Metatarsal fractures (proximal fractures of metatarsals II and V may lead to tarsometatarsal instability)
- Tarsal bone fractures

**Stifle**

- Anterior cruciate ligament disease
- Luxating patella
- Tibial tuberosity avulsion

**Hip**

- Hip dysplasia
- Avascular necrosis of femoral head
- Luxations
- Fractures of femoral head

**15.10** Some of the more commonly presented problems of specific joints. This list is far from exhaustive, but includes those conditions that should be excluded first in any investigation.

**Some of the more commonly presented conditions**

- Osteochondrosis dissecans (OCD)
- Joint incongruity
- Subluxations (especially the hip)
- Physeal injuries.

It is important to remember that skeletal growth is rapid and precedes the development of supporting muscle mass. Also, the supporting capsule and ligaments are considerably more elastic in juvenile dogs than in their adult counterparts. The implication of this is that a joint may feel adequately reduced and congruent on a basic examination, but may actually be quite lax when subjected to the rigours of boisterous puppy exercise. Careful questioning regarding lifestyle and diet is necessary, as owners may have been given inappropriate advice by breeders (e.g. to restrict exercise in a young growing dog of a breed susceptible to joint disease). Bone is a very plastic tissue and develops around the forces applied through it. Consequently, it is the type of exercise that is more damaging than the amount. Five minutes of bounding around the garden and jumping up and down at the fence to get to the cat next door can be far more damaging than several miles of controlled lead walking; there will be good bone-to-bone contact in the latter, with movement within an appropriate and controlled range, which will encourage good joint development.
Adult dogs
The increased muscle bulk associated with physical maturity and the decreased elasticity of supporting fibrous structures reduces the injury that can occur to joints through subluxation associated with joint laxity. Consequently, strain injuries are more common.
Occasionally, acute inflammation may still be the result of a previously quiescent developmental abnormality, for example late fragmentation of the coronoid process, but usually lameness associated with such conditions in adults will be due to the secondary osteoarthritis (see below).

Geriatric dogs
With advancing age the incidence of osteoarthritis increases. Any breed that is over-represented for a developmental disorder as a puppy should be considered to be over-represented for arthritis in that same joint when older.

Further investigations
Radiography
Radiography is the primary tool of choice for first-opinion investigation of orthopaedic disease. However, radiography of an entire limb in the absence of a thorough physical examination may be unrewarding or dangerously misleading. Rather, it should be used for further investigation of a specific painful or deformed anatomical region.
Radiographic abnormalities may be detected that do not correlate with clinical lameness. For example, moderate to advanced remodelling of the hip may be present in dogs with little or no hip pain, and may cause the clinician to overlook the subtle changes associated with a more clinically relevant condition, such as early cruciate disease (Figure 15.12).
Occasionally clients may present a young dog with acute-onset lameness following an apparent inciting cause. Examination may reveal a painful swollen joint and the decision to move straight to radiography may be hard to justify before empirical treatment (rest and anti-inflammatory medication) has ruled out a sprain injury. More frequently, however, a young dog is presented with a history of several days (or even weeks) of intermittent or persistent lameness, with pain localized to a specific joint on examination. In these cases it is almost always justified to admit the dog for examination and radiography under sedation. Such cases may be very early in the course of a developmental disorder and radiographic changes may be subtle. It is important to obtain good quality images that are well positioned (Figure 15.13) and appropriately collimated and exposed, in order to increase the likelihood of a diagnosis (see BSAVA Manual of Canine and Feline Radiography and Radiology). Further opinions from more experienced colleagues should be sought, if in doubt; they will also be able to advise on the limitations for further investigation and treatment within the individual practice and when referral may be necessary.

In younger adult dogs with lameness associated with a specific anatomical region and minimal gross thickening, the presumptive diagnosis of a sprain or strain injury may be top of the list of differentials, and empirical treatment is frequently justified. However,
such cases should always be re-examined 10–14 days later (sooner if lameness is especially marked) and the clinician should be open-minded about reconsidering the previous diagnosis.

Osteoarthritis as a diagnosis for lameness is more common with increasing age, but can also mask other conditions. Sudden-onset lameness, or worsening of a previously noted lameness, may be associated with a flare-up of a previously diagnosed condition – or with something new. Again, radiography is the initial diagnostic tool, with the expectation that there may be signs of chronic articular changes. However, the older, arthritic patient is also more likely to be affected by problems of other body systems and the investigation of lameness may need to run hand-in-hand with the investigation of other, apparently unrelated, conditions.

**Treatment**

A detailed discussion of treatment for specific conditions can be found in the BSAVA Manual of Canine and Feline Musculoskeletal Disorders. However, it is worth emphasizing two general areas here.

**Hip dysplasia**

In young dogs with lameness, or breeds susceptible to joint problems, type of exercise can significantly affect the development of a condition. This is most clearly demonstrated with the hip joint. In hip dysplasia (Figure 15.14), joint laxity allows the femoral head to subluxate from the acetabulum and impact on the dorsal acetabular rim. This has two detrimental effects: damage to the acetabular rim and femoral head, due to concussive injury of weight-bearing through a reduced surface area; and failure to convey weight-bearing through the articular surfaces, which is necessary for the correct formation of the coxofemoral joint.

Increased uncontrolled boisterous exercise, which might result, for example, from an owner trying to restrict exercise by allowing a dog only to play in the garden, will lead to excessive subluxation and joint damage. Increasing controlled exercise, through lead walking, will promote appropriate weight-bearing and joint development. As a general rule of thumb for any young growing dog, lead walking is beneficial, off-lead play is not; exuberant puppy energy is best diverted to on-lead walks.

**Osteoarthritis**

Osteoarthritis (OA) may be the result of:

- Wear and tear on a normal joint (normal loading of normal joint)
- Normal wear of an abnormal joint (e.g. in joint incongruency)
- Abnormal wear of a normal joint (e.g. the result of injury or excessive high-performance exercise, or the increased demands placed on a joint by obesity)
- Abnormal wear of an abnormal joint (obesity, injury or excessive exercise superimposed on a joint with imperfect development).

The first of these is common in humans but very rare in dogs, whereas the other three are much more frequently encountered in the veterinary consulting room, and dogs may develop almost crippling degenerative joint disease at a comparatively young age. There are three golden rules for the treatment of osteoarthritis.

- **Control joint inflammation to relieve pain:**
  - This is achieved primarily through the judicious use of non-steroidal anti-inflammatory drugs (NSAIDs):
    - A short course may be used to reduce inflammatory flare-up to a quiescent state
    - Lifelong medication may be needed for refractory cases.

**15.14** Hip dysplasia is essentially increased elasticity of the coxofemoral joint. *(a)* Whilst the joint may have the ability to be congruent, *(b)* weight-bearing allows the femoral head to subluxate so that weight-bearing is focused through a much reduced joint surface area.
Control exercise:
- Thick leathery joint capsules, which are often calcified at their insertions on the bones, are much less resilient to the normal wear and tear of exercise.
- Hyperextension or sudden shearing motions (such as may be encountered in uncontrolled, vigorous exercise) may lead to tearing of fibres in the capsule due to reduced elasticity, causing pain and inflammation.
- Conversely, inactivity leads to stiffness and atrophy of supporting muscles.
- Exercise is therefore very important for arthritic patients, but should be tailored to what is appropriate for a particular condition, and varied if the condition changes (Figure 15.15).

Control bodyweight:
- The peak vertical force that passes through a joint during walking massively exceeds the weight of the dog.
- Reducing excess weight will reduce the force that a damaged joint has to sustain.

<table>
<thead>
<tr>
<th>Grade of lameness</th>
<th>Type of exercise</th>
<th>Method</th>
<th>Patient example</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>No exercise; passive physiotherapy only</td>
<td>Cage rest/hospitalization</td>
<td>Articular fracture pending surgery</td>
</tr>
<tr>
<td>6</td>
<td>Minimum, low-impact</td>
<td>Short toileting walks only</td>
<td>Immediately after arthritic surgery</td>
</tr>
<tr>
<td>5</td>
<td>Supervised, controlled</td>
<td>High frequency, short duration walks</td>
<td>Recuperation after articular surgery; arthritis flare-up</td>
</tr>
<tr>
<td>4</td>
<td>Lead-controlled</td>
<td>Decreased frequency, longer duration walks</td>
<td>Progression of the above, as condition improves</td>
</tr>
<tr>
<td>3</td>
<td>Extended, lead-controlled</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Supervised, off-lead</td>
<td>NB Warm up and wind down on the lead</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Supervised, free</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>Unrestricted</td>
<td>Uncontrolled environment</td>
<td>Healthy dog</td>
</tr>
<tr>
<td>-1</td>
<td>Performance</td>
<td>Agility, etc.</td>
<td>Healthy high-performance dog</td>
</tr>
</tbody>
</table>

This is the ‘Holy Trinity’ of arthritis treatment; although there may be many other treatment options (e.g. physiotherapy, acupuncture) they remain as adjuncts to the above and should never be substituted for any of those three. This can require tactful discussions with clients. Controlling exercise and weight management in their dog requires significant input by the owner and often a lifestyle change. Also, NSAIDs can be perceived as ‘nasty’ drugs and clients may be keen to look for a ‘safer, natural’ alternative. Nutraceuticals may have a role in the treatment of arthritis in dogs, but research has shown little benefit over placebos in many trials (Vandeweerd et al., 2012). The ability to rebuild the structure of damaged articular cartilage will be limited in many canine arthritic patients, which often have severe erosion of the cartilage due to focused weight bearing on a small joint surface due to incongruency (Figure 15.16).

15.16 Arthroscopic view of the elbow in a 6-month-old Labrador Retriever, showing joint incongruency with severe cartilage destruction.

References and further reading
**QRG 15.1 Assessment of anterior cruciate instability**

This is achieved by demonstrating cranial translocation of the tibia (i.e. movement of the tibia cranially with respect to the femur) with the joint held at a fixed degree of flexion. It should be performed with the joint at varying angles, but the joint should neither flex nor extend during the test. This can usually be carried out with the dog conscious, but in painful, tense or fractious animals may be facilitated by sedation. There are two techniques.

**Cranial drawer test**

This test should be performed with the joint in varying degrees of flexion, but the joint should always be static during the test.

1. With the dog in lateral recumbency, hold the distal femur firmly with one hand by placing the thumb behind the lateral fabella, the forefinger on the patella, and supporting the distal femur and thigh with the rest of the hand.

2. Use your other hand to hold the proximal tibia firmly, placing the thumb behind the head of the fibula, the forefinger on the tibial tuberosity and supporting the proximal tibia and crus with the rest of the hand.

3. With the joint held such that it will neither flex nor extend, attempt to move the tibia cranially with respect to the femur, as if pulling a drawer forwards. In normal joints there is a small amount of movement and an abrupt stopping point as the cruciate ligament becomes taut. When there is damage to the ligament there will be excessive movement, which will gradually become tighter as the joint capsule becomes taut to limit the movement.

**Anterior tibial thrust**

1. Use one hand to hold the stifle joint to prevent flexion or extension, by seating the patella in the cup of the hand, supporting the joint with the fingers and thumb, but extending the forefinger down the tibial tuberosity.

2. Lower the stifle towards the table and push the femur proximally (the hand on the pelvis preventing movement of the dog). These actions allow abduction of the femoral head so that it rides up on to the dorsal acetabular rim.

3. Maintaining the proximal thrust on the femur, rotate the limb away from the plane of the table until the femoral head slips back over the dorsal acetabular rim and reduces into the acetabulum. This sudden reduction is accompanied by a palpable, and often audible ‘thud’, which is referred to as the Ortolani sign.

Notes:
- This laxity and the Ortolani sign can also be demonstrated bilaterally with the dog in dorsal recumbency and the femurs forced perpendicularly towards the table.
- However, the benefit of assessing each joint individually is that the degree of laxity when the femoral head abducts from the acetabulum can be felt with the overlying thumb.
- With experience this measurement, whilst still subjective, can be quite accurate.

**QRG 15.2 Assessing hip laxity**

This is best performed with the dog sedated and can be combined with radiography of the hips.

1. With the dog in lateral recumbency, flex the stifle to allow the distal femur to be grasped in one hand.

2. Rest your other hand over the pelvis, with the thumb over the greater trochanter of the femur.

3. Grasp the foot with your other hand, and gradually flex the hock (whilst always holding the stifle in a fixed degree of flexion).

4. With a normal joint there will be no movement in the stifle during attempts to flex the hock. With anterior cruciate instability there will be cranial translocation of the proximal tibia (detected by the forefinger on the tibial tuberosity) when the hock is flexed.
Paralysis and spinal pain

Alex Gough

Spinal disease is a common presentation in practice. Dogs with spinal disease can present with a range of signs, including pain (which can sometimes be quite difficult to localize), ataxia, and paresis or paralysis.

Presentations that require emergency attention include:

- Severe pain
- Paralysis or marked paresis
- Trauma that is known to or might involve damage to the vertebrae.

Obtaining a detailed history and a careful physical examination are essential in formulating a differential diagnosis, localizing the lesion and giving a prognosis. Some cases of inability or reluctance to move will be due to weakness (see Chapter 17) or pain rather than neurological conditions.

History

History-taking should include the recent general health of the animal (e.g. appetite, thirst, weight loss, exercise tolerance, cough, breathing difficulties, vomiting, diarrhoea) as well as previous ill health, vaccination status and parasite control. Any history of foreign travel or exposure to toxins should be ascertained. Historical data important in the investigation of the suspected spinal patient include urinary function, such as continence and ability to void consciously. Episodes of crying out for no apparent reason, or unusual behaviour, may suggest that pain is a feature of the condition. Speed of onset and progression of the disease are important in compiling a differential diagnosis list. For example, degenerative conditions such as degenerative myelopathy tend to be chronic and progressive, whereas a vascular event such as a fibrocartilaginous embolism is more likely to be acute, with slow improvement.

Definitions

- Ataxia refers to a failure of muscle coordination, and can be vestibular, cerebellar or proprioceptive (due to lesions in the forebrain, brainstem, spinal cord or peripheral nerve)
- Paralysis, or the suffix -plegia, refers to an inability to initiate movement
- Paresis refers to a reduced ability to initiate movement
- Monoparesis or monoplegia involves only one limb
- Hemiparesis or hemiplegia involves one side of the body
- Paraparesis or paraplegia involves the pelvic limbs
- Tetraparesis, quadriplegia or quadriplegia involves all four limbs

Clinical examination

A full neurological examination should be undertaken, including cranial nerve assessment (see also Chapters 11 and 21).

Notes on handling

- A dog with a suspected spinal cord injury should be handled sympathetically. Many cases will be in marked pain, and there is a risk of injury to owners and clinicians from aggressive behaviour
- Every effort should be made to prevent movement of the spinal column, but it is accepted that moving a patient for investigation and treatment is necessary, and can be carried out using a spinal board (if the patient will tolerate this without struggling), stretcher or blanket
- Once a patient is sedated or anaesthetized, intrinsic immobilization of the spinal column from the musculature is abolished, and it is vital at this stage that movement of the spinal column is minimal. Therefore the patient should only be sedated or anaesthetized once it has been transferred to a flat surface or a stretcher.
Observation
Specific examination of the patient with suspected spinal disease should include assessment of posture (e.g. there may be a wide-based stance) and gait. Lameness, paresis/paralysis and ataxia should be differentiated by observation of the dog walking:

- A dog with lameness due to pain will exhibit a shortened stride or even carry the affected limb
- A dog with paresis will often drag the limb.

Occasionally, lameness can be due to a neurological lesion affecting the nerve root ('nerve root signature', i.e. referred pain causing lameness or elevation of the limb). Bilateral lameness can cause signs that mimic neurological disease. Ataxic patients lack coordinated movement (see also Chapter 11). Patients with gait problems due to orthopaedic problems are discussed in Chapter 15.

Testing proprioception
After observation, the patient should be assessed for conscious proprioception. This can be done in a number of ways, including:

- Placing the dog’s foot on a piece of paper and sliding it sideways
- Hopping (picking up three of the dog’s feet to make it hop)
- Hemi-walking (picking up two feet on the same side and letting it hop sideways)
- ‘Wheelbarrowing’ (picking up the hindlegs and walking the dog forwards)
- Tactile placing (letting the dorsal part of the dog’s feet touch the side of a table while its eyes are covered).

The author’s preferred first method is to turn each foot over in turn so that the dorsal foot is in contact with the ground or table top (the knuckling test). It is important that this is done gently, so as not to elicit a withdrawal response, and that only the foot is moved, to avoid stimulation of receptors in other joints.

PRACTICAL TIP
It is important to make an allowance for the reluctance of a lame animal to return its foot to a normal position because of pain. Supporting the animal’s weight while performing the knuckling test (Figure 16.1) can help reduce this problem.

In all of these tests, a normal dog will return its leg to a normal position under its centre of gravity. A dog with poor proprioception will show a delayed response, leading to a slow or absent return to a normal position after knuckling (Figure 16.1) or the paper-slide test, or the limb moving a significantly long way beyond the centre of gravity on hopping and hemi-walking tests. Multiple tests of proprioception may be necessary, especially in equivocal cases.

Testing spinal reflexes
The spinal reflexes can be assessed next.

The most important reflex is the pedal withdrawal reflex. Pinching firmly between the pads with thumb and forefinger should lead to a firm withdrawal, involving flexion of all the joints. The amount of pressure and the strength of withdrawal can be assessed in this way. This is a useful test for sciatic nerve function.

The panniculus (cutaneous trunci) reflex is tested by pinching the skin just lateral to the spine on both sides with artery forceps, starting from the lumbosacral region and working cranially, one vertebra at a time. A normal reaction is a skin twitch. The sensory pathways of this reflex are the spinal nerves from T11 to L1, so any lesion caudal to L1 will display a normal reflex. Note: The efferent arm of this reflex is the lateral thoracic nerve, so an absence of motor function of the panniculus reflex can be due to a lesion at the level of cord segments C8 to T1, which can mislead as to the localization.

The patellar reflex is easily performed: with the animal in lateral recumbency, the upper limb is tested. The patellar ligament is struck briskly with a reflex hammer (Figure 16.2). A normal response is a single, quick extension of the stifle. Absence may indicate a spinal lesion at L4–L6, or the femoral nerve root, but dogs over the age of 10 years and dogs with stifle pathology may also have an absent patellar reflex (Levine et al., 2002).

It is important to make an allowance for the reluctance of a lame animal to return its foot to a normal position because of pain. Supporting the animal’s weight while performing the knuckling test (Figure 16.1) can help reduce this problem.

The perineal reflex is assessed by gently stroking the perineum on the right and the left. A normal response is contraction of the anal sphincter and flexion of the tail.

Other reflex tests such as triceps and gastrocnemius can be performed, but are less important. Although specific reflex tests can accurately localize a
lesion, what is more important in the initial assessment of a case is deciding whether the reflexes are generally reduced, reduced in one specific limb, or are normal. This can help localize a lesion to one of four spinal locations (see Figure 16.3), but also helps to differentiate central from peripheral lesions.

**PRACTICAL TIPS**

- Reduced spinal reflexes in all four limbs is suggestive of a polyneuropathy, but it is important to distinguish muscle weakness from neurological disease.
- A dog with muscle weakness and no neurological disease may have weak spinal reflexes, but will have normal conscious proprioception.

**Pain assessment**

Once non-painful procedures have been concluded, the next step is to assess the dog for neck and spinal pain. This can be done by firmly palpating the vertical and lateral spinal processes to assess for an aversive reaction.

**Neck pain** should also be assessed by flexing the neck. A young dog without neck pain should be able to put its nose flat along its flank. Although the dog should not be forced into this position, some reasonable pressure to overcome the dog’s natural resistance to performing this task is acceptable. Some dogs, particularly those with a history of previous neck pain, will not tolerate this procedure. In these cases, assessing their ability to move their head in all directions as they track a piece of food can be a useful substitute.

**WARNING**

It is important not to ventroflex the neck of young, small-breed dogs, because this could be dangerous in the presence of atlantoaxial subluxation.

**PRACTICAL TIP**

In older dogs, spinal arthritis and spondylosis may limit the range of neck motion.

**Lumbosacral pain** can be difficult to differentiate from hip pain. One slightly awkward method of assessing the presence of lumbosacral pain is for the vet to elevate both hindlegs off the ground while using their chin to press down on the lumbosacral region. Another, easier, method is to elevate the tail firmly, which puts pressure on the lumbosacral joint.

Palpation and manipulation of the dog’s limbs and spine also allows assessment of bony deformities, strength and muscle tone, and whether there is any evidence of atrophy. Palpation and manipulation of the tail should be performed to assess for pain. An orthopaedic assessment should also be performed to rule out conditions that might mimic neurological disorders, such as bilateral cruciate rupture or bilateral luxating patellas.

Finally, **deep pain** can be assessed. This is not necessary in a dog that has a good superficial pain response or voluntary motion in all four limbs; deep pain is expected in these cases and it is not necessary to inflict a painful test. However, in cases where there is paralysis, the deep pain test gives important prognostic information. The test for pain can be started with a relatively gentle aversive stimulus to the distal extremity of a foot, such as a pinch, and progressed in the face of a negative response with increasing pressure. A true negative deep pain response can only be confirmed with the force of applying large haemostats to the metacarpals or to the periosteum of a toe. A positive response involves conscious recognition of the stimulus, such as movement of the head, vocalization, or even just a change in respiratory pattern.

**PRACTICAL TIP**

Withdrawal of the limb during a deep pain test is not a positive response. It is a spinal reflex, and gives no information on whether the spinal cord is intact.

**Lesion localization and severity**

Establishing whether a lesion involves upper motor neurons (UMNs) or lower motor neurons (LMNs) is important to aid localization (Figure 16.3).

- **UMN lesions**: Damage to the upper motor neurons, which send inhibitory messages within the spinal cord, causes increased muscle tone.

<table>
<thead>
<tr>
<th>Spinal segments affected</th>
<th>Forelimb findings</th>
<th>Hindlimb findings</th>
<th>Other abnormalities</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1–C5 UMN signs</td>
<td>UMN signs</td>
<td>Ipsilateral Horner’s syndrome may be present. May see urinary retention and respiratory difficulty in severe cases. Cervical pain often present</td>
<td></td>
</tr>
<tr>
<td>C6–T2 LMN signs</td>
<td>UMN signs</td>
<td>Ipsilateral Horner’s syndrome may be present. May see urinary retention and respiratory difficulty in severe cases. Panniculus reflex may be absent if C8–T1 segment affected</td>
<td></td>
</tr>
<tr>
<td>T3–L3 Normal</td>
<td>UMN signs</td>
<td>Schiff–Sherrington phenomenon may be observed. Panniculus reflex reduced or absent caudal to the level of the last intact dermatome. Thoracolumbar spinal pain may be present. May see urinary retention</td>
<td></td>
</tr>
<tr>
<td>L4–S3 Normal</td>
<td>LMN signs</td>
<td>Lumbar spinal pain may be present. L4–L6 lesion: may see urinary retention and reduced or absent patellar reflex; intact withdrawal reflex. L6–S3 lesion: withdrawal reflex may be reduced or absent; patellar reflex may be increased; perineal reflex may be decreased; urinary incontinence may be present</td>
<td></td>
</tr>
</tbody>
</table>

**16.3** Neurolocalization of spinal lesions.
Paralysis and spinal pain

Chapter 16

Paralysis and spinal pain

and normal or hyper-reflexia, because inhibition from higher areas of the central nervous system has been removed.

- LMN lesions: Damage to the lower motor neurons causes muscle weakness and hyporeflexia, because there is interference with the motor neuron that directly supplies the skeletal muscle. In chronic cases, muscle atrophy will be more pronounced in LMN lesions.

Historical clues can often help narrow the diagnosis to one of these categories. For example:

- Neoplastic or degenerative diseases tend to be slowly progressive (although they can be acute, such as in the case of spinal cord compression due to extrusion of a degenerate intervertebral disc)
- Inflammatory diseases (such as meningoencephalitis of unknown origin) tend to be progressive, but more rapidly so than degenerative conditions
- Vascular diseases (such as an intracranial infarct or haemorrhage) tend to have a sudden onset and then slowly improve.

Signalment can also help narrow the differential diagnosis list. For example:

- Small-breed chondrodystrophic dogs are prone to intervertebral disc disease
- Cavalier King Charles Spaniels are prone to syringomyelia
- Young dogs (<2 years old) are less likely to suffer from degenerative intervertebral disc disease.

Figure 16.5 lists some of the common causes of spinal pain, paresis and paralysis. Other conditions mimicking spinal disease, such as orthopaedic disease or conditions that cause weakness, ataxia or cerebellar disease should also be considered (see Chapters 15 and 17).

DAMNIT-V classification of diseases

<table>
<thead>
<tr>
<th>Category</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>D: Degenerative</td>
<td>Degenerative myelopathy, Lumbosacral disease, Cervical spondylomyelopathy, Intervertebral disc disease</td>
</tr>
<tr>
<td>A: Anomalous</td>
<td>Atlantoaxial subluxation, Syringomyelia</td>
</tr>
<tr>
<td>M: Metabolic</td>
<td>Primary or metastatic tumours</td>
</tr>
<tr>
<td>N: Neoplastic</td>
<td>Discospondylitis, Meningoencephalitis of unknown origin</td>
</tr>
<tr>
<td>I: Infectious, Inflammatory, Immune-mediated, Idiopathic</td>
<td>Traumatic disc disease, Spinal fracture or luxation</td>
</tr>
<tr>
<td>T: Toxic, Traumatic</td>
<td>Fibrocartilaginous embolism</td>
</tr>
<tr>
<td>V: Vascular</td>
<td></td>
</tr>
</tbody>
</table>

As well as lesion localization, assessing severity is important because of the prognostic information it provides. Figure 16.4 shows one system for grading the severity of spinal lesions. In general, the prognosis is better for paraparesis than paraplegia, better for UMN than LMN signs, and is poor if deep pain sensation is lost.

Schiff–Sherrington phenomenon

This phenomenon (hyperextension of the forelimbs with paralysis of the hindlimbs) is due to damage to the ascending tracts of the UMNIs, and is caused by a lesion caudal to the forelimbs. Proprioception is retained in the forelimbs in these cases. This phenomenon has been traditionally associated with a poor prognosis, but in fact can be observed in many cases of thoracolumbar spinal injury, and should not be taken as a poor prognostic indicator in isolation.

Differential diagnosis

Once the location and severity of a lesion has been determined, the differential diagnoses should be considered. It can be helpful to classify these according to the DAMNIT-V (VITAMIN-D) (or similar) pathological classification system.

Grade | Features
---|---
1 | Pain but no neurological deficits
2 | Ambulatory paresis
3 | Non-ambulatory paresis
4 | Non-ambulatory paralysis
5 | Non-ambulatory paralysis with loss of deep pain sensation

16.4 Grading the severity of spinal lesions.

16.5 Common differential diagnoses for spinal pain, paresis and paralysis.
Further investigations

The clinical examination (including the neurological examination suggested above) in conjunction with the history and signalment of the patient will, in most cases, allow a reasonably accurate localization of the lesion and a list of differential diagnoses, weighted towards the most likely causes. However, in order to narrow the differential diagnosis list, and ideally achieve a definitive diagnosis, further testing is necessary.

Laboratory tests

Routine haematology and biochemistry will seldom contribute to the diagnosis in these cases, although ruling out causes of weakness such as hypoglycaemia, hypocalcaemia and anaemia can be useful, and there is value in checking blood parameters prior to general anaesthesia in an unwell animal. In certain cases more specific diagnostic blood tests might include: testing for infections such as distemper, Toxoplasma or Neospora; DNA testing for degenerative myelopathy; and endocrine function testing (e.g. thyroid status) to look for possible causes of neuropathies and myopathies. Testing for C-reactive protein, an acute-phase protein marker, can help monitor the course of an inflammatory disease such as steroid-responsive meningitis–arteritis, without the necessity for repeated cerebrospinal fluid (CSF) sampling.

Radiography

Radiography can be a useful screening test in the diagnosis of spinal disease. Spondylosis deformans may be evident, which may be a normal finding in the older dog, but can indicate areas of vertebral instability. Spinal radiography is also useful for detecting fractures/luxations (Figure 16.6) and bony neoplasia.

Advanced investigations

Definitive diagnosis of many spinal cord diseases will require advanced techniques, detailed discussion of which is beyond the scope of this chapter. However, it is useful to be familiar with the practicalities and limitations of these techniques in order to advise a client of the most appropriate next step.

Myelography can be used to detect spinal cord compression in the absence of the availability of advanced imaging techniques such as magnetic resonance imaging (MRI) or computed tomography (CT). Radiographs are taken after the injection of contrast medium into the subarachnoid space. Loss of the contrast medium column can help ascertain the site of a compressive lesion and can give a guide as to whether the compression is external to the cord (e.g. an extruded disc; Figure 16.7). However, it is not possible to image in transverse planes, and the level of detail is less than with MRI or CT. Furthermore, there are some risks associated with the technique, such as neurological deterioration and myelography-induced seizures; but for many practices that perform routine surgery for disc extrusions it is a cost-effective step in planning for surgery and remains the technique of choice.

CT gives excellent bony detail. However, its ability to image the cord parenchyma is poor, so spinal cord tumours, inflammation and vascular lesions will often not be visible. CT myelography can give further information about compression.

MRI gives poorer detail of the bone, but better information about the soft tissue structures of the spine, and is generally the imaging modality of choice for suspected spinal cord lesions (Figure 16.8).
Other tests that may be of use in selected neurological diseases are: nerve and muscle biopsy; nerve conduction velocity testing, to assess for peripheral neuropathy; and electromyography, which can give information on muscle disease and the innervation of the muscle. The reader is referred to the BSAVA Manual of Canine and Feline Neurology for more details.

**Common conditions**

**Spinal disorders**

**WARNING**

Once a spinal condition has been diagnosed, referral, or advice from a specialist neurologist or colleague with experience in managing spinal disease, should be sought.

**Disc disease**

Most cases of spinal disease that are surgical candidates involve compressive spinal lesions (e.g. intervertebral disc disease, spinal fractures, cervical spondyloymelopathy), although some non-compressive lesions such as non-displaced fractures will also benefit from surgery. The option of surgical treatment in cases for which it is appropriate should be discussed with the owner, along with the costs, complications and risks associated with the procedure. In general, cases that are very mild can be managed conservatively, at least initially.

Conservative treatment may be the most appropriate course of action (grade 1 lesion) or may be the preferred choice for financial reasons. It consists of 4–6 weeks of strict cage rest. This means confining an animal to a small cage, such as a puppy crate. During this time the dog should only be allowed out to urinate and defecate.

It is important to monitor for, and manage, complications of recumbency such as decubital ulcers. A padded, clean bed should be provided, and the patient turned every 6 hours if recumbent. Urination and defecation should be monitored and assisted if necessary; this may involve placing an indwelling urinary catheter if urinary retention is a feature. It is important to ensure adequate nutrition and analgesia.

It is also important to monitor for deterioration. If a dog’s neurological status deteriorates during conservative treatment, or if there is no improvement after 4 weeks of rest, then surgery should be reconsidered.

**WARNING**

Immobility is a form of guarding response to pain, which may be lessened with analgesic treatment. There are numerous well documented cases of acute worsening of grade 1 or 2 lesions due to extrusion of an unstable disc following movement facilitated by pain relief. It is vital to enforce strict rest.

If a satisfactory response is achieved after 4–6 weeks, then a slow increase in exercise should be started. In the past, use of high-dose methylprednisolone sodium succinate within 8 hours of acute paraplegia was advocated. Some authors have also recommended the use of anti-inflammatory doses of prednisolone for the first 7–14 days after an injury. However, studies have shown little or no benefit in using corticosteroids in cervical and thoracolumbar disc disease, and they may be associated with a worse outcome (Boag et al., 2001; Levine et al., 2007).

Consultation with a qualified physiotherapist may be useful early in the course of the disease to see at what stage physiotherapy may be of benefit. In conservatively managed cases, more intensive therapy such as hydrotherapy would not normally be started until after at least 4 weeks of cage rest. Home physiotherapy, involving passive range-of-motion exercises of the paretic or paralysed limbs for 15 minutes three times a day, will help reduce muscle atrophy.

For thoracolumbar disc disease, the most common surgical spinal disease, prognosis depends on the grade of lesion (see Figure 16.4) and whether conservative or surgical treatment was instituted:

- For grade 1 cases, conservative treatment will be successful in nearly all cases.
- In grade 3 cases, conservative treatment may improve around 85% of dogs affected, while decompression might improve nearer 95%.
- In cases where deep pain is absent, conservative treatment rarely leads to improvement, whereas decompression can help 50–70% of cases if performed promptly.
- Surgery should be strongly recommended in grade 3 or 4 cases, and in grade 5 cases where deep pain sensation has been lost within the last 24–48 hours.
- Patients that have been without deep pain sensation for >48 hours, or in which surgical treatment is not carried out, carry a poor prognosis, and euthanasia should be considered.

**Non-spinal disorders**

Common non-spinal causes of paralysis and paresis are listed in Figure 16.9.

- Cerebellar disease
- Brainstem disease
- Polymyopathies: distal denervating disease; toxoplasmosis/ neosporosis; endocrine disease (e.g. diabetes mellitus, hypothyroidism); idiopathic polysialoculoneuritis
- Mononeuropathies: trauma; neoplasia
- Vascular disease

**16.9 Common non-spinal causes of paralysis and paresis.**

**Intracranial disease**

Disease affecting the brainstem can cause proprioceptive deficits in all four limbs. There will often be accompanying cranial nerve deficits (see Chapter 11).

- Decerebrate rigidity occurs with severe cerebellar lesions. In these cases there is opisthotonus, the forelimbs are extended and the hips are flexed. Consciousness is usually retained.
- With decerebrate rigidity due to a brainstem lesion, all four limbs are extended, and consciousness is depressed, often to the level of coma.
Mono- and polyneuropathies

Mononeuropathies can be suspected when only a single limb is affected – with LMN signs.

- A lateralized disc extrusion would be a relatively common cause of a monoparesis/monoplegia, and may occur acutely, or over a few days to weeks.
- Nerve root tumours can lead to slowly progressive signs of paresis, reduced spinal reflexes, muscle atrophy and pain.
- Thoracic limb monoparesis or monoplegia can occur due to brachial plexus injury, which is common in road traffic accidents.
- Aortic or iliac thromboembolism is rare in dogs, but does occur, and can lead to signs of monoparesis; so checking both femoral pulses is worthwhile in these patients.

Polynuearopathies can be suspected when all four limbs are affected with LMN signs, particularly reduced spinal reflexes. Definitive diagnosis in these cases will require such diagnostic procedures as nerve conduction velocity testing, electromyography and nerve/muscle biopsy.

References and further reading


Chapter 17

Lethargy and weakness in endocrine disease

Sarah Packman

Definitions

- Lethargy is a state of dullness and listlessness with a lack of energy
- Weakness is a lack of muscle strength

Lethargy and weakness are common presenting signs in first-opinion practice but can be difficult to distinguish for both the owner and clinician. They may be primary signs but are more commonly secondary to another disease process. Many conditions can result in lethargy and/or weakness, and in order to determine the exact cause of the signs, a full history should be obtained and clinical examination and diagnostic work-up performed. This chapter will concentrate in detail on endocrine causes of lethargy and weakness. Other causes, such as myopathies and orthopaedic causes are discussed in Chapter 11 and 15, respectively.

Some causes of lethargy and weakness can occasionally present as emergency situations, e.g. endocrine collapse due to hypoadrenocorticism (Addison’s disease). In these cases emergency treatment, such as intravenous fluids to support the circulation, must be instigated before embarking on a diagnostic work-up.

History

A good history is vital when determining the cause of lethargy or weakness and helps to narrow the list of differential diagnoses. As weakness and lethargy are very common in any disease process, the history-taking aims to distinguish between primary conditions and secondary signs.

It is important to consider the signalment of the patient: age, sex, whether the patient is neutered, and vaccination status can help to narrow down the differential list. For example: pyometra should be on the differential list for an older entire bitch, whereas a portosystemic shunt should be considered for younger dogs. Enquiries should also be made as to foreign travel and ectoparasite control, as vector-borne infections such as Babesia and Leishmania may result in lethargy.

The owner should be asked to describe the clinical signs the dog is showing. Sometimes, asking the owner to film the episodes can be very enlightening. Further questions to ask the owner include:

- How long has the lethargy/weakness been present?
- Is the weakness constant, or are there times when the dog is normal?
- Is the dog gradually deteriorating, or do signs wax and wane?
- When was the dog last normal?
- Has anything changed in the environment recently or at the time of the onset of lethargy and/or weakness?
- Is there anything that exacerbates the clinical signs? Does the weakness get worse/improve with exercise?
- Is the dog taking any medication? (In addition to sedative drugs, other medications/preparations (e.g. antihistamines, phenobarbital, skullcap and valerian) can have sedative effects; other drugs (e.g. glucocorticoids) can cause muscle weakness.)
- Has the dog had access to toxins?
- Has there been a diet change or change in appetite?
- How much does the dog drink?

Questions should then be asked relating to organ systems. As disease in every organ system can result in lethargy and/or weakness, this line of questioning should include questions relating to gastrointestinal, urogenital, neurological, cardiopulmonary and musculoskeletal health. Examples of such questions include:

- Is the dog passing urine normally – frequency/amount/associated pain?
- Is the dog continent?
- Does the dog maintain bladder function overnight?
- Are the faeces normal – any changes in the frequency/consistency/colour?

It should be remembered that concurrent disease may make identification of the primary cause of the lethargy and/or weakness difficult to achieve.
Physical examination

A thorough clinical examination, whether head to toe or using a body systems approach, should be undertaken. In addition a neurological examination should be performed (see Chapters 11 and 16 and the BSAVA Manual of Canine and Feline Neurology).

- **Head:**
  - Examine for signs of symmetry, inflammation and muscle wastage
  - Examine the oral cavity, including the mucous membranes to look for redness, pallor, icterus, cyanosis, petechiae and to allow assessment of the dog’s hydration status. Note any evidence of halitosis and check the teeth for tooth root infections
  - Assess cranial nerve function (see Chapter 16).

- **Eyes:**
  - Examine the retina for any evidence of hypertensive damage, or inflammation
  - Examine the lens for evidence of cataract development.

- **Thorax:**
  - Auscultate the chest and upper respiratory tract, paying special attention to laryngeal noise, cardiac abnormalities and abnormal lung sounds
  - Additionally, the chest should be percussed for evidence of dullness.

- **Abdomen:**
  - Palpate for evidence of organomegaly (e.g. hepatic enlargement), pain and effusions.
  - Body condition: Examine for symmetry and for evidence of muscle atrophy.

- **Gait:** Observe gait at a walk and after more intensive exercise. Look for evidence of lameness or a stiff gait. Note whether the lethargy or weakness gets worse with exercise.

- **Skin:** Examine for abnormalities including alopecia and dry flaky skin.

- **Temperature, pulse and respiration (TPR):**
  - Assess body temperature for hypothermia or pyrexia
  - Assess pulse quality and rate. Record any abnormalities such as pulse deficits.

**WARNING**

If any obvious abnormalities are detected at this stage – such as dehydration or hypothermia – they should be treated promptly before any further diagnostic work-up is attempted.

Differential diagnosis

There is a vast list of conditions that can cause lethargy and/or weakness (Figure 17.1). When investigating a dog that presents with weakness or lethargy, investigating the other clinical signs present can significantly narrow the differential diagnosis list. For example: a dog with hyperadrenocorticism will often be weak and lethargic, but it will also be likely to have polyuria/polydipsia, polyphagia, panting and, possibly, symmetrical alopecia. A problem list approach is best applied in more complex cases.

It can be difficult to distinguish between orthopaedic disease, endocrine disease and myopathies as the cause of lethargy and weakness. Additionally, in older dogs orthopaedic conditions may occur concurrently with endocrine diseases such as hypothyroidism and osteoarthritis. These cases can be difficult to manage if the underlying cause for the lethargy or weakness is overlooked, or not identified and treated. Figure 17.2 presents an algorithm to help the clinician distinguish between myopathies, endocrine and orthopaedic disease.

<table>
<thead>
<tr>
<th>Body system/disease type</th>
<th>Potential conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiac</td>
<td>Aortic stenosis; pulmonic stenosis. Heart failure – dilated cardiac myopathy; mitral valve disease. Cardiac arrhythmia – bradycardia, tachycardia. Pericardial effusion; constrictive pericarditis</td>
</tr>
<tr>
<td>Respiratory</td>
<td>Hypoxia. Tracheal collapse. Laryngeal paralysis. Pleural effusion. Pulmonary hypertension</td>
</tr>
<tr>
<td>Haematological</td>
<td>Acute blood loss. Anaemia. Polycythaemia</td>
</tr>
<tr>
<td>End-stage disease</td>
<td>Hepatitis. Chronic renal disease/failure</td>
</tr>
<tr>
<td>Gastrointestinal</td>
<td>Severe inflammatory bowel disease. Parvovirus infection</td>
</tr>
<tr>
<td>Neoplasia</td>
<td>Lymphoma. Insulinoma. Phaeochromocytoma. Neoplasia in any body system</td>
</tr>
<tr>
<td>Pyrexia</td>
<td>Infection – pyelonephritis; pyometra; prostatitis; leptospirosis. Pancreatitis. Exercise-induced hyperthermia</td>
</tr>
<tr>
<td>Orthopaedic</td>
<td>Osteoarthritis. Polyarthritis. Spinal disease – congenital or acquired. Myopathies</td>
</tr>
<tr>
<td>Vector-borne infections</td>
<td>Ehrlichia. Babesia. Leishmania</td>
</tr>
</tbody>
</table>

**17.1** Differential diagnoses for lethargy and weakness.
Lethargy and weakness in endocrine disease

Chapter 17

Diagnostic tests

Diagnosing the cause of lethargy and weakness can be very time-consuming and expensive. From the history and physical examination the clinician should have a good idea as to where to direct the investigation.

Initially a full biochemical profile to include creatine kinase and total thyroxine (T4) is needed. A full blood count and white cell differential count should be obtained, looking for evidence of (or lack of) a stress leucogram. Additionally, urinalysis should be performed and blood pressure measured. From the results of these tests, the clinician can determine the best next step in the investigation, e.g. further biochemical testing, abdominal/thoracic imaging, electrocardiography, echocardiography, or endoscopy.

Electroencephalography, muscle and nerve biopsy, and an edrophonium response test are more specialized tests that may be performed, but these tests are more often done when other tests have not led to a diagnosis.

Endocrine disorders causing lethargy and weakness

Hypothyroidism

The pituitary gland releases thyroid stimulating hormone (TSH) which acts on the thyroid gland to release thyroxine (T4) and, to a lesser extent, triiodothyronine (T3 – the active form). These thyroid hormones control their own release, as they have a negative feedback effect on the pituitary gland that prevents further release of TSH (Figure 17.3). Hypothyroidism is caused by reduced production and release of T3 and T4 from the thyroid gland.

The most common form of hypothyroidism is acquired; congenital hypothyroidism, although very rare, is recognized most commonly in German Shepherd Dogs with panhypopituitarism caused by a cyst in Rathke’s pouch. Acquired hypothyroidism may be caused by lymphocytic thyroiditis or idiopathic thyroid atrophy. Rarely, thyroid neoplasia may cause hypothyroidism.

Signalment

Hypothyroidism most commonly affects middle-aged dogs (mean 7 years). Predisposed breeds include the Boxer, Miniature Schnauzer, Cocker Spaniel, Poodle, Golden Retriever and Irish Setter.
Clinical signs
The most common presenting complaint is progressive lethargy, inactivity and weight gain. Additionally, some dogs develop muscle weakness, myopathy, bradycardia, seizures and infertility. Skin complaints, such as non-pruritic bilateral flank alopecia (Figure 17.4), hyperpigmentation, seborrheoa and recurrent skin infections, are common, and are often the most obvious signs to the owner.

Diagnosis
The diagnosis is supported by performing routine biochemical and haematology on a blood sample. Hypercholesterolaemia is detected in 80% of cases, with hyperlipidaemia and mildly elevated creatine kinase seen less commonly. A non-regenerative anaemia (normocytic, normochronic) is seen in 50% of cases.

A subnormal thyroid hormone level is required for diagnosis. This can result from thyroidal or non-thyroidal illness (such as stress, or exogenous glucocorticoid or potentiated sulphonamide administration within the last 4 weeks).

In order to confirm hypothyroidism, the T4:TSH ratio must be calculated. Low T4 in conjunction with high TSH is supportive of hypothyroidism. However, TSH can occasionally be high in sick euthyroid syndrome or perversely low in hypothyroid dogs, so it is important to consider the findings in conjunction with the clinical signs. Additional tests which can be performed in order to confirm the diagnosis of hypothyroidism are: free thyroxine level; recombinant human TSH (rhTSH) or thyroid releasing hormone (TRH) stimulation tests; or anti-T3 and anti-T4 antibody assays. These additional tests are expensive, however, and may not provide reliable results.

A treatment trial with levothyroxine, noting the response to therapy, can be a more cost-effective approach for confirming the diagnosis in equivocal cases.

Treatment
Treatment is with levothyroxine (11–22 μg/kg orally q12h). An improvement in mentation is usually seen within 2–6 weeks. Peripheral neuropathies take 8–12 weeks to resolve, and alopecia may take up to 3 months. Serum T4 levels should be monitored. The author’s protocol for monitoring is as follows: 4 weeks after starting the treatment, 4–6 hours after the dose of levothyroxine has been administered; thereafter, every 2 months for 6–8 months whilst the thyroid levels stabilize; then twice yearly.

Prognosis
The prognosis for treated dogs is good.

Hyperadrenocorticism
Hyperadrenocorticism (HAC; Cushing’s disease) is one of the most common endocrine diseases seen in dogs. It is caused by the excessive production of cortisol by the adrenal cortex. The majority of cases (>80%) result from a microadenoma on the pituitary gland (pituitary-dependent HAC (PDHAC)). A smaller number of cases (<20%) have a tumour on the adrenal gland (adrenal-dependent HAC (ADHAC)); this tumour may be benign or malignant. Iatrogenic HAC results from exogenous administration of glucocorticoids.

Signalement
PDHAC is found in middle-aged to older dogs (median 7–9 years). Poodles and small terriers are at increased risk and there is no sex predisposition. ADHAC occurs more commonly in older (11–12 years) larger breed dogs; bitches are at greater risk of developing the disease.

Clinical signs
Dogs will present with one or a combination of the following: polyuria, polydipsia, polyphagia, weakness, lethargy, panting, a pot-bellied appearance, and symmetrical alopecia/poor hair regrowth/’rat-tail’ appearance (Figure 17.5). Smaller breeds often present with many of the clinical signs described above, but larger breeds often present with just polydipsia/polyuria. Rarely, dogs may present with seizure activity due to the growth of a pituitary mass.

PRACTICAL TIP
Remember that the ‘rat-tail’ appearance of the tail is not specific for hypoadrenocorticism, and is a common finding in both hyperadrenocorticism and hypothyroidism.

Diagnosis
On physical examination the dog may have evidence of thinning skin or comedones, muscle wastage (especially around the temporal muscles), and/or chronic infections.

The most common abnormality detected on routine biochemistry is a raised level of alkaline phosphatase (ALP), which may be raised when there are few or no changes in other liver enzymes. Other common causes of an increase in ALP, such as exogenous steroid administration, should be excluded. Other abnormalities may include hypercholesterolaemia, raised levels of other liver enzymes, and mild hyperglycaemia. A stress leucogram is often present. On urinalysis the most common finding is hyposthenuria (the kidneys are actively diluting the urine); in HAC this is due to antidiuretic hormone (ADH) acting on the collecting duct of the kidney. Other urine abnormalities include pyuria/bacteriuria and proteinuria.
HAC is confirmed by performing an adrenocorticotropic hormone (ACTH) stimulation test or a low-dose dexamethasone suppression (LDDS) test (Figure 17.6); for protocols see the *BSAVA Guide to Procedures in Small Animal Practice*.

- The ACTH test is less time-consuming and is a good test when used to confirm HAC.
- The LDDS test is a good test to perform when trying to rule out HAC. However, if the test is positive for HAC, it can then help to differentiate between PDHAC and ADHAC.

Another measure that is useful when trying to rule out HAC is the urine cortisol:creatinine ratio. This is best obtained using urine collected at home from a non-stressed patient over several days.

- A negative result, i.e. a urine cortisol:creatinine ratio <13.5, can reliably exclude HAC as a diagnosis.
- A positive test result, i.e. a urine cortisol:creatinine ratio >13.5, cannot on its own confirm the diagnosis. A positive test only indicates that there is an elevated serum cortisol level; this may be caused by adrenal or non-adrenal illness.

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**17.5** An 8-year-old neutered Staffordshire Bull Terrier bitch with hyperadrenocorticism, showing (a) flank alopecia and (b) ‘rat-tail’. (c) The same bitch following treatment with trilostane for 6 months; there is hair regrowth on the body and tail.

**17.6** Diagnostic plan for suspected cases of hyperadrenocorticism. ACTH = adrenocorticotropic hormone; ALP = alkaline phosphatase; ALT = alanine aminotransferase; USG = specific gravity.
Chapter 17  Lethargy and weakness in endocrine disease

Treatment
The only drug authorized for treating HAC in dogs in the UK is trilostane.

- The starting dose is 2–5 mg/kg/day given orally once daily with food. Sometimes twice-daily dosing is required.
- In order to check that the right dose of medication is being given, regular monitoring of blood biochemistry, electrolytes and haematology, is needed. An ACTH stimulation test should also be performed 4–6 hours after dosing.
- It is important that the clinical signs of HAC are well controlled and that the adrenal glands are not oversuppressed by a high dose of trilostane.
  - An excessive dose of trilostane may lead to signs of hypoadrenocorticism (e.g. lethargy, anorexia, vomiting, diarrhoea, cardiovascular signs, collapse). Monitoring of blood levels of cortisol (pre- and post-stimulation), liver enzymes and electrolytes to detect hypoadrenocorticism is therefore very important and should be performed after starting treatment at: 10 days; 4 weeks; 12 weeks; and thereafter every 3 months.
  - If the dose of trilostane is found to be incorrect, the dosage should be changed and monitoring repeated at the above intervals.

Additional treatments are available, such as mitotane (unauthorized), and surgical removal of the mass (see the BSAVA Manual of Canine and Feline Endocrinology).

PRACTICAL TIP
When treating HAC there is a possibility of unmasking concurrent steroid-responsive diseases such as osteoarthritis or atopy

Prognosis
Untreated, the clinical signs of HAC become progressively worse, although most dogs maintain an acceptable quality of life. When treated, the prognosis in dogs with PDHAC is good, but for dogs with ADHAC the prognosis is less good. For most dogs the clinical signs of polyuria, polydipsia, polyphagia and lethargy resolve within days to weeks. The muscle weakness and skin changes often take several months to resolve. Dogs who present with neurological signs have a poor prognosis; seizure activity can be controlled with antiseizure medications, but the side effects of some of these medications can exacerbate the lethargy and weakness.

Hypoadrenocorticism
Hypoadrenocorticism, deficient adrenal gland production of glucocorticoids and/or mineralocorticoids, can be categorized as primary (Addison’s disease) or secondary (atypical Addison’s).

Addison’s is an uncommon disease, which results in glucocorticoid and mineralocorticoid deficiency and is suspected to be caused by immune-mediated destruction or atrophy of the adrenal cortex. Aldosterone is the major mineralocorticoid in the body; its loss results in an inability to conserve water and sodium, and a failure to excrete sodium. Loss of >85% of the adrenocortical cells is required before clinical signs of hypoadrenocorticism are seen.

Atypical Addison’s is rarer still, and results from pituitary ACTH deficiency. Glucocorticoid production is deficient, but often mineralocorticoid production is preserved.

Signalment
Hypoadrenocorticism has been reported in young to old dogs, but most are between 2 and 7 years old at the time of diagnosis. There is a genetic predisposition in Standard Poodles and Bearded Collies, and the disease is over-represented in some breeds, including the West Highland White Terrier, Great Dane and Rottweiler. Bitches are twice as likely as males to have hypoadrenocorticism.

Clinical signs
Acute hypoadrenocorticism presents as hypovolaemic collapse, bradycardia, vomiting, diarrhoea, abdominal pain and/or hypothermia. Chronic signs may involve intermittent vomiting and diarrhoea, lethargy, weakness, megaoesophagus, or muscle cramping.

Diagnosis
Findings include the absence of a stress leucogram on haematology, and azotaemia, hyponatraemia, hyperkalaemia, hypochloraemia and hypoglycaemia on serum biochemistry. Hypercalcaemia is present in 30% of cases with unknown aetiology. A reduced sodium-potassium ratio is a common feature, but cannot be used as a diagnostic tool. Urinalysis often shows reduced urine specific gravity, reflecting a reduced renal medullary sodium concentration resulting in medullary washout. Survey radiographs may show a reduced cardiac silhouette, and adrenal ultrasonography may be abnormal. Electrocardiogram (ECG) abnormalities confirm hyperkalaemia (peaked T waves, prolonged P–R interval; Figure 17.7) but not the cause.

An ACTH stimulation test confirms the diagnosis. Administration of supraphysiological doses of ACTH (250 micrograms) normally produces significant increases in plasma cortisol levels, especially in

![An ECG from a 5-year-old male neutered German Shepherd Dog with hypoadrenocorticism. The marked hyperkalaemia in this case is shown on this ECG as an absence of P waves (atrial standstill) and peaked T waves.](image-url)
sick animals; however, in hypoadrenocorticism this increase is minimal or absent. Plasma ACTH concentrations are required to differentiate primary from secondary disease.

**Treatment**

Acute treatment involves fluid resuscitation, correction of electrolyte imbalances, glucocorticoid supplementation, and correction of life-threatening cardiac arrhythmias. Rapid initiation of shock boluses (20–30 ml/kg) of crystalloid fluids is essential to reduce the hyperkalaemia and improves renal perfusion. Compound sodium lactate-containing fluids help to correct the metabolic acidosis. Fluid supplementation alone will often correct hyperkalaemia; however, some cases require either a combination of intravenous glucose and insulin, or calcium gluconate administration to correct the hyperkalaemia. Glucocorticoids should be initiated early in the acute crisis.

Maintenance therapy includes fludrocortisone and prednisolone supplementation.

- **Fludrocortisone**, a synthetic adrenocortical steroid, has potent mineralocorticoid and mild glucocorticoid activity. The dose is 15–30 µg/kg orally q24h, although sometimes much higher doses are required.

- **Prednisolone** has good glucocorticoid and minimal mineralocorticoid activity. Dogs are stabilized on 0.2–0.5 mg/kg orally q24h. After stabilization this dose is reduced, and may be discontinued. If discontinued, prednisolone must be reinstated during periods of physiological stress. Side effects of treatment include iatrogenic hyperadrenocorticism; if this occurs, the dosage of prednisolone must be reduced.

Therapeutic success is monitored by measuring electrolytes whilst the dog is hospitalized, then at 1 week after discharge, and 2 weeks later, then monthly to bi-monthly. Additionally, it is important to assess levels of azotaemia.

**Prognosis**

Overall, the prognosis for dogs with hypoadrenocorticism receiving hormone replacement therapy is excellent provided there is good owner education about the disease and the importance of regular treatment and monitoring. One aspect that must be discussed in depth with the owner if prednisolone therapy is to be discontinued, is that of physiological stress. Owners understand that a visit to the vet’s might be stressful, but not that a change in environment, such as temperature, diet or exercise, might also apply a stress to the dog.

**Diabetes mellitus**

Diabetes mellitus is a common disease in dogs. Insulin is normally secreted by the pancreas in response to hyperglycaemia and reduces the blood glucose concentration by promoting the uptake of glucose by the peripheral tissues. In insulin-dependent diabetes mellitus (IDDM) there is an absolute lack of insulin; this can be idiopathic or a consequence of end-stage pancreatitis. Diabetes mellitus may also arise due to insulin resistance. IDDM is the more common form in dogs.

**Signalement**

Samoyeds, Tibetan Terriers and Yorkshire Terriers are over-represented, while Boxers, Golden Retrievers and German Shepherd Dogs are under-represented. Middle-aged to older dogs (>7 years) and entire bitches (8–10 years) are much more likely to develop diabetes mellitus.

**Clinical signs**

The common clinical signs that dogs present with are polyphagia, polyuria/polydipsia, and weight loss. Additionally, dogs can present with lethargy, depression, collapse and vomiting. Physical examination may reveal hepatomegaly and diabetic cataracts.

**Diagnosis**

Serum biochemistry findings include hyperglycaemia, hypercholesterolaemia, hypertriglyceridaemia and, commonly, raised ALP and alanine aminotransferase (ALT) levels. If diabetic ketoacidosis is present, serum biochemistry may reveal abnormalities in electrolytes, urea and creatinine. In-house urinalysis will show glucosuria if the blood glucose concentration exceeds the renal threshold for glucose (>10 mmol/l); ketonuria, haematuria, and proteinuria can additionally be tested for. As bacterial urinary tract infections are more frequent in diabetic patients, it is important to check the sediment for evidence of whole blood and red blood cells. In order to confirm the diagnosis of diabetes, blood fructosamine should be assayed; measuring this glycosylated serum protein gives a mean blood glucose level for the past 1–3 weeks. This test can confirm the diagnosis of diabetes and is useful in monitoring the response to treatment. Additional imaging can be performed to check for evidence of pancreatitis, but this is not required for the diagnosis.

**Treatment**

IDDM treatment always requires insulin (Figure 17.8). This can be administered once or twice daily; the frequency of injections depends on owner compliance and the dog’s response to treatment. The starting dose rate depends on bodyweight but is usually in the range of 0.5–1 IU/kg s.c. q12–24h. (This author usually starts dogs on a dose range

![Image showing types of insulin](image-url)
from 10–20 IU per dog s.c. q12–24h.) The dose should be adjusted according to the dog’s response to treatment. The dog’s response to insulin should be monitored initially using blood glucose curves, urinalysis and fructosamine levels. The dog will take 3–7 days to respond to any change in insulin levels so a curve is best to perform a week after initiating therapy and changing a dose. Blood pressure may also be measured.

Another important aspect to consider when treating the disease is diet. Daily feeding should be consistent in terms of volume, timing and composition of the diet. A high level of complex fibre in the diet is recommended, as it slows digestion and absorption, therefore reducing postprandial glucose spikes. Exercise levels should also be kept stable. For more detail on management of diabetes in dogs see the BSAVA Manual of Canine and Feline Endocrinology and the BSAVA Manual of Canine and Feline Rehabilitation, Supportive and Palliative Care.

**Prognosis**

Diabetes is a life-limiting disease but, with effective treatment and regular monitoring, dogs with diabetes can be managed well. It must be remembered that diabetes remains an expensive disease to treat and can be managed well. It must be remembered that treatment and regular monitoring, dogs with diabetes may result in low measured total calcium although normal levels of ionized calcium are present.

**Treatment**

Treatment is with calcium supplementation. For hypocalcaemic tetany, parenteral administration of 10% calcium gluconate is required. For maintenance, calcium and vitamin D must be supplemented and tailored to the correct dosage depending on the serum calcium level.

**Prognosis**

With regular monitoring of patients the long-term prognosis is good.

**Hyperparathyroidism**

Hyperparathyroidism may be primary (excessive PTH secretion) or secondary (an adaptive response of increased PTH secretion due to a reduced ionized calcium level – commonly secondary to chronic renal disease). Primary hyperparathyroidism is uncommon and it is often caused by a small adenoma of the parathyroid gland, although adenocarcinomas can, very rarely, be the cause.

**Signalment**

Hyperparathyroidism usually affects middle-aged to older dogs. Keeshonds appear to be over-represented. German Shepherd Dogs, Poodles, Golden Retrievers, Labrador Retrievers and Cocker Spaniels can get the disease, but no genetic link has been found in these breeds. There is no sex predisposition.
Clinical signs
Clinical signs vary from asymptomatic mild disease to severe systemic illness. Polyuria and polydipsia are the most common signs, but dogs may present with anorexia, vomiting, muscle weakness, lethargy, constipation and weight loss.

Diagnosis
Serum biochemistry in primary hyperparathyroidism reveals hypercalcaemia and hyperphosphataemia, with normal renal function. If renal failure is present, primary and secondary hyperparathyroidism can be difficult to distinguish (Figure 17.9). Circulating PTH levels are inappropriately high in cases of primary hyperparathyroidism. An important differential to consider when investigating a patient with hypercalcaemia is hypercalcaemia of malignancy. In these cases PTH concentrations are low, but PTH-related protein (PTHrP) is high.

Ultrasound examination of the parathyroid gland by an experienced ultrasonographer can help to distinguish between hyperplastic glands and parathyroid adenomas.

Treatment
Treatment of mild hypercalcaemia involves intravenous fluids to promote calcium excretion, and furosemide administration at 2–4 mg/kg i.v. q12h. For treatment of hypercalcaemic crisis see the BSAVA Manual of Canine and Feline Emergency and Critical Care. Bisphosphonates may be used to control the hypercalcaemia, and are good options for dogs with hypercalcaemia of malignancy.

Primary hyperparathyroidism may be treated by surgical removal of the parathyroid gland. Post-operative complications include hypocalcaemia, which is usually transient and easily controlled.

Prognosis
The prognosis following surgical removal of the parathyroid gland is good. Development of additional neoplastic nodules is rare.

References and further reading

<table>
<thead>
<tr>
<th>Disease</th>
<th>Serum calcium</th>
<th>Ionized calcium</th>
<th>Phosphate</th>
<th>Urea and creatinine</th>
<th>PTH</th>
<th>PTHrP</th>
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<tr>
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17.9 Differentiating causes of hypercalcaemia. PTH = parathyroid hormone; PTHrP = parathyroid hormone-related protein.
Hyperthermia and pyrexia

Sarah Packman

A raised rectal temperature is a common finding on physical examination. It is important for the clinician to determine the cause of the raised rectal temperature and to differentiate pyrexia from hyperthermia.

The thermoregulatory centre is located in the hypothalamus and is composed of two parts: the rostral region, which is involved with heat loss and is under parasympathetic control; and the caudal region, which controls heat production and is under sympathetic control. Thermoreceptors in the skin, abdomen and central nervous system help to maintain the body temperature via the thermoregulatory centre. Most internal body heat is generated via oxidative reactions in the liver; however, muscle activity can rapidly produce a lot of heat.

Hyperthermia results from increased muscle activity, increased ambient temperature, or an increased metabolic rate. Hyperthermia can be further subcategorized into heat exhaustion/heat stroke, exercise-induced hyperthermia, and malignant hyperthermia (Figure 18.1).

Pyrexia in a dog is defined as having a rectal temperature >39.2°C at rest. Pyrexia occurs when the hypothalamus resets the body’s thermoregulation to a higher point than normal, resulting in physiological mechanisms that increase the body temperature. Inflammatory mediators such as cytokines (primarily IL-1) that are released from leucocytes in response to exogenous and endogenous pyrogens (released in bacterial, viral, neoplastic and immune-mediated disease) alter this thermoregulatory set point.

History
Severe cases of hyperthermia often have an acute presentation; the history taken is usually brief and may be taken after treatment has been instigated.

With pyrexia, the signs may be acute or chronic, and may be intermittent, occurring over the preceding few weeks. Chronic cases of pyrexia often have vague signs and can be difficult to diagnose unless the dog is presented during a pyrexic episode. The breed, age, sex and neutering status can help to narrow the differential list. For example: younger dogs are more likely to develop steroid-responsive meningitis–arteritis, whilst older dogs are more likely to develop neoplastic conditions. Autoimmune disease is more common in bitches. The owners should be asked about:

- The dog’s environment in recent hours:
  - What was the ambient temperature?
  - Has it been shut in a car recently?
  - Has it had access to water?
  - Has it had any access to toxins?
- Do any other dogs, animals or people in the house have signs of illness? (Many causes of pyrexia are transmissible diseases)
- Is the dog vaccinated, and when was the last vaccination given? (Immune-mediated diseases have been linked to recent vaccination; unvaccinated dogs need to be barrier-nursed; infections such as leptospirosis and parvovirus need to be excluded from the differential list)
- Has the owner given any medications recently?
- Has the dog been exercising, and what has its recent exercise tolerance been?
- Is there a history of foreign travel? (Leishmaniosis can present with pyrexia)
- What products, if any, have been used for tick control?

<table>
<thead>
<tr>
<th>Heat exhaustion/stroke</th>
<th>Exercise-induced hyperthermia</th>
<th>Malignant hyperthermia</th>
<th>Pyrexia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marked increase in body temperature caused by exercise and/or environmental temperature rise that overwhelms the body’s normal thermoregulation. Examples: healthy dog shut in a hot car; dog with status epilepticus</td>
<td>Body temperature rises excessively in response to moderate exercise. Example: exercise-induced hyperthermia in collies</td>
<td>Abnormal calcium metabolism caused by medications or anaesthetics (e.g. halothane). Causes a rapid, often fatal increase in body temperature through uncoupled metabolic heat production</td>
<td>Increase in body temperature due to a resetting of the thermoregulatory set point in the hypothalamus. Examples: infectious and immune-mediated diseases</td>
</tr>
</tbody>
</table>

18.1 Causes of raised rectal temperature and the mechanism of action.
Has there been a recent tick bite or exposure? (Lyme disease, *Ehrlichia* and *Babesia* are spread by ticks)
Has there been a recent skin injury which might have allowed a foreign body to enter under the skin?
Has there been any recent surgery or illness?

The owner should then be questioned about body systems to help narrow the differential list. Questions should relate to the gastrointestinal tract, urinary tract, neurological system, respiratory tract, pancreas, cardiac system, and orthopaedic system.

### Clinical signs
Owners will report either one of or a combination of:

- Lethargy
- Inappetence or anorexia
- Panting
- Shivering
- Collapse.

The most common reason for dogs to present to the clinician with hyperthermia is heat stroke due to being locked in a car (Figure 18.2). Even on mild days the temperature in a car can rise very high; owner education is therefore vital to prevent recurrence. Dogs with heat stroke may present with blindness, ataxia, disorientation or collapse.

### WARNING
Severe cases of hyperthermia often have an acute presentation as the dog has not had time to adjust to the high body temperature. This is especially true in cases of heat stroke, and rapid cooling is needed in order to prevent ongoing damage.

### Physical examination
Marked pyrexia is an obvious clinical sign for the clinician to detect. Taking the rectal temperature is a quick, easy and reliable procedure and should be done routinely for any sick dog and at pre- and post-operative checks. A wide range of rectal thermometers is available (Figure 18.3), providing a reliable reasonable approximation for core body temperature. Additionally, with marked pyrexia, the dog will feel hot to the touch.

Once pyrexia is detected a full physical examination should be performed.

- **Head:**
  - Examine for signs of injury, inflammation and symmetry
  - Examine the nose for discharge and abnormalities of the mucocutaneous junction
  - Look for evidence of hypersalivation
  - Examine the oral cavity, including the mucous membranes to look for redness, pallor, icterus, cyanosis, petechiae and to allow assessment of the dog’s hydration status. Note any evidence of halitosis and check the teeth for tooth root infections. Examine under the tongue for abscesses and salivary duct abnormalities, and the roof of the mouth for pathology and symmetry.

- **Eyes:**
  - Look for redness and record any discharges
  - The sclera is the best area to check for evidence of jaundice/icterus
  - Examine the retina for signs of inflammation.

- **Neck:**
  - Examine for evidence of a dilated oesophagus
  - Perform a tracheal pinch for evidence of coughing.

- **Thorax:**
  - Auscultate the chest and upper respiratory tract, paying special attention to laryngeal noise, cardiac abnormalities and abnormal lung sounds
  - Additionally, the chest should be percussed for evidence of dullness
  - Assess pulse quality and rate, and record abnormalities such as pulse deficits.

### 18.3 Examples of digital rectal thermometers with rigid and soft tips.
Abdomen: Palpate for evidence of organomegaly (e.g. hepatic enlargement), pain and effusions.

Skeleton: Manipulate the joints and spinal column, watching for evidence of pain, swelling or weakness.

Skin: Examine for abnormalities including alopecia and dry flaky skin, infections, urticarial reactions, and tick bites.

Lymph nodes: Palpate all peripheral lymph nodes and record any enlargement.

Rectum/anus:
- A rectal examination should be performed in male dogs to assess for prostate gland size and whether any pain is elicited on palpation
- In males and females, examine the anal sacs for infection/masses.

### Diagnosis and differential diagnoses

Heat stroke, exercised-induced hyperthermia and malignant hyperthermia should be treated by reducing the body temperature as a matter of urgency (see later), as ongoing organ damage continues when the body temperature is >41.1°C.

With pyrexia, it is more important to diagnose the underlying condition. The differential diagnosis list for pyrexia is vast (some possibilities are listed in Figure 18.4), but with a good history and clinical examination this can be narrowed down.

For dogs presenting with pyrexia that is attributable to a known cause, the reader should refer to the relevant chapter of this book for diagnostic work-up, which may include performing one or many of the following: a full blood count, serum biochemistry, urinalysis, faecal analysis, imaging, endoscopy, electrolyte, and record any enlargement.

#### Disease type | Potential conditions
--- | ---


**Fungal infection** | Aspergillosis. Cryptococcus.

**Parasitic infection** | Babesia. Ehrlichia. Leishmania. Toxoplasmic encephalitis.

**Neoplasia** | Any neoplastic condition including: lymphosarcoma, multiple myeloma and myeloproliferative disorders.

**Sterile inflammatory** | Pancreatitis. Pancreatitis postsurgical fat necrosis. Nodular pancreatitis.

**Miscellaneous** | Pain. Drug reaction (e.g. tetracycline). Hypocalcaemic tetany.

#### Differential diagnoses for pyrexia.

When pyrexia is the only abnormality detected and the pyrexia lasts for longer than 3 weeks without a diagnosis, then it is classified as pyrexia of unknown origin (PUO). For cases of PUO, the following diagnostic work-up is suggested (see also Figure 18.5):

- **Haematology:** to include a full blood count, white cell differential count and smear examination for evidence of anaemia, intracellular red cell inclusions, platelet numbers, and leucocyte abnormalities.
- **Serum biochemistry:** including electrolytes and thyroid testing. Specific biochemical tests on the serum, such as canine pancreatic lipase immunoreactivity (CPLI) and serum protein electrophoresis, should be performed only if indicated.
- **Urinalysis:** to include chemistry, specific gravity, sediment examination, urine protein:creatinine ratio, culture, and cytology if indicated from previous urine results.
- **Faecal analysis:** should be performed if gastrointestinal signs are present.
- **Imaging:** survey thoracic and abdominal radiography and abdominal ultrasonography to rule out infection foci, masses, organ abnormalities, and the presence of fluid. The prostate gland should be examined in male dogs. If the above have not yielded a diagnosis, then the following tests are advised (for details of techniques see BSAVA Guide to Procedures in Small Animal Practice):
  - Bone marrow biopsy if abnormalities in the full blood count are detected.
  - Echocardiography if a diastolic aortic murmur is indicated (to check for evidence of endocarditis).
  - Antibacterial antibody (ANA) testing if two of the major signs of systemic lupus erythematosus (polyarthritis, glomerulonephritis, haemolytic anaemia, thrombocytopenia, polymyositis, skin lesions) and two of the minor signs (e.g. PUO, oral ulceration, lymphadenopathy, seizures) are detected.
  - Bronchoscopy if lower respiratory tract disease is suspected.
  - Cerebrospinal fluid sampling and cytology (for steroid-responsive meningitis–arthritis, granulomatous meningoencephalitis and infectious meningitis).
  - Cytology of fine-needle aspirates from enlarged lymph nodes (avoid the submandibular nodes unless these are the only lymph nodes that are enlarged) (see Chapter 28).
  - Combes’ test (for immune-mediated haemolytic anaemia).
  - Serology for Babesia, Toxoplasma, Neospora, Ehrlichia, Babesia, Dirofilaria.
  - Arthrocentesis (for poliarthritis).
  - As a last resort, an exploratory laparotomy to search for neoplastic changes or abscessation may be performed, although this is seldom done due to its invasive nature.
Hyperthermia and pyrexia

Chapter 18

Treatment

Treating hyperthermia

Simple hyperthermia will often subside if the dog is allowed to rest in a cool environment. Therefore, if a raised rectal temperature is found during an otherwise normal examination, re-measuring the temperature in 20 minutes can help to diagnose hyperthermia. Offering cool water by mouth if the dog is not collapsed is useful. Often no further treatment is required.

Severe cases of hyperthermia should be treated as a matter of urgency. Treatment focuses on whole body cooling. This aims to reduce the body temperature rapidly to prevent ongoing damage. Wetting the dog with cold water is the simplest and fastest way to reduce its body temperature.

- Cold water baths are very effective.
- Additionally, cool water enemas, spirit on the paw pads, placing wet towels over the dog (Figure 18.6), and using fans (with a wet dog) can be helpful.
- Administering intravenous fluids at room temperature is also an effective way of reducing core body temperature.

WARNING

- It is important to reduce the body temperature quickly, but not too rapidly, as normal thermoregulatory mechanisms are usually disrupted and as the animal cools, its heat-generating mechanisms may be impaired.
- Active cooling should be stopped when the rectal temperature reaches 39.4°C to prevent hypothermia. Any condition associated with ongoing muscular activity and heat generation should be treated (e.g. antiseizure medication for status epilepticus; see Chapter 11).
Once the dog has been stabilized, serum biochemistry should be performed to monitor for organ damage and to detect acidosis and electrolyte abnormalities in need of correction. Reduced cholesterol, low albumin, low total protein, raised creatinine, and raised total bilirubin levels are all associated with a poorer prognosis.

Dogs may develop kidney damage due to a combination of direct thermal damage to the renal tubular epithelium, hypotension, and thrombosis associated with disseminated intravascular coagulation. Hypotension can also lead to liver damage and gastrointestinal ulceration. Brain damage may result from thermal damage to neurons.

The prognosis with heat stroke is variable, and depends on the amount of organ damage present before the body is cooled down. Some cases may be fatal; others can make a full recovery. Long-term damage can be assessed by repeating serum biochemistry 1 week after the episode.

**WARNING**

The use of non-steroidal anti-inflammatory drugs (NSAIDs) is contraindicated in cases of heat stroke. They may contribute to iatrogenic hypothermia and may worsen gastrointestinal ulceration and ischaemic renal damage.

### Treating pyrexia

Because pyrexia results from a change in the thermo-regulatory set point, whole body cooling is not advised; the body will increase its metabolic rate to try and keep the body temperature at the higher level set by the hypothalamus.

There is some controversy about treating mild pyrexia as it is thought to be a protective process (Figure 18.7), although there is no conclusive evidence to support this.

Dogs with rectal temperatures >41.1°C should be treated, as prolonged severe pyrexia can interfere with cellular metabolism and lead to brain damage, organ damage and disseminated intravascular coagulation. Many cases of pyrexia need supportive treatment with intravenous fluids and nutritional support. Treating the primary condition will often result in resolution of pyrexia within 2–3 days.

- Confirmed cases of bacterial infection must be treated with appropriate antibiotics, ideally based on the results of culture and sensitivity testing.
- Immune-mediated diseases will often respond to prednisolone, alone or in combination with other immunosuppressants.
- Pain is usually best controlled with NSAIDs (as long as they are not contraindicated) or with opioid medications.
- Antifungals should be used: topically for local disease, or systemically for systemic cases of disease. Note: Before systemic antifungals are used it is important to take baseline liver parameters and also to monitor liver function during treatment.
- Neoplastic conditions need to be treated specifically (see the *BSAVA Manual of Canine and Feline Oncology*).
- Parasitic diseases, such as the vector-borne diseases, need to be treated specifically.

Referral to a canine medicine specialist should be considered for cases of PUO where, despite a thorough investigation, a diagnosis cannot be determined. It must be remembered that pyrexia can result in significant morbidity, lethargy and inappetence and therefore symptomatic treatment must sometimes be instigated. The two main classes of medications used to treat pyrexia are NSAIDs and glucocorticoids, but the latter are usually contraindicated unless there is a specific diagnosis and indication (e.g. a glucocorticoid-responsive immune-mediated disease). Additionally, sedatives such as acepromazine can be used to reduce body temperature via peripheral vasodilation for severe persistent cases that are unresponsive to treatment, but care must be taken to correct fluid deficits before using these.

### Proposed result of fever

| Release of proteolytic enzymes by lysosomes | Destructive to viruses |
| Reduces the ability of bacteria to trap iron. Pyrogens released in pyrexia may cause iron sequestration in hosts | Iron stores less available to bacteria |
| Interferon production increases | Affects viral growth |
| Leucocyte mobility, phagocytic activity and bactericidal activity increased | Better immune response |

**Proposed result of fever**

**Protective mechanism**

**Proposed result of fever**

**Protective mechanism**

**Figure 18.7** Protective mechanisms thought to be produced by pyrexia.

### References and further reading


Epistaxis, sneezing and nasal discharge

Robert Williams

Disorders of the nose and associated structures often present with similar signs. Epistaxis, sneezing and nasal discharge are three of the most common and consistent signs associated with nasal disease, and all three signs are often present in one condition (Figures 19.1 and 19.2). This chapter will outline a simple initial approach for a dog presenting with these signs and also how to investigate the more complicated or recurrent case.

Initial approach to nasal disease

The initial approach to nasal disease should focus on: history; general clinical examination; and a specific examination of the nose, face and mouth. A standardized approach should be used for every case.

History

Pertinent areas to focus on include:

- Duration and incidence of signs:
  - Are they acute or chronic, constant or intermittent?
  - Are there any temporal associations, such as sneezing after walking through a corn field?
  - Is this a recurrent problem, and is it seasonal?

- Character of the discharge:
  - Serous, mucoid, purulent, bloody, mixed?
  - Unilateral or bilateral?
  - Has the discharge changed over time?
  - Is there also an ocular discharge present?
  - Has there been a progression over time; if so, is this change acute or chronic?

- Sneezing:
  - Present or absent?
  - Frequency?
  - Are there other respiratory noises present (stridor, stertor, cough, etc.)?
  - What type of material is produced on sneezing?

- Has the dog had any treatment for nasal disease (recent or historically) and has it been effective? (A course of anti-inflammatory drugs is likely to have resolved signs associated with simple rhinitis, but a course of antibacterials will, in the vast majority of cases, only have masked signs related to a tumour or fungal infection.)

- Are other body systems affected (e.g. appetite, exercise tolerance)?

Always consider a clotting disorder as a cause of epistaxis.

Emergency treatment of epistaxis

In an emergency situation (i.e. severe blood loss) there are several simple things that can be done:

- Cage rest and keeping the animal quiet. This may necessitate the use of sedatives (e.g. acepromazine, diazepam, butorphanol) at low doses
- The application of direct pressure to the nares or ice packs on the nose
- In severe cases it may be necessary to anaesthetize the animal and pack both the nasopharynx and nasal cavity with saline-soaked swabs

PRACTICAL TIP

Always consider a clotting disorder as a cause of epistaxis.
General clinical examination

PRACTICAL TIP
The initial examination should avoid the nose and face and concentrate on gathering information from the rest of the animal first. It is often the case that dogs resent examination of their nose and face, or of any area that is painful. Concentrating on the area of interest at the outset of the examination can therefore result in a poor clinical examination due to lack of cooperation.

Following the systematic examination of the rest of the body (see Chapter 3), the area of interest can be investigated.

Examination of the nose, face and mouth

Observation: Key points include:

- Can you make any judgement with regards to unilateral or bilateral involvement (e.g. based on unilateral versus bilateral discharge, discoloration of the nasal planum)?
- Are there any signs of a bleeding disorder (e.g. petechiae, ecchymoses)?

Palpation/manipulation: The aim of the hands-on examination is to feel for structural changes, changes in normal anatomical consistency and any foci of pain.

- Palpate the nasal and maxillary bones (muzzle), face, zygoma, globes, sinuses and submandibular lymph nodes, feeling for asymmetry, swellings and pain.
- Open the mouth; note whether it will open fully or not, and any obvious resistance. Inspect the teeth, especially the canines, molars and fourth upper premolar, for signs of dental disease (see Chapter 20). Look at the hard (and soft) palate; are there any palate deficits (Figure 19.4)? Is there an oronasal fistula, or is severe periodontal disease present?
- With the mouth closed, use a thumb to occlude the nasal opening on one side. Can the dog still breathe through its other nostril? Repeat for the other nostril.
- Airflow can also be checked by holding a microscope slide in front of each nostril and watching for fogging of the slide (indicating airflow).

Information gleaned from this approach should narrow the list of differential diagnoses.

Diagnostic investigations

For a thorough and systematic investigation of nasal disease, further investigation under general anaesthesia is mandatory.

Blood tests

Haematology and biochemistry are useful, as they may highlight an underlying systemic illness or evidence of a bleeding disorder. A coagulation profile will similarly highlight any deficiency of the clotting system and is also useful prior to nasal biopsy. Serological tests for Aspergillus are available, but results are unreliable and must be interpreted carefully in the context of other clinical findings.
Oral examination
A thorough dental examination (see Chapter 20) is useful to rule out periodontal disease (this involves probing the lingual and labial gingival margins of all teeth). The soft palate should be palpated; it is relatively soft and should deform when pressure is applied. Any change in expected texture should be considered significant (e.g. tumour, nasopharyngeal polyp). Figure 19.5 shows surgical removal of a nasal polyp that was identified initially on palpation of the soft palate by finding a firm swelling on the nasal side.

Radiography
Radiography may be helpful in adding to an index of suspicion, although it can be of limited value. Two views are commonly used: dorsoventral intraoral (DVIO) and skyline frontal sinus. A lateral view of the nasal passages is rarely useful, due to superimposition of the two sides of the skull. If it is easily available, computed tomography (CT) is extremely useful as an aid to diagnosis, but may be beyond the means of many clients.

Rhinoscopy
Rhinoscopy is the ideal tool for the investigation of nasal disease as it allows direct visualization of the nasal passages. Two types of endoscope may be used: flexible bronchoscopes can be retroflexed to examine the nasopharynx and choanae and can be passed a moderate distance into the nasal passages through the external nares; a 2.7 mm rigid endoscope is used to examine the nasal passages (and frontal sinus). For a thorough description of the technique, readers are directed to the BSAVA Manual of Canine and Feline Endoscopy and Endosurgery. Samples can be collected for cytology, histology and fungal culture. Foreign bodies identified can often be removed under endoscopic guidance.

Bacterial culture
Bacterial culture and sensitivity testing of the nasal discharge or a swab sample from the nasal passages are rarely useful. Primary bacterial rhinitis is very rare and any bacterial infection present is usually secondary to one of the other causes of nasal disease.

Antibiotics in nasal disease
The use of antibiotics in cases of nasal disease can often lead to frustration and dissatisfied clients. Primary bacterial rhinitis is extremely rare, so any effect the antibiotics have is almost always due to treating a secondary bacterial infection. This may be entirely appropriate in a case of viral rhinitis with a concurrent secondary bacterial infection. However, for most other common causes of nasal disease (foreign body, inflammatory rhinitis, aspergillosis, neoplasia) there will be only temporary improvement whilst a secondary bacterial infection is controlled. Once the antibiotics are stopped, signs will recur relatively quickly. It is always worth counselling clients when prescribing antibiotics that signs of nasal disease are very likely to recur and will need further investigation.

Common conditions and presentations

Epistaxis
Epistaxis can initially be a difficult problem to deal with. It is important to distinguish between: epistaxis as a reflection of primary nasal disease; and bleeding due to a systemic disorder. A broad database should be gathered, paying particular attention to evaluating haemostasis (complete blood count including platelet count and morphology, a clotting profile), blood pressure (systemic hypertension can cause epistaxis), biochemistry and urinalysis. Systemic diseases such as hyperadrenocorticism and neoplasia (e.g. haemangiosarcoma) may also cause epistaxis. Treatment is directed at removing the underlying cause, if possible.

Seasonal allergic rhinitis
While not very common, seasonal allergic rhinitis (‘hay fever’) does occur in some dogs, usually in the warmer months of the year. It presents with sneezing and a serous ocular discharge (Figure 19.6). It can often be managed with combinations of antihistamines, steroids and avoidance of any suspected
allergens (usually pollen). There may be a variable response to treatment, and signs usually start to resolve spontaneously once environmental pollen load subsides or as the season changes.

**Inflammatory rhinitis**

Inflammatory rhinitis (lymphocytic/plasmacytic rhinitis) is a reasonably common and often frustrating cause of chronic nasal discharge in dogs. Several rounds of symptomatic treatment may have been tried with variable success, but signs will often return within 1–2 weeks of treatment ceasing. The nasal discharge is usually bilateral and mucoid. Sneezing is also common, as is stridor. Definitive diagnosis relies on endoscopic biopsy (and elimination of all other causes of nasal disease). A diagnosis of inflammatory rhinitis requires careful client counselling as it may not be possible to ‘cure’ the problem. Systemic steroids form the cornerstone of treatment. Prednisolone at a high dose (1 mg/kg orally q12h) may be required (note that it is judicious to prescribe gastroprotectant medication at this dose). There is unfortunately a variable response to treatment. Other options include topical application of steroids, either instilling steroid drops directly into the nose or by use of a nasal inhaler spray. Hypoallergenic diets have also been suggested, as the nasal disease might be an unusual presentation of a food allergy.

**Viral rhinitis**

Viral rhinitis presents as sneezing and a serous nasal (or oculonasal) discharge. These dogs will also be pyrexic, lethargic and inappetent. Viruses involved include: adenovirus type 1 and 2 and parainfluenza virus. Signs will usually resolve in 5–7 days with appropriate supportive care (non-steroidal anti-inflammatory drugs (NSAIDs), mucolytics, ± antibiotics if a purulent discharge is present).

1. Anaesthetize the dog.
2. Inflate the cuff on the ET tube.
3. Pack the nasopharynx with moist swabs.
4. Fill a 60 ml catheter tip syringe with saline.
5. Introduce the tip of the syringe into one of the nasal openings. Apply lateral-to-lateral pressure across the nares, such that a tight seal is formed around the catheter tip syringe and the contralateral naris is sealed.
6. Depress the syringe plunger forcefully. Hopefully, this will dislodge any foreign body, which may be found in the nasopharynx or within the nasopharyngeal swab.
7. This process may be repeated several times for each nasal chamber.

### 19.7 Using a catheter tip syringe to flush the nasal cavity.

Chronic foreign bodies usually present as mucopurulent nasal discharges and intermittent sneezing. The patient may initially respond to symptomatic treatment (e.g. NSAIDs ± antibiotics), but signs are likely to recur once medication is stopped.

**Aspergillosis**

Aspergillosis is a relatively common cause of nasal disease in dogs. It is usually found in young to middle-aged dogs of particular dolichocephalic breeds (e.g. German Shepherd Dog, Border Collie); brachycephalic breeds are rarely affected.

Profuse nasal discharge is present and is usually of mixed type, either mucopurulent or sanguineopurulent; or epistaxis may be present. There is often pain on palpation of the nose and sinuses and, as chronicity develops, ulceration and depigmentation of the nasal planum occurs.

Diagnosis is made by accumulating evidence that fungal disease is present, as it is easy to make both false-positive and false-negative diagnoses. Several of the following should be present:

- Characteristic clinical signs: mixed nasal discharge; pain on palpation; depigmentation of the nasal planum; chronicity
- Radiographic findings suggestive of fungal nasal disease: loss of ethmoturbinates (Figure 19.8)
- Rhinoscopy: visualization of fungal plaques and destruction of turbinates (Figure 19.9)
- Histology/cytology: large numbers of fungal hyphae seen
- Positive culture of *Aspergillus* spp.
- Positive serological test for *Aspergillus* (not to be used alone).

Acute presentations are characterized by sudden onset of sneezing, head shaking and pawing at the nose. Foreign bodies may be lodged within the nasal passages or stuck in the nasopharynx/choanae. Such foreign bodies are typically grass awns, corn heads, thorns or small twigs. Dogs presenting in this way should be examined endoscopically under general anaesthesia. If an endoscope is not available, then drawing the soft palate rostrally and using a bright light and dental mirror will allow examination of the nasopharynx. The narrow speculum of an otoscope can also be passed into the external nares of larger dogs. It is possible to flush each nasal cavity with a 60 ml catheter tip syringe filled with saline (remember to inflate the endotracheal (ET) tube cuff and pack the pharynx) to try and dislodge the foreign body (Figure 19.7).

**Severe periodontal disease (and/or oronasal fistula)**

These may occasionally present with a purulent nasal discharge and/or epistaxis. If there is severe periodontal disease or an oronasal fistula in a dog with signs of nasal disease, the oral lesion should be treated first; this will often lead to resolution of the signs that suggested nasal disease. Readers are directed to an appropriate surgical or dental textbook for details of treatment for these problems (e.g. BSAVA Manual of Canine and Feline Dentistry; BSAVA Manual of Canine and Feline Head, Neck and Thoracic Surgery).

**Foreign bodies**

Nasal foreign bodies will present in one of two ways: acute or chronic.
Treatment involves instilling a liquid or ointment preparation of clotrimazole into the nasal cavity (and frontal sinus if indicated) for 1 hour under general anaesthesia. This is the most successful treatment described, with an initial success rate of approximately 85% (Sissener et al., 2006). A more detailed description of the treatment is available in most surgery textbooks.

Neoplasia
Neoplasia is a common cause of nasal discharge in older dogs. Initially the discharge tends to be unilateral but can become bilateral as the disease advances. Other common signs include epistaxis, facial deformity/swelling, ocular discharge, exophthalmos, involvement of the hard palate and maxillary teeth, sneezing and dyspnoea.

Squamous cell carcinoma, adenocarcinoma, chondrosarcoma and osteosarcoma are all possible, though adenocarcinoma is most common in dogs. Diagnosis involves imaging:

- Radiography: generally the DVIO view is the most useful, revealing either increased soft tissue opacity and/or loss of turbinate detail. As the disease progresses there may be loss of the bony nasal septum. The tumour may also extend into the frontal sinus with increased soft tissue density filling one or both sinuses.
- Rhinoscopy (Figure 19.10): allows direct visualization of the tumour (or area of abnormality on radiographs) and allows for collection of biopsy samples.

Nasal tumours are often slow growing and slow to metastasize but carry a poor prognosis. Metastasis is usually to the brain, local lymph nodes and lung. There are treatment options available for nasal tumours; however, in most cases the mean survival time is only 3–5 months. This may be increased with combined therapies such as surgical debulking and radiation therapy, or laser ablation of the tumour. Early discussion with an oncologist for up-to-date advice on the treatment of nasal tumours is recommended.

References and further reading
Oral and dental problems

Robert Williams

Signs of disease originating in the oral cavity are a common cause for presentation in general practice. The initial reason for presentation is often vague, such as a smelly or painful mouth or difficulty with eating (see also Chapter 14). There is often a simple explanation for what the owner has identified as a problem; however, it pays to keep an open mind and to have a thorough approach to dealing with these cases, as there can sometimes be a more serious or sinister cause (Figures 20.1–20.3).

Trauma

Trauma to the head and mouth is often the result of dog fights, road traffic accidents, or a kick from a large animal (or human). Animals usually present in obvious distress and pain and often with a very distressed owner.

Once the dog has been stabilized, a more thorough examination of the mouth is possible. Pay particular attention to the temporomandibular joint (TMJ), mandible, and hard and soft palates, as injuries in these sites are likely to require repair. Fractures of the maxilla usually cause minimal displacement, are stable, and seldom require repair.

The mouth can also act as a sentinel to the general health of the animal, as colour changes in the oral mucous membranes are often readily noticed by owners and are important features during a veterinary examination.

The prognosis for most traumatic oral injuries is good, provided they are treated appropriately, after a thorough and systematic work up have been performed.
Initial approach to the non-emergency presentation

The initial approach should focus on: history; general clinical examination; and specific examination of the head and mouth. A standardized approach should be used for every case.

History
Pertinent areas to focus on include:

- Duration and incidence of signs:
  - Are they: acute or chronic; constant or intermittent?
  - Are there any temporal associations, e.g. difficulty or pain when eating, altered preference for soft over hard food?
  - Recent trauma
  - History of dog carrying sticks or owner throwing objects for the dog to retrieve
  - Does the owner feed the dog bones?

- General clinical signs of illness:
  - Alterations in appetite or water intake
  - Lethargy or reduced exercise tolerance
  - Are other body systems affected (e.g. is there ascites, coughing, vomiting)?

- Has the dog had any treatment for oral disease (recent or historically) and has it been effective?

General clinical examination

The initial examination should avoid the nose and face and concentrate on gathering information from the rest of the animal. It is often the case that dogs resent examination of their nose and face, or of any area that is painful. Concentrating on the area of interest at the outset of examination can therefore result in a poor clinical examination due to lack of cooperation.

PRACTICAL TIP
The initial examination should avoid the nose and face and concentrate on gathering information from the rest of the animal. It is often the case that dogs resent examination of their nose and face, or of any area that is painful. Concentrating on the area of interest at the outset of examination can therefore result in a poor clinical examination due to lack of cooperation.

Following the systematic examination of the rest of the body (see Chapter 3), the area of interest can be investigated.

Examination of the head and mouth
Observation may reveal asymmetry of the head (Figure 20.4). When examining the head, palpation, manipulation and some specific examinations should be carried out. It is generally possible to do this initially without general anaesthesia. The examination is repeated under general anaesthesia to reveal more information, as the dog is not then fearful or in pain. Details of dental examination are given in QRGs 20.1 and 20.2.

Palpation/manipulation: The aim of the hands-on examination is to feel for structural changes, changes in normal anatomical consistency and any foci of pain. This is initially performed with the animal conscious, but then repeated in the anaesthetized animal.

- Palpate the nasal and maxillary bones (muzzle), face, zygoma, globes, sinuses and submandibular lymph nodes, feeling for asymmetry, swellings and pain.

PRACTICAL TIP
Spending time palpating and gently manipulating the mandible in cases of fracture can be invaluable in helping to generate a mental image of the fracture configuration and which segments of the mandible are affected.
Oral and dental problems

Procedure Comment

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manipulation</td>
<td>Check range of motion of the TMJ. Check for bony instability of the mandible, maxilla, and zygoma.</td>
</tr>
<tr>
<td>Palpation</td>
<td>Bony structures of face/mouth: hard and soft palates, submandibular lymph nodes, orbit, tongue.</td>
</tr>
<tr>
<td>Probing</td>
<td>Tooth–gingival margins: any oral wounds or fistulas.</td>
</tr>
<tr>
<td>Biopsy</td>
<td>Any obvious mass present or detected by imaging: incisional biopsy (multiple), fine-needle aspiration of lymph nodes.</td>
</tr>
<tr>
<td>Imaging</td>
<td>Appropriate views as indicated for: trauma, TMJ disease, craniofacial osteopathy, suspected tumour (especially bone involvement), dental problems.</td>
</tr>
</tbody>
</table>

Further examination of the oral cavity under general anaesthesia.

Further diagnostic investigations

Imaging: The skull has complex bony anatomy which makes imaging specific lesions challenging. Oblique views are often required to try and highlight an area of interest. It is worthwhile consulting an imaging text such as the BSAVA Manual of Canine and Feline Radiography and Radiology or the BSAVA Manual of Canine and Feline Musculoskeletal Imaging from the outset.

Useful views include:

- A true dorsoventral (DV) view of the skull centred on the TMJ, which provides a good view of the TMJ (Figure 20.6).
- A DV intraoral view, if looking for fractures of the hard palate/maxilla or evidence of nasal neoplasia.
- A 45 degrees (or greater) lateral oblique view of the mandible, to highlight the TMJ and fractures/tumours of the mandible (Figure 20.7).

Biopsy: The need to biopsy masses in the oral cavity is relatively common; in many cases the mass will be a tumour. If the mass is fluctuant on palpation (or appears to be fluid-filled) then needle drainage may be appropriate initially (see Chapter 28). Biopsy should be performed on any mass that has the appearance of abnormal tissue (e.g., any raised firm pink, red, grey, or black mass, whether smooth, rough, pedunculated, ulcerated, or bleeding) or alters normal anatomy. The following should be borne in mind:

- Multiple biopsy samples increase the likelihood of a diagnosis – there is often a significant inflammatory reaction around oral tumours.
- Remember that the biopsy site (and any approach to the biopsy site) should be included in the body of tissue to be resected in the event that there is a malignant tumour.
- It is often worthwhile raising a mucoperiosteal flap directly over the area of interest, as sampling through the mucosa often reveals inflammation but not the underlying neoplastic process. Sometimes it is possible to take a superficial tissue sample and further (deeper) tissue samples through that initial site.
- Use skin biopsy punches, rongeurets, bone biopsy needles or soft tissue cup biopsy forceps as appropriate to retrieve samples (see BSAVA Guide to Procedures in Small Animal Practice). Skin biopsy punches are useful for obtaining a core of tissue from a mass, particularly once a mucoperiosteal flap has been raised.
- Fine-needle aspiration of oral lesions does not reliably yield diagnostic samples. However, fine-needle aspiration should be performed on draining lymph nodes as part of a tumour staging process.

Common problems

Figure 20.8 lists common clinical conditions associated with the presenting signs of halitosis, oral pain and difficulty in eating. These are discussed further below.
Dental disease

Dental disease is a very common presentation in canine practice. A very brief summary of common conditions is given in Figure 20.9. Tooth extraction is described in QRG 20.3. More detail of specific problems and their treatment can be found in the BSAVA Manual of Canine and Feline Dentistry.

Foreign bodies

Oral foreign bodies are a reasonably common finding in canine practice.

Sites affected include:
- Ventral to the tongue or the base of the tongue (e.g. stick injuries)
- Wedged transversely across the hard palate between the maxillary PM3 teeth
- Wedged between adjacent teeth, especially premolars and molars
- Tonsillar crypts and fauces
- Oropharynx (may present in acute respiratory distress especially if the object is large such as a tennis ball).

<table>
<thead>
<tr>
<th>Clinical condition</th>
<th>Causes halitosis?</th>
<th>Causes a painful mouth?</th>
<th>Causes difficulty in eating?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abscess</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Dental disease (excluding periodontal disease and fractures)</td>
<td>✓</td>
<td>Variable</td>
<td>Unlikely</td>
</tr>
<tr>
<td>Severe periodontal disease</td>
<td>✓</td>
<td>✓</td>
<td>Variable</td>
</tr>
<tr>
<td>Fractured tooth</td>
<td>Acute: no Chronic: possible if also infected</td>
<td>Acute: yes Chronic: probably not</td>
<td>Variable</td>
</tr>
<tr>
<td>Fractured mandible/maxilla</td>
<td>✓ if an open fracture</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Lip-fold dermatitis</td>
<td>✓</td>
<td>Variable</td>
<td>✗</td>
</tr>
<tr>
<td>Foreign body</td>
<td>Variable; yes with chronicity/infection</td>
<td>Variable</td>
<td>Variable</td>
</tr>
<tr>
<td>Trauma</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Tongue laceration</td>
<td>✗</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Cranio-maxillary osteopathy</td>
<td>✗</td>
<td>✓</td>
<td>Often</td>
</tr>
<tr>
<td>Temporomandibular joint disease</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Tumours</td>
<td>✓ if infected/necrotic</td>
<td>Variable; more likely if bone involved</td>
<td>Variable; depending on location/tissue involved</td>
</tr>
<tr>
<td>Trigeminal neuritis</td>
<td>✗</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Otitis media</td>
<td>Occasionally</td>
<td>Variable</td>
<td>Variable</td>
</tr>
</tbody>
</table>

Association of clinical conditions and common presenting signs.

Clinical problem | Comment | Treatment
--- | --- | ---
Tartar/gingivitis (mild) | Very common presentation in dogs >2 years old | Scaling (see QRG 20.2), preventive treatment (e.g. tooth brushing, appropriate diet)
Periodontal disease (Figure 20.10) | Very common presentation, particularly in older dogs | Scaling, tooth extraction (see QRG 20.3), antibiotics as appropriate
Fractured teeth | Can be secondary to trauma or severe dental disease. Teeth usually either fracture in the sagittal plane (Figure 20.11) or lose the tip of the crown | If the pulp cavity is not exposed the tooth may remain in situ. If it is exposed it may need extraction or root canal treatment. Sagittal fracture: the tooth should be extracted (see QRG 20.3). Analgesia should be provided in cases of acute fracture and where the pulp cavity is exposed
Tooth root abscess | Either a progression of periodontal disease or secondary to a foreign body. Can also result from an untreated tooth with exposed pulp | Extraction of the affected tooth (or teeth) (see QRG 20.3). Appropriate antibiotics and analgesia

Common dental problems in dogs.
This 11-year-old Cocker Spaniel bitch showed some typical signs of periodontal disease. There is tartar on PM4 and M1, with associated gingivitis. Pus is also evident between the teeth.

20.10 Sagittal fracture of PM4 resulting in periodontal disease. This tooth should be extracted (see QRG 20.3).

20.11 oropharynx, this may be very straightforward. In cases with a less obvious cause and more chronic history, a systematic exploration (digital palpation, good light source, blunt probe) of the mouth and pharynx will usually reveal the source of the problem. Treatment is directed at retrieving the foreign body. A foreign body lodged across the hard palate (i.e. wedged transversely between the maxillary PM3 teeth) may be dislodged by gentle levering or pushing it caudally. Any associated abscess should be lanced (Figure 20.12), debrided and lavaged. Appropriate antibiosis and analgesia should be given. If there is tooth root involvement, tooth extraction may be necessary (see QRG 20.3). The prognosis is generally good following removal, but in cases where the foreign body cannot be retrieved, signs may recur.

Oral tumours
Tumours affecting the oral cavity are relatively common in canine practice; examples of tumour types are listed in Figure 20.13.

Gingival hyperplasia
As the name implies, this is not strictly a tumour, but it can have the appearance of one. It is thought to be a degenerative process secondary to periodontal disease and is common in some breeds (e.g. Boxer). Multiple firm (sometimes mineralized) lesions are present at the gingival margin. Treatment is by excision and attention to underlying problems.

Benign
- Epulides
- Fibroma
- Lipoma
- Odontogenic tumours
- Osteoma
- Papillomatosis

Malignant
- Chondrosarcoma
- Fibrosarcoma
- Haemangiosarcoma
- Lymphoma
- Malignant melanoma
- Mast cell tumour
- Osteosarcoma
- Squamous cell carcinoma

Papillomatosis
Papillomas may develop on the lips, gingival margin and tongue in young dogs. They are caused by a papillomavirus and will regress spontaneously.

Epulis (peripheral odontogenic fibroma)
Epulides (Figure 20.14) are benign gingival proliferations arising from the periodontal ligament and are the most common tumour of the oral cavity. They usually affect older, large-breed dogs. They are usually pedunculated with a smooth shiny surface (unless ulcerated through self-trauma) and although they are firmly attached to the alveolar bone they are not invasive. Treatment is by excision – including the bony attachment. The acanthomatous epulis is malignant, with aggressive invasion into the underlying bone (though it does not undergo distant metastasis).

Malignant melanoma
This is the most common malignant tumour of the mouth, presenting as ulcerated masses often on the gingival margin, often with invasion of bone. They
are not always pigmented and are more common in older male dogs, especially breeds with pigmented mucosae (e.g. Cocker Spaniel, German Shepherd Dog). Growth, local invasion and metastasis to local lymph nodes (and lungs) are rapid and prognosis is poor.

Squamous cell carcinoma
Squamous cell carcinoma (SCC) may present as discrete masses or there may just be areas of ulcerated gingiva, often with bone involvement. The rostral mandible is the most common site, though SCC may also be found in any part of the oral mucosa, tonsils and tongue. Caudal sites are often painful and affect eating. The metastatic rate is low and prognosis is good for very rostral lesions, but the prognosis worsens with more caudal sites, and tonsillar SCC is highly metastatic.

Fibrosarcoma
These tumours usually affect the gingiva and hard palate, and the area between the canine tooth and PM4 is over-represented, especially in large-breed males. Fibrosarcoma often affects younger dogs (<7 years). It presents as firm, smooth masses, often with ulceration, but is locally invasive and will recur after excision unless a wide (compartmental) excision can be achieved. Thus, although slow to metastasize, the prognosis is poor, especially for very young dogs.

Osteosarcoma
Flat bone osteosarcomas are less common than the long bone variety and usually less aggressive, though prognosis remains poor. They generally affect older dogs.

Palate defects

Congenital palate defects
Congenital defects are usually midline on the hard and/or soft palate. They are easily identified and all puppies should be checked at birth (e.g. after caesarean or assisted whelping) or when first presented to the practice; a severe defect (see Figure 5.12) may prompt consideration of euthanasia. Cases that have not been identified (Figure 20.15) may present with nasal regurgitation of food, nasal discharge, gagging, coughing and ill-thrift. Repair is not straightforward and is prone to failure if performed incorrectly; details of the procedure are given in the BSAVA Manual of Canine and Feline Head, Neck and Thoracic Surgery.

Acquired palate defects
Acquired defects (e.g. oronasal fistula; Figure 20.16) are usually caused by trauma or secondary to severe dental disease. They predominantly present as cases of nasal discharge (see Chapter 19). Treatment consists of debridement of the fistula and closing the defect with a mucoperiosteal flap (see BSAVA Manual of Canine and Feline Head, Neck and Thoracic Surgery).
Temporomandibular joint disease and loss of function
TMJ disease can be very debilitating, causing considerable pain and difficulty in eating. Conditions may be challenging to treat (e.g. TMJ ankylosis) or transient (e.g. craniomandibular osteopathy). Some common causes of TMJ loss of function are outlined in Figure 20.17. Cases often present as either open-mouth or closed-mouth ‘lock jaw’.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Clinical signs</th>
<th>Treatment and prognosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>TMJ luxation</td>
<td>Isolated injury or in combination with other trauma. Inability to close mouth, with mandible deviated to affected side</td>
<td>Radiography to check for other injuries (e.g. articular fractures). Reduction under general anesthesia</td>
</tr>
<tr>
<td>TMJ fracture</td>
<td>Often associated with multiple trauma</td>
<td>Treatment is often conservative as the fractures can be relatively inaccessible and it is difficult to place implants. Immobilizing the jaw using a tape muzzle may be helpful. Variable outcome depending on injury to joint</td>
</tr>
<tr>
<td>TMJ ankylosis</td>
<td>? Post trauma/craniomandibular osteopathy True = affects joint False = affects zygoma/coronoïd Unable to close mouth (or open the mouth)</td>
<td>Excision of all affected tissue. Variable outcome</td>
</tr>
<tr>
<td>Trigeminal neuropathy</td>
<td>Bilateral temporary paralysis affecting mandibular branch of the trigeminal nerve. Dropped lower jaw. Non-painful on manipulation</td>
<td>Symptomatic and supportive care. Usually resolves spontaneously after several weeks</td>
</tr>
</tbody>
</table>

20.17 Some causes of loss of function of the temporomandibular joint (TMJ).

Craniomandibular osteopathy
Whilst craniomandibular osteopathy is commonly associated with juvenile West Highland White Terriers, it is also seen in other terrier breeds, Labradors, Great Danes and Boxers. It is idiopathic but is thought to have a genetic component. Presentation is usually in young dogs (4–8 months of age), who have difficulty in eating and pain on opening the mouth. The mandibles are often palpably enlarged, due to the non-neoplastic bilaterally symmetrical proliferation of bone affecting the mandibles, bullae and zygomatic arches. Damage to the TMJ may result in ankylosis. The condition is self-limiting and bone proliferation usually regresses, although analgesia and supportive care are vital. Corticosteroids may provide better analgesia than non-steroidal anti-inflammatory drugs (NSAIDs). The prognosis is good if the TMJ remains functional but some owners may opt for euthanasia in extreme cases due to the dog’s distress.

Masticatory muscle myositis
This can occur in any breed, although spaniels and German Shepherd Dogs may be over-represented. Presentation may be acute (pain, difficulty in eating, swelling of the masticatory muscles) or chronic (difficulty in opening the mouth and atrophy of the masticatory muscles). Diagnosis can be enhanced by muscle biopsy. Treatment is with immunosuppressive doses of steroids.

Lip-fold dermatitis
Lip-fold dermatitis (see also Chapter 27) is a common cause of halitosis. It is most often seen in spaniels and setters but can occur in any dog that drools excessively or has a pronounced lip fold. Chronic exposure of the lip fold to saliva and food debris causes cheilitis and dermatitis. Mild cases may be controlled by basic hygiene (regular bathing with chlorhexidine) and occasionally topical antibiotics, but many cases only resolve after excision of the fold (Figure 20.18).

Tongue lacerations
These are usually the result of trauma. The dog may be presented because of difficulty in eating or halitosis (chronic cases), or because the owner has noticed that the dog is bleeding or in pain. Treatment is by debridement and suturing. Double-layer suturing is necessary; 1 or 1.5 metric (5/0 or 4/0 USP) polyglactin 910 or poliglecaprone 25 in a simple interrupted pattern is appropriate.
Burns
Oral burns may be chemical or electrical and usually cause ulceration of the palate and dorsal surface of the tongue. Treatment is with supportive care: intravenous fluids, analgesia and assisted feeding.

Changes in oral mucous membranes
There are many causes for changes in the appearance or colour of the mucous membranes. These changes can often be accompanied by other serious signs such as collapse or respiratory distress, although there may be minimal clinical signs. Until proven otherwise, all cases should be viewed as potentially serious, and most dogs presenting with marked changes will need to be admitted for further investigation.

In general, the normal appearance of the oral mucous membranes is pink and moist. Changes include: pallor; injected or ‘brick-red’; yellow (jaundiced); and bluish (cyanosis).

Some breeds normally have pigmented membranes (e.g. Chow Chow).

Initial approach
The approach when presented with altered mucous membranes should be the same as for any potentially serious medical problem:

- Obtain a good history
- Perform a thorough clinical examination
- Obtain a minimum database, including urinalysis, haematology and biochemistry
- Other tests may be needed, depending on initial suspicions: e.g. clotting profile, Coombs’ test, blood film cytology, thoracic and abdominal imaging, systemic blood pressure measurement, blood-gas analysis (if available), bone marrow biopsy and echocardiography.

Jaundice
Jaundice is characterized by hyperbilirubinaemia and deposition of bile pigment in the skin, mucous membranes and the sclera, causing the typical yellow appearance of these tissues. Jaundice can be pre-hepatic, hepatic or post-hepatic in origin (Figure 20.19).

Cyanosis
Cyanotic, bluish mucous membranes occur due to increased amounts of reduced haemoglobin within the bloodstream. Central cyanosis (Figure 20.20) is due to unsaturated arterial blood or the presence of a specific haemoglobin derivative, whereas peripheral cyanosis is due to desaturation of blood due to a regional reduction in blood flow.

Pale mucous membranes
Pale mucous membranes originate from either shock (see Figure 9.2a) or anaemia (Figure 20.21).

The approach to a dog with pale mucous membranes is summarized in Figure 20.22.

Treatment
The initial approach to treatment should be to stabilize the patient, especially dogs that are in shock, collapsed (see Chapter 9) or systemically unwell. This should include:

20.19 Common causes of jaundice.

20.20 Common causes of cyanosis.

20.21 Common causes of pale mucous membranes.
Chapter 20 Oral and dental problems

Dog with pale mucous membranes

EXCLUDE: shock; hypovolaemia; poor cardiac output; high sympathetic tone?

Yes

No

KEY POINT: HISTORY
Trauma; wounds or bites; travel history; exercise tolerance; diet and scavenging; medication; vaccination; recent season; parasite control; littermates; changes in mucosal colour or bruising; duration and progression; evidence of overt bleeding

KEY POINT: PHYSICAL EXAMINATION
Mucous membrane colour – jaundice, petechiation and cyanosis; heart rate and rhythm; pulse quality; respiratory rate and effort; temperature

What is the packed cell volume (PCV)?

<30%

>30%

KEY DECISION
Is the anaemia regenerative?

Yes

No

Look for cause – immune-mediated; drugs; infectious agents; paraneoplastic

KEY DECISION
Is there haemolysis?

Yes

No

Look for bone marrow disease; precursor inadequacy (e.g. iron); hormone failure (e.g. erythropoietin, EPO)

KEY POINT: INVESTIGATION OF UNDERLYING CAUSE
Consider: full external haematology with reticulocyte count, biochemistry and analysis; imaging (thoracic radiography and abdominal ultrasonography); Coombs’ test; coagulation profile; PCR for infectious disease; faecal occult blood; oestrogen levels; iron and iron-binding proteins; bone marrow aspiration and biopsy; EPO measurement; adrenal and thyroid function testing

Look for causes of bleeding: external; gastrointestinal disease; third space – pleural, peritoneal, pericardial; assess coagulation system

20.22

An approach to the dog with mucous membrane pallor. (Courtesy of L Holm and K Sturgess)

References and further reading


Holm L and Sturgess K (2013) How to...approach a dog with pale mucous membranes. In: How To...Collected Articles from BSAVA companion, ed. M Goodfellow, pp. 50–9


Oral and dental problems

Chapter 20

QUICK REFERENCE GUIDES

QRG XX.XX continued

QRG 20.1 Examining the mouth in a conscious dog

by Lisa Milella

Oral examination in the conscious dog is limited to visual inspection and some digital palpation. Some dogs resent examination of the mouth, especially if there are painful areas. The aim of the conscious oral examination is to obtain a tentative diagnosis that can help formulate a treatment plan. As good practice, owners should be advised that it is only under a general anaesthetic that the mouth can be fully examined and the true extent of oral disease evaluated.

Approach the dog from the side or from behind. Gently make contact with the dog and stroke its head prior to examining the mouth. Gentle technique is essential as some dogs may have dental pain or discomfort.

1. Approach the dog from the side or from behind. Gently make contact with the dog and stroke its head prior to examining the mouth. Gentle technique is essential as some dogs may have dental pain or discomfort.

PRACTICAL TIP

It is important always to have good lighting when examining the mouth.

2. Examine the head externally:

- Check visual symmetry. In cases of a tooth root abscess, for example, the area of the nose below the eye may be swollen, or in cases of an oral tumour, a swelling may be obvious on one side.

A draining sinus is present in this Labrador Retriever, with cellulitis of the left maxilla secondary to a fractured maxillary carnassial tooth with pulp exposure.

- Gently palpatate the facial muscles, facial bones and salivary glands.

3. Palpate the lymph nodes:

- The mandibular and retropharyngeal lymph nodes at the angle of the jaw
- The cervical chain extending down the neck to the prescapular lymph node
- The retropharyngeal lymph nodes may only be palpable if enlarged.

PRACTICAL TIP

An enlarged lymph node may indicate infection or inflammation.

4. Perform a closed mouth examination. Gently hold the jaws closed and retract the lips. Do not pull on the fur to retract the lips. Examine the soft tissues and buccal aspects of the teeth.

Mild gingivitis and calculus accumulation can be seen on the buccal surfaces of the teeth.

- Occlusion:
  - Is this normal for the breed or are there any signs of soft tissue trauma?
  - Check the incisor relationship: the lower incisors should occlude palatal to the upper incisors
  - Check the canine interlock (the lower canine should occlude in the diastema between the upper canine and third incisor)
  - Check the premolar alignment (the teeth should interdigitate) and the distal occlusion should be that the mandibular premolars and molars occlude on the palatal surface of the maxillary premolars
  - Check the position of individual teeth.

Correct canine interlock.

- Teeth:
  - Check for missing teeth or extra teeth
  - Look at the gingival margin – is it inflamed, swollen or receded?
  - Check the crown for defects such as fractures
  - Check to see whether any of the teeth are mobile by digital manipulation

Incisor malocclusion. This puppy has a mandibular prognathism, with the maxillary incisors biting into the oral soft tissues lingual to the mandibular incisors, causing trauma to the soft tissue.

Correct incisor occlusion.

Mild gingivitis and calculus accumulation can be seen on the buccal surfaces of the teeth.

Contact ulceration of the mucosa in a Bearded Collie with chronic ulcerative paradental stomatitis.

- Mucous membranes: Check for inflammation, ulceration or any swelling of the buccal mucous membranes, gingival tissues and oral mucosa.

PRACTICAL TIP

The above may vary with brachycephalic head shapes.

Teeth:

- Check for missing teeth or extra teeth
- Look at the gingival margin – is it inflamed, swollen or receded?
- Check the crown for defects such as fractures
- Check to see whether any of the teeth are mobile by digital manipulation
Chapter 20 Oral and dental problems

QRG 20.1 continued

- Check the calculus coverage on individual teeth versus the whole mouth.

Severe inflammation of the gingiva (gingivitis) with hyperplasia of the maxillary fourth premolar and molar.

Perform an open mouth examination.

i. Approach the dog from the side.

ii. Place one hand over the muzzle, with the forefinger and thumb placed just behind the upper canine teeth. Gently press the lips into the oral cavity while tilting the dog’s head slightly upwards.

iii. Place a finger from the other hand on the lower incisors, and exert gentle pressure. In larger dogs, the thumb and forefinger are placed behind the lower canines to open the mouth. Do not use the fur under the mandible to try to pull the jaw down.

The correct way to open a dog’s mouth.

The oropharynx (soft palate, palatoglossal arch, tonsillary crypts, tonsils and fauces)

The lingual and palatal surfaces of the teeth (brief evaluation)

The occlusal surfaces of the maxillary and mandibular molars for caries decay (discoloration seen on examination)

The tongue: gently place pressure externally between the mandibles to lift up the tongue.

QRG 20.2 Scaling and polishing teeth

by Lisa Milella

Professional periodontal treatment is carried out to deal with plaque-retentive surfaces and to reduce areas of plaque stagnation, ensuring the mouth is then in the best condition to enable the client to provide ongoing plaque control.

Patient preparation

General anaesthesia is always required in order to perform a scale and polish because areas in the mouth may be painful, the dog may resist examination of the mouth and a secure watertight airway is needed to prevent aspiration of the water used for cooling equipment, or aspiration of debris and blood from the procedure itself.

The dental chart

Dental charts are a diagrammatic representation of the dentition, where information (findings and treatment) can be entered in a pictorial and/or notational form. The chart should be completed and filed following any dental examination and treatment. The canine dental chart shown here uses the modified Triadan tooth numbering system, where individual numbers are assigned to individual teeth to ensure accurate recording of the clinical findings and treatment. The numbers correspond to the 42 teeth found in the permanent dentition of dogs.

<table>
<thead>
<tr>
<th></th>
<th>Incisors</th>
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<th>Premolars</th>
<th>Molars</th>
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<tr>
<td>Maxilla</td>
<td>3</td>
<td>1</td>
<td>4</td>
<td>2</td>
<td>X2 = 42</td>
</tr>
<tr>
<td>Mandible</td>
<td>3</td>
<td>1</td>
<td>4</td>
<td>3</td>
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The dog is examined and findings are recorded on a dental chart by an assistant.
Oral and dental problems

Chapter 20

Quick Reference Guides

QRG 20.2 continued

Your practice details here

Canine Dental Chart

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Buccal

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Treatment Recommendations

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C1 (Gingivitis index)

0 = Normal; no inflammation
1 = Marginal gingivitis; red line/oedema
2 = Bleeds on gentle probing. Swollen
3 = Severe inflammation. Spontaneous bleeding

C2 (Calculus index)

0 = No calculus either side tooth
1 = Up to 25% cover bucally above/below gingiva
2 = From 25%–75% cover on buccal crown
3 = From 75%–100% cover on buccal crown

Other

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Your practice details here

Full-size downloadable chart available to BSAVA members at www.bsava.com

Equipment

Periodontal probe

The periodontal probe is a thin, rounded, blunt-ended graduated instrument. The blunt end allows the probe to be inserted into the gingival sulcus without causing trauma.

The periodontal probe is held in a modified pen grip, as with all dental instruments except elevators and luxators. Graduations (millimetres) are marked on the end of a periodontal probe to enable measurements of the gingival sulcus.

Explorer probe

The dental explorer probe is a sharp-ended instrument.

Differently shaped dental explorer probes.

Other hand instruments

- Hand scaler: the sharp point means that this can be used supragingivally only, to avoid damaging the periodontal tissues.
- Subgingival curette: the rounded blunt toe allows this instrument to be used subgingivally. A Gracey curette pattern 5/6 is a useful size to clean below the gingival margin in dogs.

Hand scaler (left) and Gracey curette (right).

Scalder

An ultrasonic scaler with a sickle-shaped tip is recommended.

Make sure that the tip is water-cooled. The water setting should be that which produces a fine mist when in motion and a fine droplet off the point. The water reduces the heat generated by the tip and also aids calculus removal by the process known as cavitation.

223
The power setting of the scaler should be set according to the manufacturer’s recommendations, but ideally at the lowest possible setting to avoid excessive heat generation.

**Procedure**

1. Prior to scaling and polishing, examine the mouth using a periodontal probe and explorer probe.
   - Use the periodontal probe to check for: bleeding of the gingival tissues; periodontal probing depths around all teeth; tooth mobility; and exposed furcations (the areas between two roots).

2. Rinse the mouth with a proprietary chlorhexidine mouthwash (e.g. Hexarinse). This reduces the bacterial aerosol created by ultrasonic scaling.

3. Remove any large pieces of calculus using extraction forceps, without contacting or traumatizing the gingiva.

4. Using the ultrasonic scaler, start by scaling the crowns of the teeth above the gingival margin (supragingival scaling). Clean all the buccal surfaces of the dental arcades that are uppermost, and then all the lingual and palatal surfaces of the opposite arcades.
   - The instrument is moved circumferentially around the tooth, using overlapping vertical strokes.
   - Oblique or horizontal strokes are also used, particularly in the furcation area of multi-rooted teeth.

   **PRACTICAL TIP**
   - The side of the tip is used against the tooth surface. The fine water spray can also be seen.
   - The instrument is moved circumferentially around the tooth, using overlapping vertical strokes.
   - Oblique or horizontal strokes are also used, particularly in the furcation area of multi-rooted teeth.

5. If calculus is present below the gingival margin, use a hand curette to remove it and any diseased cementum.
   - The instrument is positioned below the gum margin, with the working edge against the tooth surface to be cleaned, and then pulled towards the crown.

   **PRACTICAL TIP**
   - The side of the tip is used against the tooth surface. The fine water spray can also be seen.
   - The instrument is positioned below the gum margin, with the working edge against the tooth surface to be cleaned, and then pulled towards the crown.

6. Rinse the mouth with water, followed by a chlorhexidine mouthwash. Any further treatment such as extractions (see QRG 20.3) can then be carried out.

   **WARNING**
   - Immense iatrogenic damage can be caused by polishing incorrectly.
   - Always use a fine grit polishing paste with a soft rubber cup.
   - Use plenty of polishing paste to reduce friction between the rotating cup and the tooth surface.
   - Use enough pressure to flare the cup gently against the tooth surface. The cup can be gently flared below the gingival margin to clean any subgingival plaque.
   - The speed of rotation should be set so that the cup just slows down when it contacts the tooth surface. Too much pressure, too much friction or too high a speed rotation will result in excess heat being produced that can ultimately cause pulps (inflammation of the pulp – usually irreversible, leading to pulp necrosis). This can be appreciated by performing the same action against your thumb nail to feel the heat generated.

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Indications
- Severe periodontal disease (mobility, furcation exposure, periodontal probing depths) or teeth with moderate periodontal disease where homecare is not going to be provided.
- Complicated crown fracture (pulp exposed).
- A tooth where a fracture extends subgingivally, to involve the root, whether the pulp is exposed or not.
- Teeth affected by caries.
- Teeth involved in a jaw fracture.
- Unerupted teeth causing clinically significant disease.
- Teeth causing malocclusions.
- Supernumerary teeth.
- Chronic ulcerative paradental stomatitis.

Equipment
- Luxator 3 mm and 4 mm straight and curved (not essential).
- Elevators: Couplands 1 (3 mm) and Couplands 3 (4 mm).
- Periosteal elevator.
- Scalpel handle and blades.
- Extraction forceps: pattern 76N.
- Selection of burs for bone removal and sectioning the teeth. The author recommends: friction grip round 2 and 4 to remove bone; 701 tapered fissure bur to section teeth; and a large round diamond bur to smooth bone edges following the extractions.
- High-speed turbine water-cooled handpiece on a dental unit with a three-way syringe.
- Soft tissue protector, such as a plastic spatula.
- Surgical kit for closure of oral flaps.
- Monofilament absorbable suture material.

Patient preparation
- The dog should always be anaesthetized with a cuffed endotracheal tube in place. Care must always be taken to ensure that the tube is securely fastened, to minimize any movement when manipulating the head during dental treatment.
- Appropriate pain relief should be given (pre-, intra- and post-operatively). Consideration should be given to the use of opioids, NSAIDs and local anaesthetic techniques (see specific dental texts).
- Ideally, the teeth should be scaled and polished (see QRG 20.2) prior to extraction, to ensure that the oral surgery is performed in a clean mouth. As a minimum, the mouth should be rinsed with a chlorhexidine mouthwash and gross calculus removed prior to extraction.
- Pre-extraction radiographs should be taken to assess the tooth, its roots and the disease present.

Procedures

Non-surgical or ‘closed’ technique
This technique is used for all single-rooted teeth or teeth that have been sectioned into individual roots.

Multi-rooted teeth
- To section multi-rooted teeth into individual roots, use a tapered fissure friction grip bur (701) on a high-speed handpiece with water cooling.
- The furcation must first be identified. The furcation is the area between the roots and generally lies below the main cusp. It can be identified by raising some of the gingival tissue away from the bone or by gently using a puff of air from the three-way syringe.

Start sectioning the tooth from the furcation towards the cusp, from the buccal to the lingual/palatal aspect of the tooth. Care should be taken not to damage the gingival attachment at the furcation.

To check that the tooth has been adequately sectioned, place an elevator between the two sections of the tooth and gently rotate – both parts of the crown should move independently.
Each tooth root is then extracted individually as described below.
The gingival attachment is cut around the whole circumference of the tooth, using a No. 11 scalpel blade or a sharp luxator. A sharp elevator can also be used.

Either a luxator or elevator of appropriate size (e.g. Couplands 1 for incisors, premolars and molars in small dogs; Couplands 3 for carnassials and molars in large dogs) is then inserted into the periodontal ligament space to cut the periodontal ligament fibres.

Vertical releasing incisions are made mesial and distal to the tooth/teeth to be extracted.

A mucoperiosteal flap is raised using a periosteal elevator.

Once the tooth is mobile it can be extracted from the socket using either forceps or fingers. Forceps are used to twist the tooth gently without levering the root, to break down any remaining fibres and lift the tooth from its socket.

The edges of the socket are then smoothed using a large round diamond bur.

The mucoperiosteal flap is then replaced and sutured, with no tension, using a fine (1 metric; 5/0 USP) monofilament absorbable suture material. Simple interrupted sutures are placed.
Extraction of deciduous canine teeth

Indications for extraction of deciduous teeth include malocclusion in puppies and persistent deciduous teeth in adult dogs.

1. A dental radiograph is taken to assess where the permanent tooth bud is positioned or, in the case of persistent deciduous teeth, whether the root is being resorbed. With resorption there is loss of density of the dentine and periapical resorption. In cases where the root is being resorbed, a simple non-surgical extraction technique as detailed above can be used.

2. In young puppies or dogs with persistent deciduous teeth where the root is not being resorbed, raise a small mucoperiosteal flap: use a No. 11 scalpel blade to make the releasing incisions; then a periosteal elevator to raise the flap.

3. Use a small round bur to remove the buccal bone. Care must be taken not to damage the root of the permanent or adjacent teeth.

4. Use a small elevator (e.g. Super Slim which is 1.3 mm wide) to luxate the tooth gently, taking care not to position the elevator in a position where the permanent tooth could be damaged.

WARNING

In a puppy <16 weeks of age, the permanent crown is only just developing and calcifying, and immense damage can be done to this developing tooth if the luxator/elevator is positioned too far down the root or in the incorrect place. The length of the root of the deciduous tooth is usually about 2–3 times the length of the crown, so a surgical extraction technique is used if the root is not being resorbed.

PRACTICAL TIPS

- If extracting mandibular deciduous canines, no instrument should be placed on the lingual (inner) aspect of the tooth, as this will damage the permanent developing mandibular canine and probably also the third incisor.
- Avoid placing the elevator in this position, as there is a risk of damage to the developing permanent canine tooth.
- If extracting maxillary deciduous canines, take care placing any instrument on the mesial (front edge) aspect as the permanent tooth bud develops in front of the deciduous tooth.
5 Gently rotate and luxate the deciduous tooth. Once there is some mobility, use extraction forceps with a small beak (pattern 76N) in a rotational manner to break down any remaining fibres prior to the tooth being lifted out of the socket.

6 Suture the flap closed using a fine (1 metric; 5/0 USP) monofilament absorbable suture material with simple interrupted sutures, ensuring that there is no tension on the sutures.
Ocular problems are commonly encountered in general practice and can range from conjunctivitis to sight-threatening emergencies. This chapter describes how to conduct a thorough ophthalmic examination, as well as how to recognize and manage common ocular problems. The clinician needs to evaluate each individual case, the situation of the owners, any financial constraints, and the first-opinion facilities available to them. Referral is not an option in every case, but if the appropriate facilities are not available to the first-opinion clinician, referral should be considered and discussed with the owner at an earlier rather than later opportunity.

The ophthalmic examination

Examining the eye can place the examiner's face in close proximity to that of the dog, and care should always be taken. If there is any doubt the patient should be muzzled (see Chapter 1) or sedated as appropriate. However, the vast majority of dogs are very tolerant of procedures on and around the eyes, and a full examination, including procedures such as nasolacrimal duct irrigation, can usually be carried out with only minimal restraint and topical anaesthesia.

The patient is often best restrained, as for many other procedures, held against the body of the handler with the patient’s head resting on one arm of the handler and the handler’s other arm over the patient’s back (Figure 21.1). This is usually sufficient to restrain the head and is more effective than holding the chin and nose, since this often creates more resentment and movement by the patient.

It is helpful to bring the patient and examiner to the same eye level, either by elevating the examination table, or with smaller dogs, by carrying out the examination seated. Illumination is then directed along the central visual axis, to greatest effect.

Although sedation may, rarely, prove necessary to facilitate an examination, chemical restraint is not a substitute for thorough examination. If a diagnosis cannot be reached with the patient conscious, referral should be considered for a full examination with appropriate equipment, rather than resorting to examination under anaesthesia which, in itself, is unlikely to yield further information.

Examination equipment and techniques

The majority of ocular conditions can be diagnosed with very little equipment. An effective examination of the eye can be carried out with no more than a bright focal light source, some means of magnification and an examination room that can be darkened.

- **Light source**: This can be as simple as a pen torch giving a focused light beam or illumination provided by the direct ophthalmoscope. Of equipment readily available in the consulting room, the otoscope (auroscope) is often the brightest source of illumination.
- **Magnification**: A 20 Dioptre (20 D) lens gives a magnified view of the lens, cornea and anterior chamber and, when used as an indirect ophthalmoscope, enables visualization of the fundus.

**Direct ophthalmoscopy**

The ophthalmoscope provides a light beam along which the examiner looks to visualize the intraocular structures (see later). The image is real and magnified (approximately 2 optic disc diameters). However, due
to the magnification and small field of view, it is often of limited use for locating fundic lesions or appreciating fundic topography. Many lens settings are available on most direct ophthalmoscopes, but only the zero setting is required for viewing the fundus.

**Distant direct ophthalmoscopy:** With the ophthalmoscope on the zero setting, the fundus is viewed at arm’s length (Figure 21.2). Any opacities are silhouetted against the fundic reflection and appear black. This is the simplest means of identifying the presence of cataracts, which appear black, and differentiating them from nuclear sclerosis (age-related hardening of the lens) through which the fundic reflection can be readily appreciated.

**Indirect ophthalmoscopy**
The examiner looks along the light beam while holding a condensing lens (usually 20 D) at arm’s length in front of the dog’s eye. The light is focused into the eye by the condensing lens and the image of the fundus is viewed immediately in front of the condensing lens. This gives a less magnified but wider view of the fundus and is the technique of choice for general fundic examination.

Although binocular indirect ophthalmoscopes (Figure 21.3) can represent a considerable investment, monocular indirect ophthalmoscopy can be carried out using an inexpensive 20 D lens with a focal light source (Figure 21.4). A pen torch can be held to the side of the clinician’s head, while viewing the image with the eye adjacent to the penlight, or the image can be viewed through an otoscope (without the otoscope lens or speculum) held up to the clinician’s eye.

**Assessing vision**

**Obstacle course:** A simple obstacle course can be readily constructed from items in the consulting room (e.g. the legs of the consulting table, chairs, bin) to assess whether the patient has functional vision. Poor performance in low-level lighting can indicate impaired rod function, such as in generalized progressive retinal atrophy (see later).

**Menace response:** The menace response can be the simplest and most effective means of determining whether an eye is visual. It is best elicited by advancing a hand across the field of view from beyond the lateral canthus (Figure 21.5). Advancing a hand or finger directly towards the dog’s eye is less likely to elicit a response, and may create a draught resulting in a false-positive result.
Ocular problems

Chapter 21

Pupillary light reflex:
- Direct: The pupil constricts in response to illumination of the eye.
- Indirect: The pupil constricts in response to illumination of the contralateral eye.

Swinging flashlight test: The light source is shone from one eye to the other. Both pupils should normally be constricted and remain constricted. This enables the examiner to distinguish between blindness and impaired pupil mobility (Figure 21.6).

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<td>Blindness</td>
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</tr>
<tr>
<td>Impaired pupil mobility</td>
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21.6 Swinging flashlight test results.

Assessing ocular structures
A methodical examination is required, starting with the globe as a whole and then progressing from the eyelids rostrally through to the fundus caudally, as appropriate.

PRACTICAL TIPS
- Try to adhere to an examination routine: starting at the front of the eye and working systematically to the back.
- Try to avoid being drawn immediately to an obvious lesion to the exclusion of all else.

Globe: Both globes should be compared with regard to position and size. Ease of retropulsion and third eyelid mobility are assessed by pressing firmly on the globe through the upper lid.

Schirmer tear test
If there is any mucoid or mucopurulent discharge, a Schirmer tear test (STT) should be carried out at the beginning of the examination. Fold the STT paper strips over at the notch while still in the packet to avoid touching the ends, and then apply the test strip over the central lower eyelid for 60 seconds. Tear production of <9 mm on a STT is consistent with keratoconjunctivitis sicca (KCS).

Eyelids: Eyelid innervation is assessed using the menace response (mediated by cranial nerve (CN) II and CN VII; see Figure 21.5) and the palpebral reflex (the blink elicited when the eyelid is touched; mediated by CN V and CN VII). The eyelids should be assessed for size, shape and position of the palpebral aperture, and regularity and position of the eyelid margins. The presence of distichia should be noted (the extra lashes may be more readily identified by silhouetting them against the sclera; see Figure 21.16) and the eyelids everted to check for ectopic cilia (see Figure 21.17).

Cornea: Assessing corneal reflection gives an indication of the regularity of the corneal contour and its lubrication; any irregularities and opacities should be noted (Figure 21.7 and 21.8). Fluorescein instilled on to the cornea highlights any ulceration by staining exposed corneal stroma; the cornea should be irrigated with sterile saline after application to prevent fluorescein retention by mucus.

Anterior chamber: This is assessed for depth, clarity and abnormal contents. Uveitis may create an aqueous flare, evident as haziness in the anterior chamber.

Iris and pupil: The iris and pupil are assessed for mobility by observing constriction of the pupil on exposure to a light source and dilation of the pupil after the application of topical tropicamide. Pupillary distortion may be seen in cases of iris adhesions to the anterior lens capsule or cornea, or in cases of iris neoplasia.

Lens: Cataracts are most readily identified using distant direct ophthalmoscopy.

Mydriasis
Mydriasis with tropicamide facilitates examination of the whole lens and the identification of lens subluxation. The eye is assessed before mydriasis and then afterwards, allowing 20–30 minutes for the pupil to dilate. It is important to explain to the owner that it is essential to wait for mydriasis to occur before completing the examination; it may be necessary to ask them to wait or to send them away until the end of a busy surgery. Sometimes it may be preferable to admit the patient to allow for examination later.

White
- Lipid: crystalline
- Scarring: diffuse, milky
- Oedema: diffuse, blue-white, denser if pressure applied to the globe through the upper lid

Vascularization
- Superficial: branching. Indicates superficial corneal lesion
- Deep: straighter. Indicates deeper corneal lesion or intraocular disease

Pigmentation
- Usually superficial in response to chronic inflammation

21.7 Corneal opacities.
Posterior segment (vitreous and fundus): The vitreous is examined for any opacities. The fundus is assessed for colour, tapetal reflectivity (increased with retinal necrosis), vascularization (attenuated with retinal degeneration) and the size and colour of the optic disc (smaller and darker with optic nerve degeneration). A normal fundus is shown in Figure 21.9.

Surgical equipment

- For the majority of ophthalmic surgical procedures, correct instrumentation, illumination and magnification are necessary, along with appropriate experience
- Head loupes, particularly those with an attached light source, can be invaluable when carrying out eyelid surgery and corneal surgery
- Operating microscopes provide greater magnification and also coaxial illumination, and are mandatory for virtually all intraocular procedures
- A surgical kit containing small strabismus or tenotomy scissors, Foster needle-holders and Adson forceps will facilitate eyelid and adnexal surgery, but for corneal and intraocular procedures microsurgical instruments are required

PRACTICAL TIP

A fundic examination is not always necessary in cases of surface ocular disease, and significant intraocular disease can usually be ruled out simply by assessing the pupillary light reflex and fundic reflection

Conditions of the eyelids

Entropion

Entropion is the inversion of the eyelid causing the palpebral hairs to contact the cornea or bulbar conjunctiva (Figure 21.10). It may be seen as a localized eyelid abnormality or may occur in conjunction with abnormalities of facial conformation. The clinical signs are those of corneal abrasion (discomfort and epiphora, with or without ulcerative or non-ulcerative keratitis).
Lower lid entropion in a 7-month-old male Bulldog.

Lateral upper lid entropion
This is usually associated with a conformation of excessive facial skin (e.g. St Bernard, Shar Pei) or ageing dogs with pendulous, low set ears (e.g. Cocker Spaniel). A Hotz–Celsius resection may be insufficient to alleviate the entropion or, in cases of progressive facial droop, may provide only temporary relief. More extensive eyelid resection may be necessary and, in pronounced cases where the globe is largely obscured by the upper lid, a facelift procedure may be required.

Medial lower lid entropion
Entropion of the medial lower lid is typically seen in brachycephalic dogs, often associated with a macro-palpebral aperture. The entropion and macro-palpebral aperture can both be addressed simultaneously by carrying out a permanent medial tarsorrhaphy.

Ectropion
Ectropion is an eversion of the eyelid, most commonly seen as eversion of the central lower lid in conjunction with lateral lower lid entropion in the ‘diamond eye’ conformation of breeds such as the St Bernard (Figure 21.13). Ectropion may be corrected by a simple lid-shortening wedge excision of the lower lid, but more often surgery needs to address the overall eyelid conformation.

Lower lid entropion is most readily corrected by excising a crescent from the affected lower eyelid (Hotz–Celsius resection). Keeping the incision close to the lid margin (ideally within 2 mm) turns the eyelid out instead of pulling it down, and reduces the risk of iatrogenic ectropion.
Trauma
Eyelids are well vascularized and heal readily. When repairing traumatic lacerations it is important to re-create the smooth eyelid margin (see later). Debridement of any tissue of questionable viability should be minimal, since even heavily contused tissues may prove to be viable.

Neoplasia
Eyelid neoplasms (see Chapter 28) are, in the vast majority of cases, benign and rarely present a risk of metastatic disease. They can present a surgical challenge if occupying a significant proportion of the eyelid margin, and early removal is indicated to avoid the need for complex eyelid reconstruction. If the tumour is occupying <20% of the eyelid margin, the mass may be removed by full-thickness wedge excision. Repair of the defect is readily achieved by direct closure using 1 or 1.5 metric (5/0 or 4/0 USP) swaged-on suture material, taking care to re-form a smooth, regular eyelid margin while avoiding corneal abrasion by the suture material (Figures 21.14 and 21.15). Soluble material such as polyglactin 910 can be used to avoid the need for suture removal.

Distichiasis
Distichiasis are extra eyelashes that arise from the meibomian glands and emerge from the meibomian gland openings on the eyelid margin (Figure 21.16). These lashes may be single or multiple, usually emerging over the first 18 months of life, and can be of varying clinical significance. They may cause ocular discomfort, keratitis and, rarely, corneal
Distichiasis. The extra lashes arising from the meibomian glands are readily identified when silhouetted against the sclera.

Ulceration, but they can be clinically silent. Clinical signs may be temporarily alleviated by plucking the extra lashes, and this can be of use in determining their significance. Permanent removal requires destruction or excision of the follicles, which can be variously achieved by cryosurgery, electrolysis or surgical excision. These surgical procedures require specific instrumentation and magnification and should not be attempted in their absence due to the risk of significant distortion of the eyelid margin.

Ectopic cilia

Ectopic cilia also arise from the meibomian glands, more commonly of the upper eyelid, but emerge directly through the conjunctiva and therefore impinge directly on the cornea (Figure 21.17). They are almost invariably associated with ocular discomfort, which can be acute in onset, and characteristically presents as unremitting ocular discomfort in the juvenile. Secondary ulceration, typically focal, central and progressive, can occur. Do not forget to look under the upper lid in cases of ocular discomfort, with or without ulceration, in juvenile dogs. Treatment of ectopic cilia is as for distichiasis.

Conditions of the nictitating membrane (third eyelid)

Prolapse of the third eyelid gland (‘cherry eye’)

Prolapse of the gland of the third eyelid presents as a pink regular mass, protruding from behind the third eyelid (Figure 21.18). The gland produces a proportion of the precorneal tear film and its preservation is advocated. The prolapsed gland may be repositioned into a pocket deep to the bulbar conjunctiva, which is then closed over the gland while leaving ports at either end of the closure to allow the egress of tears from the gland.

Excision of the gland is indicated in the Neapolitan Mastiff in which pronounced granulomatous reactions can occur in response to suture material buried within the conjunctiva.

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Scrolled third eyelid cartilage

This can present with some similarity to prolapse of the third eyelid gland, but is caused by eversion of the free margin of the third eyelid due to distortion of the cartilage. It may not be clinically significant but can result in exposure and inflammation of the third eyelid (nictitating membrane). The condition is corrected by excision of the deviant portion of the cartilage, approached from the bulbar aspect of the third eyelid. The conjunctiva is left unsutured.

In the Great Dane, surgery to correct a scrolled third eyelid cartilage can be followed by prolapse of the third eyelid gland, and prophylactic surgery to prevent gland prolapse should be considered.

Neoplasia

Neoplasia of the third eyelid may present as protrusion of the lid and a space-occupying lesion of the third eyelid may be appreciated on inspection and/or palpation under topical anaesthesia. Such a mass is usually readily accessible for biopsy. If neoplasia is confirmed histologically, excision of the third eyelid may be indicated.

The third eyelid plays an important role in protecting the cornea and its excision is indicated only in cases of neoplasia.
Chapter 21 Ocular problems

Conditions of the conjunctival sac

Conjunctivitis
Primary conjunctivitis may be caused by infection, allergy or environmental irritants (e.g. cement or plaster dust from building work). It presents as hyperaemia of the conjunctiva and an ocular discharge (serous, mucoid or mucopurulent), and is not normally associated with ocular pain. Most cases respond to symptomatic treatment with topical antibiotics and/or steroids. Conjunctival swabs may be taken for bacterial culture and sensitivity testing but may yield only opportunistic bacteria of doubtful significance. It is important to check for, and treat, any underlying diseases such as KCS or eyelid abnormalities, and to eliminate any environmental causes.

Foreign body
Remarkably large foreign bodies, such as grass awns, may reside within the conjunctival sac, particularly beneath the third eyelid. They can result in non-responsive cases of ocular discharge, conjunctivitis, discomfort and/or corneal ulceration, particularly medially. It is important to examine the conjunctival sac and beneath the third eyelid under topical anaesthesia.

Conditions of the sclera

Limbal melanoma
This is a benign melanoma, which sits astride the limbus. It is well circumscribed and slow-growing in older dogs but can progress more rapidly in younger individuals. It should be monitored to assess its rate of progression, and, if progressing significantly, surgical excision or laser ablation, with corneoscleral reconstruction, may be indicated.

Nodular granulomatous episclerokeratitis
The sclera and episclera may be affected by inflammatory conditions, often idiopathic, categorized by the structures affected (scleritis, episcleritis, episclerokeratitis). The most common inflammatory condition is nodular granulomatous episclerokeratitis (NGEK), which presents, as the name suggests, as one or more inflammatory nodule(s) overlying the sclera, with associated conjunctival hyperaemia and variable corneal involvement. Symptomatic treatment is indicated and some or all of topical corticosteroids, oral corticosteroids, subconjunctival corticosteroids and oral azathioprine may be required to control the inflammation. The condition may resolve, or long-term treatment may prove necessary to maintain control.

Conditions of the nasolacrimal system

Dacryocystitis
Dacryocystitis is inflammation of the nasolacrimal duct and is characterized by a mucopurulent discharge in the presence of normal tear production. It may resolve with nasolacrimal duct irrigation (which may need to be carried out on more than one occasion), but if a foreign body is present (often characterized by blood on irrigation) surgical exploration is indicated.

Keratoconjunctivitis sicca
KCS typically presents as a dry tenacious mucopurulent ocular discharge (Figure 21.19). As the condition progresses, a keratitis with varying degrees of corneal vascularization develops, typically in the dorsolateral quadrant of the cornea. Tear production of <9 mm on a STT (see above) is consistent with KCS. The underlying cause in the majority of cases is lacrimal gland adenitis, which may respond to topical ciclosporin. Adjunctive treatment with topical corticosteroids to control any keratitis, and topical lacrimomimetics, may be indicated. KCS can be induced by oral sulphonamide medication, particularly sulfasalazine, and such drugs should be withdrawn if a concurrent KCS develops.

PRACTICAL TIP
Always perform an STT in any case of ocular discharge or non-responsive conjunctivitis

Treatment
- Topical ciclosporin q12h to restore tear production.
- Topical ocular lubricants q6h or as needed.
- Topical corticosteroids to control any keratitis (e.g. dexamethasone and neomycin q6h initially).
- Treat as above for 6 weeks. If there is no improvement, medication with an increased concentration of ciclosporin, or with tacrolimus, may be indicated; however, neither drug is authorized for this use in the UK.
- Parotid duct transposition (PDT) (to be considered if all medical options have been exhausted):
  - Can be very effective in providing lubrication but can be associated with side effects such as corneal opacification and blepharitis
  - If a PDT does prove necessary, it is best carried out before an extensive keratitis has developed.
Conditions of the cornea

Ulceration

Corneal ulceration is usually traumatic in origin but may be complicated by secondary infection, or a failure of the cornea to heal appropriately. Ulcers may be defined by their depth:

- Superficial: affecting only the epithelium
- Stromal: involving the stroma to a varying depth
- Descemetocele: extending down to Descemet’s membrane.

PRACTICAL TIP

Remember to check for underlying disease, such as ectopic cilia or entropion, in cases of corneal ulceration.

Simple traumatic ulceration can be expected to heal if the underlying cause is no longer present or removed (e.g., a conjunctival sac foreign body) and secondary infection is controlled with a topical antibiotic. Oral non-steroidal anti-inflammatory drugs (NSAIDs) should also be considered to control any discomfort and reflex uveitis. It is very important that stromal ulceration is monitored regularly at the veterinary surgery (e.g., every 3–5 days depending on the depth and extent) until it is fluorescein-negative; it should not be left to the owner to ‘see how it goes’.

Corneal vascularization may develop with significant or long-standing ulcers and may facilitate healing but will also result in corneal scarring. Vascularization persisting when the ulceration has healed may be encouraged to regress with the administration of topical corticosteroids.

WARNING

Topical steroids impede corneal healing and if applied to an ulcerated cornea can result in progression of the ulcer and possible perforation of the globe. Always check for corneal ulceration with fluorescein before prescribing a topical steroid.

Epithelial dystrophy

Also known as spontaneous chronic corneal epithelial defect (SCCED), this presents as a non-healing, superficial ulceration with under-running of the epithelium. It can occur in any dog, but is typically seen in the Boxer, while Corgis, Staffordshire Bull Terriers and Border Collies are also predisposed. The characteristic appearance is of a shallow ulcer with a margin of loose epithelium (Figure 21.20), which should be removed under topical anaesthesia by gentle abrasion with a cotton bud. Sclerosis of the superficial corneal stroma can prevent healing by direct re-epithelialization. The ulcer may heal by granulation if corneal vascularization develops, but surgical intervention may prove necessary.

Treatments that have been advocated include: keratotomy, using either a hypodermic needle or mechanical Burr to penetrate the affected superficial stroma; keratectomy; chemical cautery with liquefied phenol; bandage contact lens; and third eyelid flap. Topical antibiotics (to prevent secondary infection) and analgesia are also indicated.

Healing of a superficial ulcer may be protracted and the owner should be advised that it can take a few weeks. In cases of non-progressive superficial ulceration the patient may only need to be re-examined every 1–2 weeks and surgical intervention may need to be considered only if the ulcer is failing to heal over a period of 2–4 weeks.

Descemetocele

A descemetocele (Figure 21.21) is a deep ulcer exposing Descemet’s membrane, which appears as a dark area at the base of the ulcer which fails to stain with fluorescein, in contrast to the adjacent oedematous fluorescein-positive corneal stroma. Descemetoceles carry a significant risk of corneal perforation. Small, non-progressive descemetoceles may heal by granulation and may be managed conservatively if there is a significant vascular response. The majority of cases, however, are preferably managed by surgical repair with a conjunctival graft or corneoscleral transposition, for which adequate magnification and appropriate instrumentation are essential.
Keratomalacia

Keratomalacia (melting ulcer) occurs in the presence of collagenase, typically seen with *Pseudomonas aeruginosa* infections, and is characterized by a rapidly progressive corneal ulceration with a gelatinous appearance of the corneal stroma (Figure 21.22). *It is a sight-threatening disease, which requires immediate, intensive medication to preserve the globe.* Once the keratomalacia has been controlled, surgical repair of the cornea may be contemplated, or the cornea may heal uneventfully by granulation. In either case significant corneal scarring can be anticipated.

Minimizing the exposure to ultraviolet light. In advanced cases, subconjunctival depot steroid injections may be of benefit. Once the inflammation is controlled, the frequency of topical medication may be reduced, but lifelong medication, once or twice daily, is necessary to prevent recurrence or progression of the keratitis.

Lipid keratopathy

The most common cause of corneal lipid deposits is corneal lipid dystrophy, an idiopathic condition, which presents as a crystalline lipid deposit, approximating to an oval shape, usually immediately ventral to the central visual axis. The deposit is characteristically bilateral and non-progressive, and is rarely clinically significant. Lipid deposits in the corneal stroma may also be seen in cases of hypothyroidism and hyperlipidaemia.

Endothelial dystrophy

The corneal endothelium maintains the cornea in a transparent, dehydrated state. Impaired endothelium function, allowing the ingress of aqueous into the corneal stroma, can occur due to endothelial dystrophy. The resulting corneal oedema can present bilaterally symmetrically or unilaterally, and may result in corneal ulceration and keratitis, eventually causing significant visual impairment. The oedema and associated keratitis may be controlled with long-term topical hyperosmotic medication such as topical 5% sodium chloride 3–4 times daily.

Foreign bodies

Corneal foreign bodies (typically thorns) may be non-penetrating, embedded in the corneal stroma, or may penetrate into the anterior chamber. Clinical signs of ocular discomfort, corneal oedema/keratitis and uveitis will vary, depending on the size of the foreign body and degree of penetration.

If it is proud of the corneal surface, a foreign body can be removed by impaling it on a 25 G hypodermic needle. To avoid pushing the foreign body further into the cornea or anterior chamber the needle is advanced at a tangent to the corneal surface and perpendicular to the long axis of the foreign body.
Neoplasia

Melanoma
Most iris melanomas in dogs are benign. They present as dark, circumscribed space-occupying lesions of the iris and can be differentiated from benign iris pigmentation by elevation of the surface contour of the iris and/or distortion of the pupil (which may only be evident with mydriasis). The rate of progression of the melanoma can be an indicator of its malignant potential.

- A slowly growing melanoma is unlikely to be malignant and may not prove to be clinically significant for many years. While still circumscribed the melanoma may be amenable to curative transcorneal laser ablation. Left untreated, the melanoma may ultimately occupy the anterior chamber or may progress around the filtration angle (ring melanoma) and can result in glaucoma or globe perforation necessitating enucleation.

- A rapidly progressing melanoma is more likely to be malignant, and the risk of metastasis may be high. Early enucleation in such cases is indicated, and the patient should be monitored for signs of any subsequent metastatic disease.

Ciliary body adenoma
Ciliary body adenomas are benign, non-pigmented tumours arising immediately caudal to the iris and presenting as pale, sparsely vascularized masses visible at the pupil. The risk of metastatic disease is very low and the tumour may be amenable to local excision, with or without adjunctive laser ablation. If local excision is not appropriate, enucleation can be expected to be curative.

Atrophy
Atrophy of the iris musculature can be seen in ageing dogs, resulting in a poorly responsive pupil but with no associated visual impairment. This can manifest as an irregular and/or dilated pupil, and occasionally full-thickness defects in the iris, but is rarely clinically significant.

Uveitis
Uveitis is inflammation of the uvea, the vascular layer within the eye that comprises the iris, ciliary body and choroid. It may affect the iris and ciliary body (anterior uveitis), the choroid (posterior uveitis), or the iris and choroid (panuveitis). Clinically these different categories may not be easily differentiated, and the term uveitis is typically used to refer to anterior uveitis, with or without involvement of the choroid.

Uveitis may be caused by ocular trauma, or by inflammatory corneal disease, particularly deep corneal ulceration. It may be seen in cases of intraocular disease, or can arise due to the presence of a systemic inflammatory condition.

The cardinal sign of uveitis is miosis (constriction of the pupil), which may be associated with protein exudate into the anterior chamber (aqueous flare) condensing on the ventral corneal endothelium as keratic precipitates, and perilimbal vascular congestion. There may be signs of ocular discomfort, and responses to vision tests may be attenuated or absent. If the cause of the uveitis is not readily apparent, initial
investigations should include serum biochemistry and haematology. Serology for specific infectious causes (e.g. *Neospora, Borrelia*) can be carried out, but symptomatic medication should be initiated while awaiting laboratory results.

**Treatment**

Prompt treatment to relieve the ciliary spasm and achieve mydriasis is imperative, while also controlling the inflammation and identifying and treating any underlying cause.

- **Mydriasis:**
  - Topical atropine ± topical phenylephrine, q30min until full mydriasis has been achieved. Subsequently, tropicamide should be used q12h until the uveitis has fully resolved.

- **Systemic anti-inflammatory medication:**
  - NSAIDs provide analgesia in addition to anti-inflammatory activity, but corticosteroids may have a greater anti-inflammatory effect
  - Initially, in cases of intense inflammation, NSAIDs and soluble dexamethasone can be administered simultaneously, in conjunction with an H1 antagonist (e.g. cimetidine) to protect the gastric mucosa
  - Systemic or oral steroids should be used with care in cases of corneal ulceration (see above) but are unlikely to compromise corneal integrity in the short term.

- **Topical steroid medication:**
  - Prednisolone acetate applied q4h can help to control intraocular inflammation, but must only be used in the absence of corneal ulceration.

- **Topical antibiotics:**
  - Should be used if corneal ulceration is present.

- **Systemic or oral antibiotics:**
  - Of limited benefit, but will penetrate the anterior chamber in the presence of uveitis and are indicated if there has been penetration of the globe.

**Glaucoma**

Glaucoma usually manifests as increased intraocular pressure (IOP). It can occur as a primary condition, or may be secondary to other intraocular disease. Primary glaucoma most commonly arises due to pectinate ligament dysplasia, resulting in occlusion of the iridocorneal angle. Primary open-angle glaucoma, where there is no gross abnormality of the iridocorneal angle, has been studied extensively in a colony of Beagles but is rarely encountered in practice. Secondary glaucoma occurs as a result of other intraocular diseases such as uveitis, lens luxation and neoplasia.

In the majority of cases, primary canine glaucoma presents as an acute condition. Typical signs of elevated IOP include:

- Absence of response to vision tests
- Generalized corneal oedema
- Episcleral vascular congestion (Figure 21.25)
- Mid-sized or dilated pupil, sometimes irregular
- Megaloglobus

**PRACTICAL TIP**

If a tonometer is not readily available, IOP can be gauged by assessing the ease with which the globe can be indented with a blunt probe (such as a thermometer bulb) and comparing this with the contralateral eye. A glaucomatous eye will be tense, whereas a uveitic eye will be soft and easily indented.

**Treatment**

Immediate treatment of increased IOP is essential to preserve vision of the affected globe; however, once gross changes to the eye are evident the vision has usually already been irreversibly lost due to optic disc atrophy. Management of glaucoma should aim to ensure that the first affected eye, if blind, is not a source of discomfort, while monitoring the contralateral eye to identify any increase in IOP and treating this promptly.

Effective treatment of glaucoma requires accurate measurement of IOP. In the absence of accurate tonometry, glaucoma treatment can only be of dubious benefit.

**Medical treatment**

This may include:

- Topical prostaglandin analogues (latanoprost, travoprost):
  - Increase uveoscleral outflow
Cataracts are most readily diagnosed by distant direct ophthalmoscopy. If the cataract is small and progressing only slowly, no action need necessarily be taken. If the cataract is extensive, bilateral or progressing rapidly, referral at this stage is indicated (even if a lenticetomy is not currently necessary) while at least one fundus can be visualized and assessed for the presence of any underlying retinal degeneration. In cases of rapidly developing cataracts a lens-induced uveitis (phacolytic uveitis) may occur. This may be subtle and can easily be mistaken for conjunctivitis. Such cases require symptomatic medication to control the uveitis, and prompt referral if cataract surgery is being contemplated.

**PRACTICAL TIP**
Nuclear sclerosis, an age-related hardening of the lens, appears as a bilateral blush-grey haziness and can readily be mistaken for a cataract. These are most readily differentiated by distant direct ophthalmoscopy. The fundic reflection is unobstructed by nuclear sclerosis, while a cataract will obscure the reflection and appear black.

**Luxation**
Primary lens luxation (PLL) is the result of an inherited weakness of the zonular fibres. It is typically seen in terriers but can occur in a variety of breeds. It is usually encountered in ‘middle-aged’ dogs (4–6 years old).

**WARNING**
In a terrier breed with an acute onset painful eye, suspect lens luxation and treat accordingly until the position of the lens has been identified.

**Genetic testing**
The gene responsible for PLL in many breeds has been identified, and genetic testing is now readily available. This is advisable in any susceptible dog intended for breeding. If an individual is identified as being at risk of PLL, prophylactic lens extraction surgery, before any lens instability has developed, can be considered.

The degeneration of the zonular fibres may allow vitreous to pass into the anterior chamber and this may be seen as a smoke-like wisp or plume extending through the pupil. As zonular fibre degeneration progresses, the lens becomes more unstable, although still supported on the anterior face of the vitreous. The anterior chamber becomes deeper and a tremor of the iris (iridodenesis) may be apparent. Ventral subluxation of the lens may be evident, with an aphakic crescent visible dorsally, but this can only be appreciated with mydriasis. (If a case presents with a readily evident aphakic crescent, a mydriasis will already be present, suggestive of a primary glaucoma.) Referral for lens extraction surgery should be considered at this stage.

**Conditions of the lens**

**Cataract**
A cataract is an opacity of the lens. Cataracts may vary in their position within the lens, their rate of progression and their clinical significance. In particular breeds (e.g. Labrador Retriever; Figure 21.26), cataracts may be inherited and may be of a characteristic appearance. Cataracts may be seen in cases of uveitis and lens trauma and may develop secondary to retinal degeneration or secondary to diabetes mellitus. They may also arise due to senile lens changes, or can be apparently spontaneous.
Chapter 21 Ocular problems

Anterior lens luxation

If sufficiently unstable, the lens may luxate anteriorly, occupying the anterior chamber and coming into contact with the cornea (Figure 21.27). The attached vitreous can occlude the pupil, obstructing the flow of aqueous from the ciliary body to the iridocorneal angle and causing a pupil-block glaucoma.

The clinical signs of an anterior lens luxation are an acutely painful eye, corneal oedema and episcleral vascular congestion. The clinician should have a high index of suspicion of lens luxation in an acutely painful eye in a middle-aged dog of a susceptible breed.

Prompt management of an anterior luxation is critical to preserve vision in the affected eye. The administration of a topical mydriatic and systemic NSAID should alleviate a pupil block. With the concomitant reduction in IOP, the corneal oedema should reduce and the position of the lens may become apparent. A residual localized ventral corneal oedema may then be appreciated due to the contact of the lens against the corneal endothelium. With effective mydriasis, a lens luxation is no longer an ocular emergency but prompt referral is indicated for lens extraction surgery.

Posterior lens luxation

If, in a case of subluxation, the vitreous degenerates and liquefies, the lens is no longer supported at the pupil and will migrate to the floor of the posterior segment. In such a case there is low risk of anterior luxation and pupillary block glaucoma but there is a significant risk of the development of chronic glaucoma. Surgical intervention before a posterior luxation has developed is preferable.

Conditions of the retina

Progressive retinal atrophy

Generalized progressive retinal atrophy (gPRA) is a blanket term, referring to a number of inherited retinal degenerations and dysplasias, which present with an ophthalmoscopically similar appearance. gPRA presents as a progressive blindness, becoming apparent over a period of months or years, initially evident as night blindness with poor vision in low-light conditions and then progressing to reduced visual acuity in daylight and, ultimately, a total loss of vision. The ophthalmoscopic appearance is characterized by attenuation of the retinal vasculature, hyper-reflectivity of the tapetal fundus, demyelination and atrophy of the optic disc, and depigmentation of the non-tapetal fundus (Figure 21.28). Secondary cataracts commonly develop but, in such cases, cataract surgery will be of limited benefit.

Collie eye anomaly

Collie eye anomaly (CEA) is a condition seen in collie breeds and some others. It is characterized by the presence of an optic disc coloboma (a ballooning of the globe at the optic disc) and/or choroidal hypoplasia (presenting as a choroidal defect lateral to the optic disc). It has largely been eliminated from working collies as a result of testing under the BVA/KC/ISDS examination scheme. In other breeds, most notably the Shetland Sheepdog, the condition is very prevalent. CEA may be associated with retinal detachment and retinal haemorrhage, but this is encountered rarely in affected dogs and most cases are clinically silent.

Retinal detachment

The neurosensory retina lies in apposition to the underlying retinal pigment epithelium (RPE) and is held in position by the vacuum within the potential...
space between the two layers. Any material occupying that potential space, or any lesion destroying the vacuum within it, will create a retinal detachment.

- **Effusive retinal detachment** may be seen in cases of retinitis and can present as bilateral retinal detachments, sometimes idiopathic. The detachment may respond to oral prednisolone at 1–2 mg/kg q24h in conjunction with treatment of any underlying systemic disease.

- **Rhegmatogenous detachment** is caused by a retinal tear that allows the vitreous, if liquefied, to pass into the subretinal space. The prognosis for restoring vision in such cases is very guarded. Treatment necessitates surgical access to the posterior segment to reposition the retina and to create adhesions between the neuroretina and RPE using an ophthalmic laser.

## Conditions of the globe and orbit

### Retrobulbar space-occupying lesions

Neoplasia and cellulitis/abscessation are the most commonly encountered retrobulbar space-occupying diseases. The cardinal signs of a retrobulbar space-occupying lesion are rostral displacement of the globe accompanied by protrusion of the third eyelid, to be distinguished from globe enlargement in cases of glaucoma where protrusion of the third eyelid does not occur. Clinical suspicions may be confirmed by ultrasoundography, identifying a lesion of soft tissue density (neoplasia) or a fluid focus (retrobulbar abscess).

**Cellulitis**

Retrobulbar cellulitis can occur due to traumatic inoculation of infection into the orbit or by extension from an adjacent septic focus such as a tooth root abscess, but many cases are idiopathic and are presumed to be due to haematogenous spread of infection. The condition often presents acutely, with swelling of the conjunctiva, and characteristically with pain on opening the mouth. Most cases of retrobulbar cellulitis will respond to broad-spectrum systemic/oral antibiotics. Rarely, in refractory or peracute cases, drainage via the oral mucosa caudal to the caudal upper molar is necessary, but this carries some risk of trauma to the optic nerve.

**Neoplasia**

Retrobulbar neoplasia typically has a less acute onset than cellulitis and is non-painful. Displacement of the globe other than rostrally may be appreciated, depending on the position of the neoplasm. Magnetic resonance imaging (MRI) and computed tomography (CT) are the methods of choice for accurately localizing a retrobulbar neoplasm. Fine-needle aspiration of an orbital neoplasm may be attempted, but the cells harvested may not be representative and results can be misleading.

Since the majority of the orbit is encased in bone, orbital neoplasia is rarely amenable to en bloc resection with clear surgical margins. Enucleation and tumour excision is rarely curative but may be indicated to alleviate pain associated with the corneal desiccation and ulceration that may accompany globe displacement. A clear margin of dissection may be achieved with a medial orbitectomy, but this may entail entry into the cranial vault.

### Traumatic globe proptosis

Typically seen in road traffic accident cases, traumatic globe proptosis is characterized by rostral displacement of the globe and entrapment of the eyelids behind the globe equator. The proptosis is alleviated by drawing the eyelids in front of the globe (facilitated by a lateral canthotomy if necessary) and suturing them in apposition to protect the globe while the retrobulbar swelling resolves over the next few days with anti-inflammatory medication. Often, in such cases, optic nerve trauma renders the globe blind. Rupture of the medial rectus muscle can occur, causing lateral deviation and rostral displacement of the globe, and may necessitate enucleation.

**Horner’s syndrome**

Horner’s syndrome is caused by a lesion affecting the sympathetic innervation of the eye. It can result from brachial plexus avulsion or otitis media, but most cases are idiopathic. The clinical syndrome comprises enophthalmos, third eyelid protrusion, drooping of the upper lid, miosis and conjunctival hyperaemia. This needs to be distinguished from similar clinical signs that may be seen with corneal pain. Horner’s syndrome is confirmed by resolution of the clinical signs following the instillation of topical phenylephrine into the conjunctival sac.

The ocular signs are rarely clinically significant and idiopathic cases often resolve in 6–8 weeks. Any underlying disease (e.g. otitis media, see Chapter 22) should be identified and managed. Topical phenylephrine may be applied to the eye twice daily to control the clinical signs and prevent the third eyelid obstructing the central visual axis.

### References and further reading


Ear problems and head tilt

Robert Williams

Disorders of the ears are some of the most common presentations in first-opinion canine practice; rarely will a day go by when a practitioner doesn’t need to deal with a case of ear disease. They can often be a source of frustration for the vet and owner, and a source of much discomfort for the dog.

Ear disease can present in a variety of ways including:

- Ear scratching, head shaking, face rubbing
- Aural malodour, otorrhoea
- Erythema of the pinna
- Nystagmus, ataxia, paresis
- Head tilt
- No signs.

There are few, if any, true emergencies arising from ear problems, but owners may perceive that urgent attention is required if there is:

- An acute onset: ear problems that present acutely (e.g. vestibular syndrome or aural haematoma) can cause significant anxiety for owners
- Acute worsening of a pre-existing problem: the dog may become extremely distressed, scratching repeatedly at the ear (e.g. otitis externa)
- A foreign body in the ear canal, such as a grass awn.

Prompt examination is warranted in all these cases.

Clinical examination of the ear

Clinical examination of the ear should be preceded by a thorough general examination of the skin looking for signs of inflammatory skin disease, multifocal lesions or signs of parasitic infestation (fleas, mites, lice).

Once this has been performed, examination of the ear can begin. Each clinician will develop their own way of doing this, but a systematic approach is often useful.

1. Palpate the external ear canal and periauricular tissues.
2. Examine and palpate the pinna.
   - Examine the outer edges of the pinna for crusting associated with scabies.
   - Note whether the concave section of the pinna is erythematous (a strong indicator of allergic disease).
3. Use a fine comb to brush the pinna, looking for parasites such as lice.
4. Using a cotton swab, obtain a cytology sample from the ear canal. If infection is suspected, obtain a sample for culture and sensitivity testing.
5. Cytology (see QRG 22.1) allows the characterization of inflammatory cells and any microbes present (e.g. Gram-positive cocci, Gram-negative rods, yeast). If Gram-negative

Top tips for ear problems

1. Adopt a consistent approach to each case
2. Client education is vital in medicine, and particularly when dealing with ear disease
   - Ear disorders are often slow to resolve and may be indicative of a more generalized problem – if a client appreciates this from the outset they may be more patient
   - If the client understands what is wrong with their dog and how it can be managed, they are more likely to be understanding of the particular difficulties of treating ear disease
   - Owner compliance is often poor, as medicating painful ears is difficult
3. Owners can also get disheartened, as they may feel that the problem is never-ending
   - It is important to explain to the client what is happening in the dog’s ear, to provide a clear demonstration of how to clean and medicate the ear, and to outline the objectives of the treatment
4. Repeat examinations are vital for treatment success. Retaining these cases and seeing them repeatedly until they resolve is of paramount importance. Successful conclusion of a case is more likely when both vet and client work together to achieve a result
5. A consistent approach, involving several members of the practice as a team, will give good results
rods are found, culture and sensitivity testing should be performed.

6. Perform otoscopy (see QRG 22.2). It is very important to examine the entire length of the external ear canal and the tympanic membrane. This may not be possible in conscious animals with severe aural pain, canal stenosis or an uncooperative temperament. Such dogs are likely to require examination under deep sedation or anaesthesia.

Mites

Ear mites are a relatively common presentation, particularly in juvenile dogs.

*Otodectes cynotis* mites (Figure 22.1) cause acute inflammation of the external ear canal. The mites activate the ceruminous glands, which produce copious amounts of dark brown cerumen. The mites are white and easily visible moving around on the wax. Multiple drugs can be used, but moxidectin and selamectin are particularly useful. They are available as topical spot-on treatments; a second dose should be applied after 4 weeks. It is also necessary to clean the ears and to treat any secondary otitis externa. Infection is contagious, so in-contact dogs (and cats) should also be treated.

![Otodectes cynotis ear mite. (Original magnification X80) (Courtesy of Ken Robinson)](image)

**22.1** *Otodectes cynotis* ear mite. (Original magnification X80) (Courtesy of Ken Robinson)

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**PRACTICAL TIPS**

It is very important to check for an underlying cause of the head shaking that usually precedes the haematoma.

The pinna should always be examined for signs of disease (including ectoparasites), and otoscopy performed to look for otitis externa or a foreign body.

If any underlying problem is found, this will need treating concurrently.

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**Treatment**

Many treatments for aural haematoma have been described; the following is the author’s preferred approach. Whichever drainage technique is used, it is usually necessary also to treat the underlying otitis externa.

**Non-surgical drainage**

The haematoma can be drained using a 19 G butterfly needle and 10 ml syringe (Figure 22.3).

![Needle drainage of an aural haematoma.](image)

**22.3** Needle drainage of an aural haematoma.
An alternative is to apply local anaesthetic cream (e.g. EMLA) to the lowermost section of the swollen concave aspect of the pinna (distal to the ear canal opening) and then to create an opening using a biopsy punch (8 mm). This leaves a permanent drainage hole, allowing sustained drainage. Antibiotic cover is recommended.

**Surgical treatment**
Surgery may be necessary in cases refractory to needle drainage, so it is important to advise clients from the outset that this may ultimately be required. The technique is straightforward (see QRG 22.3).

## Lacerations of the pinna
Lacerations of the pinna are most often caused during dog fights or by dogs running free and snagging an ear on a sharp object, such as barbed wire. Torn ears bleed profusely (Figure 22.4).

22.4 Laceration of the pinna; note the profuse bleeding.

Treatment of small tip lacerations is often achieved most easily by amputating the tip and suturing over the exposed end of the pinna. Larger lacerations should be repaired: a two-layer closure is best, suturing both skin surfaces separately with a fine-gauge suture material (1.5 metric; 4/0 USP).

Local anaesthetic cream (e.g. EMLA) may be applied topically over the repair. It is important to pay attention to pain relief as these dogs are often quite sore in the first 1–2 days after the operation. Bandaging ears postoperatively, particularly after pinna surgery, is often advocated. If done incorrectly, however, this may cause ischaemic damage to the pinna. The author prefers not to bandage ears as it rarely appears to be necessary, and head bandages are often poorly tolerated.

## Foreign bodies
The foreign bodies encountered most commonly in the ear canal are grass awns, and the condition is thus more common in summertime. Dogs present with acute-onset vigorous head shaking and ear scratching, often following a period of outdoor activity. The proximal ear canal is visibly inflamed and dogs resent (strongly) palpation or manipulation of the external ear canal. It is preferable to examine the external ear canal under heavy sedation (or light anaesthesia). The foreign body can be anywhere in the external ear canal but is usually distal, close to the tympanum.

Once located, the easiest way to remove the foreign body is to grasp it using crocodile forceps under otoscopic guidance, and to use gentle traction to remove the foreign body, forceps and otoscope from the ear canal in one movement. All foreign material should be removed. It is very important to examine the ear canal once the foreign body has been removed, and to check the state of the tympanum. Most tears will resolve in a number of weeks; however, it would be advisable to avoid topical medication if the tympanum is not intact. Most dogs will benefit from a short course of anti-inflammatory drugs to reduce the discomfort associated with the foreign body. These can be delivered topically if the tympanic membrane is intact.

## Otitis externa
Otitis externa (OE) is defined as inflammation and/or infection of the external ear canal and associated structures. OE may be acute or chronic, and may be associated with other diseases of the ear (aural haematoma or otitis media), or can be a part of generalized skin disease. The disease process is often thought of in terms of predisposing factors, primary factors and perpetuating factors (Figure 22.5). Cases will have a combination of several of these factors present; it is important to identify each factor and manage or eliminate it as appropriate. All breeds of dog can be affected by OE, although certain breeds are more commonly affected (e.g. spaniels, Boxer, Labrador Retriever, West Highland White Terrier).

### Predisposing factors
- Ear canal conformation
- Excess cerumen
- Obstructive ear disease
- Systemic diseases
- Excess moisture

### Primary factors
- Parasites
- Foreign body
- Hypersensitivity diseases
- Autoimmune diseases
- Disorders of keratinization
- Cutaneous (ceruminal gland hyperplasia)

### Perpetuating factors
- Bacteria
- Yeast
- Pathological changes (skin)
- Otitis media
- Inappropriate treatment

22.5 Predisposing, primary and perpetuating factors in otitis externa.

## Clinical signs
Dogs presenting with acute OE tend to display head shaking and scratching, with erythema of the pinna and proximal external ear canal (Figure 22.6). There can be variable amounts of discharge present (Figure 22.7). Chronic OE may have few signs other than a malodorous ear discharge (with soiling of the proximal external ear canal and pinna); head shaking and
Ear problems and head tilt

Chapter 22

Scratching are variable and may be absent. There may also be thickening of the external ear canal (Figure 22.8), and pain on palpation.

Treatment of a simple case (first presentation)

In most cases the following is appropriate:

- Ear cleaning (see below) once daily
- Topical medicated eardrops effective against cocci and Malassezia, and with some anti-inflammatory steroid present
- It may also be useful to use steroids orally to reduce severe inflammation of the ear canal, especially if the canal is too narrow (due to inflammation) to allow full examination; subsequent re-examination may allow a better inspection of the ear canal
- Cases should be checked after 7–10 days, repeating cytology and otoscopy. Treatment and checks should continue until the ear canal has returned to normal on visual inspection, and cytology fails to demonstrate inflammatory cells or microbes. It is always worth checking whether the owner is cleaning and medicating the ears correctly. Compliance may be poor for a variety of reasons, including a poor understanding by the owner of the condition, and patient factors such as aural discomfort.

It is useful to employ adjunctive treatments, such as tris-EDTA in cases of Pseudomonas infection. Where topical treatment is not possible (e.g. it would be too painful), oral antibiotics and steroids can be used. It is also helpful to treat any underlying inflammatory or immune-mediated skin disease (see Chapter 27).

The prognosis for OE is variable, and should be excellent for cases caused by parasites such as Otodectes, or in simple cases with minimal inflammation and sparse cocci seen on cytology.

Discharge colour/ type | Likely cause
--- | ---
Dark brown/black | Staphylococcus, Streptococcus, Gram-positive cocci, ear mites, Malassezia
Yellow/cream/ green | Pseudomonas, Proteus, Klebsiella, Gram-negative rods
Blood | Neoplasia, trauma

Types and likely causes of aural discharge in otitis externa.

Ear cleaning

- Ear cleaning is very important as it can dramatically improve treatment outcomes
- It allows for a thorough evaluation of the ear canal and tympanum
- It removes pus and debris, which can inactivate certain antibiotics; this also reduces some of the stimuli to the inflammatory process
- There are many ear cleaning products available. Ceruminolytic products containing docusate sodium, propylene glycol, glycerine or mineral oil work particularly well. Further information on specific ear cleaners can be obtained by consulting a dermatology text such as the BSAVA Manual of Canine and Feline Dermatology
- In severely soiled ears, or where a severe infection is present, lavage of the ear canal is also beneficial. A ceruminolytic agent should be used first, followed by copious lavage of the canal with sterile saline. Various methods of lavage are possible (e.g. fluid bag, three-way-tap, intravenous cannula and syringe, nasogastric feeding tube and syringe, or specific ear lavage systems; all require deep sedation or, ideally, general anaesthesia)
Chronic or complex cases
In severe cases, long-standing chronic cases, cases associated with underlying skin disease or intractable cases, it may only be possible to manage the condition rather than cure it. In these situations, it is important to discuss this fact with the owner and explain why the treatment will aim to manage and not to cure. Surgery such as lateral wall resection, total ear canal ablation (TECA) or lateral bulla osteotomy (LBO) is an option, though this surgery is not for all cases and not for the inexperienced surgeon.

Otitis media
Otitis media (OM) is inflammation of the middle ear and is often secondary to otitis externa (see above). The inflammation may be secondary to infection, neoplasia or foreign bodies. In cases of infection the pathogens are usually similar to those encountered in OE and may have spread across the tympanic membrane or along the auditory tube. Cases may progress to otitis interna. Clinical signs are similar to those of OE and there may also be pain on opening the mouth, during eating or on palpation of the ear canal or bulla. Facial nerve paralysis and Horner’s syndrome may also be present.

Otoscopy should be performed under general anaesthesia and may show the tympanic membrane to be: ruptured; intact (in which case it may appear opaque due to pus accumulation in the middle ear); or bulging into the ear canal. Samples should be taken for cytology and culture; myringotomy may be required if the membrane is intact (see BSAVA Guide to Procedures in Small Animal Practice). Radiography (using a skyline bulla view) may show fluid in the bulla or sclerosis of the bone.

Treatment may be successful with lavage and antibiotics, but surgery (ear canal ablation and bulla osteotomy) may be required in some cases, especially if there are chronic changes in the external ear canal.

Vestibular disease
Head tilt is a common presentation, particularly in geriatric dogs (Figure 22.9) and is a manifestation of dysfunction of the vestibular system. Peripheral vestibular disease (PVD) is due to dysfunction of the peripheral vestibular system, which consists of the semicircular canals, the utricle and saccule, vestibular neurons and the vestibular portion of cranial nerve VIII. Central vestibular disease is due to abnormalities of the central vestibular structures, including the brainstem vestibular nuclei and cerebellum. It is important to distinguish between central and peripheral disease (see Chapter 11).

Common causes of PVD include:
- Geriatric vestibular syndrome
- Otitis media/interna (see earlier)
- Neoplasia/polyps of the middle ear
- Trauma
- Ototoxic drugs
- Hypothyroidism(?).

Geriatric vestibular syndrome
This is the most common form of peripheral vestibular disease, predominantly affecting dogs >10 years of age. It is an acute idiopathic syndrome that presents as an emergency and is often erroneously referred to as a ‘stroke’. The neurological signs are head tilt, ataxia, vomiting/nausea, horizontal/rotatory nystagmus and strabismus with Horner’s syndrome or facial nerve deficits. It is important to perform a thorough clinical examination and to perform otoscopy on both ears (geriatric vestibular syndrome is a diagnosis of exclusion).

This idiopathic disease is self-limiting; a large proportion of affected dogs will have started to improve by the time they reach the clinic and will continue to do so over the next 48–72 hours. The prognosis is excellent. There is no specific treatment for this syndrome. The dog should be confined indoors until the signs resolve. In first-opinion practice a number of medications are commonly prescribed, including:
- Anti-emetic drugs (e.g. maropitant, metoclopramide), as vomiting and nausea are common signs
Ear problems and head tilt

Chapter 22

■ Steroids (for their anti-inflammatory effects)
■ Propentofylline (often used in geriatric patients with central nervous system signs).

To the author’s knowledge there is no evidence for the use of the latter two.

Aural neoplasia/polyps

Tumours sited in the bullae may damage or involve the peripheral vestibular structures, or there may be extension from a tumour affecting the external ear canal after it has crossed the tympanic membrane. Inflammatory polyps (Figure 22.10) may also cause vestibular dysfunction if similarly involving the bulla.

Ototoxic drugs

Many drugs and chemicals are described as ototoxic. If vestibular signs develop after topical administration of a drug or chemical into the ear canal, the agent should be stopped. Signs will generally resolve over time.

Hypothyroidism

Hypothyroidism has been implicated in many cases of peripheral neurological dysfunction, although the exact pathophysiology is not known and the response to thyroid hormone supplements often has a poor effect on improving the vestibular dysfunction.

References and further reading


QRG 22.1 Ear cytology

This should be done prior to cleaning the ear.

Most dogs will allow sample collection without sedation. An experienced handler, such as a veterinary nurse, should be available to help restrain the dog’s head.

1 Introduce a sterile sample collection swab into the ear canal, under direct visualization. Gently roll the swab against the ear canal wall. The cotton tip of the swab will become covered in a representative sample of the external ear canal contents, including cerumen and pus, if present.

2 Gently roll the cotton tip along a clean microscope slide to transfer some of the sample to the slide. It is usually possible to make two or three smears per sample.

3 Stain the slide using Gram’s stain or a bench-top stain such as Diff-Quik.

4 Examine the slide using light microscopy. Depending on the underlying disease process, smears may include epithelial cells, neutrophils, bacterial rods, cocci or yeast.

Bacterial rods in a sample from an ear canal. Some bacteria are being phagocytosed by neutrophils, showing that the infection is active. (Original magnification X1000)

Bacterial cocci in a sample from an ear canal. Some bacteria are being phagocytosed by neutrophils, showing that the infection is active. (Original magnification X1000)
Ear problems and head tilt

Chapter 22
QUICK REFERENCE GUIDES

QRG 22.2 Otoscopy

Patient preparation and positioning

- Most dogs will require some level of restraint to enable otoscopic examination. This can range from relatively minimal hand restraint to hold the dog’s head still, to full anaesthesia for a particularly fractious and/or painful dog. The level of restraint that is required is a matter of clinical judgement.
- Heavily haired ears may require some hair plucking; this may be possible with the dog conscious, but judging the temperament of the dog is important.
- Heavily soiled ears should be lavaged with sterile saline warmed to body temperature. Often a 10 ml syringe and soft intravenous catheter will suffice. Allowing the dog to shake its head afterwards will aid in drying the ear canal.
- The conscious patient is best examined in a sitting position with the head held in a neutral position (i.e. looking straight ahead). Lateral recumbency, with the ear of interest uppermost, is the position if the dog is anaesthetized.

Procedure

1. Grasp the most proximal part of the external ear canal and gently pull it laterally and ventrally. This action helps to bring the vertical and horizontal canals into a straight line.
2. Whilst looking through the otoscope, introduce the speculum into the external ear canal, always under direct visual guidance.
3. The ear canal is then visualized by moving the otoscope ventrally, dorsally and laterally (small movements).
4. Advance the otoscope slowly along the ear canal to view the tympanum. It is important to try and view the tympanum in every case. It is divided into two areas: the pars tensa, which has a greyish-blue striated appearance; and the dorsal pars flaccida, which has a pinkish appearance. The manubrium of the malleus is visible in the pars tensa; there are blood vessels visible along the manubrium.

Video-otoscopy

Video-otoscopy is becoming more widely available

- It is an invaluable diagnostic aid and is also extremely useful in client education, as it allows the client to see the condition of the dog’s ear canal
- It allows visualization under lavage in soiled ears, and the collection of samples under direct visualization
- It can also be used to document the response to treatment

© Sue Paterson
Surgical treatment of aural haematoma

by Tim Hutchinson

Patient preparation and positioning

With the dog under general anaesthesia, place it in lateral recumbency, with the affected ear uppermost.

**PRACTICAL TIP**

It is essential to perform otoscopy (see QRG 22.2) prior to preparation of the pinna for surgery, as it is important to assess the external ear canal for underlying pathology

- Both surfaces of the pinna should be clipped and prepared aseptically.
- Once the pinna has been prepared, it is draped such that both surfaces of the pinna are accessible.

Procedure

1. Make an incision on the concave surface of the pinna, through the skin along the length of the haematoma swelling.

2. Drain the haematoma. The fluid component will drain freely through the incision, but it is also important to remove any clots and fibrous tissue by swabbing inside the haematoma cavity (grasping a swab in mosquito forceps to push it into the space is helpful).

3. Using monofilament suture material and starting on the concave surface, pass the needle full-thickness through the pinna. Pass the needle back through the convex surface of the pinna and tie a knot on the concave surface, such that a simple mattress suture is formed.

- 2 or 3 metric (3/0 or 2/0 USP) nylon or polypropylene would be appropriate; or pseudomonofilament (e.g. 3 metric (2/0 USP) sheathed polyamide).
- The sutures are started about 1 cm away from the incision edge and staggered in rows separated by 10–15 mm. The orientation of the sutures is vertical rather than horizontal.
- The incision is not sutured closed. This allows free drainage of any fluid postoperatively.

Postoperative care

- An Elizabethan collar is fitted, and non-steroidal anti-inflammatory drugs and antibiotics dispensed.
- Sutures are removed after 14 days.

**PRACTICAL TIPS**

- Ensure that the whole blood clot is removed prior to placing sutures.
- Leave a drainage hole for further fluid to escape. Remember to warn the owners that this could be messy.
- Do not tie sutures too tightly, as this will cause irritation if they cut into the skin.
- Leave sutures in place for at least 2 weeks. Contrary to popular belief, the aim of suturing is not to compress the skin back to the cartilage, but to promote fibrous reactions around the suture material and effectively ‘spot-weld’ the tissues together.
Abnormalities of the throat and neck

Robert Williams

Abnormalities of the throat and neck are among the less common presentations in general canine practice; however, they can be a cause of frustration as many of them are difficult to deal with. This chapter will highlight some of the more common presentations and how to avoid some of the pitfalls in dealing with these cases. Clinical signs affecting the throat and neck may include:

- Swellings and lumps (see also Chapter 28)
- Wounds (NB may be an emergency presentation, see Chapter 10)
- Abnormal function (e.g. laryngeal paralysis (see Chapter 24); gagging/retching)
- Pain (e.g. sore throat due to infection; cervical spine-associated pain, see Chapter 16).

**Swellings and lumps**

Soft tissue swellings and lumps that affect the neck include:

- Salivary gland disease (sialoceles predominantly)
- Lymphadenopathy
- Thyroid neoplasia
- Foreign body
- Abscess.

**Salivary gland disease**

Sialoceles, siailitis and salivary gland tumours are all described in dogs, but the sialocele (salivary mucocele) is by far the most common salivary gland disorder.

A sialocele is the collection of saliva within the subcutaneous tissues. Leakage of saliva occurs either from rupture of the salivary gland itself or, more commonly, from the draining salivary duct. The saliva incites an inflammatory reaction within the surrounding tissue and the sialocele has a lining composed of mostly fibrous tissue (a pseudocapsule). The majority of cases are idiopathic, though reported causes include siailitis, trauma, foreign body and neoplasia.

Breeds commonly affected include poodles, German Shepherd Dogs, spaniels and Dachshunds, and dogs are typically young. Presentations and clinical signs vary depending on the gland affected, but include:

- Zygomatic gland: exophthalmos; third eyelid protrusion; painless orbital swelling
- Pharyngeal gland: laboured breathing; swelling in the region of the epiglottis
- Sublingual gland: dysphagia; tongue deviation
- Cervical gland: affects the submandibular and sublingual glands and most commonly presents as an intermandibular/ventral neck swelling.

**Cervical gland sialocele**

This presents as an acute, non-painful, fluctuant swelling of the intermandibular and ventral cervical region (Figure 23.1). Diagnosis is made by aspirating the swelling to reveal a thick, viscous fluid which is yellow to pink in colour. Cytology will demonstrate small numbers of lymphocytes, macrophages, neutrophils and red blood cells within a proteinaceous background.
Abnormalities of the throat and neck

Chapter 23

Two points are critical for success:

- Do not be tempted to treat the sialocele conservatively; this is a surgical disease and although drainage of the mucus will lead to short-term improvement there will, inevitably, be a return of the mucocele.
- It is important to establish which side is affected (remember the salivary glands are paired). When the dog is placed in dorsal recumbency, the swelling will typically fall to the affected side. If there is doubt, then contrast sialography or exploration of the swelling and following the tract cranially can also aid diagnosis.

Treatment is through excision of the affected glands, which in most cases involves removing the submandibular and sublingual glands on the affected side (Figure 23.2). Prognosis is excellent, provided the affected glands are removed entirely; recurrence is reported to be about 5%.

**Lymphadenopathy**

Lymphadenopathy of the submandibular lymph nodes is a common finding on clinical examination. These lymph nodes are the major draining lymph nodes for the head and thus any disease process affecting the head (e.g. dental disease, otitis externa, rhinitis) is likely to cause lymphadenopathy. The approach to masses, including abnormal lymph nodes, is discussed in more detail in Chapter 28. Finding enlarged submandibular lymph nodes should provoke a more thorough examination of the head, looking for signs of infection, inflammation or neoplasia. As with any abnormal swelling or mass, it is worthwhile obtaining a fine-needle aspirate to characterize the enlarged node cytologically.

**Thyroid neoplasia**

Tumours of the thyroid gland can also present as a ventral neck mass. They generally affect middle-aged and older dogs, without sex predilection. Thirty to fifty percent may be benign adenomas and well encapsulated, but the majority of thyroid tumours are adenocarcinomas. These can be large, extremely vascular, poorly encapsulated and locally invasive. Presentation is usually because the owner has noticed a firm, painless, ventral cervical swelling, although occasionally there may be clinical signs associated with dysfunction of cervical structures, e.g. coughing, gagging, dysphonia, dysphagia, retching or regurgitation. Thyroid neoplasms in dogs are almost exclusively non-functional; hyperthyroidism in this species is very rare indeed.

Further investigation involves fine-needle aspiration or biopsy (ultrasound guidance is preferred, due to the vascular nature of the tissue). Well encapsulated masses can be excised, but any highly vascular or invasive tumour should be discussed with an experienced oncologist.

**Foreign bodies**

Foreign bodies affecting the neck occur commonly, often secondary to pharyngeal stick injuries. Clinical signs most frequently reported include cervical swelling, discharging sinus, oral pain and dysphagia.

- With acute stick injuries, the dog is usually very quiet and guarded, exhibiting pain around the head and neck and resenting movement of the head and opening of the mouth. Drooling is often present, and the dribbling saliva may be blood-tinged.
- Cervical swelling and a discharging sinus are more typical of chronic foreign bodies.

Cases suspected of having a cervical foreign body can be imaged in a variety of ways. A plain lateral-to-lateral radiographic view of the cervical region is one of the most useful images, and cervical emphysema will indicate the extent of a penetrating wound. Advanced imaging may also be useful.

With acute stick injuries it is important to examine the wound thoroughly, with the dog under general anaesthesia. There may be no foreign body apparent, in which case flushing of the wound, antibiosis and analgesia are employed. However, if a cervical foreign body is identified, surgery should be considered. There are three approaches that are commonly employed to resolve the problem:

- Ventral midline cervical exploration to identify the disrupted fascial plane and remove the foreign body.
- Exploration and debridement of a cervical discharging tract.
- Debridement and lavage of any oropharyngeal wound.

In chronic cases an abscess will have formed around the foreign body. This should be lanced and flushed, explored for any foreign material, and left open to drain. It is often worthwhile to debride as much inflammatory tissue as possible. Owners should be warned that signs may recur in spite of appropriate management.
Wounds

Dog bite wounds and draining sinus tracts are common presentations affecting the neck. Further information on wound management is given in Chapter 10.

Bite wounds

Dog fights are common occurrences; although bite wounds can occur anywhere on the body, the ventral neck is particularly vulnerable to attack (Figure 23.3).

The following points offer a quick guide to dealing with dog bite wounds.

- Remember ABC – Airway, Breathing, Circulation (see Chapter 10).
- It is easy to get carried away with the stress of the situation, particularly as the owner is likely to be very distressed. It is important to stay calm.
- The skin wounds are often not the most important problem for the dog. The overlying skin usually moves with the teeth, so small puncture wounds can conceal significant deeper damage.
- Treat shock, give pain relief and antibiotic cover initially, and stabilize any major problems (i.e. respiratory distress) (see Chapter 8). The initial goal should be to stabilize the animal prior to any invasive procedure (this includes imaging).
- Once the animal is stabilized and any life-threatening issues have been dealt with, it is then possible to perform imaging and/or exploratory surgery as required.
- In dogs that have purely superficial wounds and no damage to vital structures the wounds are often best cleaned and left open, with the animal prescribed antibiotics and pain relief. Repair, if needed, should be delayed for 48–72 hours and until after any discharge has ceased. A light absorptive bandage may be applied to keep the wounds clean.

Draining sinus tracts

Draining sinus tracts occasionally occur in the neck and are typically caused by a foreign body or previous surgery. Draining sinus tracts can be extremely difficult to deal with. It is important to be up front with clients when dealing with a sinus tract that there are no easy answers to this problem. Conservative treatment will almost certainly fail.

Close questioning regarding previous history is important:

- Has the dog had surgery on the neck or associated structures (e.g. total ear canal ablation, lateral/ventral bulla osteotomy, salivary gland removal)?
- Does the dog chew/carry sticks, or does the owner throw sticks for the dog to retrieve?
- Is the dog a working dog (e.g. gundog)?
- How long has the draining tract been present?
- Has there been any previous treatment?

A draining sinus tract can be dealt with in two ways. Ideally, advanced imaging such as magnetic resonance imaging (MRI) can be employed to try and locate the source of the draining tract prior to surgery, but this may not be feasible for the client, so thorough careful and meticulous dissection of the tract can be followed from the skin to its source, removing all abnormal tissue encountered. Whatever approach is adopted it is probably not a surgery for the novice surgeon. It is often suggested that injecting contrast medium into the tract to outline it is useful; in most cases, however, the radiographs are of very limited value.

Abnormal function

Abnormal function of structures in the throat and neck can have profound consequences for the affected animal (e.g. laryngeal paralysis; see Chapter 24).

Gagging and retching are two common presenting complaints in first opinion practice.

- Gagging is the reflex contraction of the muscles of the throat, generally caused by stimulation of the pharynx, that may induce retching.
Retching is a strong involuntary and unproductive effort to vomit.

The approach to both complaints should be as for every other condition:

- Obtain a good history
- Perform a thorough clinical examination
- Perform localized examination/tests as indicated by the initial examination
- Keep a simple approach to these cases initially, as most of the time the answer may be straightforward (e.g. simple gastritis)
- If a case is a repeat presentation or has very obvious systemic involvement or intractable signs, then a more proactive approach is required.

As can be seen from these lists, there is no prescriptive way of approaching these cases other than being thorough and methodical.

Common causes of gagging
- Pharyngitis/aryngitis
- Pharyngeal/laryngeal foreign body
- Trauma
- Elongated soft palate
- Tracheal collapse
- Laryngeal paralysis
- Neoplasia (caudal oral cavity, pharynx, larynx)
- Smoke inhalation
- Chemical burn (following ingestion)
- Myasthenia gravis

Common causes of retching
- Oesophageal/gastric foreign body
- Oesophagitis/gastro-oesophageal reflux/chemical irritation
- Hiatal hernia
- Gastric dilatation/gastric dilatation–volvulus
- Any other cause of vomiting

References and further reading


Cardiorespiratory problems

Mark Maltman

Cardiorespiratory signs are a common reason for presentation in canine practice, and in acute situations involving collapse (see Chapter 9) or dyspnoea (see Chapter 8) can be a source of stress to clinician and owner alike. This chapter will present a clinical approach to the following signs: cough; dyspnoea; heart murmur; and arrhythmia. In doing this, attention will not be paid to the specific aetiology, pathogenesis and treatment of each individual condition, and the reader is referred to the BSAVA Manual of Canine and Feline Cardiorespiratory Medicine for more specific information. Further reading for more detail on diagnostic modalities is suggested at the end of the chapter.

General approach to cardiorespiratory signs

The equipment necessary to investigate cardiorespiratory disease is now present in most veterinary practices, but the ability to take an accurate history and carefully examine the animal remains essential.

History

Common clinical signs associated with cardiorespiratory disease include:

- Coughing
- Dyspnoea
- Exercise intolerance
- Abdominal distension
- Syncope (see Chapter 9).

Other non-specific signs, such as weight loss and anorexia, may also occur. The vet should consider the signalment of the patient and how likely it would be for any particular dog to be affected with certain types of disease. For example, a Cavalier King Charles Spaniel with cough and dyspnoea or a Dobermann with syncope are most likely to be affected by cardiac diseases; while a young terrier with a chronic honking cough may well be suffering from tracheal collapse. Gough and Thomas (2010) have thoroughly reviewed breed predispositions.

Clinical examination

Careful observation of the patient prior to physical examination can elicit important information such as: whether the dog can walk; the pattern of respiration; and whether there is spontaneous coughing. A general examination should be carried out, paying particular attention to the following:

- Mucous membrane colour
- Capillary refill time
- Presence or absence of jugular vein distension, with or without ascites
- Size of submandibular and prescapular lymph nodes
- Pulse rate and quality
- Perfusion of the extremities.

PRACTICAL TIP

Gentle compression of the trachea should produce just a single cough: induction of a bout of repeated coughing suggests tracheobronchial disease.

Thoracic auscultation

- Respiratory auscultation is performed across the top of the chest and, to a lesser extent, in the cranoventral thorax.
- Different heart valves may be heard in specific locations. Rather than attempting to identify the position of valves relative to specific intercostal spaces at a designated level, a more straightforward approach allows for individual variation (Figure 24.1).
  - Normal resting heart rates in dogs are generally accepted to be 70–160 beats per minute (depending on breed), which takes into account physiological increases associated with stress.
  - Variations in heart rate and rhythm are assessed, as well as the presence of abnormal sounds such as the turbulence associated with cardiac murmurs and the audibility of the S3 and S4 heart sounds forming a ‘gallop’ rhythm, which is due almost exclusively in dogs to cardiac disease rather than a variant of normal physiology.
Cardiorespiratory problems

Chapter 24

A common pitfall is to allow the patient to lie on its side whilst other tests are performed, but during this time the dependent lung will quickly collapse, leading to difficulty with radiograph interpretation. Dorsoventral (DV) or ventrodorsal (VD) radiographs should be obtained before lateral views.

Both right and left lateral views are required to assess for lung lesions (most commonly neoplasia), as these may be masked when the affected lung is collapsed in the dependent position.

24.1 Starting on the left side of the dog, the stethoscope is placed on the chest wall just caudal to the elbow where the heart is loudest; this will approximate to the mitral valve (M) where the first heart sound (S1 or ‘lub’) will be most audible. In order to hear the aortic valve (A), the stethoscope is slid craniodorsally into the axilla, such that S1 fades and the lower pitched second heart sound (S2 or ‘dub’) becomes more notable. The pulmonary valve (P) is found by dropping slightly cranioventrally from the aortic valve to a position very close to the sternum behind the foreleg; the sounds of this valve are quieter than the other two due to the lower pressures on the right side of the heart. The tricuspid valve is found on the right side of the body (T) and represents the place where S1 is loudest on this side.

Diagnostic investigations

Radiography

The ability to produce a high-quality thoracic radiograph through good positioning, without rotation of the chest, and with exposure at peak inspiration remains the first line of investigation for all cardiothoracic disease. This can often be achieved with the patient conscious or lightly sedated, patience and plenty of sandbags (Figure 24.2). Where this is not possible, unless it is contraindicated, general anaesthesia should be used to ensure that diagnostic radiographs are obtained.

Figure 24.3 illustrates some common patterns seen on thoracic radiographs. Often the lung pattern is mixed: bronchial and diffuse interstitial patterns are frequently seen together; occasionally (e.g. with angiostrongylosis) all four lung patterns may be present on the same radiograph.

<table>
<thead>
<tr>
<th>PRACTICAL TIPS</th>
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24.2 (a) Lateral radiographs are centred approximately at the caudal border of the scapula and two-thirds of the way down the thorax, with the forelegs drawn forward and a wedge placed under the sternum to ensure that the sternum and spine are level. Occasionally in some breeds, especially Bull Terriers, this wedge may need to be under the spine to achieve the same result. (b) DV radiographs are preferred for assessment of the cardiac silhouette: although if it is safe to put the animal on its back (i.e. there is no dyspnoea or pleural effusion) a VD view may offer greater information on the lung fields. The radiograph is centred in the midline at the caudal border of the scapulae, with the forelegs once again drawn forward. Effort is required to ensure that none of the body is rotated, in order to keep the thorax straight.
24.3 Some patterns commonly seen on thoracic radiography. (a) Bronchial patterning is characterized by an increase in radiopacity of the lower bronchial walls, seen as ‘tramlines’ and ‘doughnuts’ in the peripheral lung fields. They may be associated with bronchitis, angiostrongylosis, asthma/allergy and chronic respiratory obstruction (e.g. laryngeal paralysis or brachycephalic obstructive airway syndrome). This image shows the dorsocaudal lung fields of a dog with angiostrongylosis; the pattern is bronchointerstitial and numerous bronchial rings are visible (good examples arrowed). (b) Diffuse interstitial patterning is more subtle and is seen simply as a general obscuring of detail. It may be associated with pulmonary oedema, angiostrongylosis, bronchopneumonia and diffuse lymphoma in lung tissue. This image is from a dog with cardiac failure; bronchial patterning is also visible. (c) Nodular interstitial patterns show multiple radiopaque nodules. They may be seen with metastatic neoplasia, Angiostrongylus, fungal disease or pulmonary abscessation. This image is from a Boxer with pulmonary metastasis of a distant adenocarcinoma. (d) An alveolar pattern represents disease in the terminal bronchioles and alveoli, such as severe oedema, haemorrhage, angiostrongylosis or bronchopneumonia. Lung tissue is consolidated, showing a general increase in radiopacity so that darker bronchi are highlighted as they course through the lung lobe, so-called ‘air bronchograms’. Occasionally, an entire lung lobe will be consolidated, seen as a region of marked increased radiopacity with sharp borders. (e) Vascular patterns are seen as increased opacity and size of the pulmonary blood vessels. They are best assessed by measuring the cranial lobar vessels as they cross the 4th rib on a lateral radiograph, where they should not be wider than the rib itself, or the caudal lobar vessels as they cross the 9th rib on a DV view, where again they should be smaller in width than the rib; on the lateral view, the artery is dorsal to the vein (separated from it by the radiolucent bronchus); on the DV view the artery is lateral to the vein (separated from it by the radiolucent bronchus). Pulmonary venous enlargement is indicative of left-sided cardiac congestion, whilst arterial engorgement is associated with obstructive disease such as angiostrongylosis or thromboembolism; an equal increase may be seen in cases of pulmonary hypertension, either idiopathic or secondary to diseases such as hyperadrenocorticism or renal insufficiency.
**Electrocardiography**

Electrocardiography is used to assess the rate and rhythm of the heart. Whilst measurement of components of the P–QRS–T complex (see Figure 24.17a) can be an indicator of cardiac chamber size, this is not reliable and it is advisable to combine radiography and echocardiography for this purpose. The technique is standardized by recording traces with animals in right lateral recumbency, with a 6-lead electrocardiogram (ECG) being sufficient for general practice cases. Most machines now have atraumatic clips, which are better tolerated by patients.

**Emergency cases**

On presentation, a rapid assessment of the dog will show whether coughing represents a life-threatening abnormality, in which case history-taking and physical examination will need to be undertaken quickly, whilst simultaneously providing oxygen and other treatment (see Chapter 8).

### Organ/system affected | Conditions
--- | ---
**Pharynx** | Non-pathogenic: reverse sneezing and cough
Infectious tracheobronchitis
Laryngeal paralysis
Neoplasia: Pharyngolaryngeal foreign body
**Trachea** | Infectious tracheobronchitis
Chronic tracheobronchial syndrome
BOAS: tracheal hypoplasia
Tracheal collapse
Aspiration secondary to swallowing disorder and/or megaesophagus
Neoplasia: intramural or compression from extramural masses
Foreign body
Enlarged tracheobronchial lymph nodes
Parasitic: e.g. *Ostertagia*
**Bronchi and lower airways** | Chronic bronchitis: idiopathic, allergic, irritant (e.g. smoke)
Neoplasia: primary bronchial tumour, metastatic neoplasia invading or compressing lower airway
Allergic/asthmatic
Bronchiectasis
**Lung parenchyma** | Bronchopneumonia: secondary to megaesophagus, ciliary dyskinesia, inhalation pneumonia, force feeding
Idiopathic pulmonary fibrosis (West Highland White Terrier)
Neoplasia: primary, metastatic
Eosinophilic broncho pneumonopathy (formerly known as pulmonary infiltrate with eosinophils)
Parasitic: *Angiostrongylus, Crenosoma, Pneumocystis, Dirofilaria, Toxocara*
Migration in puppies
Pneumonia, force feeding
Pulmonary hypertension
Pulmonary thromboembolism
Pulmonary haemorrhage: trauma, coagulopathy
Non-cardiogenic pulmonary oedema: e.g. near drowning, electrocution, parquat poisoning
Smoke inhalation
Pulmonary abscess
Pulmonary granuloma (rare in UK)
Fungal pneumonia: only *Aspergillus in UK*
**Heart** | Left atrial enlargement
Pulmonary oedema secondary to left-sided heart failure

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**A clinical approach to coughing**

Coughing is a reflex triggered as a result of tracheal irritation, inflammation or compression. It is one protective mechanism by which an animal may clear its airway of foreign material (gross or microscopic) or respiratory secretions (normal or pathological). Occasional coughing is normal, but coughing may be increased in various diseases (Figure 24.4).
History
In addition to general history-taking, information regarding the nature of the cough is required.

- Did the cough start suddenly? Or has the onset been more insidious over the preceding days and weeks?
  - Acute onset is more likely to be associated with kennel cough, inhalation of a foreign body or bronchopneumonia.
  - Cardiac disease, bronchitis, laryngeal paralysis and angiostrongylosis are usually associated with a slower onset.
- Is the patient heard to give a single cough in isolation (more often the case in chronic disease) or are there long bouts of coughing, with or without retching?
- Is the cough productive?
  - A productive cough reflects increased production of mucus in the airways or blood/oedema in the bronchioles and alveoli.
  - Drier coughs are more consistent with a foreign body in the initial stages or with external compression of the airway, such as from left atrial enlargement, tracheobronchial lymph nodes or a mass.
  - Paroxymal coughing may be associated with a terminal retch and the expectoration of large amounts of respiratory mucus, which has the same consistency as egg whites; most owners will describe this as ‘vomiting’, so careful questioning is required to differentiate.
  - Regurgitation associated with oesophageal disease may also lead to coughing due to aspiration, and so the material produced may be regurgitated.
  - It is necessary to determine whether the origin of any material is respiratory, oesophageal or gastric, to avoid pursuing the wrong diagnostic pathway.
  - The presence of blood (haemoptysis) is a notable finding. In the absence of trauma, it is usually associated with bleeding from a neoplastic lesion, damage to the airway wall from a foreign body, angiostrongylosis and/or coagulopathy.

Signalement may provide useful clues:

- An aged large-breed dog is most likely to have laryngeal paralysis, neoplasia or cardiac disease
- A Cavalier King Charles Spaniel may well have endocardiosis
- An adolescent Yorkshire Terrier with a honking cough probably has tracheal collapse
- Brachycephalic dogs, especially bulldogs, may display coughing and respiratory embarrassment due to brachycephalic obstructive airway syndrome (BOAS), which comprises varying combinations of stenotic nares (Figure 24.5), soft palate elongation, laryngeal saccule eversion and/or tracheal hypoplasia.

Lungworm
With an increasing incidence of angiostrongylosis in the UK, the owner should be asked about the frequency of use of appropriate parasiticides

Physical examination
Faster intervention is required in cases where coughing is accompanied by collapse, dyspnoea or cyanosis, but generally a thorough physical examination is carried out. It is usually possible to differentiate whether the cough is cardiac or respiratory in origin.

- Mucous membrane colour will usually be normal, but occasionally abnormalities will be noted. Cyanosis indicates a more severe problem of ventilation–perfusion mismatch. Pale membranes suggest anaemia or poor peripheral circulation, the latter is associated with cardiac failure or other forms of shock.

- Generalized enlargement of the peripheral lymph nodes may suggest lymphoma and concurrent intrathoracic lymphadenopathy compressing the terminal trachea and bronchi. Equally, severe enlargement of the submandibular lymph nodes can lead to cough and gag, especially when eating, at the level of the pharynx.

  The presence of a cardiac murmur (see later) is highly suggestive of heart disease, but care should be taken not to be misled by cases of cor pulmonale (failure of the right side of the heart brought on by long-term high blood pressure in the pulmonary arteries and right ventricle) or anaemia, which may give rise to a murmur without primary cardiac disease.

  Respiratory auscultation may identify a general increase in adventitious noise, in which case one should attempt to determine whether this is of upper or lower respiratory tract origin. Auscultation of the trachea will reveal harsh movement of air in upper respiratory disease, which will also be heard, albeit more quietly, over the lung fields. The respiratory rate should be measured and the pattern of respiration noted.

Upper respiratory tract noise

- Stridor is noisy respiration associated with the upper airway that may be heard without the stethoscope; it suggests laryngotracheal disease such as laryngeal paralysis, BOAS or kennel cough
- Stertor is respiratory noise originating from the nasal passages, such as may occur with excessive nasal secretions (e.g. in hyperplastic rhinitis) or a physical obstruction (e.g. a foreign body, polyp or tumour)
Cardiorespiratory problems

Pneumonia) or promote consideration of potential intercurrent disease such as renal/hepatic compromise with implications for treatment. For example, pre-existing renal disease will be potentially compromised further if diuretics and angiotensin-converting enzyme (ACE) inhibitors are prescribed for cardiac failure.

Markers of primary coagulation (platelet count, buccal mucosal bleeding time) and secondary coagulation (prothrombin time (PT), activated partial thromboplastin time (APTT), activated clotting time (ACT) or whole blood clotting time (WBCT)) are imperative where angiostrongylosis is suspected.

Faecal examination for Angiostrongylus, whilst less sensitive than microscopy of bronchoalveolar lavage fluid, is a useful screening test. In addition, there is now a blood ELISA for parasitic antigen available, which is a highly sensitive, in-house test for Angiostrongylus.

Radiography

In cases of cardiac disease, thoracic radiographs are examined for cardiomegaly (see later) and for complications such as pulmonary oedema or pleural effusion. Abnormal lung patterns may be identified (see Figure 24.3); these often do not point to a specific disease process but they do allow a narrowing of the differential list.

Abnormal lung noises

- Crackles: the reopening of airways that have collapsed during expiration and/or the movement of air through excessive secretions/fluid in the terminal airways, e.g. in pulmonary oedema or bronchopneumonia
- Wheezing: the narrowing of airways due to the accumulation of secretions and/or the thickening of airway walls due to inflammation or infiltration, e.g. in chronic bronchitis

Manual compression of the cervical trachea will produce a bout of coughing in dogs with tracheal inflammation.

Abdominal palpation may reveal liver/spleen enlargement and/or ascites due to right-sided heart failure, which may be due to primary cardiac disease or to cor pulmonale (e.g. angiostrongylosis or pulmonary hypertension). The presence of one or more abdominal masses may point towards the possibility of pulmonary metastasis or multicentric lymphoma.

Rectal temperature will be normal in most cases of coughing, but pyrexia suggests an acute and deep inflammatory process in the respiratory system, such as bronchopneumonia or neoplasia.

Diagnostic investigations

Overt cardiac disease will dictate the need for radiography, echocardiography and electrocardiography (see earlier), while respiratory disease may require investigation by radiography, bronchoscopy and lavage.

Kennel cough

Cases of acute laryngotracheitis associated with kennel cough do not require immediate investigation; such cases will present with an acute-onset paroxysmal cough that usually ends in a terminal retch and expectoration of mucus, often of sufficient audibility to keep both dog and owner awake. Crucially, although they may be distressing, such cases will have no genuine respiratory embarrassment, aiding differentiation from patients that require more prompt investigation. Once a confident diagnosis of kennel cough has been made, time and supportive treatment may be employed, and most cases will resolve spontaneously. A few cases will progress to chronic tracheobronchitis, so if the dog is still coughing 2–3 weeks later, then further investigation may be required. Unless the condition is complicated by pneumonia, extremes of age, immunosuppression or significant intercurrent disease, antibiotics are not indicated in the first instance.

Laboratory tests

Where further investigation is required, a minimum database of haematology and biochemistry should be obtained. Although this is very unlikely to offer a specific diagnosis, it may offer supportive clues (e.g. left-shifted neutrophilia in cases of broncho-pneumonia) or promote consideration of potential intercurrent disease such as renal/hepatic compromise with implications for treatment. For example, pre-existing renal disease will be potentially compromised further if diuretics and angiotensin-converting enzyme (ACE) inhibitors are prescribed for cardiac failure.

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PRACTICAL TIP

If coughing is due to aspiration, and megaesophagus is suspected, this must be assessed on a radiograph taken with the dog fully conscious (Figure 24.6), as air will enter a normal oesophagus under sedation/anaesthesia and mimic the appearance. Occasionally, the same false-positive image may occur in a very ‘air-hungry’ dog, where air accumulates in the oesophagus and, more so, the stomach due to dyspnoeic breathing.

24.6 (a) Radiograph from a Springer Spaniel with an idiopathic megaesophagus. The radiopaque walls of the oesophagus are seen as they course through the mediastinum (arrowed), whilst the air in the oesophagus does not change the appearance of the lung fields within these boundaries. (continues)
Bronchoscopy
Bronchoscopy allows direct inspection of the bronchial lining and collection of lavage fluid for cytology and culture (see BSAVA Manual of Canine and Feline Endoscopy and Endosurgery).

Induction of general anaesthesia prior to bronchoscopy allows inspection of laryngeal function under light planes of anaesthesia; this is essential for confirming laryngeal paralysis. Information may be gained on: the level of inflammation/mucus; the presence of purulent exudate, which may be followed to its source; foreign bodies; blood; and neoplasia.

Lavage fluid may give a specific diagnosis in some diseases (e.g. angiostrongylosis, eosinophilic bronchopneumopathy, neoplasia) but often will only show non-specific evidence of inflammation. Most organisms cultured from canine lavage fluid will simply be opportunistic pathogens and care should be taken to avoid overinterpretation of the findings, but this still gives important information as to antibiotic sensitivity.

A clinical approach to dyspnoea

Definitions
- The term dyspnoea is taken from human medicine, where it can be experienced as a symptom and means a severe, usually acute, shortness of breath. In veterinary medicine it is used to describe the situation where the vet feels, subjectively, that an animal is having difficulty breathing. It is also termed ‘respiratory distress’
- Tachypnoea is an increased respiratory rate
- Hyperpnoea is increased respiratory depth
- Orthopnoea describes the adoption of an abnormal posture to facilitate breathing, illustrated in Figure 24.7

Dyspnoea may occur due to mechanical obstruction to ventilation, failure of respiratory muscles or increased respiratory drive (e.g. in acidosis or anaemia). Differential diagnoses are shown in Figure 24.8.
Cardiorespiratory problems

Respiratory noise may have been recognized by the owners and is often associated with airway obstruction. Obstruction may be:

- Intraluminal (e.g. foreign body)
- Mural (e.g. tumour of the airway wall)
- Extraluminal: due to compression (e.g. left atrial enlargement, tracheobronchial lymphadenopathy, mediastinal tumour)
- Due to compromise of the structural integrity of the airway (e.g. laryngeal paralysis, tracheal collapse).

Trauma is a more likely cause of dyspnoea than it is of coughing alone, in which case the signs will be peracute in onset and the cause usually witnessed by the owner. Problems such as haemo-/pneumothorax, pneumon Mediastinal tumour, pulmonary haemorrhage, fractured ribs, diaphragmatic rupture and tracheal/bronchial tears should be considered in these cases. Urinary tract rupture may also lead to tachypnoea through metabolic acidosis.

Angiostrongylosis can cause accumulations of blood in the lungs, pleural space or mediastinum through coagulopathy, as may other disorders involving secondary coagulation (e.g. rodenticide toxicity, disseminated intravascular coagulopathy). The owner should be questioned about the regular use of para­silicides and the possibility of access to rat bait.

Signs of systemic illness may be useful indicators. For example, depression and pyrexia are most likely with severe inflammatory processes such as bronchopneumonia or pyothorax, whilst pre-existing polyuria/polydipsia would be likely with a dog now presenting with tachypnoea due to diabetic ketoacidosis. Generalized myopathy (e.g. moderate to severe hypokalaemia) or peripheral neurological disease can lead to dyspnoea through respiratory muscle failure, and owners may have noted previous musculoskeletal weakness.

Emergency cases

The golden rule of managing dyspnoea is to avoid making the situation worse. Animals may be on the verge of a life-threatening deterioration, and stress associated with forcing clinical examination or radiography may be all that is required to precipitate this. The patient should be placed in a cool environment with supplementary oxygen until intervention is possible.

History

The co-existence of coughing and dyspnoea points towards the possibility of airway, pulmonary, cardiac or mediastinal disease; history and physical examination indicators for dyspnoea will be similar to those for coughing. However, this does not rule out concurrent conditions that may be associated with diseases that also cause coughing and are directly causing the dyspnoea, but not the cough. For example: a dog with biventricular heart failure may well have a pleural effusion worsening the dyspnoea, but this effusion will not be the cause of its cough; whilst a dog with immune-mediated haemolytic anaemia secondary to lymphoma could have a cough due to mediastinal lymphadenopathy, while the dyspnoea is a consequence of anaemia or thromboembolism. Therefore, a thorough consideration of each presenting problem should be made.

Cases that started with coughing and have progressed to dyspnoea, with or without pyrexia, could be associated with aspiration pneumonia, or with an inhaled foreign body (leading to pulmonary absces­sation or pneumo-/pyothorax as it migrates). A history of regurgitation may point to the former. Migrating foreign bodies will be most likely in dogs that run at speed with a wide-open glottis in crop fields or long grass.

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<thead>
<tr>
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<td>Pleural effusion (see Figure 24.9)</td>
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<td></td>
<td>Ruptured diaphragm</td>
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<tr>
<td></td>
<td>Chest wall trauma: fractured ribs, flail chest, open chest</td>
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<td>Anaemia</td>
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(continued) Differential diagnoses for dyspnoea. More common conditions are in bold.

History

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being more audible on one side is not common; however, the presence of a large tumour or other mass on one side may lead to this finding by displacing the heart. Diaphragmatic rupture may cause mixed findings; the presence of abdominal contents will muffle heart sounds on one or both sides, but if they lie uni- or bilaterally then displacement of the mediastinum may increase heart sounds on the contralateral side.

Ascites caused by cardiorespiratory disorders will most commonly reflect a modified transudate associated with reduced venous return (e.g. biventricular cardiac failure, pericardial effusion, pulmonary hypertension). Alternatively, a collapsed dyspnoeic patient with abdominal fluid may have a haemoperitoneum associated with organ rupture whilst the dyspnoea is secondary to hypovolaemic shock and anaemia. Characterization of the fluid obtained by abdominocentesis is essential (see Figure 24.12).

Peripheral pulse quality offers a good clue for narrowing the differential list: weak pulses are noted with cardiac failure or hypovolaemia; patients with respiratory or pleural disease not involving blood loss or shock, or with more chronic anaemia, should have stronger pulses due to sympathetic stimulation.

Pyrexia is likely to be associated with more severe inflammatory processes such as pneumonia or pyothorax rather than cardiac disease, but may also be a reflection of pain or inability to lose heat with laryngeal paralysis. By the time a dog with laryngeal paralysis cannot thermoregulate by panting, it is often so ‘air hungry’ that the larynx can be visualized in the conscious animal.

Diagnostic investigations

Radiography

Provided it can be carried out without further endangering the patient, radiography will provide the first line investigation. Changes associated with the heart and lungs may be seen, as described for coughing (see above) and heart murmurs (see below), and are indicative of those diseases.

Pleural effusion (Figure 24.9) and pneumothorax (Figure 24.10) are easily recognized on lateral radiographs.

WARNING

Pleural effusion is also apparent in the lateral aspects of a DV radiograph. A VD radiograph should never be attempted in a dyspnoeic dog or one with suspected pleural effusion even if it is not dyspnoeic.

Mass lesions may cause displacement of the mediastinum to one side or other, best visualized on a DV radiograph. As radiographs from dyspnoeic patients will usually be taken with the dog conscious, an apparent megaesophagus should not be due to intake of air during anaesthesia, but care should be taken in severely dyspnoeic patients where air may accumulate in the normal oesophagus/stomach due to gasping attempts at ventilation.

Pericardial effusions are encountered relatively commonly in first-opinion small animal practice. They may be idiopathic or associated with tumours, either of the heart itself (haemangiosarcoma) or of the chemoreceptors in the aorta at the heart base (chemodectomas). Radiography shows a large globular cardiac silhouette with abnormally sharp borders, owing to the lack of movement of the stretched pericardial sac compared with the normal situation where it is closely opposed to the moving myocardial wall (Figure 24.11). Therapeutic pericardiocentesis is discussed in QRG 24.1.

Microcardia should immediately prompt consideration of hypovolaemia and, in the absence of other chest abnormalities, the possibility of haemoperitoneum. Hypoadrenocorticism may cause microcardia, but this is not likely to present with dyspnoea. Pulmonary thromboembolism may give rise to normal radiographs and, without CT scanning, will need to be a diagnosis of exclusion in general practice. Concurrent predisposing diseases such as...
hypoadrenocorticism, immune-mediated haemolytic anaemia, loss of antithrombin III in renal disease, and angiostrongylosis may point towards thrombosis.

Thoracocentesis
Where radiography is deemed unsafe and there is a high index of suspicion of pleural effusion (muffling and inspiratory effort) or pneumothorax, diagnostic thoracocentesis may be possible. It will also allow preparation, including if necessary sedation, to drain the effusion or air, before radiographing a more stable patient to ensure that this has been achieved. Administration of oxygen to these patients may fail to stabilize them, as significant impairment will still remain. Analysis of pleural fluid (Figure 24.12) will assist in making a diagnosis. Therapeutic chest drainage is discussed in QRG 24.2.

Echocardiography
Echocardiography is indicated where there is suspicion of cardiac disease. However, in a severely dyspnoeic dog it may not be possible to hear the heart sufficiently well, due to muffling from fluid or harsh breath sounds; thus, these cases are not straightforward to identify as cardiac in origin. A basic ultrasound screen of the heart can be undertaken relatively quickly and should assess:

- Whether pericardial fluid is present (Figure 24.13)
- The sizes of the left and right atria (Figure 24.14): not likely to be normal if there is failure of one or both ventricles as the cause of dyspnoea
- The contractility of the left ventricle: poor contractility is an inappropriate response to sympathetic stimulation.

In the absence of these abnormalities, it is reasonable to move on from cardiac disease as the cause of dyspnoea for the sake of speed in a primary assessment.

Laboratory tests
It can be useful to obtain blood samples for laboratory analysis, but this should not be at the expense of inducing stress in a respiratory compromised dog. Stabilization of an acute case should always be performed first.

- Biochemistry and haematology are not likely to provide specific diagnoses unless the cause is increased respiratory drive, in which case anaemia or acidosis may be identified.
- Acute anaemia due to bleeding will not cause an immediate fall in red cell parameters, as proportional amounts of plasma will also be lost.

<table>
<thead>
<tr>
<th>Type of fluid</th>
<th>Gross characteristics</th>
<th>Biochemistry/cytology</th>
<th>Differential diagnoses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transudate</td>
<td>Clear; colourless</td>
<td>Low protein; acellular</td>
<td>Hypoproteinaemia</td>
</tr>
<tr>
<td>Modified transudate</td>
<td>Clear/slightly turbid; pale yellow; may be blood-tinted</td>
<td>Low protein and low cell content but slightly increased compared with true transudate</td>
<td>Congestive cardiac failure; neoplasia; lung lobe torsion; ruptured diaphragm</td>
</tr>
<tr>
<td>Exudate (non-septic)</td>
<td>Turbid; darker coloured – red/darker yellow</td>
<td>Higher protein; greater mixed cell content, including non-degenerate neutrophils</td>
<td>Neoplasia; thoracostomy tube</td>
</tr>
<tr>
<td>Exudate (septic)</td>
<td>Thick and turbid; variable colour; foul smelling</td>
<td>High protein; high mixed cell count, with numerous degenerate neutrophils and phagocytosed/free bacteria</td>
<td>Pyothorax</td>
</tr>
<tr>
<td>Chylous effusion</td>
<td>Milky white, may be blood-tinted or pinkish</td>
<td>Moderate protein and cell levels; small lymphocytes present</td>
<td>Congestive cardiac failure; neoplasia; trauma to thoracic duct; congenital obstruction to venous return, e.g. right atrial tumour; caudal vena cava thrombosis; idiopathic; lymphangiectasia/lymphangitis</td>
</tr>
<tr>
<td>Haemorrhagic effusion</td>
<td>Frank blood</td>
<td>Similar proportions of cells to peripheral blood, but cell counts lower than peripheral blood</td>
<td>Neoplasia; trauma; coagulopathy; lung lobe torsion; ruptured diaphragm</td>
</tr>
</tbody>
</table>

24.12 Characterization of pleural fluid.
Chapter 24 Cardiorespiratory problems

24.13 Echocardiogram of a pericardial effusion caused by a clearly apparent haemangiosarcoma of the cardiac wall in a Greyhound. Such tumours may be secondary to splenic haemangiosarcoma, but this one was not. The patient was euthanased. LA = left atrium; LV = left ventricle; PE = pericardial effusion; RA = right atrium; RV = right ventricle.

- Hypokalaemia is an uncommon finding in dogs, compared with cats, but when severe may lead to weakness of the respiratory muscles.
- Urinary tract rupture can present with profound tachypnoea due to acidosis and this should be considered in any animal where chest radiography is normal, especially in cases of trauma, as it may be the first clue; the classic triad of azotaemia, hyperkalaemia and metabolic acidosis will be noted.
- Coagulation tests (PT, APTT, ACT, WBCT) are indicated when blood is found in the pleural space or alveoli, to differentiate trauma from coagulopathy.

24.14 Even a quick ultrasound scan of the heart will allow assessment of left atrial size, which is not likely to be normal if cardiac failure is the cause of dyspnoea. In dogs, left atrial size (LA) is compared with the width of the aorta (Ao). Both measurements are taken at the level of the aortic valve in the right parasternal short-axis view, to allow standardization of the measurement irrespective of the size of the dog, as the aortic diameter will increase in direct proportion to bodyweight and not change with disease state. An LA:Ao ratio of ≤1.6 is considered to be normal. These images are taken from two dogs, both presenting with dyspnoea due to pulmonary congestion but with markedly different aetiologies.

(a) Normal echocardiographic measurement of the left atrium, with an LA:Ao ratio of 1.5. This measurement quickly suggested that cardiac disease was not the cause of the problem; bronchopneumonia was subsequently diagnosed.

(b) In this image of the Staffordshire Bull Terrier in Figure 24.16, the left atrium is clearly enlarged (LA:Ao ratio = 2.4). This allowed a cardiac diagnostic pathway and treatment plan to be promptly pursued.

A clinical approach to heart murmurs

A cardiac murmur indicates a disturbance in the flow of blood through the heart which may occur due to:

- Cardiac disease
- Cor pulmonale and pulmonary hypertension, e.g. with Angiostrongylus
- Changes in blood viscosity, e.g. in anaemia/polycythaemia, hypo-/hyperproteinaemia
- Physiological murmurs, e.g. outflow tract murmurs in very athletically fit individuals, innocent murmurs in puppies
- Variants of normal anatomy, e.g. the relatively narrow aorta (even in the absence of congenital aortic stenosis) seen in Boxers compared with other breeds.

This discussion will concentrate on murmurs caused by cardiac disease.

Innocent murmurs in puppies

Innocent murmurs in puppies should be soft murmurs, graded 1/6 to 2/6 (see later), in otherwise normal individuals, and should disappear by 20 weeks of age. They are a common finding at primary vaccination appointments and need explanation to new owners in order to balance the reassurance that most cases will not be pathological with the importance of monitoring them to identify those cases that persist. Unless the murmur is loud (≥3/6) and/or there are clinical signs such as syncope or failure to thrive, the author’s approach is to monitor the puppy monthly until 20 weeks of age and only then to recommend investigation if the murmur is still present. However, louder murmurs or those associated with clinical signs should dictate the need for immediate investigation.
**Cardiorespiratory problems**

**History**
The murmur will not be the presenting complaint unless it is severe enough to be associated with a precordial thrill and audible without a stethoscope (grade 5/6 to 6/6) or is causing clinical signs. Many murmurs remain clinically silent and will only be noted at routine examinations, usually in association with compensated cardiac disease. Where a murmur is haemodynamically significant, owners may report signs of exercise intolerance, coughing, syncope, dyspnoea/tachypnoea and cyanosis, as well as more generalized signs such as inappetence and weight loss.

Signalment will play an important role in defining a narrower list of differential diagnoses:

- Puppies <12 months of age are most likely affected by congenital heart disease
- Middle-aged to older dogs will generally have acquired heart disease
- Certain breeds are more commonly associated with congenital heart disease; for example:
  - German Shepherd Dogs and poodles with patent ductus arteriosus (PDA)
  - Golden Retrievers and Boxers with aortic stenosis (AS)
  - Bulldogs and Boxers with pulmonic stenosis (PS)
- With respect to acquired heart disease:
  - Smaller breeds (in particular Cavalier King Charles Spaniels) are likely to have mitral valve disease (endocardiosis)
  - Larger breeds are likely to have endocardiosis or dilated cardiomyopathy (DCM); valvular heart disease is also common in larger breeds.

**Physical examination**
The heart is assessed for rate and rhythm, as well as the presence and character of any murmur present. It is necessary to decide whether the murmur is clinically relevant to the presenting signs:

- Cardiac disease may exist for some time in a compensated state before clinical signs of cardiac failure develop and, during this time, the finding of a murmur is not likely to be haemodynamically significant
- In general, a murmur associated with slower heart rates (<100 beats/min), strong pulses and, in particular, sinus arrhythmia is not likely to be associated with heart failure and, whilst investigation may still be warranted, other differential diagnoses for the presenting complaint should be considered in these cases.

Murmur intensity is graded according to loudness and intensity (Figure 24.15).

<table>
<thead>
<tr>
<th>Grade</th>
<th>Characteristics on auscultation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Murmur barely audible</td>
</tr>
<tr>
<td>2</td>
<td>Murmur audible but less intense than normal cardiac sounds (S1/S2)</td>
</tr>
<tr>
<td>3</td>
<td>Murmur of equal intensity to S1/S2</td>
</tr>
<tr>
<td>4</td>
<td>Murmur of greater intensity than S1/S2</td>
</tr>
<tr>
<td>5</td>
<td>Loud murmur associated with precordial thrill</td>
</tr>
<tr>
<td>6</td>
<td>Murmur can be heard with stethoscope held away from chest wall</td>
</tr>
</tbody>
</table>

**24.15 Grading heart murmurs.**

Almost all small animal murmurs are systolic, occurring between S1 and S2. Diastolic murmurs may occasionally be heard with incompetence of the aortic or, less commonly, pulmonic valves (usually associated with damage due to endocarditis). PDA produces the characteristic ‘machinery’ murmur, with both systolic and diastolic components.

The point of maximal intensity should be identified and an attempt made to relate this to the positions of the heart valves (see Figure 24.1). Left-sided murmurs may be associated with the cardiac apex (mitral valve) or heart base (aortic/pulmonic valves), whilst tricuspid murmurs and those associated with a ventricular septal defect are loudest on the right side. Pulmonary hypertension creates a cardiac murmur via tricuspid regurgitation and so this too is loudest on the right; it may also lead to a soft diastolic murmur over the pulmonic valve on the left side.

Significant regurgitant murmurs are usually long (holosystolic) and uniform (band-shaped) with harsh sounds associated with endocarditis and softer sounds with DCM. Ejection murmurs associated with aortic or pulmonic stenosis produce crescendo/decrescendo murmurs where the intensity peaks and then tails off as systole proceeds.

The other cardiac sounds, S3 (passive ventricular filling) and S4 (atrial contraction), which create a ‘gallop’ rhythm are uncommonly heard in dogs, compared with cats and large animal species; when they are heard, they are almost always associated with marked cardiac failure.

Pulmonary auscultation may reveal pulmonary crackles if there is concurrent pulmonary oedema and the presence of a pleural effusion will cause heart sounds to be muffled. Ascites may be present.

The occurrence of generalized malaise and pyrexia should prompt consideration as to whether the murmur may be associated with endocarditis, which most commonly affects the valves on the left side of the heart in small animals but is still much less common than other acquired diseases.

**Diagnostic investigations**

A murmur deemed to be clinically significant to the presenting complaint should be investigated using chest radiography, echocardiography, electrocardiography and haematology/biochemistry.

**Radiography**
Cardiomegaly may be noted on thoracic radiography and may be generalized, or specific to certain chambers of the heart.
Most cases of the common acquired diseases (endocardiosis, DCM) have either the left side or both sides of the heart affected rather than the right side alone. This is seen on the lateral view as left atrial ‘tenting’, elevation of the tracheal bifurcation and a straight caudal border to the heart (Figure 24.16); on the DV view the left atrium pushes the mainstem bronchi apart and the left ventricle shows enlargement in the 3 to 6 o’clock positions. Enlargement of the right ventricle will increase sternal contact with the ventral border of the heart on the lateral view, whilst the right atrium will push the trachea dorsally in a position more cranial to the carina; the right ventricle and atrium occupy the 6–9 and 9–11 o’clock positions, respectively, on the DV radiograph.

Assessment of cardiac size is reviewed extremely thoroughly in the BSAVA Manual of Canine and Feline Thoracic Imaging. This Manual also documents the use and limitations of the vertebral heart score (VHS), in which the long and short axes of the cardiac silhouette are measured on a lateral view, summed together and then scaled against the thoracic vertebral column from the level of the T4 vertebra. While the VHS may be useful for those new to evaluating cardiac size and for sequential measurements on the same patient, it has not been proven to be superior to subjective assessment, and considerable variation has been documented between different breeds.

In addition to cardiomegaly, pulmonary oedema may be noted as patchy interstitial patterning most prominent in the perihilar regions; alveolar patterns may occur in more severe cases. Oedema represents left-sided cardiac failure. Pleural effusion (see Figure 24.9) may be seen with right-sided disease; ascites may also be documented on abdominal imaging.

Echocardiography
Echocardiography has come to be the mainstay of murmur investigation, but should be used as an adjunct to good physical examination and radiography rather than a replacement.

Two-dimensional images allow direct visualization of the heart. Measurements of chamber size can be made in both two-dimensional B-mode and one-dimensional M-mode. The size of the left atrium is measured as a ratio to the width of the aortic root in order to standardize what would be expected to be normal for the size of patient.

Spectral Doppler may be used to measure the forward and, if present, regurgitant flow through all the heart valves, as well as through abnormal apertures such as ventricular septal defects. Calculations may be made by the scanner for markers of systolic function (fractional shortening and ejection fraction). In general, forward flow velocity through valves increases in cases of stenosis and there is poststenotic dilatation. Colour flow Doppler allows visualization of blood flow and easy identification of regurgitant jets.

Cases of cor pulmonale, including in angiostrongylosis, will usually have pulmonary hypertension that is noted and measured echocardiographically as regurgitation through the tricuspid valve in systole and through the pulmonary valve in diastole. These cases may progress to show other signs of right-sided failure.

Electrocardiography
Electrocardiography is not useful for investigating the cause of murmurs or cardiomegaly specifically. Whilst it gives valid information pertaining to the rate and rhythm of the heart, which may themselves be altered by the cardiac disease, it is unreliable for measuring cardiac chamber size. It is preferable to use radiography and echocardiography for assessing heart size.

Laboratory tests
Laboratory tests may be indicated; for example:
- Basic haematology and biochemistry will rule out changes in erythrocyte or protein levels that may alter flow patterns leading to functional murmurs
- Renal and hepatic biochemistry assesses the effect of cardiac failure on the rest of the body and provides a baseline for monitoring treatment
- Faecal parasitology may detect Angiostrongylus larvae or an in-house blood ELISA can be used to detect parasitic antigens
- Blood culture may be required in suspected endocarditis

A clinical approach to arrhythmias
Cardiac arrhythmia is usually detected on clinical examination, with the owner normally reporting malaise, exercise intolerance or, in extreme cases, syncope. Some patients will be presented collapsed (see Chapter 9), though other cases may be clinically silent. Physical examination will detect a loss of the normal regular rhythm. Arrhythmias may be slow (bradyarrhythmia), fast (tachyarrhythmia) or a mixture (sick sinus syndrome). This chapter will concentrate on the most commonly encountered arrhythmias in general practice.
Tachyarrhythmias
The most commonly detected tachyarrhythmias in small animal first-opinion practice are:

- Atrial fibrillation (Figure 24.17b)
- Ventricular premature complexes (VPCs; Figure 24.17c), progressing in some cases to ventricular tachycardia (VT)
- Supraventricular premature complexes (SVPCs; Figure 24.17d), progressing occasionally to supraventricular tachycardia (SVT).

These abnormal rhythms are auscultated as ‘extra’ beats disrupting the normal rhythm and can sometimes be very chaotic. It is not usually possible to differentiate them by auscultation alone. Variations in strength of the peripheral pulse, as well as dropped pulses, may be detected when palpating concurrently with auscultation.

- **Atrial fibrillation** occurs due to left atrial enlargement, which is usually pathological in dogs. It is most commonly associated with DCM but can occasionally be seen in the normal sized left atrium of giant-breed dogs. Treatment is aimed at resolution or improvement of the underlying cause (usually cardiac failure) and reduction of the ventricular rate to <160 beats/min; restoration of normal sinus rhythm is often not possible.
- **VPCs** may be seen secondary to cardiac disease where there is stretching and subsequent poor perfusion of the myocardium but are also common secondary to a range of systemic diseases, which commonly include gastric dilatation–volvulus, splenic masses, pancreatitis, pyometra and sepsis. Treatment is aimed at abolishing the underlying cause. The recognition of runs of VPCs as ventricular tachycardia requires urgent intervention.
- **SVPCs** are less commonly observed. They are usually secondary to cardiac or non-cardiac disease and are generally haemodynamically insignificant whilst, nonetheless, giving irregularity to the auscultated rhythm. Treatment is aimed only at the underlying cause. In cases where SVPCs run together for periods, they create supraventricular tachycardia, which may need to be specifically addressed as it can be haemodynamically significant owing to the reduction in diastolic filling times.

Sinus arrhythmia is a variant of normal in the dog, where the rhythm slows and speeds up again in line with the animal’s respiration. It is a repeated and smooth pattern, thus referred to as ‘regularly irregular’.
Chapter 24 Cardiorespiratory problems

Bradyarrhythmias

In the author’s experience, significant bradyarrhythmias are much less commonly noted than tachyarrhythmias in first-opinion practice. Bradyarrhythmia can occur as a result of: a failure or interruption of impulse generation at the sinoatrial node (e.g. sinus arrest or block); or impedance of conduction through atrial tissue or the atrioventricular node and associated tissue (e.g. atrioventricular block). Many cases are clinically silent, but where heart rates drop particularly low or there is a significant pause between beats, clinical signs such as malaise, exercise intolerance and syncope may be seen. The clinician needs to rule out systemic causes such as hypothyroidism and electrolyte disturbance; once this is done, clinically affected patients will benefit from referral for pacemaker implantation as drug therapy is usually unrewarding.

Sick sinus syndrome is an arrhythmia seen most commonly in small breeds such as terriers, where there are periods of bradyarrhythmia interspersed with tachycardia/tachyarrhythmia; these cases will also need referral.

Transient arrhythmias

Transient arrhythmias can be challenging to diagnose. Heart rhythm may normalize by the time the patient is examined or a resting ECG is recorded at the surgery, and the arrhythmia therefore remains undiagnosed. Some arrhythmias may be highly situational (e.g. associated with particular forms of exercise) and also prove hard to capture. Holter monitor recording of a continuous ECG for 24 hours (or even up to 7 days) is indicated in these cases (Figure 24.18). Such monitors are readily available for hire and are easy to fit to patients. Owners should be asked to keep a diary of activity, which can be interpreted in conjunction with the ECG trace.

References and further reading


Murphy K (2012) How to place chest drains. BSAVA Companion June 2012, pp.12–18


Sinus tachycardia

Sinus tachycardia is simply a faster, yet normal rhythm, seen in a variety of diseases including cardiac failure, where there is sympathetic stimulation. It may also be seen due to fear in the consulting room, pyrexia or pain.
Pericardial effusion in dogs most commonly forms either idiopathically or secondary to neoplasia; the latter is usually either a chemodectoma at the heart base or haemangiosarcoma of the myocardium.

Prior to drainage, echocardiography should be used to assess for the presence of cardiac or heart base tumours, as these are usually easier to image whilst there is fluid to highlight them.

In the presence of a tumour, drainage is only likely to be palliative and it is more appropriate to consider partial pericardectomy as a longer-term management option. This is suitable for heart base tumours but not for malignant tumours of the cardiac wall (e.g. haemangiosarcoma) where the prognosis is always poor.

In cases of malignant cardiac wall tumours, there may be a tear in the myocardium through which fresh blood can quickly replace a drained effusion. Therefore, if a larger than expected volume of effusion is drained, even if a tumour has not yet been identified, the possibility of such a tumour should be considered.

**Patient positioning and preparation**

- Drainage is carried out with the patient in left lateral recumbency. Removal of even small amounts of fluid will ease tamponade. Pericardiocentesis is performed from the right side of the chest, in order to take advantage of the cardiac notch between lung lobes, thus avoiding penetration of lung tissue whilst also avoiding the large left coronary artery on the left side.
- A wide area of skin is clipped and surgically prepared.

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**Technique**

1. The approach is made through the 5th or 6th intercostal space at the level of the costochondral junction. The wide-bore introduction needle is introduced into the chest at the designated point, through a small stab incision in the skin.

   Insert the introduction needle until the typical ‘scratching’ sensation of the tip on the fibrous pericardial sac is felt; typically at this point, one may feel the needle tip moving with the cardiac motion. To the novice, this ‘scratching’ sensation may appear an enigma but one quickly becomes familiar with it, after even just one or two procedures.

2. Push the introduction needle into the pericardial sac. A ‘port wine’ effusion will immediately emerge from the hub; advancement should stop to prevent penetration of the myocardium.

3. Feed the guidewire through the needle and into the pericardial space.

4. Withdraw the needle over the wire, taking care not to pull the guidewire out inadvertently.

**Equipment**

Various types of catheter can be used but the author’s preference is a veterinary pericardiocentesis catheter set, placed using the Seldinger technique. For details of the technique using an over-the-needle catheter or small-bore wire-guided drain, see the BSAVA Guide to Procedures in Small Animal Practice, 2nd edn.

**PRACTICAL TIP**

An ECG should be recorded throughout to note any disturbance in rhythm, which is most likely to occur when the introduction needle is within the pericardial sac and potentially touching the myocardium.

**PRACTICAL TIP**

It is not uncommon to find pleural effusion coming out of the needle before the pericardium is penetrated. This is likely to be serosanguineous in nature, compared with the ‘port wine’ colour of a pericardial effusion, so should be easily differentiated to avoid inadvertently draining the pleural effusion whilst thinking one is draining the pericardial one.

**PRACTICAL TIP**

The ECG should be carefully monitored in particular at this stage. The occurrence of ventricular premature complexes or runs of ventricular tachycardia at this stage would suggest the needle tip is pushing on, or is within, the myocardium and should be repositioned.
Cardiorespiratory problems

Chapter 24
QUICK REFERENCE GUIDES
QRG 24.1 continued

7. Attach a syringe to the catheter and withdraw a small volume of fluid that can be saved as a sample for laboratory submission.

8. Connect a three-way tap to the catheter, and attach the syringe to one of the other arms of the tap.

9. Connect the third arm of the three-way tap to a long giving set, to allow the effusion to be expelled into a bucket well away from the sterile area.

10. Once the effusion is drained, withdraw the catheter from the pericardial sac. At this stage, the catheter may be used to withdraw pleural effusion if desired, but this is not usually required unless the pleural effusion is large. Once the catheter is completely withdrawn, close the stab incision with a single nylon suture.

PRACTICAL TIP
Keep hold of the guidewire at all times when it is partially in the pericardium

5. Feed the catheter over the guidewire into the pericardial space.

6. Remove the guidewire, taking care not to pull the catheter with it.

PRACTICAL TIP
Before drainage is performed, the sample can be checked to ensure that it does not clot. Clotting would give rise to concern that the sample has come from within the heart, as pericardial fluid should not clot

Post-drainage care
- Ascites should resolve within 24–48 hours without the need for diuretics.
- Venous return to the right side of the heart quickly increases following drainage and this can lead to increased right-sided output to the lungs, causing transient pulmonary overload. This usually passes quickly and the inexperienced clinician should not be alarmed. If signs are notable, however, then this is the one instance where a small dose of intravenous furosemide (2 mg/kg) is considered for a pericardial effusion; otherwise diuretics are avoided as they only serve to reduce preload to the heart.
QRG 24.2  Thoracocentesis and thoracic drain placement

Once the underlying cause of an effusion has been identified, and steps taken to control it, many effusions can be left to disperse without drainage, e.g. using diuresis for cardiac disease. However, if life-threatening compression of the lungs is present, the effusion should be drained. Likewise, pus associated with a pyothorax is unlikely to resolve without repeated drainage. The drainage of blood should be undertaken only in animals with severe respiratory compromise and only once clotting is known to be normal. Overzealous drainage of haemothorax risks worsening anaemia/hypovolaemia as more blood quickly replaces the drained blood in the pleural space if continued traumatic bleeding and/or coagulopathy is not addressed.

Mild pneumothorax may disperse naturally provided the ruptured lung tissue has closed over. If trauma is the aetiology and dyspnoea is mild or absent, then one may simply monitor the case. Drainage of air is indicated in more severe cases. Persistent accumulation of air associated with marked dyspnoea is a reason to assume the position of its choosing to necessitate referral to a specialist centre, and stabilization of these cases for transport can be challenging and, at times, impossible.

If a haemothorax is confirmed, do not continue to drain it until careful consideration has been given as to whether there is continued bleeding whether there is continued bleeding or not. If more copious blood starts to drain, stop and put 2 ml of the aspirate in a plain tube to see if it clots; blood from a haemothorax will not clot, whereas blood aspirated from inadvertent cardiac puncture will clot.

WARNING

If a pneumothorax, negative pressure may never be achieved: the withdrawn air is continually replaced in the pleural space with freshly inspired air leaking through the lung (or intrathoracic airway).

This is an indication that continual drainage via a thoracostomy tube is required, in the hope that the leak will seal spontaneously with time. If this is still ineffective, surgical exploration of the chest to repair the leak or remove the affected lung will be the only option. However, the latter is likely to necessitate referral to a specialist centre, and stabilization of these cases for transport can be challenging and, at times, impossible.

Procedure

1. Using sterile gloves, introduce the needle slowly, just cranial to the rib in order to avoid the neurovascular bundle on the caudal aspect of each rib.

2. Apply a small amount of suction to the syringe.

3. Aspirate until negative pressure is achieved and then withdraw the needle/catheter whilst maintaining suction on it with the syringe.

4. Save aspirated fluid for analysis – biochemical, cytological and microbiological.

Equipment

- A needle, butterfly needle or catheter is used, approximately 0.75–1.25 inches long for smaller dogs, up to 2 inches for larger dogs. Generally, 19–21 G is appropriate.

- Ideally, a catheter is used with the stylet withdrawn after introduction as this will be less traumatic to lung tissue when the lungs reinflate as drainage proceeds. However, it can be difficult to withdraw fluid and air through a catheter, which tends to collapse, so there may be no alternative but to use a needle; if so, care should be taken to keep the needle as parallel to the chest wall as possible, and not to stab around in a perpendicular position.

Preparation and positioning

- Position the patient in sternal recumbency (or standing). Within reason, the patient should be allowed to assume the position of its choosing so that its breathing is facilitated.

- Most dogs will tolerate thoracocentesis without sedation, but if this is not the case then sedation should be considered rather than allowing excessive movement and distress which is likely to worsen dyspnoea more than prudent selection of light sedatives. Sedation with minimal cardiorespiratory depressant effects should be chosen.
Abdominal pain and swelling

Scott Kilpatrick

An approach to the acute abdomen

Presentation of the dog with acute abdominal pain is common in veterinary practice (Figure 25.1). The general causes of abdominal pain include: distension of a hollow viscus or organ capsule; ischaemia; traction; and inflammation secondary to a variety of conditions (Figure 25.2).

Gastrointestinal system
- Gastrointestinal perforation
- Gastric dilatation–volvulus
- Gastrointestinal dehiscence
- Intestinal obstruction
- Gastrointestinal neoplasia

Reproductive system
- Pyometra/uterine rupture
- Dystocia
- Ovarian cyst
- Ovarian neoplasia
- Prostatic abscess
- Prostatic neoplasia
- Testicular torsion

Hepatobiliary system
- Hepatic abscess
- Acute hepatitis
- Hepatic trauma/rupture
- Hepatobiliary neoplasia
- Cholangiohepatitis
- Biliary obstruction/rupture

Pancreatic system
- Acute pancreatitis
- Pancreatic abscess
- Pancreatic neoplasia

Urinary system
- Urinary calculi (renal, ureters, bladder, urethra)
- Pyelonephritis
- Renal neoplasia

Haemopoietic system
- Splenic mass
- Splenic rupture
- Splenic torsion

Peritoneum and abdominal wall
- Blunt trauma to abdominal wall
- Penetrating trauma to abdominal wall
- Septic peritonitis
- Chemical peritonitis (bile, urine, pancreatic)
- Mesenteric volvulus

25.1 A 12-year-old male entire Weimaraner with abdominal distension due to an abdominal mass originating from a retained testicle.

PRACTICAL TIPS
- Not all life-threatening intra-abdominal problems are painful, especially in profoundly sick animals with mental depression
- Extra-abdominal sites of pain may present as an apparent acute abdomen. This happens most commonly with spinal pain

WARNING
All dogs with an acute abdomen potentially have a life-threatening condition that may require rapid surgical intervention. Although a thorough diagnostic work-up should be completed at some stage, emergency treatment must take priority

25.2 Common causes of an acute abdomen.
Initial evaluation and stabilization

On initial presentation, a primary examination (see also Chapters 8 and 9) should include evaluation of:

- Level of consciousness
- Airway
- Breathing
- Circulation.

This should be completed within 30–60 seconds. A very brief history should be obtained at this time, but resuscitation should not be delayed in the critical patient while a complete history is obtained (Figure 25.3).

The history of a patient presenting with an acute abdomen is often vague, but reported signs will frequently include depression, anorexia and vomiting. In other instances the history may be extremely suggestive of the underlying cause. The progression of the clinical signs can also help determine the urgency of diagnosing the underlying cause. Chronic abdominal pain that has remained relatively static in its progression is not usually an emergency, although deterioration could precipitate a crisis. A dog that has a chronic problem and has deteriorated rapidly, or an animal with an acute problem, warrants a more aggressive approach to define the underlying cause.

In many cases the patient’s signalment may lead to a higher index of suspicion of the aetiology. For example:

- Parvoviral enteritis may be suspected in dogs with an uncertain vaccination history
- Intussusception is more common in young animals
- Male dogs are much more likely than females to suffer from urethral obstruction
- German Shepherd Dogs and Golden Retrievers (median age of affected dogs 10 years) have a higher incidence than other breeds of haemobdomen associated with splenic neoplasia
- Large- and giant-breed dogs have a much higher incidence of gastric dilatation and volvulus (GDV) than smaller breeds
- Entire males are at much higher risk of severe prostatitis than neutered males
- Entire female dogs may develop pyometra.

Physical examination

A full physical examination should be performed, but with initial attention to the cardiovascular, respiratory, central nervous and renal systems.
Examination of the abdomen

1. **Visual inspection of the external abdomen.**
   - Abnormalities detected can include: distension (e.g. caused by effusion, gastric dilatation or organomegaly); subcutaneous swelling (e.g. resulting from cellulitis associated with urine leakage); and bruising (e.g. associated with trauma or a coagulopathy).
   - Careful observation of the periumbilical area for evidence of reddening or haemorrhage may lead to a diagnosis of haemobaden.
   - Any obvious wounds should also be carefully noted.

2. **Auscultation of gastrointestinal sounds.**
   - Ingestion of toxins, acute intestinal obstruction and gastroenteritis may cause an increased frequency and character of gut sounds.
   - Conditions such as ileus, anorexia, chronic intestinal obstruction and abdominal effusions can cause decreased frequency and character of gut sounds.
   - The abdomen should be listened to over a period of 2–3 minutes to determine whether gastrointestinal sounds are actually absent.
   - Abnormal sounds are not pathognomonic for any particular disease process.
   - **Note:** Auscultation should precede palpation since palpation can cause gut sounds to diminish.

3. **Percussion of the abdomen.**
   - Hands are placed lightly on either side of the abdomen and the thorax, to avoid inadvertently missing important findings that may present in other body systems. Additionally, examination of the abdomen may elicit pain and discomfort that may prevent further evaluation of the patient.
   - The abdomen should be percussed in a systematic fashion.
   - **Note:** Occasionally a fluid wave can be elicited in animals without abdominal effusion. Obese animals, as well as those with a full bladder or fluid-filled viscus (e.g. pyometra) are good examples of this.

4. **Palpation.**
   - The abdomen should be palpated in a systematic fashion.
   - Superficial and gentle palpation should be carried out to help to localize pain.
     - Animals may react vigorously and become tense, ‘guarding’ their abdomen in response to superficial palpation.
     - Other more violent reactions may include vocalizing, groaning, yelping, vomiting, or attempting to bite the person performing the examination.
   - **Note:** Some animals without abdominal pain will resent abdominal palpation and guard their abdomen. In these situations stroking the animal or spending some time building up the intensity of palpation will facilitate examination.
   - The examination should, where appropriate, proceed to deeper palpation.
     - Some conditions may be associated with localized pain (e.g. cranial abdominal pain with pancreatitis and caudal abdominal pain with prostatic disease).
     - Palpation of the cranial abdomen in deep-chested dogs is improved by elevating their thoracic limbs above floor level.
     - Foreign bodies may be directly palpated and bunched up intestines may suggest a linear foreign body.
     - A thick tubular structure may indicate a foreign body or intussusception.
     - Septic peritonitis in dogs is usually, but not always, associated with severe, diffuse abdominal pain.
     - Urabdomen and bile peritonitis may or may not be painful.
     - In many cases, sequential examination of the abdomen allows accurate assessment of the clinical condition.

**Other examinations required**

- Rectal temperature should always be taken, but note that in a dog with severe hypoperfusion the rectal temperature may not be elevated even if there is a raised core body temperature.
- The vulva of an intact bitch should be examined for any evidence of discharge, as seen in the case of an open pyometra.
- The oral cavity should always be examined for evidence of ingestion of caustic substances.
- Examination per rectum should always be performed to assess the caudal to middle pelvis, pelvic urethra and characteristics of the faeces. In male dogs the prostate gland should always be palpated.

**Diagnostic investigations**

**Laboratory tests**

- **Minimum database:** Blood tests including packed cell volume (PCV), total solids (TS) via refractometer, blood urea nitrogen (BUN; by dipstick) and glucose should all be part of a minimum database (Figure 25.4). A urine sample should also be obtained at the earliest opportunity; for the measurement of specific gravity, the urine sample should be obtained before any fluid therapy.
  - The minimum database is unlikely to provide a definitive diagnosis, but may be helpful in prioritizing differential diagnoses and further testing. For example:
    - A low TS value in the face of a normal PCV should prompt a search for haemorrhage or severe vasculitis. In acute haemorrhage, the level of TS falls but splenic contraction blunts the expected
Abdominal pain and swelling

Chapter 25

Fall in PCV. In patients with vasculitis, most commonly due to septic peritonitis, protein loss into the abdomen causes a fall in TS levels without affecting the PCV.

■ Decreased blood glucose is often associated with sepsis and warrants an aggressive approach to find the underlying cause of the acute abdominal pain, particularly if septic peritonitis might be present.

■ Dipstick BUN provides an estimate of azotaemia. Increased BUN may be due to prerenal, renal or postrenal causes. Increased BUN may also be noted in animals with acute abdominal pain caused by pyelonephritis, or urethral or ureteral obstruction.

Further tests:

■ Ideally, venous blood gas and electrolyte measurements should be carried out along with serum biochemistry as part of a more extensive investigation.

■ A complete blood count should be performed, with microscopic evaluation of a blood smear in order to complete a manual differential count, estimate the number of platelets, and evaluate both white and red cell morphology.

■ Coagulation parameters should be evaluated in patients with suspected liver disease, systemic inflammatory response syndrome (SIRS) or sepsis.

■ Serum amylase and lipase are sometimes used as indicators (albeit neither sensitive nor specific) of pancreatitis in canine patients. In cases of acute pancreatitis the preferred test that is specifically useful and sensitive is the canine pancreatic lipase immunoreactivity (cPLI) assay; the sample may be sent to a laboratory for a quantitative result, but an in-house test for positive versus negative is useful for an immediate answer.

Abdominal imaging

Abdominal imaging should be performed in most cases of acute abdominal pain, as soon as the patient is sufficiently stable.

Radiography: Generally, two orthogonal views of the abdomen (lateral and dorsoventral) should be taken. A systematic and detailed review of all abdominal and adjacent structures should be performed.

Radiographs should be checked for:

■ Radiopaque foreign bodies
■ Intestinal dilatation
■ Gastric size, position and content
■ Liver and kidney size
■ Uterine size
■ Abnormal abdominal objects (e.g. cystoliths, Figure 25.5) or masses.

Loss of abdominal detail on plain abdominal radiographs may be due to lack of fat in the abdomen (in puppies or very thin animals), free abdominal fluid or a large abdominal mass. Free gas in the abdomen of a patient that has not undergone recent abdominal surgery or had a penetrating injury is consistent with bowel rupture or perforation.

Gastric distension with a normally positioned stomach is likely to be due to dilatation. If there is displacement with gastric dilatation, volvulus is likely. In cases of GDV, the stomach appears compartmentalized with band-like soft tissue opacities between gas-filled segments.

Segmental gaseous or fluid-filled distension of the small bowel suggests an intestinal obstruction. The
normal diameter of the small intestine in the dog is approximately 2–3 times the width of a rib, or less than the width of an intercostal space. Additionally, all of the small intestinal loops should have a similar diameter, and it is abnormal for one segment to be 50% larger than other portions. Localized small intestinal distension is not always a definitive finding for intestinal obstruction but should prompt further investigation if an obvious foreign body is not evident (Figure 25.6). One option is to repeat radiography 3 hours later. If the intestine remains distended in the same position, this would indicate obstruction.

Contrast radiography may be necessary in some dogs with an acute abdomen, particularly those with partial gastrointestinal obstruction. Contrast radiography may be contraindicated in dogs with frequent vomiting, due to the high risk of aspiration pneumonia. The use of water-soluble contrast agents is often advocated if gastrointestinal perforation is suspected, to avoid barium contamination of the peritoneal cavity.

**Ultrasonography:** Ultrason examination is more sensitive than radiography for examining abdominal masses and the presence of free fluid within the abdominal cavity. The pancreas, liver, kidneys and prostate gland can be evaluated more fully, and ultrasonography is one of the best ways of detecting pancreatitis and pancreatic masses. While pyometra may often be diagnosed radiographically, ultrasonography is one of the best methods for confirming a suspected and subtle presentation of pyometra.

**An approach to the swollen abdomen**

Animals can develop a swollen abdomen for many reasons (Figure 25.7) and this can present as an emergency.

- Fluid: free fluid in abdomen; fluid inside organs; fluid in cysts
- Tissue: pregnancy; organ enlargement; neoplasia; fat; granuloma
- Faeces: megacolon; obstruction
- Gas: gastric dilatation–volvulus; obstruction or ileus of the gastrointestinal tract; post-surgical; rupture of the gastrointestinal tract; bacterial peritonitis

**Definitions**

- **Peritoneal effusion** is the abnormal accumulation of fluid in the peritoneal cavity and is not diagnostic in itself, but is a clinical sign of disease. It can result from the accumulation of transudative or exudative fluid, chylous effusions, blood, urine or bile.
- **Ascites** is defined as an accumulation of serous fluid in the peritoneal cavity and is usually reserved for a transudate that is associated with liver disease or right-sided heart failure.

**Diagnostic investigations**

As with any clinical problem, it is important to adopt a methodical approach (Figure 25.8).

**Ultrasonography**

One of the most straightforward ways of confirming the presence of free fluid in the abdominal cavity is with ultrasonography. Abdominal radiography is less useful in patients with large volumes of abdominal fluid, due to loss of intra-abdominal contrast. In some cases the presence of free fluid will be very obvious, and hypoechoic sharp angles will become immediately apparent once the ultrasound probe is placed on the patient (Figure 25.9).

Adopting a more structured 4-point FAST (focused assessment with sonography for trauma) scan (see QRG 25.1) will pick up on more subtle abdominal effusions (Figure 25.10). These scans can be performed very quickly and with no expert knowledge of ultrasonography needed. This is a procedure that can be carried out simultaneously with other interventions and can be repeated with little cost to the client.

**Laboratory tests**

Analysis of free abdominal fluid is a vital part of the evaluation of any animal with an acute/swollen abdomen. Abdominocectesis (see QRG 25.2), with or without ultrasound guidance, is a quick and easy way of retrieving abdominal fluid. It is unusual for complications to occur due to abdominocectesis and there are few contraindications to performing this procedure. Caution is advised, however, when a coagulopathy or thrombocytopenia is possible, or if there is organomegaly, or adhesions from previous surgery. A volume of at least 5–6 ml of free abdominal fluid per kilogram needs to be present for successful abdominocectesis. Diagnostic peritoneal lavage (see QRG 25.3) may be necessary in cases where fluid is not obtained.

Once abdominal fluid has been obtained, it is important to classify this to allow a more accurate diagnosis to be made. Analysis of the abdominal fluid should include: gross examination; measurement of PCV, TS by refractometer; and total nucleated cell count. Cytological examination is also very important. Biochemical and microbiological analysis are appropriate in certain cases. Classification of the main types of abdominal effusion is summarized in Figure 25.11; some further details are given below.
Abdominal enlargement

History/clinical examination

- Fluid thrill
- Radiography
- Ultrasonography (FAST scan)

Ascites suspected?

Yes

Abdominocectesis

- Fluid sample not obtained
- Diagnostic peritoneal lavage

No

Investigate other causes of abdominal enlargement (e.g. obesity, pregnancy, bladder distension, abdominal mass, organomegaly, hyperadrenocorticism)

Fluid sample obtained

Fluid analysis

Pure transudate
- Hypoalbuminaemia; protein-losing enteropathy or nephropathy; liver disease

Modified transudate
- Neoplasia; cardiac disease (right-sided heart failure); liver disease

Exudate
- Neoplasia; peritonitis; pancreatitis; biliary tract rupture

Chyle
- Neoplasia; liver disease; cardiac disease; steatitis; lymphangiectasia

Haemorrhage
- Neoplasia; traumatic organ rupture; coagulopathy

Urine
- Ruptured lower urinary tract

A diagnostic work-up for abdominal swelling.

25.8 Obvious free fluid (arrowed) within the abdominal cavity detected using ultrasonography.

25.9 Subtle area of free fluid (arrowed) between the liver and spleen.
### Classification of abdominal fluid

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Transudate</th>
<th>Modified transudate</th>
<th>Exudate</th>
<th>Chylous effusion</th>
<th>Haemorrhagic effusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance of fluid</td>
<td>Clear, colourless</td>
<td>Clear, straw-coloured or blood-tinged</td>
<td>Turbid</td>
<td>Milky or pinkish opaque fluid</td>
<td>Appears similar to peripheral blood</td>
</tr>
<tr>
<td>Total protein (g/l)</td>
<td>&lt;25</td>
<td>&gt;25</td>
<td>&gt;25</td>
<td>25–60</td>
<td>&gt;30</td>
</tr>
<tr>
<td>Specific gravity</td>
<td>&lt;1.015</td>
<td>1.015–1.025</td>
<td>&gt;1.025</td>
<td>&gt;1.025</td>
<td>&gt;1.025</td>
</tr>
<tr>
<td>Nucleated cells</td>
<td>&lt;1</td>
<td>1–7</td>
<td>&gt;5</td>
<td>0.25–20</td>
<td>&gt;1</td>
</tr>
<tr>
<td>Predominant cell type</td>
<td>Primarily mesothelial cells and macrophages</td>
<td>Increasing numbers of neutrophils and small lymphocytes, macrophages and possibly neoplastic cells</td>
<td>Primarily neutrophils (non-degenerate, or degenerate if septic)</td>
<td>Small lymphocytes, neutrophils, macrophages</td>
<td>Large proportion of red blood cells and usually without platelets</td>
</tr>
<tr>
<td>Other features</td>
<td>With time pure transudates will become modified due to irritation of the mesothelium</td>
<td>Most modified transudates are caused by neoplasia or heart failure</td>
<td>Can be classified as septic or non-septic</td>
<td>Contains high levels of triglycerides</td>
<td>This type of effusion does not normally clot</td>
</tr>
</tbody>
</table>

### Transudates
- Usually characterized by having low cellularity, low specific gravity (SG) and low total protein
- Occur secondary to decreases in oncotic pressure due to hypoalbuminaemia (protein-losing enteropathy, protein-losing nephropathy, liver failure) or an increased hydrostatic pressure (portal hypertension, right-sided heart failure)
- Not normally associated with acute abdominal pain.

### Modified transudates
- Contain more protein and cells than pure transudates
- Usually occur due to an increased hydrostatic pressure, or increased vascular permeability in the early stages of inflammatory disease
- Often caused by neoplastic disease.

### Exudates
- Highly cellular and can be septic or non-septic:
  - The presence of toxic degenerate neutrophils with intracellular bacteria is indicative of septic peritonitis (Figure 25.12)
  - Non-septic exudates are characterized by the presence of non-degenerate neutrophils and the absence of bacteria
  - Unfortunately these cytological changes are not always present and further testing may be needed.
    - A glucose level can be taken from the effusion. An abdominal fluid glucose level of <2.8 mmol/l has been shown to indicate septic peritonitis unequivocally, since bacteria metabolize glucose present in the effusion
    - Another method is to compare the blood/effusion levels of lactate. If the lactate concentration in the peritoneal effusion is >2.5 mmol/l and higher than the blood lactate level, a septic effusion is likely.

### Chylous effusion
- Many effusions can be run through blood analysers in the same way as a blood sample
- The triglyceride level in a chylous effusion is usually 2–3 times higher than in serum, while cholesterol is lower in the effusion than in serum
- The most common causes of chylous effusions are rupture of a lymph vessel due to neoplasia, right-sided heart failure and lymphoproliferative disease.

### Bilious effusions
- Biliary rupture will rapidly create a modified transudate that progresses to an exudate later in the disease process
- Bile effusions occur secondary to rupture of the bile duct or gall bladder. This happens secondary to trauma, cholelithiasis, pancreatitis, or necrotizing cholecystitis
- If bile peritonitis is suspected, total bilirubin should be measured. If the bilirubin concentration in the abdominal fluid is greater than that in the serum, bile peritonitis is confirmed. Normally, there should not be any bilirubin present in abdominal fluid. The fluid is often green and may contain bilirubin crystals.

### Uroabdomen
- Fluid from a patient with uroabdomen can range from a modified transudate to an exudate
- The presence of intracellular bacteria (arrow) is an indication of septic peritonitis. (H&E stain; original magnification X100)
• Abdominal pain and swelling can result from trauma or from iatrogenic causes (e.g., careless catheterization or cystocentesis). It is important to note that animals with ruptured bladders may still have palpable bladders and the ability to urinate.

• If uroabdomen is suspected, the most useful abdominal fluid chemistry evaluation is creatinine. Urea nitrogen can also be measured but, because it is a smaller molecule, this diffuses rapidly and equilibrates with the plasma. A creatinine level in abdominal fluid that is twice that in serum is highly suggestive of uroabdomen.

• Potassium levels are also higher in the abdominal fluid compared with blood.

• Note: If the dog has been receiving intravenous fluids, there is the potential for misdiagnosis of uroabdomen in an azotaemic patient with ascites. This is because creatinine, BUN and potassium concentrations in the plasma will be actively diluted, whereas those in the abdomen will not.

Haemoabdomen:

• Haemorrhage into the abdomen may occur for many reasons, including trauma, neoplasia, coagulopathies and iatrogenic causes.

• A PCV of 5% or higher in diagnostic peritoneal lavage fluid is suggestive of significant haemorrhage.

• Cytologically, it may be difficult to differentiate acute haemorrhage from iatrogenically induced haemorrhage such as from inadvertent trauma of the liver or spleen. Platelets quickly aggregate, degranulate and disappear within an effusion, so their presence may be suggestive of iatrogenically induced haemorrhage.

Malignant effusions:

• Malignant effusions are often a subtype of modified transudate or exudate that contain neoplastic cells.

• Care should be taken in interpreting malignancy on cytology due to normal mesothelial cells displaying criteria that could be mistaken for neoplasia. Review by a pathologist is essential.

Surgical management

One of the most challenging decisions regarding dogs with acute abdominal pain or swelling is deciding whether prompt surgery is indicated.

Indications for prompt surgery

- Abdominal abscess
- Abdominal wall perforation
- Bile peritonitis
- Free abdominal gas (not associated with previous surgery or invasive procedures)
- Gastric dilatation–volvulus
- Intestinal foreign body causing pain or bowel obstruction
- Intestinal obstruction
- Ischaemic bowel
- Mesenteric volvulus
- Persistent abdominal haemorrhage
- Septic peritonitis
- Uroperitoneum

In some situations the decision to undertake surgery may not be straightforward.

WARNING

Even if prompt surgery is indicated, the immediate necessity is to stabilize the patient.

References and further reading


### QRG 25.1 FAST scan

**Positioning and preparation**
- Right lateral recumbency is recommended, as this is also the best position for abdominocentesis, electrocardiography and echocardiography. However, this procedure can be carried out in a standing animal.
- One of the benefits of this procedure is that it can often be carried out in the conscious patient.

**Technique**
Placing the ultrasound probe on the four areas shown and scanning widely in both sagittal and transverse planes gives the best chance of detecting more subtle fluid accumulation (see Figure 25.10).

**Limitations**
- There is always the possibility of false-positive or false-negative results. For example, the gall bladder and common bile duct can appear as hypoechoic sharp angles, similar to free fluid, depending on the plane of imaging.
- If in doubt, the scan should be repeated on a regular basis to detect any changes.

### QRG 25.2 Abdominocentesis

**Positioning and preparation**
- Sedation may or may not be required.
- The dog should be restrained in right lateral recumbency and it might be worth emptying the patient’s bladder before the procedure.
- The abdomen should be clipped and prepared as for a non-surgical procedure.

**Equipment**
- A 5 ml syringe, collection tubes (EDTA, plain and sterile) and some microscope slides should be prepared.
- Use an 18–22 G, 2.5–3.75 cm needle or over-the-needle catheter.

**Technique**
Abdominocentesis can be performed by a single centesis or using a four-quadrant approach.

1. The site for single abdominocentesis is a point 1 cm lateral and to the right of the ventral midline and 1–2 cm caudal to the umbilicus.
2. Once the needle has been inserted through the skin and abdominal wall, allow fluid to drip from the needle (or catheter with needle removed) into a tube, or gently aspirate with a 2–5 ml syringe. Unless there is a large volume of free fluid it is preferable to allow it to drip from the needle hub, rather than aspirating, to avoid sucking omentum or viscera into the needle.
3. If fluid is not obtained from the first site, repeat the procedure in the three remaining sites.
4. Collect fluid into an EDTA tube for cytology and cell count, and into a plain tube for culture and biochemical analysis.
5. Make several air-dried smears.
Positioning and preparation
Positioning and preparation is as for abdominocentesis (see QRG 25.2). However, a higher proportion of patients will need to be sedated for diagnostic peritoneal lavage. Local anaesthetic is infiltrated into the ventral midline, just caudal to the umbilicus.

PRACTICAL TIP
As diagnostic peritoneal lavage introduces fluid into the peritoneal cavity, diagnostic imaging should be carried out before this procedure.

Technique
1. Using a scalpel, make a small stab incision through the skin.
2. Introduce a large-bore 10–14 G over-the-needle catheter (pre-​lenestrated) through the skin and body wall, aiming caudally towards the pelvis.
3. Remove the stylet, leaving the cannula in place.
4. Attach an extension set and a three-way tap.
5. Infuse 20 ml/kg of warmed isotonic crystalloid fluid using gravity flow or gentle pressure.
6. Gently roll the patient (with the catheter in place if possible) and wait for 20–30 minutes.
7. Drain the fluid from the catheter:
   • Use EDTA tubes for samples used to test total cell count and cytology
   • Use plain tubes for samples for total protein and any other biochemical tests
   • Fresh air-dried smears should be made
   • Some fluid should be kept in a plain tube to be submitted for culture if necessary.

Notes:
- Only a very small amount of the infused volume will be retrieved (usually only 1–2 ml). Any remaining fluid will be absorbed across the peritoneum.
- If the fluid obtained suggests that the gastrointestinal tract has been punctured, any hole should seal when the needle is removed.

WARNING
Stop the procedure if blood is aspirated. Place the blood in a glass tube and monitor for clot formation. Free blood from the abdominal cavity will not clot (due to lack of platelets) but blood from a vessel or organ will clot.
Disorders of the urogenital and reproductive systems are among the most common presentations at veterinary practices. There are many different disorders, and a bewildering array of investigative tests that may be applied to differentiate the disorders. This chapter suggests basic principles of thorough clinical examination, either to reach a prompt diagnosis or to decide on appropriate tests. Common disorders are discussed and recommendations for treatment are given. Further information on the diagnosis and treatment of urological disorders may be found in the BSAVA Manual of Canine and Feline Nephrology and Urology.

Reproductive disorders are discussed separately for males and females. Given the high rates of neutering in the UK, conditions will also depend on which reproductive organs are still in place or the age of the dog when they were removed. With a basic knowledge of normal anatomy and physiology and a detailed history of the problem, it is usually not difficult to make a diagnosis even though this does not always mean that the reproductive problem is treatable.

Clinical signs and causes

Owners may have noticed the dog squatting more frequently to pass urine (pollakiuria), straining to pass urine (dysuria/stranguria), licking around the genitals, or an unusual discharge from the genitals. Although there is some overlap between the terms, dysuria is usually an observed painful or abnormal urination, whereas stranguria refers to a very diminished urine flow (usually only a few drops passed). Alternatively, the owner may be concerned about incontinence, or polydipsia. Polyuria/polydipsia (PU/PD) is discussed in Chapter 14.

Urological and genital/reproductive causes of dysuria/stranguria are listed in Figure 26.1. Neurological disorders (disc disease, spinal/pelvic injury, upper motor neuron (UMN) and lower motor neuron (LMN) disorders) may also affect micturition.

Other conditions that may mimic signs of dysuria/stranguria

- Colitis/dyschezia (straining to pass faeces may be confused with micturition)
- Perineal hernia (not involving bladder)
- Anal sac disease

Urological disorders

- Urethral obstruction: urolithiasis, neoplasia, urethritis, intrapelvic disease (constipation, obstipation, lymph node enlargement, neoplasia)
- Perineal hernia (involving bladder)
- Urinary tract infection
- Bladder/urethral neoplasia
- Neurological: urethral spasm, reflex dysynergia

Genital/reproductive disorders

- Prostate gland enlargement: benign prostatic hyperplasia, prostatitis, prostatic abscess, prostatic cancer, squamous prostatic metaplasia
- Prostatic cysts
- Spermatic cord torsion
- Clitoral hypertrophy
- Vaginal strictures
- Vaginal hyperplasia
- Tumours of the vulva/vagina
- Vaginitis
- Occlusion of the vulva by excessive skin folds

Causes of dysuria/stranguria.

Haematuria is one of the most common causes of abnormal coloration of urine. Figure 26.2 lists common conditions associated with abnormally coloured urine or other urethral discharges. It is of prime importance to distinguish urological causes from non-urological (reproductive, haematological, extracorporeal) causes. Urological causes can often be diagnosed on the basis of history, clinical examination and examination of the discharge. Genital or reproductive disorders in the bitch are often
characterized by discharge: in the male rarely so. Thorough clinical examination and history-taking will usually distinguish reproductive causes from urological ones. Non-urological causes of haematuria, haemoglobinuria and myoglobinuria are listed in Figure 26.3.

### Reproductive system
- **Bitch:**
  - Normal: pro-oestrus, oestrus, postpartum
  - Abnormal: vaginal tumours, ulcerated polyps, vaginal foreign body, pyometra, fetal death, placental separation, subinvolution of placental sites (SIP)
- **Male dog:** orchitis, epididymitis, testicular tumours, balanitis, phimosis/paraphimosis, urethral prolapse, fractured os penis, penile trauma, tumors of the penis, prostatitis, prostatic cyst, prostatic abscess, prostatic neoplasia

### Renal system
- Nephrogenic cysts, neoplasia, pyelonephritis, trauma, nephroliths, drug-induced (cyclophosphamide), idiopathic haematuria

### Urinary tract
- Trauma, ureteroliths, cystitis, urolithiasis, bladder neoplasia, urethritis, urethral/neoplasia

### Coagulopathies
- Thrombocytopenia, disseminated intravascular coagulopathy, haemolytic anaemia, drug-associated

### Environmental
- Heat stroke, exercise-induced

#### 26.2 Conditions causing abnormal urine or a discharge. Haematuria is the most common abnormality but discharge can be clear or cloudy, bloody brown or green.

### Haematuria
- Iatrogenic (caused by sampling)
- Coagulopathies: anticoagulant exposure, disseminated intravascular coagulation, thrombocytopenia
- Drugs: e.g. cyclophosphamide
- Strienuous exercise
- Idiopathic renal haematuria
- Hyper-reflexivity of the detrusor muscle

### Haemoglobinuria
- Intravascular haemolytic anaemia
- Transfusion reaction
- Disseminated intravascular coagulation
- Postcaval syndrome (heartworm)
- Splenic torsion
- Heat stroke

### Myoglobinuria
- Status epilepticus
- Crushing injury

#### 26.3 Non-urological causes of haematuria, haemoglobinuria and myoglobinuria.

### History and signalment
As with other diseases, a full clinical history should be taken. This is particularly relevant for reproductive problems, as the onset of illness may be related to a stage of the reproductive cycle. For example, a history of a ‘season’ 4–8 weeks prior to onset of illness in an older entire bitch may increase one’s suspicion for pyometra. It is important to ask the following questions.

For male dogs:
- Is the dog sexually active?
- Has it mated successfully in the past?
- Has a recent mating resulted in any trauma?

For bitches:
- Are they nulliparous (have had no litters), primiparous (are gestating for the first time) or multiparous (had previous litters)? If previous matings have not been successful, then any previous test results (pre-mating progesterone levels, vaginal swabs, ultrasonography) should be reviewed
- Have there been any previous problems with dystocia; was treatment required (oxytocin injections, caesarean section)?

Both sexes:
- Has a discharge been seen by the owner? If so, what colour was it? Was it odorous? Was the discharge seen during micturition, or independently (the latter is commonly seen in prostate disease)?
- How much does the dog drink?
- How often and how much does it urinate?
- Is there urinary incontinence; if so how often and for what duration?
- Has dysuria or stranguria been noted?
- Has the owner noticed any other signs of illness (e.g. vomiting/diarrhoea, lameness, weakness)?
- Have there been any changes in the appearance, colour and smell of the urine?

Age at onset of clinical signs is important, as problems of the reproductive tract in young animals are usually caused by anatomical and/or genetic abnormalities, whereas conditions of older entire dogs and bitches are mostly hormone-induced or neoplastic.

### Examples of breed predilections
German Shepherd Dogs and Dobermanns are over-represented for prostatic disease
There are strong breed associations with various types of urolith (Adams and Syme, 2005)
Breed at increased risk of pyometra include
Golden Retriever, Rough Collie, Rottweiler and Cavalier King Charles Spaniel, with mongrels having a reduced incidence
Brachycephalic and chondrodysplastic breeds, such as the British Bulldog, Pug and French Bulldog, have an extremely elevated risk of dystocia

### Physical examination
A full clinical examination should be carried out, paying particular attention to the size of bladder and the physical appearance of the external genitalia. A full urinalysis should also be performed: any abnormalities should be followed up by urine culture and imaging of the urinary tract. A diagnosis of urethral sphincter mechanism incompetence (USMI) is usually made on the basis of negative test results, signalment and history.
The presence and smell of any discharge should be noted: matted hairs around the prepuce or vulva may indicate that the patient has been licking the area. Urine scalding may be evident in incontinent bitches and should be distinguished from intertrigo (skin and fold infection) due to excess vulval skin folds.

Diagnostic investigations

Urinalysis

Urine collection

Urine can be collected by free catch, catheterization or cystocentesis. There are pros and cons to each method and in some instances it is appropriate to obtain urine by more than one method.

- **Free-catch** samples are the easiest to obtain.
  - Owners should be instructed to use a proprietary urine collecting bottle rather than a kitchen receptacle, as impurities (such as sugar or vinegar) can affect test results.
  - Free-catch samples are not appropriate for bacterial culture, as considerable contamination may come from environmental microbes or normal genital/skin flora. Blood may also be present if there are reproductive tract or preputial/vulval lesions.

- **Catheterization** samples are difficult to obtain with the animal conscious, especially from bitches.
  - Care must be taken to avoid microbial contamination of the catheter tip on insertion, as this could not only result in culture of contaminating bacteria but might also lead to ascending urethral infection.
  - Catheterization may be therapeutic, allowing emptying of a blocked bladder, or collection of biopsy samples in addition to urine collection (see later).

- **Cystocentesis** is a safe, convenient way of obtaining a urine sample.
  - If performed using ultrasound guidance, urine may be obtained from bladders with very low urine volumes.
  - Care should be taken if the bladder is overfull and taut, as there is an increased risk of bladder rupture.
  - Most dogs require no or only light sedation.

Cystocentesis

- The patient is held in lateral recumbency (or standing). An area of skin overlying the puncture site is clipped and basic skin preparation performed (it is not necessary to perform full aseptic skin preparation).
- The bladder is palpated and held in position close to the body wall with one hand, whilst the other hand inserts a 21–23 G, 2.5 cm hypodermic needle affixed to a 5 or 10 ml syringe through the body wall into the bladder.
- Urine should be collected into a plain tube for urinalysis and a boric acid tube for bacterial culture.

Urine examination

Urine should be examined as soon as possible: ideally within 30 minutes of collection. When delay is unavoidable, the sample can be stored at 4°C and brought back to room temperature just before testing. Delay can alter crystal numbers and composition, and affect morphology of casts and cells. There are five components to urine examination.

**Visual inspection:** The colour and clarity of the sample give clues to pathology.

Normal urine may be slightly turbid and is light yellow. Changes in colour are usually due to variations in concentration of the urine, or else the presence of pigments such as haemoglobin, bilirubin or methaemoglobin. Several drugs can also cause colour changes (e.g. metronidazole (yellow/brown); amitriptyline (blue/green); doxorubicin (red/pink)). Changes in turbidity are usually due to haematuria, pyuria, crystalluria or lipiduria. Haematuria (frank blood in the urine) can be distinguished from haemoglobinuria (haemoglobin pigment in the urine, often a sign of intravascular haemolysis) by centrifuging the urine sample at 1500–2000 rpm for 5 minutes and looking for a cellular sediment (Figure 26.4).

**Chemical analysis:** This is normally carried out using multi-test dipsticks (see Figure 14.6), although most in-house laboratory analysers can determine urea and several other indices with good accuracy. The dipstick should be immersed completely in the sample and then tapped to remove excess urine.
The test pad colours should be compared with the colour scale at the prescribed time. Interpretation of urine dipstick test results is shown in Figure 26.5.

**Measurement of urine specific gravity (USG):** This should be performed using a refractometer, which should be regularly calibrated using distilled water to ensure accuracy. It is one of the most informative single tests for urine. A brief explanation of abnormal results follows, but the clinician is advised to refer to a more detailed text for further information.

- **USG <1.008 = hyposthenuria:**
  - Renal failure is unlikely in these cases, as urine must be actively diluted to be hyposthenuric
  - Diabetes insipidus (DI), primary polydipsia or medullary ‘washout’ may be present. DI may be central (lack of antidiuretic hormone production) or nephrogenic. Nephrogenic DI can be primary (very rare) or secondary to various conditions including: hypothyroidism, hyper- or hypoaldrenocorticism, pyometra, pyelonephritis
  - Full haematology and biochemistry is indicated to investigate further.

- **USG 1.008 to 1.012 = isosthenuria:**
  - Some degree of renal failure is possible
  - Biochemistry should be performed to investigate the presence of azotaemia.

- **USG 1.013 to 1.029:** Some urine concentration is occurring.
  - Biochemistry should be investigated, or else water intake should be monitored and USG repeated.

- **USG 1.030 and above: Normal.**

**Sediment microscopy:** The sample should be centrifuged at 1500–2000 rpm for 5 minutes and the majority of the supernatant tipped off. A small amount of fluid will remain in the centrifuge tube, and tapping the bottom of the tube will resuspend the sediment. A drop of this fluid should be transferred to a slide and a coverslip applied. Presence of crystals, casts and cells should be noted at low power. High power should then be used to look for bacteria and to identify cells. It is not unusual to see a few crystals in urine: their significance will depend on numbers present and other clinical signs. For more details see specialist texts such as Cowell et al. (1999) and the BSAVA Manual of Canine and Feline Nephrology and Urology.

**Urine culture:** Samples for culture should be obtained by cystocentesis, and ideally collected into a plain tube. Any positive culture is significant, although contamination of the sample should always be borne in mind if the isolate is a common commensal.

**Diagnostic imaging**

Indications for further imaging of the urinary or reproductive tract include:

- Urinary outflow obstruction
- Abnormal vulval or penile discharge
- Incontinence
- Dysuria/stranguria that fails to respond to treatment or presents with abnormal test results.

Although ultrasonography enables diagnosis of many urinary tract disorders, there is still a role for radiography. At the very least, a survey study of the chest and abdomen should be carried out if neoplasia is suspected.

**Radiography**

Invariably, patients must be sedated or anaesthetized to allow radiographic procedures to be carried out. Radiography may demonstrate pregnancy, pyometra or masses that directly or indirectly involve the

<table>
<thead>
<tr>
<th>Test</th>
<th>Reference value</th>
<th>Causes of derangement; follow-up tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEU (leucocytes)</td>
<td>Not applicable</td>
<td>Not a sensitive test in dogs: cytology is preferred. Microscopy should be performed on the basis of increased urine turbidity or clinical signs, or as routine</td>
</tr>
<tr>
<td>NIT (nitrites)</td>
<td>Not applicable</td>
<td>Not accurate in dogs: ignore results</td>
</tr>
<tr>
<td>PRO (protein)</td>
<td>Trace or 1+</td>
<td>Any protein seen in urine with USG &lt;1.035 is abnormal. Proteinuria with USG &gt;1.035 may be caused by UTI, exercise, seizures or glomerulonephropathy. To investigate further, UPC should be determined</td>
</tr>
<tr>
<td>pH</td>
<td>5.0–8.5</td>
<td>Certain drugs (e.g. thiazide diuretics, carbonic anhydrase inhibitors) can alter pH. Low (acidic) pH can be caused by metabolic or respiratory acidosis, severe vomiting or diarrhoea. High (alkaline) pH can be caused by UTI, certain diets, and respiratory or metabolic alkalosis. High pH should be followed up by urine culture and cytology.</td>
</tr>
<tr>
<td>BLD (haemoglobin/</td>
<td>NEG (none)</td>
<td>Haematuria, haemoglobinuria, myoglobinuria. Confirm haematuria by centrifugation and microscopy. Haemoglobinuria should be investigated with haematology. Should myoglobinuria be suspected, serum creatine kinase should be measured</td>
</tr>
<tr>
<td>haematuria)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SG.DEN (specific</td>
<td>&gt;1.030</td>
<td>Dipsticks are inaccurate for USG and a refractometer should be used. For details about USG abnormalities refer to text</td>
</tr>
<tr>
<td>gravity)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KET (ketones)</td>
<td>NEG (none)</td>
<td>Generally considered in combination with patient condition and blood glucose/urine glucose. Ketonuria with glucosuria and a weak, lethargic dog indicates ketoadicosis</td>
</tr>
<tr>
<td>GLU (glucose)</td>
<td>NEG (none)</td>
<td>A positive finding demands measurement of blood glucose. Hyperglycaemia with glucosuria usually indicates diabetes mellitus. Normal blood glucose with glucosuria may be due to proximal renal tubular disease and should prompt evaluation of BUN and creatinine. Primary glucosuria (Fanconi syndrome) can occur in some breeds (e.g. Basenji).</td>
</tr>
</tbody>
</table>

26.5 Interpretation of urine dipstick test results. BUN = blood urea nitrogen; UPC = urine protein:creatinine ratio; USG = urine specific gravity; UTI = urinary tract infection.
urinary or reproductive tracts. It is not possible to detect masses within the bladder on plain radiography, although some uroliths are radiopaque.

Contrast radiography, with administration of either air (negative contrast) or iodine-containing media (positive contrast), is indicated for the investigation of bladder or urethral masses, uroliths or trauma, vaginal/rectal fistulas and incontinence, and ureteral investigations (using intravenous contrast agents). For further details see the BSAVA Manual of Canine and Feline Abdominal Imaging.

Ultrasonography
Ultrasonography is ideally suited to examination of the bladder due to the inherently high contrast between urine and the bladder wall. It is not possible to visualize the normal ureter, nor the intrapelvic urethra; but the stretch of urethra between the perineum and the os penis of the male dog may be imaged. It is usually possible to perform ultrasound examinations with the patient conscious, or with only light sedation. A moderately full bladder is ideal; if the patient has just voided, then the bladder wall will appear naturally thicker and irregular. Bladder masses, uroliths and corrugations of the bladder mucosa can be readily identified using ultrasonography, although artefacts may cause spurious interpretations (Figure 26.6).

 Ultrasound investigation of the female reproductive tract can readily identify pyometra (Figure 26.7) but subtle lesions may easily be missed or confused. The aspirant sonographer is encouraged to undertake further training and to consult specialized imaging textbooks such as the BSAVA Manual of Canine and Feline Ultrasonography.

Endoscopy
Endoscopy is a very useful, if expensive, tool for looking at anatomical abnormalities, infections of the vagina and uterus, and trauma in the bitch. It is also routinely used for transcervical inseminations. The endoscopes that are used are rigid and about 30 cm long, and have been specifically designed for this purpose. For more information, see the BSAVA Manual of Canine and Feline Endoscopy and Endosurgery.

Cytology
Vaginal cytology is used routinely to determine different stages during pro-oestrus and oestrus in the bitch. The cells that may be found will indicate whether there is any hormonal influence (see Chapter 5). Cytology is also a cheap and quick way to examine any abnormal vaginal discharge (Figure 26.8).
Conditions causing difficulties with urination

Urinary tract disorders

Urinary tract obstruction: emergency treatment

Signs of repeated straining with no production of urine, a hunched posture, lethargy and weakness should prompt concerns about a blocked bladder or urethra, especially if there has been a recent history of haematuria or dysuria. Palpation should readily reveal an enlarged bladder, and pain may be evident in the caudal abdomen.

Intravenous fluid therapy should be initiated and blood samples taken to evaluate hyperkalaemia and azotaemia. The immediate goal should be removal of the blockage and decompression of the bladder. In most cases a small-bore catheter can be passed up the urethra; however, in those cases where this is not possible, emergency relief can be attained by cystocentesis (although there is a small risk of rupture of the bladder). Hydropulsion may be used to dislodge a stone and flush it retrograde into the bladder.

Urethral retrograde hydropulsion

1. The patient is positioned in lateral recumbency and the penis and prepuce are flushed with dilute chlorhexidine.
2. A gloved assistant places a finger into the rectum and applies pressure to the urethra.
3. A urinary catheter is passed into the urethra to the level of the obstruction. The penis is gripped to form a seal around the catheter, and sterile saline is introduced into the urethra from a syringe attached to the catheter. This causes a pressure increase in the urethra.
4. The gloved assistant releases pressure on the urethra, resulting in a pressure wave forcing the urolith back towards the bladder.

Fluid therapy should be continued for at least 24 hours to establish diuresis (which will help in the dissolution of uroliths) and any urinary tract infection must be treated on the basis of culture and sensitivity results. In cases of repeated blockage, or in rare instances where it is not possible to pass a catheter, urethrostomy should be considered.

Analgesia is mandatory and should include an opioid. Midazolam or diazepam is often added, to improve urethral muscle relaxation. Care should be exercised with non-steroidal anti-inflammatory drugs (NSAIDs) until the renal status of the patient has been ascertained or stabilized.

Urolithiasis

Palpation (especially of thin patients) may reveal the presence of uroliths in the bladder or urethra. However, imaging is usually required to confirm the presence and distribution of stones. Most uroliths are visible on radiographs: calcium oxalate (Figure 26.9) and struvite are the most radiodense; silicate and cysteine uroliths are often slightly indistinct. Urate uroliths are not visible on plain radiographs, but will show up with contrast cystography. Ultrasonography will reveal the presence of uroliths; however, many clinicians prefer radiographs, as it is easier to gain an appreciation of numbers and distribution of stones (particularly when some have passed into the urethra).

Treatment should be by surgical removal, although dissolving uroliths may be attempted if they are small (using medicated food, allopurinol or N-(2-mercapto-propionyl)-glycine, depending on the urolith type) (Figure 26.10). See also emergency treatment for obstruction, above. Analgesia should be provided; NSAIDs are appropriate and effective, provided hydration is good and there is no evidence of azotaemia.

Lateral abdominal radiograph of a 5-year-old male entire cross-bred dog with a presenting history of dysuria and haematuria. The radiograph shows several small radiodense masses within the urinary bladder. The stones were removed and found to be formed of calcium oxalate.

Struvite uroliths taken from a 13-year-old neutered Jack Russell Terrier bitch with a history of haematuria and dysuria.
Urinary tract infection
Urine microscopy reveals pyuria (degenerate neutrophils with phagocytosed bacteria), bacteriuria and haematuria. Urine culture should be attempted, although Gram staining of a slide may provide a good enough idea of the bacteria involved to make a rational choice of antibiotics before results are back. A good review of antibiotic selection for urinary tract infections (UTIs) is given by Grauer (2009). Antibiotic treatment should be continued for at least 2 weeks.

Dogs that fail to improve, or that have recurrent infections, should be investigated for underlying disease including pyelonephritis. Bladder ultrasonography should be performed, along with biochemistry and investigation for endocrine diseases including diabetes mellitus and hyperadrenocorticism.

Neoplasia
Transitional cell carcinoma (TCC) is the most common bladder neoplasm, although the bladder and other parts of the urinary tract can be affected by other tumours, including leiomyoma, leiomyosarcoma and transmissible venereal tumour (TVT), and through spread from prostatic carcinoma. Abnormal cells may be seen on microscopy and a mass lesion is usually readily visualized using ultrasonography (the sublumbar lymph nodes can also be examined for evidence of spread). Biopsy should be performed to rule out other tumours or inflammatory lesions. Biopsy methods include ultrasound-guided needle biopsy (although there is a small risk of iatrogenic spread along the needle tract), surgical biopsy or catheter biopsy (applying suction to a catheter placed by ultrasound guidance to lie over the mass). Cystoscopy, where available, is ideal, as biopsy samples can be taken and the bladder can be more fully assessed. Options for treatment include surgery, chemotherapy and radiotherapy. Unfortunately, TCC shows a predilection for the trigone, ruling surgery out in these cases. The prognosis for combined surgical management and chemotherapy (e.g. doxorubicin or carboplatin) is usually <1 year. There is some evidence to suggest that COX 2-specific NSAIDs may have some efficacy in reducing tumour size (Mohammed et al., 2006).

Other causes of dysuria
- Pelvic masses may be palpable per rectum, or else may be imaged radiographically or ultrasonographically.
- Perineal hernia is diagnosed on the basis of other clinical signs (see Chapter 30).
- Neurological dysuria is usually diagnosed on the basis of other clinical signs and lack of findings on urinalysis.

Genital/reproductive disorders (bitch)
Anatomical abnormalities
Occlusion of the vulva by excessive skin folds is quite common in large breeds with a lot of skin or in obese animals, or may sometimes be a feature of individual anatomy. Exudative dermatitis, vaginitis and cystitis can develop as a result. Problems during mating and, if pregnancy is achieved, during parturition are common. Surgical vulvoplasty is the treatment of choice as recurrence is very high with topical treatments.

Clitoral hypertrophy (Figure 26.11) may be caused by excessive licking, treatments with androgens (in racing Greyhounds) and, most commonly, in intersex animals. Approximately 50% of male pseudohermaphrodites and 100% of true hermaphrodites show clitoral hypertrophy.

Vaginal strictures are a common occurrence in bitches and can have different origins and appearances. They are usually found at the vestibulovaginal junction and are easily palpated. They can cause pruritus, vestibulitis and cystitis. In bitches that do not
show any clinical signs they may be discovered when a male dog cannot achieve intromission during mating attempts. Strictures may be circumferential or septal.

- Circumferential strictures may consist of persistent hymens or remnants thereof. These fuse quite elastic and can usually be broken down digitally in oestrus bitches. More fibrous circumferential strictures are the result of inadequate fusion of the Müllerian ducts to the urogenital sinus during fetal development. Diagnosis may be made through contrast radiography or vaginal endoscopy. Treatment of choice is surgical removal of the stricture, which is not always easy.

- Septal strictures originate from the incomplete fusion of the Müllerian ducts and may vary in length from a small band, which may be broken down manually, to an elongated septum dividing the vagina.

Vaginal hyperplasia

Vaginal hyperplasia occurs during pro-oestrus and early oestrus, due to excessive oedema under normal oestrus stimulation. It is not known why some bitches respond in this way, while others do not. Brachycephalic breeds, Staffordshire Bull Terriers and Mastiffs are more commonly affected. Bitches usually show first signs in the first 3 years of life, with a worsening of the condition with each successive oestrus.

Oedematous tissue occludes the vagina and often prolapses through the vulval lips. It is important to avoid lacerations of the prolapsed vaginal mucosa. The prolapse usually only lasts during the 7–10 days of pro-oestrus, a period dominated by oestrogen. As progesterone rises, the oedema decreases and it is sometimes possible to mate bitches. Problems can occur when oestrogen rises again towards the end of pregnancy and the oedema reappears at the time of parturition.

If the oedema becomes pronounced, the bitch should not be used for breeding. Ovariohysterectomy prevents recurrence of the problem.

Tumours of the vagina and vulva

Vaginal tumours are the second most common urogenital tumours in entire bitches after mammary gland tumours. Most of these tumours are hormone-dependent and almost 90% are benign. The most common tumours are leiomyomas, fibromas, fibrocytomas and vaginal polyps. Malignant tumours are leiomyosarcomas, adenocarcinomas, haemangiosarcomas and mast cell tumours. Treatment of choice is surgical removal of the tumour with concurrent ovariectomy.

Trauma

Trauma may involve many causes and injuries.

- Trauma caused by mating is relatively rare and must be assessed in the individual patient. Repairs may be possible via the external genital opening, but sometimes an episiotomy may be necessary to gain full access.

- Foreign bodies (e.g. grass awns) are possible causes of trauma, though they usually lead to frequent micturition and a sanguineous or purulent discharge. An endoscopic examination may be necessary to identify the problem and remove the object.

Genital/reproductive disorders (male dog)

Benign prostatic hyperplasia

Benign prostatic hyperplasia (BPH; Figure 26.12) is an age-related condition of entire males. Testosterone is metabolized in the prostate gland and leads to a symmetrical increase in glandular and connective tissue. The prostate gland encircles the urethra at the neck of the urinary bladder and is surrounded by a capsule. Most entire dogs will have BPH by the time they are 5 or 6, although the majority do not have any clinical signs.

![Post-mortem photograph from a dog with benign prostatic hyperplasia: the prostate gland (arrowed) was as large as the bladder (*)](image)

Clinical signs of BPH include:

- Problems with urinating
- Faecal tenesmus
- Bloody discharge between or following micturition.

Initial assessment for BPH is by rectal digital examination, but this is not always possible, especially if the enlarged prostate gland has moved into the abdominal cavity. Ultrasonography and radiography may be more conclusive.

Treatment in older dogs not used for breeding is castration. In dogs that are still at stud, osaterone acetate is the treatment of choice.

Prostatitis

Prostatitis is an inflammation of the prostate gland that is usually secondary to other underlying problems, most commonly BPH in entire dogs or adenocarcinoma in castrated dogs. In addition to the clinical signs of prostatic disease (see above), there is usually lethargy, pyrexia and inappetence. Prostatic fluid may be collected by ejaculation, or prostatic tissue can be sampled by ultrasound-guided fine-needle biopsy, and cytology used to distinguish prostatitis from cancer. Treatment includes antibiotics, based on sensitivity testing and penetration into the prostate gland, with further therapy for any underlying causes. Fluoroquinolones, such as enrofloxacin and ciprofloxacin, diffuse readily into the prostate gland regardless of the surrounding tissue or pH. Dogs with prostatitis should be treated for 4–6 weeks to avoid recurrence.

Prostatic cysts

Prostatic cysts may be retraction cysts, originating in the tissue of the prostate gland or paraprostatic...
cysts. Clinical signs depend on the size and position of the cysts. On ultrasound examination cysts can vary in size, thickness of wall, sediment or clear fluid, subdivisions and associations with other structures. Treatment of choice is surgical omentalization of the cysts.

**Prostatic abscess**

Prostatic infections may progress into abscesses, forming purulent pockets within the prostatic parenchyma. In acute cases dogs will present with fever and abdominal pain. In chronic cases the abscess is walled off and difficult to diagnose, unless diagnostic imaging is performed. Antibiotic treatment is rarely successful, as penetration into the abscess capsule is poor; surgical drainage and omentalization is the treatment of choice, with concurrent castration.

**Prostatic neoplasia**

Neoplasia of the prostate gland is uncommon. The most common prostatic neoplasm is adenocarcinoma, which tends to metastasize by direct spread into adjacent tissues and to the iliac and sublumbar lymph nodes. Clinical signs will depend on the increased size of the prostate gland and can include haemorrhagic discharge and even hindlimb lameness. Smaller breeds (terriers) are over-represented, and it may be more common in castrated than in entire dogs. Prostatic neoplasia is an extremely painful condition and prognosis is very guarded. Careful assessment of progressive illness should be made before embarking on treatments; euthanasia is almost always justified by the time the disease is clinically apparent (Figure 26.13). Osaterone acetate may provide transient relief. Analgesia should be commenced, but the response, even to strong opioids, is frequently disappointing.

**Spermatic cord torsion**

Spermatic cord torsion is a progressively painful event with obvious swelling of the spermatic cord, epididymis and testicle. The dog will be reluctant to move and become increasingly depressed. Removal of the engorged testicle is usually necessary (Figure 26.14).

**Conditions causing a discharge or abnormal urine**

**Bitch**

Discharge, especially sanguineous, is a normal sign of pro-oestrus and oestrus in the bitch. This is accompanied by swelling of the vulva and behavioural changes; male dogs will show interest and the bitch may be more aggressive toward other females. The discharge, which is never purulent, changes in quantity and composition over the pro-oestrus period and ceases as metaoestrus sets in. During the postpartum period it is also normal for a bitch to produce a discharge: first, greenish-black lochia; later, ever-decreasing amounts of sanguineous discharge. This can last for up to 3 weeks but for most bitches will have subsided considerably after 1 week. Details are described in Chapter 5.

**Vaginitis**

Juvenile vaginitis, defined as vaginal discharge before the first oestrus, is not uncommon in prepubescent bitches. The causes are not known, but there is a creamy odourless discharge, with no general signs for the affected young bitch. Antibiotics may bring transient relief. The condition is self-limiting, resolving with the first oestrus, and usually does not recur. Early neutering is not recommended in these cases, as neutering prior to puberty will prevent the development of the vaginal structures that allows the condition to resolve.
Chronic vaginitis, often with transient relief from antibiotic treatment, is a condition found in neutered females. It is most probably caused by a lack of oestrogen changing the composition of the commensal vaginal flora and leading to an imbalance that gives rise to ‘unwanted’ bacteria. Treatment with low-dose oestrogen often brings relief.

**Cystic endometrial hyperplasia**

Cystic endometrial hyperplasia (CEH), a thickening of the endometrial lining and subsequent cystic enlargement of some of the uterine glands, is a normal progressive process as a result of repeated oestrous cycles. The degree of change varies between individuals but most entire females will have some degree of CEH once they are >8 years of age. CEH itself does not have any clinical signs but can cause reduced fertility and may allow the establishment of ascending infection in the uterus that can lead to pyometra.

**Pyometra**

During oestrus the cervix opens and allows the normal vaginal flora to ascend into the uterus. In a healthy uterus these can be eliminated when the season is finished, the cervix has closed again and a large influx of polymorphonuclear leucocytes is present. During the development of pyometra this does not happen: the contamination cannot be eliminated, the endometrium thickens and a purulent discharge develops inside the uterine lumen. In some cases the cervix remains closed (‘closed pyometra’) but in most bitches it is open and some discharge can be seen. The most common isolate is *Escherichia coli* but other bacteria may be cultured. Pyometra is most common in older nulliparous bitches that have been in season in the last 4–10 weeks.

Bitches normally present with a purulent and/or bloody discharge, which has a characteristic smell. Other clinical signs are polydipsia (about 60% of cases), inappetence, vomiting and depression. In more severe cases abdominal distension can be significant.

Diagnosis of pyometra is easiest in cases with vaginal discharge and ultrasonography that confirms a filled uterus. Haematology often reveals leucocytosis with a left shift. Blood biochemical analysis is helpful to assess kidney function.

The treatment of choice in clinically ill bitches is ovariohysterectomy (Figure 26.15; see also QRG 5.1) and fluid therapy.

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**Non-surgical treatment of pyometra**

In some cases where clinical signs are slight, and the bitch is still intended to be used for breeding, a progesterone receptor antagonist may be used:

- Aglepristone 10 mg/kg on days 1, 2 and 7 or 1, 2 and 8
- Antibiotics for 3–4 weeks (start on day 1)

An ultrasound examination should be performed at the end of treatment to ensure that there is no fluid left in the uterus. Bitches should be bred at the next season if possible, as recurrence rates of pyometra after treatment are around 30%. Pregnancy rates for these bitches are above 50%.

**Abnormal pregnancy**

Fetal death during pregnancy will lead to various kinds of discharge, ranging from bloody to purulent to black/malodorous, depending on the stage of pregnancy and degree of maceration. The loss of one puppy does not necessarily lead to a loss of the whole pregnancy and the rest of the puppies may be carried to full term. In some cases fetuses that have died at different stages as well as live puppies may be delivered (Figure 26.16). *Utero verdin* (greenish/black discharge) in the absence of normal first-stage labour is a sign of uterine inertia and requires immediate attention. If placental separation precedes labour, or no labour is taking place, a caesarean section should be performed.

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**Male dog**

**Testicular neoplasia**

Testicular tumours are very common, occurring in 0.9% of entire dogs (Nødtvedt et al., 2011).

- Sertoli cell tumours are slow-growing and often unilateral. They usually produce oestrogen, which...
leads to feminization (bilateral alopecia, gynaecomastia and attractiveness to other males). Sertoli cell tumours rarely metastasize or become malignant. Removal of the affected testicle is usually curative and fertility may recover in the remaining testicle.

- Seminomas are very similar to Sertoli cell tumours and are often only distinguishable through histology.
- Interstitial cell tumours arise from the Leydig cells in the testicle and are quite small (1–2 cm); they may be multiple and present in both testicles. They are usually not hormonally active, but cause shrinkage of the testicle through atrophy of the seminiferous tubules. Spermatogenesis is arrested. Castration is the treatment of choice.

Testicular tumours are more frequent in abdominal testicles, although the incidence is not as high as previously thought and problems do not normally arise until the dog is at least 5–6 years of age. Given the position of the testicle, they are much harder to diagnose.

Phimosis
Phimosis is the inability to protrude the penis from the prepuce and is uncommon in the dog. It may be caused by a constriction of the preputial orifice, congenitally or through injury, persistent penile frenulum or anatomical abnormalities in intersex animals. Treatments include: surgical widening of the prepuce; transection of the frenulum (usually easy); or gonadectomy in intersex animals.

Paraphimosis
Paraphimosis is the inability to retract the penis into the prepuce. It occurs most commonly as a result of preputial skin rolling inwards following masturbation, but can also be caused by balanoposthitis or a small preputial opening.

Cooling and lubrication may bring transient relief, before dealing with the underlying causes. Medical or surgical castration, treatment of any infections or widening of the preputial opening may be necessary.

Fractured os penis
Fracture of the os penis is uncommon, usually caused by trauma and is very painful during urination and palpation. Radiographic imaging is helpful in diagnosis. Healing usually occurs unaided, but an indwelling urethral catheter may be necessary. In extreme cases the penis may have to be amputated.

Urinary incontinence
Incontinent dogs may be more prone to ascending urethral infection and irritation of the external urethral orifice through constant wetting and urine scalding. However, it is often the owners who suffer the most with the problem. The smell of urine, staining of carpets and furnishings, and increased cleaning costs and effort can drive a wedge into the human–pet bond and make the owner increasingly resentful towards and annoyed with their dog. The realization that the animal cannot control the leakage adds guilt to the emotions, often resulting in owners hiding their true concerns about the condition. Thus, incontinence should be investigated as a priority and a high level of compassion should be shown.

There are several causes of incontinence, which may be roughly divided into:
- Problems of urine overflow: these are characterized by a large bladder on palpation, and include urogenital lesions, reflex dyssynergia, or outflow obstruction
- Problems of urine retention: these are characterized by a small bladder, and include USMI, hyper-reflexivity of the detrusor muscle and congenital abnormalities.

It is important to establish that the problem really is incontinence: patches of urine appearing around the house may be a sign of dysuria, or increased urge to urinate, or behavioural (see Chapter 12). Incontinence is a lack of voluntary urine retention and typically results in urine being released while the dog is lying down; in some instances there is a continual leakage of urine, which may result in scalding of the vulva, prepuce or hindquarters. Occasionally, the loss of urine can be so slight that it is hardly detected, but may cause a bitch to lick the vulval area in order to clean itself. This and the leakage of urine can lead to recurring vaginitis that does not respond to antibiotic treatment. It is also important to distinguish incontinence from pollakiuria/polydipsia, which can result in reduced ability to control voiding due to large volumes of urine production (see Chapter 14).

**PRACTICAL TIP**
Urinalysis including specific gravity, dipstick analysis and cytology should be routinely performed in suspected incontinent cases to rule out PU/PD

**Problems of urine overflow**

**Neurogenic disorders**
Typically, dogs with neurogenic disorders of the bladder will have other neurological abnormalities on examination, such as ataxia, paresis or proprioception deficiencies. There may also be a history of spinal or pelvic trauma. However, rare neurogenic tumours or other disorders can occur. Chapters 11 and 16 discuss neurological examination in detail.

As a general oversimplification:
- If the bladder is full and easy to express, then the lesion is likely to be a LMN lesion (located at or below L5)
- If the bladder is full and hard to express, a UMN lesion should be suspected (cranial to L5).

Reflex dyssynergia (RD) is a neurological cause of incontinence seen mainly in large-breed male dogs. A typical presentation is that of a dog cocking its leg to urinate normally, passing a reasonable stream that soon diminishes into spurts. The dog then may walk off still dribbling or spurtting urine. This may be difficult to distinguish from urinary outflow obstruction, but a urinary catheter is easily passed in these cases and no blockage can be found.
Urinary outflow obstruction
In these cases there is urine overflow: that is, the pressure within the bladder increases until there is sufficient pressure for urine to escape around an obstruction. Typically, the patient will be uncomfortable or in pain and may be seen frequently straining with no urine forthcoming. Urine may be seen to leak from the urethral opening. The outflow obstruction may be caused by calculi, neoplasia, pressure from extraurethral masses, urethritis or strictures. Prostatic disease in older dogs (see earlier) is a relatively common cause of outflow obstruction.

Problems of urine retention
Urethral sphincter mechanism incompetence
Although the condition can be congenital, the acquired form is much more prevalent. USMI does occur in male dogs but is uncommon.

USMI is by far the most common cause of urinary incontinence in the bitch, especially in the spayed bitch, which (due to a lack of oestrogen) may be around eight times more likely to develop the condition than the intact bitch. The onset of incontinence after spaying can vary between a few months and many years, but is not associated with the age at which a bitch is neutered, with the exception of six key breeds.

Breed predilections for USMI
The following breeds should not be spayed prior to their first season, as there is a very high risk of rapidly developing post-spay urinary incontinence:
- Old English Sheepdog
- Dobermann
- Rottweiler
- Irish Setter
- Weimaraner
- Springer Spaniel

Other factors are believed to play an important role in the development of USMI, including:
- length of the urethra; position of the bladder neck (infra- or extrapelvic); breed; and obesity, with larger, overweight bitches being more prone to developing or worsening USMI.

Hyper-reflexivity of the detrusor muscle
This is an inability to control voiding secondary to inflammation of the bladder or urethra stimulating the detrusor muscle. The most common cause is bacterial UTI, although tumours, calculi or chronic cystitis can also cause it. Haematuria is a common feature of this condition and the affected dog may also exhibit polakiuria and dysuria/stranguria.

Congenital abnormalities
Puppies and immature dogs with incontinence may have ectopic ureters, persistent urachus, vaginal strictures, or congenital fistulas. Of these, ectopic ureters are the most common, and bitches are more prone. Typically a constant dribble of urine is seen, although in unilaterally affected cases urine can also be voided normally.

Treatment of incontinence
Treatment of urinary outflow obstruction is described earlier in the chapter. Neurogenic causes are best treated by addressing any underlying neurological disease, although the prognosis often remains guarded for these cases. Surgical treatment of ectopic ureters and other congenital abnormalities is outside the scope of this book and the interested reader is directed to a surgery book such as the BSAVA Manual of Canine and Feline Abdominal Surgery.

USMI treatment can be divided into medical and surgical approaches. Due to the multifactorial nature of USMI, no individual treatment has been found to deal with all cases and it is necessary to adjust treatment periodically in most cases. Approximately 50% of dogs do not respond fully to treatment.

- Medical treatment: The mainstays of treatment are phenylpropanolamine and estriol. If there is a lack of response or the animal becomes refractory to treatment, it is possible to use the two drugs in combination. Recently, the gonadotropin-releasing hormone (GnRH) superagonist deslorelin has been shown to be effective in some USMI cases, possibly by stabilizing the bladder wall; however, this drug is not authorized for this use at present. Analgesia is generally not required for incontinence; however, urine scalding can occur in chronic cases. This can cause great irritation in the vulval region and is generally treated by NSAIDs and improved hygiene, including chlorhexidine washing and use of petroleum jelly.

- Surgical treatment: There are various surgical options, including colposuspension, bladder neck reconstruction, periurethral surgical slings and injection of bulking agents into the proximal urethra. The techniques are regarded as complex and require a good deal of surgical expertise. Again, the reader is encouraged to study a surgical textbook.

References and further reading
Cowell RL, Tyler RD and Merketh JH (1996) Diagnostic Cytology and Haematology of the Dog and Cat. 2nd edn. Mosby, St. Louis
Hagman R and Kuhn I (2002) Escherichia coli strains isolated from the uterus and urinary bladder of bitches suffering from pyometra. Comparison by restriction enzyme digestion and pulsed field gel electrophoresis. Veterinary Microbiology 84, 143–153
Chapter 26  Urination problems; genital discharge

Nadeviewd A, Gamlem H, Gunnes G et al. (2011) Breed differences in the proportional morbidity of testicular tumours and distribution of histopathologic types in a population-based canine cancer registry. Veterinary and Comparative Oncology 9, 45–54
The main presenting signs of skin disease are: pruritus; alopecia (symmetrical, localized, diffuse, patchy); scaling and crusting; erosions and ulceration; papules, pustules and vesicles; lumps and nodules; and pigmentation disorders. Solving each dermatological conundrum requires an ability to listen, observe, feel and smell. Using all the information gathered through these senses, the cause of most dermatological presentations can be ascertained. When presented with a dog with a skin problem, a thorough history should first be obtained. Following the history-taking and physical examination, a basic differential diagnosis list can be drawn up and may indicate further diagnostic tests. The investigations noted here, coupled with a logical approach derived from the history and physical examination, should allow most cases to be diagnosed and suitable treatment selected. It is useful to divide cases on presentation into pruritic and non-pruritic (or pruritus not being the primary sign) cases, and algorithms are provided for both types of presentation. Should a case not resolve, it is necessary to go back to the beginning and review the case again, as new lesions or historical facts may be present. It is also important to check that therapy has been administered properly. Common conditions are discussed in approximate order of prevalence. Details of specific tests and drug doses, along with details of uncommon conditions listed, can be found in the BSAVA Manual of Canine and Feline Dermatology.

There are few true emergencies in canine dermatology. Toxic epidermal necrolysis probably constitutes the only one in the UK and is rare, while in other countries venomous bites would be considered an emergency.

History
The time invested in getting a good history can prevent wasting time doing unnecessary diagnostic investigations and also provide unnecessary expense for the owner. It is helpful to develop a basic line of questioning to avoid missing any information. A questionnaire can be used (an example is given at the end of the chapter), but it is possible to memorise a sequence of questions that can be asked during the physical and dermatological examination, for efficient use of time. The following questions should be asked:

- How old was the dog when the problem started?
  For example: an early age of onset could indicate demodicosis or a congenital or hereditary condition; between 1 and 3 years of age could suggest atopic dermatitis; older than 6 years could suggest endocrine, metabolic or neoplastic disease.

- What did the skin problem look like originally? For example: atopy is often merely pruritic initially, with few or no skin lesions.

- Where on the body did the first lesions appear, and what did they look like?

- Is the dog itchy and, if so, how severe is the itch? Itching, scratching, licking, chewing, biting or rubbing are all signs of pruritus and may not be volunteered by the owner.

- Is the diet of good quality and is there any relation to the onset of skin signs when it is fed?

- Are in-contact animals or people affected?

- Has the dog recently been acquired from or visited kennels?

- What percentage of time is spent indoors? Do clinical signs vary with the amount of time spent outdoors or indoors?

- Is there any seasonality? This may be seen with atopy or parasitism.

- Are siblings or other relatives of the dog affected?

- Is there effective flea control on all the animals in the house, and in the environment?

- What medications (dermatological and others, including supplements) is the dog taking? Has the condition responded to medication?
  Uncomplicated atopy is very steroid-responsive, while food allergy, scabies and forms of pyoderma can be poorly responsive.

- Is there a recent history of foreign travel?

Non-dermatological information can also be used to direct investigation of a dermatosis:

- Bouts of vomiting and diarrhoea may indicate food intolerance.
Polydipsia and polyuria may indicate an endocrinopathy, e.g. hyperadrenocorticism. Lethargy and thermophilia may indicate hypothyroidism. Abnormalities of the oestrus cycle can be associated with endocrinopathies. Changes in biochemistry profiles, particularly hepatic, could indicate hepatocutaneous syndrome or endocrinopathies.

### Physical examination

#### PRACTICAL TIP

A physical examination of all major body systems should be carried out. General signs such as anaemia (systemic disease), lymphadenopathy (demodicosis, juvenile cellulitis, lymphoma), bradycardia and being overweight (hypothyroidism), swollen abdomen and hepatomegaly (hyperadrenocorticism) help point the clinician towards a diagnosis.

A thorough examination of all the skin is required, not just the affected areas presented by the owner. Particular attention should be paid to the interdigital skin, paws, nails, mucocutaneous regions and ears. Areas such as the ventrum, dorsum, face, axillae and groin are examined by parting the coat to find lesions that might not be obvious on initial inspection. It may be necessary to clip areas to show lesions. An illuminated magnifying glass is very useful. Some dermatological lesions are illustrated in Figure 27.1; a fuller description of individual lesions can be found in the BSAVA Manual of Canine and Feline Dermatology. Lesions can be categorized as primary or secondary, although some can be either. All lesions should be carefully recorded in the clinical notes.

The distribution of lesions can point towards certain problems:

- Lesions involving the face, ears, axillae, groin and feet strongly suggest atopy or food allergy.
- Lesions involving the lumbosacral area strongly suggest flea-allergic dermatitis.
- Lesions involving the elbows and pinnae suggest scabies.

The nature of the lesions may suggest the cause:

- Papules may indicate pyoderma, scabies, ectoparasitism or hypersensitivity.
- Pustules might suggest pyoderma, but also demodicosis or pemphigus foliaceus.
  - Large pustules may be associated with endocrine disease complicated by pyoderma.
- Follicular casts may be seen with pyoderma, demodicosis, dermatophytosis or keratinization disorders.
- There may be a malodour, possibly suggesting a Malassezia infection.

The skin should be palpated to detect thickening (lichenification) or thinning (suggesting hyperadrenocorticism). The haircoat should also be examined; chewed hair has a rough feel when brushed backwards with the fingers.

![Examples of dermatological lesions. (a) Papule: a solid elevated lesion, <1 cm diameter (arrowed). (b) Pustule: a circumscribed elevation of the skin, which contains pus (arrowed). (c) Hypopigmentation: (i) <1 cm macule; (ii) >1 cm patch. (d) Scale: an accumulation of loose fragments of the cornified layer of the skin (arrowed). (continues) ▶](image)
Diagnostic techniques

More information on these techniques can be found in the BSAVA Manual of Canine and Feline Dermatology.

PRACTICAL TIP

In a busy clinic it can be difficult to perform these tests during a consulting session, so if time is limited collect the samples and look at them after the appointments have finished; then ring the owners to discuss the findings.

Parasite collection and identification

All dermatological cases should have skin scraping performed (see QRG 27.1) to avoid missing a parasite problem. Superficial parasites can also be checked for by using an acetate strip (e.g. for Cheyletiella) or a flea comb. It is useful to have a chart with diagrams of parasites adjacent to the microscope, to help identification (obtainable from some pharmaceutical companies, or one can be made).

Cytology

Cytology of adhesive tape or direct smear samples (see QRG 27.2) is an inexpensive and much underused diagnostic technique available in practice. It can be used to detect infective agents, immune-mediated cells, inflammatory infiltrate, acanthocytes and neoplastic cells. Establishing whether cocci, rods or Malassezia are present can direct appropriate antimicrobial therapy.

Trichograms

Trichograms (see QRG 27.3) are another underused and inexpensive diagnostic aid. Anagen and telogen hairs can be identified and the anagen:telogen ratio calculated. If telogen hairs predominate, then an endocrine or nutritional disorder is likely. Shaft deformities (trauma, congenital) and melanin clumping (colour dilution alopecia) may be seen. Broken hair shaft ends suggest trauma. Fungal hyphae can be seen on hairs infected by dermatophytes.

Bacteriology, fungal culture and Wood's lamp examination

If a bacterial or fungal cause is suspected, samples can be sent for bacterial culture and sensitivity testing (particularly indicated if bacterial rods are present) and/or fungal culture.

Wood's lamp examination

- Wood's lamp examination can demonstrate yellow/green fluorescence in Microsporum canis-infected hair shafts in about 30–80% of isolates. Some rare dermatophytes may also fluoresce.
- Care should be taken to avoid falsely identifying fluorescence due to medications or debris.
- Allow the lamp to heat up adequately (5–10 minutes) before use.

Skin biopsy

Skin biopsy (see QRG 27.4) can identify some specific conditions, but most often helps in ruling out
Pruritic conditions

Pruritus is the most common dermatological presentation in practice, and often the most stressful for practitioners. Owners will not tolerate pruritus in their pets, so there is pressure to apply a ‘quick fix’, but this will usually only result in postponing the problem. Common causes of pruritus are listed in Figure 27.2; other conditions may present with pruritus (e.g. pemphigus, toxic epidermal necrolysis and erythema multiforme).

27.2 Causes of pruritus. The most common causes are in bold.

A logical step-by-step approach is required (Figure 27.3). In dealing with pruritic cases, the concept of pruritic threshold should be considered: several skin conditions can collectively exceed the threshold; clearing one or two of these dermatoses can often bring the animal below the threshold and thus reduce the itch.

Fleas

Fleas are still the commonest ectoparasite seen in practice, despite all the insecticide products available. This is largely because of poor advice and improper use of preparations. Animals may have large numbers of fleas and yet very few clinical signs or, in the case of flea-allergic dogs, severe signs with only a few fleas. Animals of any age can be affected.

Flea hypersensitivity is rare in animals <6 months of age but usually developed by 1–3 years. Lesions commonly involve the lumbosacral region, caudal thighs and groin. There may be papules, erythema and alopecia. Some cases can present as pyotraumatic dermatitis.

The coat should be examined for evidence of fleas, flea eggs and flea dirt (Figure 27.4). It is important to check whether there are other animals in the house, especially cats, and if they or the people in the household have lesions.

27.3 Step-by-step approach to finding the cause of pruritus in an animal. The step-by-step approach starts with the assessment of the type of pruritus, the etiology, and the management strategy. The case is a 3-year-old mixed-breed dog with a 2-week history of pruritus. The owner is concerned that the dog has a skin infection and is taking a prolonged course of a topical medication. The owner reports a 5% reduction in pruritus. The dermatologist recommends an additional course of oral medication and a home hygiene program.

PRACTICAL TIP

The type of flea or its life stage may indicate the source. Mainly small juvenile fleas would suggest poor environmental control.

The owner should be asked about flea control in order to establish whether they are using an effective preparation in an appropriate way. It is also necessary to ascertain how often the dog is bathed or goes swimming, as this could decrease the efficacy of topical treatments.

- Treat all the animals in the household with a topical monthly preparation that has a good duration of activity, or with oral spinosad. Alternatively, in the case of dogs, one of the new isoxazolines (fluralaner, afoxolaner) can be used.
- Treat the environment with an insecticide and insect growth regulator (IGR) spray.
- Lufenuron is an oral IGR that can be given to all animals in the household to inhibit flea breeding.
- Vacuum the house and dispose of the contents of the vacuum cleaner.
- Treat the outside environment and the car with an insecticide. Note that some preparations are affected by exposure to UV radiation.

Fleas

27.4 Causes of pruritus in dogs. Fleas are not the only cause of pruritus in dogs. Other causes include food hypersensitivity, atopic dermatitis, pyotraumatic dermatitis, acral lick dermatitis, superficial pyodermas, Malassezia infections, Cheyletiella infections, Demodex infections, Pediculus infections, Neotrombicula infections, and neoplasms.

PRACTICAL TIP

Some form of assessment scale can be used (score 1–10) to review response to therapy, as the comment ‘it is no better’ can be very misleading. The itch may be 50% reduced but still present, as may often be the case if a pyodermia has cleared but there was an underlying allergy.

Atopic dermatitis

Atopic dermatitis is a common cause of pruritus in dogs. Initially there are few if any skin lesions, but lesions develop later due to self-trauma. Areas commonly affected include the face (Figure 27.5), eyelids, ears (especially the convex surface of the pinna, often without initial involvement of the horizontal canal), axillae, groin, interdigital region, perineum, and carpal and tarsal regions. Pruritus can be severe (scratching, licking, biting, chewing or rubbing) and can be exacerbated by secondary flare factors like fleas and other parasites, bacteria, Malassezia or diet. Atopic dogs are particularly prone to secondary microbial infections. The condition is often seasonal initially, but in most cases progresses to occurring all year round. Relapses can be affected.
An approach to the dog with pruritus. Prior to embarking on using the chart, a thorough clinical history should be taken and a physical examination carried out.

Comma-shaped flea faeces (f), along with white flea eggs (e) are visible in these haircoat combings on an examination table.

Alopecia, erythema and papules on the eyelids in an early case of atopic dermatitis in a young Staffordshire Bull Terrier.
PRACTICAL TIP

An atopic case that has been previously well controlled and suddenly worsens should be investigated for complicating secondary changes.

A successful diagnosis depends on careful history-taking. The condition is rarely seen before 6 months of age (though some breeds can present very young, e.g. Golden Retriever or Shar Pei); most cases present at between 1 and 3 years of age. There is a breed predisposition that can vary with country and region, and includes the Boxer, Labrador Retriever, Golden Retriever, setters, terriers (Scottish, West Highland, Cairn, Staffordshire), Lhasa Apso, Shih Tzu, Bulldog, Cocker Spaniel, Shar Pei, German Shepherd Dog and Dalmatian. Favrot et al. (2010) proposed a series of criteria from which a combination of five would be highly suggestive of atopic dermatitis (Figure 27.6).

27.6 Criteria for diagnosing atopic dermatitis. A combination of five of these criteria would be highly suggestive of atopic dermatitis (Favrot et al., 2010).

- Onset of signs <3 years of age
- Predominantly indoor lifestyle
- Pruritus responds to glucocorticoids
- Initially pruritus without lesions
- Forefoot involvement
- Pinnae of ears involvement
- Ear margins not affected
- Dorsolumbar region not affected

PRACTICAL TIP

Intradermal skin testing and serology should not be used as a short cut to diagnosis. The main purpose of these is to design an immunotherapy regime.

Atopic dermatitis is regarded as a steroid-responsive disease: proven effective treatments include steroids (prednisolone 1.1 mg/kg orally q24h, reducing later), ciclosporin (5 mg/kg orally q24h), oclacitinib (0.4–0.6 mg/kg orally q12h, reducing later), ciclosporin (5 mg/kg orally q24h), and immunotherapy. Therapies with variable responses include antihistamines, essential fatty acids and Chinese herbs. Topical therapy is also very important in management, especially to restore the skin barrier function. Where there is secondary infection, antimicrobials are essential. Regular check-ups are required to monitor progress.

Owner communication

Good communication is mandatory to ensure a successful outcome. It is essential to inform owners from the outset, that this is a lifelong disease requiring long-term management and that it is not curable. Not making this clear is probably the commonest cause of clients seeking a second opinion.

Pyotraumatic dermatitis (acute moist dermatitis)

In this condition lesions are produced by self-trauma in response to a painful or pruritic insult. Lesions appear as red, moist and exudative close to the cause, with a sticky surface discharge, and radiating from the initial lesion (Figure 27.7). The surface is contaminated with bacteria. The classic appearance of the lesions suggests the diagnosis. The condition is more common in densely coated breeds (Golden and Labrador Retrievers, Collies, German Shepherd Dogs, St Bernards and Newfoundlands), due to the poor ventilation at skin level. It is more common in hot humid weather. There is an acute onset, often within hours, as a result of an itch–scratch–itch cycle. Underlying causes include ectoparasites, allergy, anal sac disease, otitis externa, an unkempt coat, a painful orthopaedic problem, or behavioural disorders.

The affected area should be clipped and cleaned with an antiseptic solution. Sedation is often needed, as the condition is painful. Steroids are required to break the itch cycle, and should be used until there is total resolution. Topical ointments can be used but are often not as effective as oral steroids. Some cases require oral antibiotics, in particular if there is evidence of papules developing associated with a folliculitis.

There is a high risk of relapse. Even successful cases can take time to heal, with regression due to contracture of the associated scab formation over the lesion causing further irritation. It is important to inform the owner about the anticipated course of this disease to avoid frustration when these setbacks occur.

Acral lick dermatitis (lick granuloma)

In this condition a raised ulcerated lesion is seen, usually on the limbs. It is important to differentiate behavioural from organic causes. Other behavioural problems seen include flank sucking and anal licking. Organic causes (e.g. bacteria, fungi, demodiconosis, allergy, joint disease) should be treated or eliminated before assigning a behavioural cause. A thorough behavioural investigation should then be carried out to identify the initiating causes (see Chapter 12). Certain breeds have been associated with behavioural causes, often being anxious individuals (Dobermann, Great Dane, German Shepherd Dog, Irish Setter, Labrador and Golden Retrievers).
Skin problems: a clinical approach

11/06/2015   14:51

Dermatology is referred to the BSAVA Manual of Canine and Feline use of avermectins (ivermectin/milbemycin). The reader A poor response to treatment may require 'off-label' (the latter at an 'off-label' frequency of every 2 weeks). 

therapy is required. Sometimes trial must be taken in interpreting results as there is skin scrapings are negative but suspicion is high (care and using potassium hydroxide solution (KOH) instead from the pinnal edges and elbows will improve yield, are not uncommon. Multiple deep scrapings taken scrapings (see QRG 27.1), although negative results

Diagnosis is by identifying the mite in deep skin scrapings (see QRG 27.1), although negative results are not uncommon. Multiple deep scrapings taken from the pinnal edges and elbows will improve yield, and using potassium hydroxide solution (KOH) instead of liquid paraffin on the slide will dissolve the keratin to allow better visualization. Serology can be used where skin scrapings are negative but suspicion is high (care must be taken in interpreting results as there is cross-reaction with housedust mites). Sometimes trial therapy is required. 

Treatment is with amitraz or a spot-on insecticide (the latter at an 'off-label' frequency of every 2 weeks). A poor response to treatment may require 'off-label' use of avermectins (ivermectin/milbemycin). The reader is referred to the BSAVA Manual of Canine and Feline Dermatology for further discussion.

Superficial pyoderma, folliculitis and furunculosis

These can be very pruritic conditions. Most infections are staphylococcal, mainly involving Staphylococcus pseudintermedius. Lesions seen include papules, pustules, patchy alopecia, erythema and epidermal collarettes, later extending to oedematous purulent/haemorrhagic exudate when infections are deeper.

Most cases are complications of other conditions, e.g. atopic dermatitis, but lesions can be primary (e.g. short-haired breed folliculitis presenting as a ‘moth-eaten’ coat). The BSAVA Manual of Canine and Feline Dermatology has a very good flowchart illustrating the approach to bacterial skin infections. Cytology is performed on material gathered from intact pustules or papules, by opening them with a needle and then swabbing. Degenerative neutrophils are seen, with active phagocytosis of bacterial cocci (see QRG 27.2) or, rarely, rods. Furunculosis lesions may yield less and contain a mixed cell population with macrophages, lymphocytes and plasma cells as well as neutrophils. Culture and sensitivity testing is indicated in recurrent infections.

Superficial infections require a minimum of 3–4 weeks treatment with an antibiotic appropriate for the skin (e.g. co-amoxiclav, first-generation cephalosporin, clindamycin) and should be continued until 1 week past lesion resolution. Potentiated sulphonamides may still be useful, where finance is an issue for owners; although there is a relatively high incidence of resistance, an improved response can be achieved at higher doses.

WARNING

Do not prescribe potentiated sulphonamides for Dobermanns.

Deep infections require culture and sensitivity testing to identify the most appropriate antibiotic. This should be administered for a minimum of 6–8 weeks, and be continued for 2 weeks beyond clinical cure.

PRACTICAL TIP

A very common mistake is not using antibiotics for the long periods required. This will result in relapses and the potential development of antibiotic resistance

Antimicrobial topical ointments (e.g. containing fusidic acid or mupirocin) can be used for both superficial and deep infections.

Food hypersensitivity/intolerance

This condition presents with lesions very similar to those of atopic dermatitis and can often be found in association with it. Food hypersensitivity may also present as relapsing pyoderma or urticaria. Lesions involving predominantly the ears, feet or perineum are strongly suggestive. Onset can be at any age, including <6 months (in contrast to atopic dermatitis, see above). There may be a history of gastrointestinal signs, and a poor response to steroid therapy may have been observed. 

A variety of foodstuffs may be responsible, so a careful diet history must be taken. Some foods seem to feature more commonly, e.g. dairy produce, beef, fish and cereals, and the offending food may have been fed for some time. 

Diagnosis is through an elimination diet trial, avoiding any previously fed foods. A home-cooked
diet is preferable but commercial hydrolysed diets can be used if the owner is not prepared to cook food for the dog. Ideally, the elimination diet should be fed for 6–8 weeks, followed by challenging again with the original diet to demonstrate relapse, usually occurring within 24 hours to 2 weeks. Serology cannot currently be recommended for diagnosis.

Management consists of avoiding the food(s) responsible, and treatment of any secondary changes and pruritus.

**Malassezia infection**

This yeast infection can complicate many dermatoses, especially allergic disease. There is a high prevalence in certain regions of the body: periocular, ears, axillae, feet (interdigital and nail folds), groin, and perineum/anus. There is a musty malodorous smell, with greasy skin and coat, and erythema. Pruritus is common and there is a brown discolouration of the skin and coat. Chronic cases become alopecic, with lichenification and hyperpigmentation. Basset Hounds are predisposed to infection. Cytology is performed on samples taken from lesions using acetate tape impressions or superficial scrapings with a moistened blunt scalpel blade. *Malassezia pachydermatis* is a peanut-shaped yeast (see QRG 27.2). Culture can also be performed. Treatment is with topical antifungals (e.g. miconazole 2%/chlorhexidine 2% shampoo, selenium sulphide shampoo) or with oral ketoconazole (5–10 mg/kg orally q8–12h) or itraconazole (5 mg/kg orally q24h).

**Contact dermatitis (irritant or hypersensitivity)**

The distribution of lesions reflects those areas in contact with the offending substance. Seasonal reactions to vegetation can occur. Pruritus can be very intense, leading to significant self-trauma. There is often a history of a poor response to steroids (in contrast to atopic dermatitis, see above). The owner should be asked whether there has been a change in bedding, washing powder, carpet, walking routes, etc. Diagnosis can be through avoidance or by patch testing with samples of suspected materials. Management is ideally through avoidance of the offending material, but some cases will require symptomatic therapy.

**Pediculosis**

Louse infestation may involve *Linognathus setosus* (sucking louse) or *Trichodectes canis* (biting louse); the latter is an intermediate host for the *Dipylidium caninum* tapeworm. These lice are specific to the canine host. They are more common in young, old or debilitated individuals. Affected animals are pruritic. Direct observation of the coat will reveal the parasite, and then identification of species can be performed by microscopy. Treatment is with an appropriate insecticide for 3–4 weeks.

**Demodicosis**

Demodicosis can present as a pruritic problem, especially when there is secondary pyoderma. For details on *Demodex* see Alopecia, below.

**Neotrombiculosis**

Larval stages of the harvest mite *Neotrombicula* can affect the ventral abdomen (Figure 27.9), as well as the more usual sites involving the feet and pinnae. For more details, see Chapter 29.

**Cheyletiellosis**

The surface-dwelling parasite *Cheyletiella* mainly affects the dorsum, with scaling, erythema and variable pruritus (more severe in young animals). It is contagious and can affect both humans and animals. The dog may have been recently acquired from, or stayed at, kennels. Acetate strip samples or superficial skin scrapings are examined for mites or eggs attached to hairs. Treatment is with a topical insecticide. The environment should also be treated.

**Non-pruritic conditions**

An approach to non-pruritic conditions, and conditions where pruritus is not the major clinical sign, is given in Figure 27.10.

**Alopecia**

Alopecia can be primary or can result from hair loss as a result of other lesions. The distribution pattern can help to differentiate causes (symmetrical, localized, diffuse/patchy).

**Symmetrical alopecia**

Causes of symmetrical hair loss are listed in Figure 27.11.

**Hyperadrenocorticism:** Hyperadrenocorticism (HAC; see also Chapter 17) is a relatively common endocrine condition, 85–90% of canine cases are pituitary-dependent, with the remainder associated with adrenal nodules. A breed predisposition makes the Poodle, Boxer, Dachshund, Beagle, Boston Terrier and other terriers more commonly affected. HAC affects middle-aged to older animals.
An approach to the dog with non-pruritic skin disease. Prior to embarking on using the chart, a thorough clinical history should be taken and physical examination carried out.
Chapter 27: Skin problems: a clinical approach

While dogs with HAC are normally non-pruritic, the presence of secondary pyoderma or demodicosis may cause pruritus.

Non-dermatological signs include:
- Polydipsia and polyuria (90% of cases)
- Polyphagia
- Swollen abdomen
- Muscle weakness
- Anoestrus/testicular atrophy.

Typical changes are seen in biochemistry (raised cholesterol, alanine aminotransferase, alkaline phosphatase and glucose; decreased blood urea nitrogen); haematology (leucocytosis, neutrophilia, lymphopenia, eosinopenia); and urinalysis (low specific gravity and sometimes proteinuria). Specific screening tests include the adrenocorticotropic hormone (ACTH) stimulation test, dexamethasone suppression test and urine cortisol:creatinine ratio (the latter used only to rule out cases). Radiography and ultrasonography can be used to assess the adrenal glands. Specific screening tests include the adrenocorticotropic hormone (ACTH) stimulation test, dexamethasone suppression test and urine cortisol:creatinine ratio (the latter used only to rule out cases).

Trilostane is the treatment of choice (see Chapter 17). Alternatives are ketoconazole or mitotane (not available in the UK). Surgery is indicated in some cases, especially with adrenal neoplasia. More details on HAC can be found in the BSAVA Manual of Canine and Feline Endocrinology.

Hypothyroidism: Hypothyroidism is a relatively common endocrine disease. Certain breeds seem predisposed: Beagle, Great Dane, Golden Retriever, Doberman, Irish Setter, Miniature Schnauzer, Cocker Spaniel, Shar Pei and Chow Chow. The peak age of onset is 5 years, and there is typically a slow progression. Dermatological signs include:
- Initially, a patchy alopecia at frictional sites (e.g., bridge of nose, tail)
- Later diffuse alopecia
- Scaling and dry brittle hair
- Occasionally pyoderma and otitis externa.

Dermatological signs include:
- Alopecia
- Hyperpigmentation
- Skin thinning
- Comedones
- Calcinoisis cuits
- Phlebectasia (macular to papular erythematous lesions).

PRACTICAL TIP
While dogs with HAC are normally non-pruritic, the presence of secondary pyoderma or demodicosis may cause pruritus.

Non-dermatological signs include:
- Polydipsia and polyuria (90% of cases)
- Polyphagia
- Swollen abdomen
- Muscle weakness
- Anoestrus/testicular atrophy.

Blood samples may show raised cholesterol and mild anaemia. Measuring total thyroxine and thyroid stimulating hormone is the diagnostic approach of choice. Other parameters that can be measured are free thyroxine and anti-thyroglobulin autoantibodies. The thyroid stimulation test (see BSAVA Manual of Canine and Feline Endocrinology) is regarded as the best available definitive test.

Treatment is through supplementation with thyroid medication (levothyroxine at 22 µg/kg orally q12h). After 8 weeks, post-pill screening allows dose adjustment. Therapy is lifelong.

Alopecia X: This denotes a broad group of conditions encompassing many that were previously referred to by various names, including growth hormone abnormalities, adrenal disease and follicular dysplasia in Nordic breeds. The cause in most cases has not been ascertained, but is likely a hormonal dysfunction. There is primary hair loss initially, especially on frictional areas (neck, thighs and tail), followed by the rest of the hairs in this region and the primary hairs on the trunk. The coat has a puppy-like appearance, which gradually thins, and hyperpigmentation develops. The head and legs are generally unaffected. Breeds affected are the Nordic breeds and poodles.

Careful history-taking and physical examination are used to rule out other diseases. Biopsy can be performed to rule conditions in or out. Interestingly, hair often regrows at biopsy sites.

The condition can present with a variety of these signs (Figure 27.12).
Non-dermatological signs include:
- Lethargy
- Weight gain
- Poor tolerance of cold and exercise
- Bradycardia
- Neurological and myopathy signs
- Corneal lipidosis.

PRACTICAL TIPS
- Concurrent disease and certain medications can alter thyroid testing
- Euthyroid syndrome can give false-positive results

Treatment is through supplementation with thyroid medication (levothyroxine at 22 µg/kg orally q12h). After 8 weeks, post-pill screening allows dose adjustment. Therapy is lifelong.
Treatments that have been tried include castration, mitotane and trilostane (1–2 mg/kg q12h). It must be noted, however, that these are benign conditions, and consideration should be given as to whether the treatment might be worse than the condition. Melatonin (3–6 mg/dog q6–12h) has caused some cases to respond after several months (Paradis, 1999) and is tolerated well.

Seasonal flank alopecia: There is episodic hair loss, often seasonal, involving the trunk, especially the flanks. The condition is possibly related to photoperiod but has a genetic component, as there is a higher incidence in the Boxer, Bulldog and Airedale Terrier. There is a fairly rapid onset of benign alopecia of the thoracolumbar region, which lasts a few months and then resolves. Relapses often occur at the same time each year. Hyperpigmentation occurs and remains. History, clinical signs and biopsy results are used to rule out other diseases. This is a cosmetic disease, and the coat will regrow seasonally in most cases. Melatonin has been used with success when given before the onset.

Sex hormone-related alopecia: Several conditions have been associated with hormone abnormalities but, with the exception of hyperoestrogenism, most are probably due to other conditions. Hyperoestrogenism can be caused by testicular neoplasia, cystic ovaries and ovarian tumours. There is a symmetrical alopecia of the perineum and genital region that can extend along the ventrum to the neck, with hyperpigmentation. In males, nipple enlargement and a pendulous prepuce are seen, and an erythematous line is seen running along the median raphe of the prepuce. In females, nipple and vulvar enlargement along with oestrous cycle abnormalities are seen. Radiography and ultrasonography, and skin biopsy, can be performed to detect underlying causes. Treatment is by neutering.

Colour dilution alopecia: This is due to an abnormality in melanosomes, causing clumping and distortion of hair shafts. Several breeds have dilute variants in coat colour (e.g. Dobermann, Weimaraner, Yorkshire Terrier) and the alopecia only affects the diluted areas (Figure 27.13). Pyoderma can complicate the dry skin. Biopsy of the skin in diluted coat regions, along with trichograms, will demonstrate melanin clumping. Oral treatments that have been tried include melatonin, retinoids, essential fatty acids and antibiotics (with variable to poor responses). Topical therapy with shampoos and emollients for dry skin have also been used to help improve skin condition.

Localized alopecia
Causes of localized alopecia are listed in Figure 27.14.

- **Black hair follicle dysplasia**
- **Post-clipping/traction/cicatricial alopecia**
- **Alopecia areata**
- **Pattern and pinnal alopecia**
- **Melanoderma**
- **Follicular lipidosis**
- **Steroid injection or vaccine vasculitis**
- **Localized scleroderma (rare)**

**27.14 Causes of localized alopecia. The most common causes are in bold.**

**Black hair follicle dysplasia:** This is an alopecia that affects only the black coated regions. Several breeds are affected (e.g. Bearded and Border Collies, Basset Hound, Beagle, Cavalier King Charles Spaniel). On biopsy, black-haired regions show melanin clumping while other areas are unaffected. Symptomatic therapy is used for the dry skin. There is no treatment for the hair loss.

**Post-clipping, tractional and cicatricial alopecia:** There is arrest of follicular growth following hair clipping, and the hair can take a long time to regrow. Tractional alopecia is usually associated with application of bands to tie hair up. No treatment is required other than checking for underlying endocrinopathies.

**Alopecia areata:** This is an uncommon focal or multifocal asymptomatic alopecia. It is an immune-mediated disease of anagen hair follicles. Biopsy of affected regions shows a lymphocyte accumulation around the hair follicle, among other changes. Occasionally microscopic examination of the hair will show shafts with suddenly tapered ends. Most cases recover with time, either spontaneously or after steroid treatment, albeit with lighter coloured hair. Topical and intralesional steroids are used.

**Pattern and pinnal alopecia:** This is a symmetrical localized hair loss associated with several fine-coated breeds (e.g. Dachshund). A ventral variant affects the perineum, thighs, ventrum including the neck, and behind the ears. A pinnal variant involves the outer surface of the pinnae. No treatment is necessary.

**Melanoderma and alopecia in Yorkshire Terriers:** Alopecia and hyperpigmentation affect the bridge of the nose and pinnae, and occasionally the tail and feet, in Yorkshire Terriers.

**Follicular lipidosis:** This occurs in Rottweilers, causing alopecia of the mahogany areas of the face and nose only; the black and other mahogany areas are unaffected.

**Diffuse/patchy alopecia**
Causes of diffuse or patchy alopecia are listed in Figure 27.15. Epitheliotropic lymphoma is discussed.
under Lumps and nodules; pemphigus foliaceus is discussed under Papules, pustules and vesicles; primary and secondary keratinization abnormalities and sebaceous adenitis are discussed under Scaling and crusting; and colour dilution alopecia is discussed under Symmetrical alopecia.

27.15 Causes of diffuse/patchy alopecia. The most common causes are in **bold**.

**Demodicosis:** Increased numbers of *Demodex* mites (part of the normal skin flora) cause an inflammatory dermatosis when an immunological disorder allows proliferation. Lesions include alopecia, scaling, follicular casts, crusts, erythema, hyperpigmentation and lichenification. Ceruminous otitis can occur. Secondary bacterial infection occurs. Pruritus can occur, especially with *D. cornei*.

**Localized** demodicosis is the most common form, with mild erythema and scale, mainly affecting the face (Figure 27.17), periorbital and periocular areas. This form usually resolves spontaneously.

**Generalized** demodicosis has more severe signs, with secondary infection that can lead to furunculosis, severe inflammation, exudation and a granulomatous reaction. It is important to look for underlying reasons.

Skin scrapings from affected areas (follicles should be squeezed prior to taking samples) and hair plucks may demonstrate the mites (see QRG 27.1). Biopsy may be necessary, especially with Shar Pei or foot lesions. There are several species (e.g. *D. canis*, *D. injai*, *D. cornei*).

Treatments include amitraz, ivermectin (200–600 µg/kg q24h) and milbemycin (1–2 mg/kg q24h). It is important to treat until two negative skin scrapings are achieved 2 weeks apart and then stop. A further skin scrape should be obtained 1 month after cessation of therapy to ensure remission.

**Dermatophytosis:** Dermatophyte fungi include *Microsporum canis* (often contracted from a cat), *Trichophyton mentagrophytes* (often from rodents) and *M. gypseum* (from the soil). Contact does not always result in infection. A variety of signs are seen, including alopecia, scales (Figure 27.18a), erythema, hyperpigmentation and pruritus. An uncommon presentation is a fungal nodule called a kerion. Dermatophytosis is mainly seen in young or older animals. It is important to note that it is a zoonosis. Diagnostic investigations include Wood’s lamp investigation, microscopy, fungal culture and biopsy. Systemic antifungal treatment is used (e.g. ketoconazole at 10 mg/kg q24h; itraconazole at 5–10 mg/kg q24h). Topical antifungal therapy can be used with systemic therapy or, less effectively, as a sole treatment.

**Follicular dysplasia:** This is a non-colour-linked interruption of the normal hair cycle; both cyclical and structural interruption can occur. It is seen in various breeds with different presentations:

- Siberian Husky and Malamute: Onset is usually at 3–4 weeks but can be at 3–4 years. There is a
change in colour and loss of guard hairs. The head and distal limbs are spared.

- Dobermann, Miniature Pinscher and Manchester Terrier: Onset is at 1–4 years and the condition is cyclical.
- Airedale Terrier, Boxer, Bulldog, Staffordshire Terrier, Wirehaired Griffon and Affenpinscher: Onset is at 2–4 years. There is flank and saddle region cyclical alopecia.
- Irish Water Spaniel, Portuguese Water Dog and Curly Coated Retriever: Onset is at 2–4 years. There are fractured hairs. Initially the owner notices excess shedding when the coat is brushed, then there is partial thinning. Regrowth with weak hairs can occur but ultimately there is loss of the coat.
- Other breeds reported include the Labrador Retriever and Sheltie.

Biopsy of affected areas is required for diagnosis. There is no specific treatment, but gentle grooming and skin care can help to minimize clinical signs.

Dermatomyositis: This is a hereditary inflammatory disease of the skin and muscles seen in collies, Shetland Sheepdogs and Bauceron and occasionally in other breeds. The condition is uncommon, but should be suspected if skin and muscle lesions are seen starting at an early age. Affected dogs can have difficulty eating and swallowing. Biopsy of skin and muscle are required for diagnosis. Treatment is difficult, but prednisolone (1–2 mg/kg q24h), vitamin E (200–500 IU q24h) and pentoxifylline (15 mg/kg q12h) have been used. Dermatomyositis carries a poor prognosis. Consult specialized texts for further details.

Anagen/telogen defluxion:

- Anagen defluxion is an abnormality of the hair follicle and shaft following an insult (e.g. drug, infection, endocrine, metabolic); it causes a sudden loss of hair but resolves with the next hair cycle.
- Telogen defluxion is an abrupt cessation of hair growth following an insult (e.g. high fever, pregnancy, shock, severe illness, surgery or anaesthesia) with hair loss 1–3 months later.

Diagnosis is via a trichogram (see QRG 27.3). Spontaneous resolution occurs in the next hair cycle.

Scaling and crusting

Causes of scaling and crusting are listed in Figure 27.19. Many dermatoses can result in secondary scaling and crusting, including allergic skin disease, skin infections, parasitic disease, endocrine and metabolic disorders and autoimmune disease. In such secondary cases, the underlying disease and seborrhoea need to be treated.

- Sebaceous adenitis
- Primary keratinization disorders
- Secondary seborrhoea
- Idiopathic nasodigital hyperkeratosis
- Zinc-responsive dermatosis
- Neoplasia
- Congenital disease (e.g. ichthyosis)
- Nutritional deficiency (e.g. generic dog food)
- Vitamin A-responsive (rare, adult onset in Cocker Spaniel)
- Epidermal dysplasia (rare, West Highland White Terrier)
- Lethal acrodermatitis (see Chapter 29)
- Leishmaniosis

Sebaceous adenitis

This is caused by sebaceous gland inflammation, and affects young to middle-aged dogs. There is partial alopecia.

- Long-coated variant (e.g. Standard Poodle, Akita, Samoyed, German Shepherd Dog): Affected dogs have dull brittle hair with tightly adherent silvery white scale and follicular casts (Figure 27.20), initially occurring on the dorsum. Secondary infections can occur, resulting in pruritus and a smell. The Akita develops a more severe form with systemic illness. The German Shepherd Dog often has lesions starting on the tail and extending cranially.
- Short-coated variant (e.g. Vizsla, Dachshund): There is a ‘moth-eaten’ alopecia (serpiginous or circular) with mild scaling of the trunk, head and ears. Secondary infection is uncommon.
Diagnosis is via biopsy of affected areas; a granulomatous reaction is seen around the sebaceous glands.

The condition waxes and wanes naturally. Topical therapy involves spraying the affected areas with propylene glycol (50–70% in water) daily or the use of baby oil soaks. The preferred treatment is systemic therapy with ciclosporin (5 mg/kg orally q12h). Other therapies include tetracycline (250–500 mg/dog) + niacinamide (250–500 mg/kg) given in combination three times a day, essential fatty acids and retinoids. Secondary infections require antibiotics.

Primary keratinization disorders
Lesions vary from focal, thickly crusted plaques to diffuse and generalized scaling/crusting. There is also alopecia, erythema, lichenification and hyperpigmentation. The skin can be dry, greasy or a combination of both. Lesions are mainly truncal, though a ceruminous otitis can occur. Secondary infection is common (bacterial and *Malassezia*), especially in body folds, causing a malodorous change. The condition is exacerbated by inadequate diet, parasites, and by endocrine and metabolic disorders.

Various breeds can be affected, including the Cocker Spaniel, English Springer Spaniel, West Highland White Terrier, Basset Hound, Bulldog, German Shepherd Dog, Dobermann, Irish Setter, Shar Pei, Miniature Schnauzer, Cavalier King Charles Spaniel, Dachshund and Labrador Retriever. Biopsy of affected areas is helpful for diagnosis.

It is important to explain to the owner that the disease cannot be cured and the aim is to manage the clinical signs. Antiseborrhoeic shampoos and moisturizers are used:

- For dry skin, a shampoo containing salicylic acid and sulphur two or three times per week, followed by a moisturizer
- For greasy skin, shampoos containing benzoyl peroxidase or selenium sulphide are preferred, and more frequent applications.

Retinoids help in some cases. Secondary infections (a common reason for a sudden deterioration) should be treated.

**Idiopathic nasodigital hyperkeratosis**
Excess scale and crusting of the nasal planum and/or footpad is regarded as a senile change in breeds such as the Cocker Spaniel, Beagle, Bulldog and Basset Hound. The condition is generally asymptomatic but cracking can occur, with secondary infection resulting in pain. Footpad hyperkeratosis is seen in young dogs of certain breeds (see Chapter 29). Diagnosis is via biopsy of an affected region. Topical moisturizers can be helpful.

**Epitheliotropic lymphoma**
Epitheliotropic lymphoma (sometimes called mycosis fungoides) is a primary neoplastic cause of scaling, but is often missed. Scaling occurs in middle-aged to older animals. There are various syndromes and there is often a chronic history, often initially mimicking other diseases. There is exfoliative erythroderma, with erythema, scaling, depigmentation, alopecia and crusting (Figure 27.21), often involving allergic skin disease sites, mucocutaneous and oral sites. Most cases develop nodules or tumours within 3 months to 4 years. Pruritus is uncommon, except in the rare Sézary syndrome, where it can be severe and accompanied by lymphadenopathy. Diagnosis is via biopsy and cytology of lesions. Treatment is with lomustine (60–70 mg/m² orally q3–4wk for an average of 3–5 weeks), high doses of linoleic acid (3 ml/kg twice weekly), corticosteroids, retinoids or imiquimod. Advice should be sought from an oncologist. Prognosis is guarded to poor.

**Zinc-responsive dermatosis**
Alopecia, scaling, crusting and erythema of the eyelids (Figure 27.22), ears, feet, lips and external orifices is seen. One form occurs in young adult Siberian Huskies and Alaskan Malamutes; a second form is seen in rapidly growing large breeds, especially those fed on dry diets high in phytates. Diagnosis is via biopsy of affected lesions. Therapy includes oral zinc supplementation, with dietary change if indicated.

**Erosions and ulceration**
Conditions specifically associated with erosions or ulceration are listed in Figure 27.23. Dermatoses involving pruritus or self-damage, and rupture of pustules or vesicles, can also result in erosions or ulceration. Anal furunculosis is discussed in Chapter 30.
Physical/chemical damage
- Mucocutaneous pyoderma
- German Shepherd Dog folliculitis, furunculosis, cellulitis
- Drug-induced eruptions: erythema multiforme, toxic epidermal necrolysis
- Familial dermatophytosis
- Superficial necrotic dermatitis
- Discoid and systemic lupus erythematosus
- Pemphigus foliaceus and bullous pemphigoid
- Neoplasia
- Vasculitis
- Cutaneous asthenia (collagen abnormality)
- Aplasia cutis

Conditions specifically associated with erosions or ulceration. The most common conditions are in bold.

Physical/chemical damage
Damage to the overlying epithelium (e.g. from chemical burns) should be treated with cleaning and the use of topical antibacterial ointments to deter secondary infection.

Mucocutaneous pyoderma
This is a relatively common condition but of unknown aetiology. It occurs in German Shepherd Dogs and crosses. There is swelling and erythema, with crust- ing and fissures of the mucocutaneous junctions, especially the lips. Diagnosis is via biopsy and cytology of the affected areas. Topical and systemic antimicrobials are used for a minimum of 4 weeks, but relapses occur.

German Shepherd Dog folliculitis, furunculosis and cellulitis
This is an immunologically mediated disease and is often severe. It affects middle-aged German Shepherd Dogs. Lesions include ulceration, fistulas, furunculosis, alopecia and hyperpigmentation, involving the rump, dorsum, ventral abdomen and thighs. Cellulitis can develop, along with pain. Diagnosis is via biopsy, cytology and culture of lesions.

It is essential to clip affected areas and to apply topical antimicrobial washes about twice a week. Long courses of systemic antibiotics are required. Relapses are not uncommon.

Drug-induced eruptions
Various drugs have been implicated (e.g. potentiated sulphonamides, cefalexin).

Erythema multiforme (EM) can also have a viral, bacterial, neoplastic or idiopathic aetiology. Lesions include mucocutaneous vesicles leading to ulceration and erosion, oral lesions, and involvement of the footpads (lameness) and pinnae. Macular popular rash sometimes occur (can be pruritic), as well as exfoliative erythroderma, with scaling. Urticaria and neuroangioedema can occur. Types of lesion include serpiginous, polycyclic and bull’s eye lesions.

Toxic epidermal necrolysis (TEN) is probably a more severe form of EM. Affected animals can have depression, fever and anorexia.

Diagnosis is via biochemistry, haematology, serology for antinuclear antibody (ANA) and skin biopsy, and reviewing the drug history. Any implicated medication should be stopped. Ciclosporin or pentoxifylline may help to reduce clinical signs. Corticosteroid use is controversial.

**WARNING**

TEN is a severe disease. Referral should be considered as it usually requires intensive care.

Prognosis is poor.

Superficial necrotic dermatitis
This is a rare and severe skin disease. There is mucocutaneous erosion and ulceration of the lips, eyelids and anus, later developing crusts. Hyperpigmentation and lichenification of the skin are seen. Footpad lesions are prominent and fissures can develop, leading to pain. Pruritus can occur. Lesions involve pressure points, pinnae and genitalia. Secondary infection is common. Skin signs often precede systemic signs of lethargy, anorexia and weight loss. Polydipsia and polyuria can develop. Blood analysis can show liver enzyme changes and hypoalbuminaemia. Skin biopsy of lesions shows characteristic histopathological changes. The prognosis is guarded to poor, and therapy is aimed at treating secondary infections and supportive therapy for the systemic disease.

Discoid and systemic lupus erythematosus
- Discoid lupus erythematosus (DLE) is a relatively common immune-mediated disease and is relatively mild. Certain breeds are over-represented: collies, German Shepherd Dog, Siberian Husky, Sheltie, Alaskan Malamute, Chow Chow. Possible causes include drug reaction, UV light exposure and viral infection. Depigmentation and erosion or ulceration of the nasal planum is seen. The face, ears and mucous membranes are less often affected.

- Systemic lupus erythematosus (SLE) can be associated with some or all of a range of systemic signs, such as swollen joints, oral lesions, fever, lymphadenopathy, splenomegaly, hepatomegaly, and cardiac and pleural disease.

Diagnosis is through biopsy of lesional areas. Further tests include serology for ANA, the lupus erythematosus test and the Coombs’ test; abnormal results are mostly seen in SLE but not DLE.
Treatments include tetracycline/niacinamide, vitamin E, topical steroids, prednisolone ± azathioprine or chlorambucil, pentoxifylline, ciclosporin and tacrolimus ointment. Exposure to UV light should be avoided. Prognosis is good for DLE but guarded for SLE.

**Pemphigus complex and bullous pemphigoid**

Pemphigus complex is uncommon to rare but may be seen in middle-aged to older dogs. Bullous pemphigoid is very rare.

Pemphigus foliaceus is the commonest condition in the group and is seen in the Akita, Bearded Collie, Chow Chow, Dachshund, Dobermann, Cocker Spaniel and Shar Pei amongst others. Often it is a reaction to medications (e.g. sulphonamides, cephalosporins). Vesicles, pustules leading to crusts (Figure 27.24), scaling, epidermal collarettes, erosions and alopecia are seen. Hyperkeratosis of the footpads, with fissuring can occur. Various nail abnormalities may also be seen. Lesions are located on the nasal planum, muzzle, periorbital area, pinnae and trunk and may also be found on the paws. Lymphadenopathy, depression and fever may occur, with variable pain and pruritis. Cytology of the pustules may show acantholytic cells (see ORG 27.2); biopsy of intact pustules is usually diagnostic. Various treatments are used, including corticosteroids, azathioprine, chlorambucil, ciclosporin, dapsone, cyclophosphamide and chrysophenol. See specialist texts for therapeutic details and other syndromes in the pemphigus complex.

**Vasculitis**

Vasculitis is an inflammation of blood vessels. Causes include SLE, cold agglutinin, frostbite, disseminated intravascular coagulopathy, lymphoreticular tumours, drugs, vaccines, tick bite and staphylococcal/food hypersensitivity, but about 50% of cases are idiopathic. There is palpable purpura, haemorrhagic bullae, necrosis and ‘punched out’ ulcers involving the extremities, paws, pinnae, lips, tail and oral cavity. The skin can be painful when touched. Systemic signs include lethargy, lymphadenopathy, fever and weight loss; hepatic, renal or central nervous system involvement can occur. Various types of vasculitis are seen, including: naso-arteritis (St Bernard, Schnauzer); juvenile polyarteritis (Beagle); ear margin vasculitis (Dachshund); familial cutaneous vasculopathy (German Shepherd Dog) and cutaneous and renal vasculopathy (Greyhound). Diagnosis is via biopsy of ulcerated areas. Further tests to perform may include ANA serology; Coombs’ test and cold agglutinin assay. The underlying disease needs to be treated in addition to immunosuppressive therapy. Prognosis is guarded.

**Papules, pustules and vesicles**

Conditions that present primarily with papules, pustules or vesicles are listed in Figure 27.25. Bacterial infections are the primary cause of papule/pustule presentations and are discussed under Pruritic conditions (see Superficial pyoderma). Dermatophytosis, demodicosis and dermatomyositis are discussed under Alopecia; pustulosis foliaceus is discussed under Erosions and ulceration; sebaceous adenitis is discussed under Scaling and crusting.

- **Bacterial infection** (see Pruritus)
- **Furunculosis**
- **Demodicosis**
- **Dermatophytosis**
- **Canine acne**
- **Juvenile cellitis**
- **Pemphigus foliaceus and other autoimmune diseases**
- **Schnauzer comedone syndrome**
- **Sebaceous adenitis**
- **Mucinosis**
- **Dermatomyositis**
- **Sterile pustular dermatosis**

**Furunculosis**

This is a deep follicular bacterial infection, requiring prolonged antibiotic therapy. It has been discussed previously. It is often pruritic, and discharging.

**Canine acne**

Canine acne is a deep folliculitis and furunculosis involving the chin and lip of young dogs. It occurs almost exclusively in short-haired breeds (e.g. Boxer, Bulldog, Great Dane, Rottweiler, Mastiff). Initially it presents as erythematous papules or pustules, progressing to furunculosis with repeated trauma. It is pruritic, but can be painful. Skin scrapes and cytology are used to rule out demodicosis and dermatophytosis. Chronic lesions may be cultured. Mild lesions are treated with a benzoyl peroxide shampoo and topical fucidin or mupirocin. More severe cases will require an appropriate course of antibiotics (3–6 weeks). Scarring can occur with chronic cases.

**Juvenile cellitis**

Juvenile cellitis (‘puppy strangles’) is an uncommon granulomatous/pustular dermatosis of the face and pinnae of puppies aged 3 weeks to 4 months. Various breeds can be affected but the Golden Retriever, Dachshund and Gordon Setter are more susceptible. Initial swelling occurs on the eyelids, lip and muzzle, with enlarged submandibular lymph nodes. There is progression to pustules all over the
face and ears, especially the pinnae; these are often painful. There may also be lethargy and pyrexia. Some cases have lesions on the genital and perineal region. Cytology shows pyogranulomatous inflammation but no microorganisms. Culture of lesions is usually sterile. Biopsy of lesions can be done if required. Aggressive and early therapy with steroids is necessary to prevent severe scarring.

**Schnauzer comedone syndrome**

Multiple comedones appear along the back in Miniature Schnauzers. There are palpable papules which can become infected. Biopsy can aid diagnosis. Topical antiseborrhoeic therapy is helpful. Human acne waxes, benzoyl peroxidase gels and shampoos can also be used and, if there is no response, selenium sulphide shampoo. The condition can be controlled but not cured.

**Mucinosis**

This condition can occur secondary to other conditions but an idiopathic form occurs in the Shar Pei. Excessive skin folding and vesicles are seen, with an abnormal accumulation of mucin in the skin. Biopsy is helpful, and a sticky very viscous liquid can be expressed (Figure 27.26). Corticosteroid therapy can help if the condition is problematic.

A young Shar Pei with mucinosis undergoing excessive skin fold removal. Sticky tenacious fluid can be seen coming from the resection site.

![Image](image_url)

**Lumps and nodules**

Causes of lumps and nodules are listed in Figure 27.27. Skin tumours and cysts are discussed in Chapter 28.

- Neoplasia/cysts
- Foreign body reaction
- Callus
- Calcinosis cutis
- Calcinosis circumscripta
- Idiopathic sterile granuloma and pyogranuloma
- Sterile nodular panniculitis
- Kerion (dermatophyte nodule, uncommon)
- Amyloidosis
- Nodular dermatofibrosis
- Cutaneous xanthoma
- Malignant histiocytosis
- Reactive histiocytosis

**Foreign body reaction**

Various items can be involved, e.g. grass awns, thorns, sticks, gun pellets. The reaction appears as a localized lesion with draining tracts and/or nodules. Surgical resection of the lesion and removal of the foreign body is required. Antibiotics are prescribed to clear associated infections.

**Callus**

This is a very common problem of older dogs, especially in large breeds and overweight animals. The elbow and hock are most commonly affected, but calluses may also occur on the sternum. They are a normal response to pressure and friction, but can become excessively thickened and infected, with erosion and ulceration. Diagnosis is through visual inspection. Protective bandaging, topical skin softeners and antimicrobial creams can be helpful. Some cases may require surgical bandaging, but there is a risk of wound breakdown.

**Calcinosis cutis**

Lesions develop secondary to iatrogenic hypercorticoidism. Firm gritty papules, plaques and nodules with yellow/white contents are seen on the dorsum, axillae and groin. The condition is often mistaken for pyoderma in the early stages. Biopsy of affected skin can demonstrate calcium deposits, which along with the history, establishes the diagnosis. Weaning the dog off steroids over 2–12 months will usually cause lesions to resolve.

**Calcinosis circumscripta**

This is an uncommon condition of young large-breed dogs, especially the German Shepherd Dog. Lesions appear as firm white deposits, progressing to ulceration with a white discharge. They often occur at pressure points, but can occur on the tongue and palate. Diagnosis is from the physical appearance and lesion biopsy. Treatment is surgical excision of the lesions.

**Idiopathic sterile granuloma or pyogranuloma**

This is an uncommon inflammatory reaction, with collies, Weimaraners, Great Danes, Boxers and Golden Retrievers over-represented. Usually there are multiple lesions on the bridge of the nose, muzzle, periorcical area, pinnae and paws. The lesions appear as firm papules, plaques or nodules, which are painless and non-pruritic. Ulceration and alopecia can develop. Diagnosis is via biopsy of the lesions; culture is usually negative for infection. Surgery is indicated for solitary lesions. If there are multiple lesions then systemic therapy is required, e.g. prednisolone (2–4 mg/kg q24h, then tapered) possibly with the addition of azathioprine (2 mg/kg q24h, tapering after response). There have been reports of response to tetracycline + niacinamide in combination.

**Sterile nodular panniculitis**

This is an uncommon condition. Affected dogs have deep nodules with ulceration and discharge, and can be systemically ill. There are various causes. Diagnosis is via biopsy of affected areas and cytology. Culture is used to rule out infectious causes. Surgical resection of small lesions can be performed and/or treatment with prednisolone (provided there is no infection).
Pigmentation disorders
Some causes of pigmentation disorders are listed in Figure 27.28.

- Inflammatory hyperpigmentation
- Vitiligo
- Uveodermatological syndrome
- Congenital conditions
- Canine acanthosis nigricans (Dachshund)

![27.28](Some causes of pigmentation disorders. The most common causes are in bold.)

Inflammatory hyperpigmentation
This is the commonest cause of pigment being deposited in the skin. It occurs following an inflammatory reaction in the skin and is a useful indicator of previous inflammatory lesions, for example in atopic dogs.

Vitiligo
Vitiligo is a loss of pigmentation in the skin and hair. The cause is unknown. It is found in young dogs, and breeds affected include the Belgian Tervuren, Rottweiler (Figure 27.29), German Shepherd Dog and Dobermann. There is no treatment. The condition can wax and wane, which may lead people to presume a response to supplements.

Uveodermatological syndrome
The skin lesions of depigmentation usually follow uveitis. There is ulceration and crusting late on in disease. Certain breeds are over-represented, including the Akita, Chow Chow, Samoyed and Siberian Husky. It is recommended to consult an ophthalmic practitioner, as the uveitis can be difficult to resolve.

References and further reading

QRG 27.1 Skin scraping for parasites

Equipment
- Microscope slides
- Coverslips
- Scalpel blades (No. 15/21, blunted by rubbing sharp edge on metal)
- Dental spatula
- Liquid paraffin
- Potassium hydroxide 10% (KOH)

Technique
1. Identify representative lesions on the skin; fresh lesions are best.
2. Carefully clip hair from the area, avoiding losing any surface features such as scales and crust.
3. Apply a small amount of liquid paraffin or KOH to the scalpel blade or spatula (this helps collection of scraped material on to the instrument).
4. If looking for Sarcoptes mites it is useful to use potassium hydroxide as this helps clear the debris.
5. Scrape at a 45 degree angle to the skin, along the line of hair growth, and deep enough that blood can be seen seeping from capillaries.
6. A dental spatula is preferable where skin is delicate, e.g. eyelids.
7. Squeezing the skin prior to skin scraping can aid recovery of certain mites, e.g. Demodex.
8. Transfer the accumulated scraped material from the instrument to a slide, and apply a cover slip. This last point is essential for successful viewing of samples.
Place the slide on the microscope stage and examine using the low power objective lens (X4 or X10).

Demodex canis mites: note the characteristic cigar shape of the adults. j = juvenile. (Original magnification X100)

Cheyletiella mite from a skin scrape. (Original magnification X200)

Sarcoptes scabiei mite from a deep skin scrape. (Original magnification X200; examined using potassium hydroxide)

**QRG 27.2 Skin cytology**

**Equipment**
- Clear adhesive tape
- Dental spatula
- Microscope slides
- Romanowsky-type stain (e.g. Diff-Quik)

**Tape strip technique**
1. Take a piece of adhesive tape, approximately one and a half times the length of a microscope slide, holding it by the ends and not touching the central portion. Apply the tape to lesional skin, pressing it several times against the same area to obtain a good sample.
2. Attach the tape to one end of a microscope slide and fold the tape over on itself to leave the sticky surface, containing the sample, uppermost. Then fold the other end round to stick on the slide.
3. Dip the slide in the first stain (light blue) for only a couple of seconds; this avoids the tape clouding.
4. Dip the slide into the red stain for five to ten 1-second dips.
5. Dip the slide into the dark blue stain for five to ten 1-second dips.
6. Rinse the slide with water.
7. Undo one end of the tape. Wrap the tape around the slide so that the stained material is sandwiched between the tape and the slide, and reapply the free end to the slide.

**Direct smear technique**
1. Apply a microscope slide directly to a lesion that is moist, discharging or ulcerated.
2. Alternatively, a dental spatula, with a small amount of water applied, can be used to scrape even dry or greasy areas, and obtain samples that can be smeared on to a microscope slide.
3. Air-dry the slide and stain (see above).
4. When rinsing, it is advisable to run the water on the non-stained back of the slide, letting the water flow around it, to avoid washing off material.
Chapter 27
Skin problems: a clinical approach

**QRG 27.2 continued**

4. Allow the slide to dry, and examine as described above.

Cytology sample from a pyoderma lesion showing bacterial cocci (c) and active phagocytosis by neutrophils (n). (Diff-Quik; original magnification X1000, examined under oil emersion)

Mast cells containing granules, including a dividing cell, in a sample from a mastocytoma. (Diff-Quik; original magnification X1000, examined under oil emersion)

Sample from a pustule in a case of pemphigus foliaceous showing epithelial cells (acantholytic (a) cells), that have lost their adhesion to adjacent cells, giving them a rounded appearance. Neutrophils (n) are also present. (Diff-Quik; original magnification X1000, examined under oil emersion)

**QRG 27.3 Obtaining a trichogram**

**Equipment**
- Microscope slides
- Coverslips
- Liquid paraffin
- Artery forceps

**PRACTICAL TIPS**
- Do not pluck using fingers, as anagen hairs will likely not be removed.
- Note how easily the hair is removed: dead hairs epilate easily (e.g. as seen in endocrine or immune-mediated disease).

**Technique**
1. Apply a small amount of liquid paraffin to a slide.
2. Select a representative group of hairs and pluck using artery forceps.
3. Align the hairs on the slide in the liquid paraffin, trying to keep the roots together, and apply a coverslip.
4. Examine the shafts, tips and roots of the hairs, using the X4 or X10 objective lens. Look for:
   - Telogen and anagen hairs
   - Shaft pathology
   - Fractured hair (broken tips may indicate pruritus)
   - Parasites
   - Infection.

Anagen hairs, showing rounded bulb ends. (Original magnification X100)

Telogen hair showing a tapered end. (Original magnification X200)

Dermatophytosis: arthroconidia can be seen surrounding the hair shaft (arrowed). (Original magnification X400)
Skin problems: a clinical approach

Chapter 27

QUICK REFERENCE GUIDES

QRG 27.4 Skin biopsy

**Equipment**

- Small surgical kit:
  - Scalpel handle and No. 15 blade
  - Small scissors
  - Tissue forceps
  - Artery forceps
  - Needle-holders
- Biopsy hook
- Biopsy punch 4–8 mm
- 2 metric (3/0 USP) suture material (e.g. polyglactin 910)
- Pots of formalin
- Plain pot

**Patient preparation**

- Biopsy may be performed with the dog sedated and with local anaesthesia, or under general anaesthesia, depending on the location of the lesion, how painful the area is, and the dog’s temperament and health.
- For local anaesthesia, lidocaine without adrenaline should be used to avoid altering the pathology. The solution is infiltrated around the lesion, avoiding iatrogenic damage. After 10–15 minutes the area is checked for numbness.

**Technique**

1. Make an elliptical incision with the scalpel around the sample area.

2. Lift the sample, ideally using a biopsy hook (atraumatic forceps can be used to grasp the deep fat).

3. Cut the sample free and transfer it to a sample pot (formalin for histopathology; plain for culture).

4. Close the wound using two or three sutures.

5. Send the samples to a recognized dermatohistopathologist.

**PRACTICAL TIPS**

- Haired areas are clipped gently, avoiding removing surface features such as scale and crusts.
- Aseptic surgical preparation is not performed, to avoid removing surface features.
- Ulcerated lesions should be sampled at the edge, including both sides of the ulcer’s periphery
- Samples should be obtained from both primary and secondary lesions
- Avoid self-traumatized lesions, which contain misleading changes
- As many representative samples as is practical should be submitted, to ensure a good return
- The submission form should contain a detailed history
- Discuss the case with the pathologist
An example of a questionnaire for a dog with a skin problem.

**Pet's name:** ................................................................. **Owner's name:** .................................................................

**Breed:** ................................................................. **Sex:** ........................................................................... **Age:** ...........................................................................

**Vaccination status:** ................................................................. **Last worming:** .................................................................

**Current medications:** .................................................................

Describe the skin complaint.................................................................

Circle the signs you have noticed: Scratching  Biting  Chewing  Licking  Rubbing  Dry skin  Dandruff  Reddened skin

Greasy skin  Smell

At what age did it begin?...........................................................................

Where on the body did it begin?...........................................................................

What did it look like initially?...........................................................................

How did it progress from there?...........................................................................

Circle 1 or 2 for each lesion if involved (1 for initially and 2 for now):  Nose 1  2  Around eyes 1  2  Ears 1  2  Neck 1  2  Back 1  2  Hindend 1  2  Chest 1  2  Abdomen 1  2  Armpits 1  2  Groin 1  2  Forelegs 1  2  Forepaws 1  2  Hindlegs 1  2  Hindpaws 1  2

Rate the severity of the problem, 1 for mild to 5 for severe:...........................................................................

How itchy is the problem? 0 for not to 10 for severe:...........................................................................

Has the condition worsened with time?:...........................................................................

Is the problem worse at any time of year, and if so when?:...........................................................................

Does the condition alter with travelling to different areas?:...........................................................................

If so, does your dog travel abroad and to where?:...........................................................................

Describe where your pet sleeps and on what:...........................................................................

Are there any other pets and are they affected?:...........................................................................

Do any of your dog's relatives have skin problems?:...........................................................................

Do any in-contact people have skin problems?:...........................................................................

List the percentage of time your dog spends Indoors  Outdoors

What medications have been prescribed for the problem?:...........................................................................

Did any medications help?:...........................................................................

Have steroids been prescribed? If so, what was the response?:...........................................................................

Do you treat your pets for fleas? If so, with what and how often?:...........................................................................

Do you treat the house for fleas? If so, with what and how often?:...........................................................................

List all the foods fed to your dog, including all treats:...........................................................................

Does your pet have any of these signs? Cough  Sneeze  Runny eyes  Vomiting  Diarrhoea  Excessive thirst  Excessive appetite  Limp  Lethargy  Poor exercise tolerance  Ear infections (please circle)

Have you any observations you would like to note?:...........................................................................

............................................................................................................................................................................................................................................................................................
Owners will often present a dog having noticed one of the following:

- Lump
- Swelling
- Nodule
- Bump
- Tumour
- Boil
- Abscess
- Mass.

These terms are, colloquially, often used interchangeably to refer to cutaneous or subcutaneous accumulations of tissue that form a noticeable lesion either visually or on palpation. For simplicity, the term 'mass' will be used throughout this chapter.

Broadly, masses can be thought of in three ways:

- Simple masses (e.g. a small injection site reaction)
- Tumours (benign or malignant)
- Other masses (e.g. perineal hernia).

There are numerous possible explanations for the finding of a mass, from the ‘simple’ (e.g. a small subcutaneous lipoma in the flank) to the ‘complex’ (e.g. a grade III mast cell tumour affecting the prepuce). This chapter will describe a simple approach to dealing with the presentation of a mass as the chief complaint.

**History**

Pertinent questions might include the following:

- How long has the mass been present?
- Has it changed in size, appearance or colour recently?
- Has the animal had recent surgery?
- Has the dog been involved in a fight or any other traumatic experience?
- Where does the owner walk the dog; is the dog on or off the lead?
- Is the dog a working dog?
- Has the dog had any recent injections?
- Has the dog been licking or chewing the mass?
- Has there been any discharge from the mass?

Some history findings and possible interpretations are noted in Figure 28.1.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Comment</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>Constant size for a long duration</td>
<td>Suggests benignity or low grade of malignancy</td>
</tr>
<tr>
<td></td>
<td>Small then suddenly large (or vice versa); or rapid growth</td>
<td>Rapid alteration in size may suggest: a change to malignancy; degranulation of mast cells; haemorrhage; or a burst abscess</td>
</tr>
<tr>
<td>Time present</td>
<td>Short duration: days to 1–2 weeks Long duration: &gt;2 weeks to months to years</td>
<td>A mass present for a long time suggests benignity</td>
</tr>
<tr>
<td>Pruritus</td>
<td>Some owners will be alerted to the presence of a mass by the dog licking or chewing an area</td>
<td>Masses may be itchy, due to: release of histamine (e.g. mast cell tumour, urticaria); or inflammation (e.g. ulcerated carcinoma, interdigital granuloma)</td>
</tr>
<tr>
<td>Discharge</td>
<td>An obvious discharge may alert an owner to a problem</td>
<td>A burst abscess, infected ulcerated tumour or a seroma may all produce or leak fluid</td>
</tr>
<tr>
<td>Recent surgery</td>
<td>Several possible masses can be associated with recent surgery</td>
<td>Examples: seroma; incisional dehiscence; wound infection; suture reaction; failure of surgery</td>
</tr>
<tr>
<td>Recent injection</td>
<td>A soft non-painful pea- to bean-sized swelling at the site of a subcutaneous injection</td>
<td>Sterile granulomas occur occasionally following subcutaneous injection</td>
</tr>
<tr>
<td>Previous history</td>
<td>Seasonal problem</td>
<td>Interdigital granuloma; urticaria</td>
</tr>
<tr>
<td>History of lipoma/wart, etc.</td>
<td></td>
<td>Warts/lipomas can be multiple</td>
</tr>
<tr>
<td>Previous malignancy</td>
<td>Recurrence of tumour</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 28.1** History findings and how they can relate to the mass.
Clinical examination

A thorough clinical examination is very important.

**PRACTICAL TIP**

Try to avoid specific examination of the mass until the end of the examination. This will help prevent overlooking anything else that is pertinent.

General points to consider are as follows:

- Is the mass solitary or are there multiple sites affected?
- Are there any signs of systemic illness? Malignant tumours can produce a variety of systemic signs. For example: hypercalcaemia in anal gland adenocarcinoma; vomiting/melaena due to histamine release from mast cell tumours; coughing associated with pulmonary metastases. It is important to note all systemic signs at the time of examination of a mass as they may be helpful in clinical staging once a diagnosis has been reached.
- Are there more pressing medical problems affecting the dog than the mass, e.g. an elderly dog presented with a lipoma that is in obvious congestive heart failure?
- Is there any lymph node involvement, especially of the local draining lymph node?

It is important to record specific details of the mass, for example:

- Size
- Cutaneous versus subcutaneous
- Intact or ulcerated
- Hairy or hairless
- Sessile or pedunculated
- Red, hot or swollen
- Painful or not.

**Diagnostic tests**

On completion of the clinical examination, further information as to the type of mass can be acquired by examination of tissue samples obtained via fine-needle aspiration (FNA; see QRG 28.1) or biopsy (see QRG 28.2). The choice of sampling technique often depends on circumstance (such as owner finances, owner interest, temperament of the dog); however, there are several points to bear in mind.

- Making FNA a routine procedure as part of the examination of any mass, and the default tissue sampling technique, is good practice. The benefits are:
  - An appreciation by clients of an efficient and economic in-house test
  - The ability to identify benign lesions not requiring treatment, e.g. injection reaction
  - Avoiding the ‘keep your eye on it’ approach that risks missing a potentially serious problem.
- Whichever technique is employed, it should be remembered that the mass may be malignant and that a planned excision of the mass may be required, including a wide and deep margin.

- With FNA and incisional biopsy, the needle tract (or surgical approach) should pass only through tissue that would be excised in any future surgical treatment of the mass, and should not add to the area that would need to be excised.
- It is important to avoid seeding tumour cells into what may well be the tumour-free margin.

- Excisional biopsy should not be used in cases where there is a suspicion of a malignant mass, especially of a tissue type that requires a large tumour-free margin, such as a mast cell tumour (MCT) or a sarcoma.
- Excisional biopsy could be employed when there is a likelihood of a mammary gland tumour (MGT) or lipoma, where the aim is to treat the mass and obtain tissue simultaneously and large tumour-free margins will not be required.

Tissue sampling options for suspected mass types are summarized in Figure 28.2. Cytological features of malignancy are described in Figure 28.3.

<table>
<thead>
<tr>
<th>Mass type suspected</th>
<th>FNA</th>
<th>Incisional biopsy</th>
<th>Excisional biopsy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Simple</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abscess</td>
<td>✓</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Granuloma</td>
<td>✓</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Sebaceous cyst</td>
<td>✓</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Interdigital granuloma</td>
<td>✓</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Seroma</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Benign</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lipoma</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mammary gland tumour</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Histiocytoma</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sebaceous adenoma</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trichoepithelioma</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Malignant</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mast cell tumour</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mammary gland tumour</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carcinoma</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sarcoma</td>
<td>✓</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Lymphoma</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Melanoma</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

28.2 Tissue sampling options for suspected mass types. *Try to avoid sampling seromas; a healing surgical wound that develops a fluid-filled swelling should give a high index of suspicion that a seroma is present.

28.3 Cytological features of malignancy.

- Variable/ Increased nucleus/cytoplasm ratio
- Clumped chromatin
- Large multiple and irregular nuclei
- Multinucleate cells
- Increased basophilia
- Vacuolation
- Larger than typical cells for that cell type
- Heterogeneous populations of the same cell type
- Large sheets of attached cells (especially epithelial tumours); clumping of cells
- Actively dividing cells, mitotic figures
Common conditions

This section deals with simple masses, benign and malignant masses in turn. This is not intended to be an exhaustive discussion but shows an approach that could be adopted for each type, along with a brief synopsis of the more common presentations. For more details on diagnosis, staging and treatment see the BSAVA Manual of Canine and Feline Oncology and the BSAVA Manual of Canine and Feline Rehabilitation, Supportive and Palliative Care: Case Studies in Patient Management.

Simple masses

There are numerous simple non-tumour masses that present regularly in first-opinion practice, often requiring minimal intervention. A lot of these masses are associated with younger or very active animals or those that have recently had veterinary treatment. It is appropriate to use FNA for most of these masses. Some of the more common simple masses are listed in Figure 28.4. Urticaria is discussed in Chapter 27; interdigital granuloma/abscess/foreign body is discussed in Chapter 29; impacted anal gland is discussed in Chapter 30; and mastitis is discussed in Chapter 26.

Injection site reaction

It is quite common to find a small, soft-to-firm, pea/bean-sized mass in the subcutaneous space at sites of injection such as the scruff. These masses are non-painful and the animals show no systemic signs of illness. The mass is a sterile granuloma and is usually a reaction to the drug carrier or adjuvant. The reaction is usually self-limiting and does not require treatment.

Granuloma

Other types of granuloma are described in Figure 28.5.

Abscess

Abscesses can be a variety of shapes and sizes, and can affect any part of the body. There are many causes, including penetrating trauma, foreign body, dog fights and post-surgical reactions. Abscesses produce typical clinical signs of heat, pain and swelling; as they mature, they will become soft to the touch, giving the impression that there is some fluid within the swelling. Dogs can be pyrexic and may display general signs of illness. FNA yields purulent material, which is pathognomonic. Treatment involves drainage, lavage, appropriate antibiotics and pain relief. The prognosis is generally excellent.

In severe cases, especially those affecting the limbs, the infection may be dissipated within the subcutaneous space (i.e. cellulitis). This can be a very debilitating condition, which may require hospitalization and aggressive treatment to manage.

Haematoma

Haematomas are the result of traumatic rupture of blood vessels and are acute in onset. There is often evidence of blunt trauma, such as a bruise on the overlying skin. FNA will yield blood (or serous fluid if the haematoma is chronic).

PRACTICAL TIP

It is worth bearing in mind that animals with a coagulopathy may well present with a haematoma and no other signs, so it is always worth considering the coagulation status of any animal presenting with a haematoma, particularly if the lesion is unexplained.

Seroma

Seromas are fluid accumulations within the subcutaneous space of a surgical wound; formation occurs following surgery with poor haemostasis and failure to close dead space. Prevention is better than cure: particular attention should be paid to Halsted’s principles of surgery, notably good haemostasis, accurate apposition of tissues and elimination of dead space; also, as little as possible foreign material (e.g. suture material) should be placed into the wound.

Seromas tend to be non-painful with minimal signs of inflammation. For the most part they require little in the way of treatment. The majority will resolve in 10–14 days. If the seroma is particularly large, re-operating to close dead space may be necessary. The prognosis is excellent.

Granuloma types and treatment.

<table>
<thead>
<tr>
<th>Granuloma type</th>
<th>Examples</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bacterial</td>
<td>Canine furunculosis caused by <em>Staphylococcus intermedius</em></td>
<td>Appropriate medical therapy</td>
</tr>
<tr>
<td>Endogenous foreign body</td>
<td>Hair/keratin leading to bacterial furunculosis</td>
<td>Appropriate medical therapy + surgical excision</td>
</tr>
<tr>
<td>Exogenous foreign body</td>
<td>Sutures, grass awns, thorns, glass splinters</td>
<td>Surgical excision</td>
</tr>
<tr>
<td>Parasitic</td>
<td>Tick bite</td>
<td>No treatment usually required; Excision if causing problems</td>
</tr>
<tr>
<td>Acral lick dermatosis</td>
<td>Deep bacterial folliculitis/furunculosis caused by repeated licking due to behaviour or immune-mediated problems (see Chapters 12 and 27)</td>
<td>Surgical excision. Treat underlying cause. Acupuncture</td>
</tr>
<tr>
<td>Idiopathic</td>
<td>Sterile pyogranulomatous dermatosis. Juvenile cellulitis</td>
<td>Appropriate medical therapy</td>
</tr>
</tbody>
</table>

28.4 Some common simple superficial non-tumorous masses.

28.5 Granuloma types and treatment.
Chapter 28  Lumps and bumps

**Reactive lymph node**
This is a reasonably common finding, particularly if there is skin disease affecting the distal limb. FNA and cytology should be performed on all lymph nodes that appear enlarged, particularly if there is no obvious reason for the enlargement.

**Benign tumours**
Common benign tumours are listed in Figure 28.6 and breed predispositions are considered in Figure 28.7. Most are amenable to FNA or simple excision. It is also possible to leave a benign mass in situ and monitor its behaviour.

**PRACTICAL TIP**
If choosing to leave a benign mass as it is, measure the dimensions, note the gross appearance and/or take a digital photograph of the mass and record this data in the dog’s clinical notes. This will act as a baseline measure against which to judge the future behaviour of the mass.

**WARNING**
Do not be tempted to drain a seroma; it will refill and there is a risk of introducing bacteria into an otherwise sterile environment.

**Histiocytoma**
These tumours are common in young dogs, with more than half of cases occurring before 2 years of age (hence their colloquial name of ‘juvenile wart’).

Although sometimes multiple, they usually present as solitary lesions on the head, pinnae or limbs especially and appear as raised, firm, well circumscribed dermal masses (Figure 28.8). The majority will regress spontaneously (though may be excised if traumatized). They often become quite inflamed immediately prior to regression.

**Lipoma**
These benign tumours of adipose tissue are a common finding in the subcutaneous tissues, or between muscle bellies in older dogs. They may be left in situ unless they are interfering with function (e.g. a large lipoma in the axilla or between limb muscles), in which case excision is recommended. Liposarcomas (malignant) are rare.

**Meibomian gland tumour**
These are the most common tumours of the eyelid (see also Chapter 21). They often appear like raised cauliflower-like lesions (Figure 28.9). Excision is indicated if they cause irritation.

**Papilloma**
These sessile or pedunculated cauliflower-like growths (Figure 28.10) are common in dogs and are often multiple. They are caused by the papillomavirus and can therefore be contagious. They rarely require treatment, though may be excised if traumatized. They may undergo malignant change to squamous cell carcinoma.

**28.6 Common benign tumours.**

<table>
<thead>
<tr>
<th>Tumour</th>
<th>Breeds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Histiocytoma</td>
<td>Staffordshire Bull Terrier, Boxer, Cocker Spaniel, Dobbermann, English Springer Spaniel, Labrador Retriever, West Highland White Terrier, Rottweiler, Shetland Sheepdog</td>
</tr>
<tr>
<td>Lipoma</td>
<td>Labrador Retriever, Dobbermann, Cocker Spaniel, Weimaraner</td>
</tr>
<tr>
<td>Meibomian adenoma</td>
<td>Retriever breeds</td>
</tr>
<tr>
<td>Papilloma</td>
<td>Cocker Spaniel, Kerry Blue, Yorkshire Terrier, Poodle</td>
</tr>
<tr>
<td>Perianal adenoma</td>
<td>German Shepherd Dog, Lhasa Apso, Shih Tzu, English Bulldog, Cocker Spaniel, Samoyed, terriers</td>
</tr>
<tr>
<td>Sebaceous gland tumour</td>
<td>Beagle, spaniels, Lhasa Apso, Dachshund, Shh Tzu, Poodle</td>
</tr>
<tr>
<td>Trichoepithelioma</td>
<td>Cocker Spaniel, English Springer Spaniel, Basset Hound, German Shepherd Dog, Miniature Schnauzer</td>
</tr>
</tbody>
</table>

**28.7 Breed predispositions for some common benign tumours.**

**Meibomian gland tumour affecting the upper eyelid of a 10-year-old Labrador Retriever.**
Excision was curative.
Perianal gland adenoma

These common tumours of the perianal glands (which are modified sebaceous glands) are usually seen in older, intact male dogs. They can also be seen in bitches, when it is important to check adrenal function as there is the suggestion of an underlying endocrinopathy. The tumours are ovoid masses that may be solitary or multiple and become ulcerated due to the stretching of the overlying skin as they enlarge. Castration alone will lead to regression of the majority, so excision combined with castration carries an excellent prognosis. In the bitch, excision should be curative.

Sebaceous gland tumour

These tumours are common and present as solitary, well circumscribed, raised, smooth, cutaneous masses. They may also be greasy, hyperkeratotic or wart-like. Ulceration is common, which may result in the discharge of thick creamy to caseous material. Excision is curative.

Trichoepithelioma

These cutaneous masses are common in middle-aged and older dogs, especially on the trunk (Figure 28.11). They may be solid or cystic and are well circumscribed. Excision is curative.

Malignant tumours

The approach to a suspected malignancy is described in Figure 28.12. Once the tumour has been fully described, judgments can be made regarding treatment options and prognosis. Some of the more common presentations are outlined below.

1. History.
2. Clinical examination.
3. FNA of mass(es).
4. FNA of local lymph nodes, especially if enlarged.
5. Haematology, biochemistry and urinalysis, to help further define the health status of the dog and highlight any underlying illness or paraneoplastic syndrome (e.g. hypercalcaemia of malignancy).
6. Other appropriate tests (e.g. a coagulation profile in cases of haemorrhage or where haemorrhage can be expected; gastroscopy in dogs with mast cell tumours that show melena ± vomiting).
7. If FNA cytology is non-diagnostic, or a tissue sample is required to define the tumour, then surgical biopsy is indicated.
   - It is often worthwhile performing a biopsy on a lymph node in cases of lymphoma to characterise which cell line is involved, as this gives information regarding prognosis and likely response to chemotherapy.
   - Biopsy can also aid in surgical planning, e.g. histological grading of mast cell tumour.
8. Tumour staging using the TNM (tumour, metastasis, node) system.
   - It is always worth using imaging to search for metastasis: three inflated views of the thorax (or CT if easily available), and abdominal ultrasonography. As previously mentioned, FNA of draining lymph nodes is also good practice.

Malignant histiocytosis

Malignant histiocytosis, though rare, is possible and is most commonly seen in older Bernese Mountain Dogs and Retriever breeds. Cutaneous lesions are not common and signs include lethargy, weight loss, lymphadenopathy, hepatomegaly and pancytopenia, with a rapid progression to fatality.

Mammary gland tumour

MGTs are common in older (median age 11–12 years), predominantly entire bitches. Neutering prior to the first season will almost completely prevent their occurrence; neutering after the first season will decrease the occurrence, whereas after the second season there is little preventive effect (see also Chapter 5). Tumours may be benign or malignant, and there may be mixed tissue types within the same mass so cytology can often be unreliable.

Treatment is by:
- Excision of the mass (for small solitary tumours or excisional biopsy)
- Mastectomy of a gland (for larger masses)
- Mastectomy of an entire mammary strip (for multiple masses or where propensity to metastasis is anticipated).

PRACTICAL TIPS

- Thoracic radiographs are mandatory prior to surgery, as approximately 25% of malignant tumours will have pulmonary metastases at the time of diagnosis.
- If both chains of mammary glands are affected, it is better to stage excisions a few weeks apart to prevent the risk of wound dehiscence.
- Ovariohysterectomy may be performed at the same time, and is often advocated, though it will not affect the prognosis or the likelihood of developing additional tumours in the remaining glands.
Mast cell tumour
Mast cell tumours are the most common malignant cutaneous tumours of dogs and can affect dogs of any age. Although many MCTs appear as well defined, raised, red, hairless lesions, they can also mimic other lesions (including lipomas) or appear as soft fluctuant masses, which may appear bruised and contain sanguineous fluid (Figure 28.13). This illustrates the importance of FNA and cytology for all masses.

Manipulation of MCTs may cause histamine release and result in a wheal or flare reaction (‘Darier’s sign’). Histamine release may also cause vomiting and gastrointestinal ulceration, and these systemic signs are an important consideration in staging.

MCTs are easily diagnosed on cytology, due to the small to medium-sized round cells with abundant pink/red-staining cytoplasmic granules (when stained with Diff-Quik). Histology is useful, as the histological grade is an accurate prognostic indicator, with MCTs classed as low, intermediate or high grade depending on how well differentiated the cells are.

Surgery is the treatment of choice, with a wide excision. This may be combined with radiotherapy for aggressive tumours or where sufficient margins will be hard to achieve; early discussion with an oncologist may be helpful. There are two chemotherapy drugs for cases in which surgery is not possible, or where adequate margins cannot be guaranteed: masitinib and toceranib. Owners should always be given a cautious prognosis, even when excision appears to have been complete.

Soft tissue sarcoma
Soft tissue sarcomas originate from mesenchymal connective tissue and the exact tumour type is dependent on the tissue of origin, e.g. fibrosarcoma, haemangiopericytoma, peripheral nerve sheath tumour, haemangiosarcoma, leiomyosarcoma.

These are usually solitary tumours (Figure 28.14) and are most common in middle-aged and older dogs. The tumours may be soft or firm. They have poorly defined margins (even if pressure on surrounding tissues creates a pseudocapsule), such that they will infiltrate normal tissue and along fascial planes. Distant metastasis is via the haematogenous route and local lymph node involvement is rare.

Treatment is by wide surgical excision, including a fascial plane deep to the tumour. If ‘clean’ tumour-free margins are seen histologically, then prognosis is often good; ‘dirty’ margins, i.e. containing tumour cells, may indicate a need for wider excision or radiotherapy or chemotherapy. The first surgery gives the best chance of a cure, so it is always worth discussing these cases with a more-experienced colleague.

Lymphoma
Lymphoma can occur at any age, though it is more common in middle-aged and older dogs. Because it arises in lymphoid tissue, it can affect any part of the body (including skin and gastrointestinal tract), though typical sites are the lymph nodes, spleen and bone marrow; 85% of cases have multicentric disease.

Lymphoma is most commonly suspected following identification of generalized lymphadenopathy on clinical examination, as the submandibular, prescapular and popliteal nodes are readily palpable. Other non-specific signs that may alert the clinician include weight loss, lethargy and anorexia. Paraneoplastic hypercalcaemia is possible and so cases may
It is worth avoiding taking samples from the submandibular nodes, as inadvertent sampling of salivary tissue is frustratingly common.

Chemotherapy for lymphoma is commonly used in many veterinary practices and can give good rates of remission. If chemotherapy is declined, systemic steroid therapy may give palliative care, but progression of the disease will be rapid and euthanasia will be inevitable.

**Paraneoplastic syndromes**

Tumours often exert metabolic, endocrine and haematological effects on the body. These effects are known as ‘paraneoplastic syndromes’. They are important factors to bear in mind, as they may be the reason for presentation or may complicate the management of an existing neoplastic disease. Common syndromes include:

- **Haematological**: anaemia, haemolysis, thrombocytopenia, disseminated intravascular coagulopathy
- **Metabolic**: cancer cachexia, fever
- **Endocrine**: hypercalcaemia, hypoglycaemia, hyperhistaminemia
- **Neurological**: myasthenia gravis, hypertrophic pulmonary osteopathy
- **Dermatological**: hepatocutaneous syndrome

**References and further reading**


**QRG 28.1 Fine-needle aspiration of a superficial mass**

**Equipment**
- 23 G needle
- 5 ml syringe
- Several clean microscope slides
- Cytology stain, such as Diff-Quik
- Microscope

**Needle-only method**

1. Firmly secure the mass with the non-dominant hand.
2. Introduce the needle into the mass and move it forwards and backwards within the mass several times before completely withdrawing it.
   - Don’t spend too much time within the mass and don’t push through and out of the mass (potentially seeding a tumour).
3. Fill a syringe with air, attach the needle and gently express the sample on to a glass slide.
4. Make a smear, stain and examine it with the microscope.

**Needle and syringe method**

1. Firmly secure the mass with the non-dominant hand.
2. Introduce the needle into the mass, moving it forwards and backwards within the mass while simultaneously applying negative pressure with the attached syringe.
3. Once the sample has been collected into the syringe, stop applying negative pressure and then remove the needle from the mass.
4. Remove the needle from the syringe and fill the syringe with air. Re-attach the needle and gently express the sample on to a glass slide.
5. Make a smear, stain and examine it with the microscope.

---

**QRG 28.2 Biopsy of a superficial mass**

**Equipment**
- Routine equipment to prepare for aseptic surgery
- Basic surgical kit
- Sterile drape and swabs
- No. 10 scalpel blade
- Biopsy punch
- Suture for skin closure
- Histology pot containing formalin solution

**Incisional biopsy**

1. With the dog under general anaesthesia, prepare the mass for sterile surgery.
2. Using a scalpel blade, make a wedge-shaped incision into the mass, keeping within the confines of the mass.
   - This sampling technique is analogous to taking a wedge-shaped slice from a pie.
   - It is important not to disturb the surrounding tissue. If the mass is in a subcutaneous position, then make as small a skin incision as possible directly over the mass.
3. Remove the wedge and place it in formalin.
4. Close the biopsy site routinely.

**Excisional biopsy**

1. Under general anaesthesia prepare the mass for sterile surgery.
2. Excise the entire mass with a small rim of unaffected skin.
   - An elliptical incision is best.
   - For very small masses it is possible to use a skin biopsy punch.
3. Place the sample in formalin.
4. Close the resultant wound.
Disorders of the paw

Ken Robinson

While it is possible for skin lesions to affect the paws exclusively, it is more common to have involvement of other areas as well. An approach to pruritic and non-pruritic skin disorders is given in Chapter 27. This chapter concentrates on those conditions that affect the feet and nails predominantly or exclusively. The paws, being weight-bearing, are also vulnerable to injury, e.g. lacerations, fractures. As with any other area of the body, paws can show congenital malformations but these are generally not common in practice.

Foot and footpad injuries
The canine footpad is designed to withstand shock, standing and abrasive forces. The stratum corneum is pigmented, thick and keratinized, with a rough surface composed of conical papillae. Despite this toughness, injuries can occur. More detail on wound management can be found in Chapter 10.

Physical problems that can affect the paw
- Foot and footpad lacerations (Figure 29.1)
- Abrasions (Figure 29.2), erosions and degloving injuries (Figure 29.3)
- Foreign bodies (Figure 29.4)
- Thermal and chemical injuries

29.2 Vigorous exercise on hard surfaces (especially if protruding flints) can lead to shaving injuries to the pads, as in this collie cross. Healing is by the pad growing out to provide a new layer of dead surface. Clients should be warned that this is a slow process. (Courtesy of Helen Redfern)

29.3 Road traffic accidents often lead to degloving injuries, as in this Whippet. With careful bandaging even large deficits can heal well by second intention. (Courtesy of Emma Hall)

29.1 A laceration of the stopper pad in a 3-year-old cross-breed dog. (Courtesy of Rebecca Bailey)
Chapter 29 Disorders of the paw

Laceration
Superficial cuts to the foot and footpad can be treated by cleaning and bandaging (see QRG 29.1).

Lacerations in the skin are sutured as for other areas of the body (Figure 29.5).

- The wound edges are closed in a routine fashion and the foot protected with frequently changed dressings.
- Sutures are removed after 10 days.

Fusion podoplasty may be considered where there are severed flexor tendons, or in cases of severe refractory interdigital pyoderma. It is strongly advised that these cases are referred to a specialist in this field.

Abrasions, erosions and degloving injuries
These wounds are best treated by allowing healing by secondary intention with contraction and epithelialization. A non-adherent absorbent/semi-absorbent dressing (see Chapter 10) is used, with antibiotic cover. Splinting can help healing, counteracting wound contraction antagonism, as weight-bearing pushes the wound edges apart. Acemannan hydrogel wound dressing containing aloe vera is useful. It is advisable to restrict exercise.

Digit amputation may be required in cases of severe trauma, or for tumours or chronic bacterial/fungal infection. The primary weight-bearing digits are the 3rd and 4th and should be preserved if possible. Lameness postoperatively is more likely if more than two digits are removed, or the 3rd or 4th digit is lost. The basic technique is described in QRG 29.2.

Thermal injuries
The paws are susceptible to burns and frostbite. Lesions should be debrided of all necrotic tissue and then can be treated in the same way as abrasions (see above). These cases often have extensive damage. More detail on burns can be found in Chapter 10.
Disorders of the paw

Chapter 29

Dew claw removal
Dew claw removal is carried out because of injury to, or from, the dew claws, especially on the hindlegs. While legally allowed until puppies’ eyes are open, the author prefers an age of 7 days as the upper limit for performing dew claw removal without general anaesthesia. Care should be taken in weak or ill puppies, delaying the procedure until they are strong enough. The area is sterilized, the digit removed with scissors and any bleeding cauterized. The area is kept clean for the next few days but does not need to be bandaged.

In dogs older than this, general anaesthesia is required. The procedure (see QRG 29.3) is then performed after 3 months of age and is often performed at the same time as neutering.

Skin disorders affecting the paws

It is useful to divide cases according to their presenting signs. Algorithms for addressing pruritic and non-pruritic skin conditions are provided in Chapter 27.

Pruritus and erythema
Licking, chewing and biting of the feet is a relatively common presenting sign. There may be associated erythema, coat staining and hair loss. Causes of pruritus and erythema include (most common in bold):

- **Atopic dermatitis:**
  - Pedal lesions involve the interdigital areas (dorsal, palmar and plantar), and the carpal (Figure 29.7) and tarsal areas
  - While most dogs will have other areas affected, some may present with predominantly pedal signs. In treated cases, the feet may remain difficult to control.

- **Demodicosis:**
  - Does not always present with pruritus. Secondary lesions include pigmentation, scaling, crusting, exudation, nodules and draining tracts, and can be associated with pain. Secondary pyoderma is common
  - Can be restricted to just the feet (e.g. in Old English Sheepdog)
  - Skin scrapings should be performed on ALL pododermatitis cases. While skin scrapings and hair plucks should yield mites, chronic cases and some breeds (e.g. Shar Pei) may require biopsy
  - Pedal lesions are difficult to treat and may be resistant to therapy. As well as systemic therapy, localized treatment using amitraz mixed 1:9 with mineral oil or propylene glycol, applied once or twice weekly, may help (though this is an unauthorized use).

- **Bacteria or Malassezia:**
  - These cases are usually secondary, and require further investigation to establish the underlying cause
  - Various bacteria can be involved, especially Staphylococcus pseudintermedius, Pseudomonas and Proteus. Mixed infections can occur
  - Malassezia infection often presents as a brown exudate around the nailbed (see Figure 29.16) and on the nails
  - Cytology can be used to show whether cocci, rods or Malassezia are involved (see QRG 27.2)
  - Recurrent cases, with more than one foot involved and where the dog is non-pruritic between episodes, may indicate an underlying immune deficiency disorder, hypothyroidism or non-pruritic demodicosis.

- **Contact dermatitis:**
  - The ventral (Figure 29.8) and interdigital surfaces are usually the most severely affected, though less commonly it can involve the whole paw
  - Pruritus is often severe and difficult to control
  - Where only the feet are affected, attention should be directed towards finding out the main areas where the dog walks. Covering one foot with a sock for 2–3 days and checking for improvement on that foot may justify further investigation.

- **Food hypersensitivity (see Chapter 27)**

- **Trombiculosis (see below).**
**Trombiculosis**
This is a seasonal dermatitis, occurring from late summer to mid autumn, caused by the orange larval stages of the harvest mite *Trombicula* (subgen. *Neotrombicula* *autumnalis*, which are visible to the naked eye (Figure 29.9). Infestation is predominantly pedal, but other areas of the skin can be affected, such as the ventral abdomen and pinnae (Henry’s pocket). Papular lesions, some with crusting, are seen. The larvae, with 3 pairs of legs, can be identified microscopically. While infection is self-limiting, most animals find the mites irritating, and topical fipronil spray can be used once or twice weekly.

![Image of Trombicula mites](image)

**Nodules**
A number of conditions may present with nodules, with or without draining tracts. Some of these conditions are very painful, and dogs may present with lameness.

Causes of nodules include (most common in **bold**):
- **Foreign bodies**
- **Bacterial furunculosis and pyogranulomas**
- **Demodicosis** (see above and Chapter 27)
- **Neoplasia**
- **Fungal granulomas** (see Chapter 27)
- **Ruptured follicular cysts**: Draining cysts requiring surgical resection and antibiotics
- **Sterile pyogranulomas** (see Chapter 27)
- **Calciosis cutis/circumscripta** (see Chapter 27)
- **Nodular dermatofibrosis of German Shepherd Dogs**: Rare condition associated with renal or uterine tumours
- **Xanthomatosis**: Yellowish/white nodules associated with dietary or metabolic causes.

**Foreign body reaction**
Common foreign bodies include splinters, thorns (see Figure 29.4) and interdigital grass awns (especially in long-coated breeds; Figure 29.11a). They often present as a discharging sinus. Diagnosis is by surgical exploration of the tract. Short-haired breeds (Figure 29.11b) can develop nodular lesions as a result of broken bristle-like hairs enclosed in a granuloma.

![Image of foreign body reaction](image)

**Non-pruritic alopecia**
Alopecic lesions without evidence of pruritus (e.g. fractured hair shafts or hair staining) are not a common presentation for the feet. Causes of non-pruritic alopecia include (most common in **bold**):
- **Demodicosis**: Pedal lesions include scale and alopecia (Figure 29.10)
- **Dermatophytosis**: This may occasionally affect the feet exclusively, with scale, crust, follicular papules and pustules. Rarely, it can involve the nails (onychomycosis)
- **Bacterial overgrowth** (see Chapter 27)
- **Ischaemic folliculopathy**: Uncommon but warrants consideration in refractory cases. Causes include dermatomyositis and post-vaccination vasculitis.

![Image of Demodicosis](image)
Treatment involves opening the nodule and removing the foreign body, or surgical resection of the granulomatous nodule. Where removal of the whole lesion is not achieved, it is important to leave the wound open to drain and heal by granulation. Bandaging should ideally be avoided, unless a poultice is applied; daily changing of the dressing is then required. The majority of cases require a course of antibiotics.

The footpad can be affected, with thorns and glass being common perforating foreign bodies; lesions appear as small draining openings on the pad, and the dog is often lame.

In footpad lesions, lateral pressure on the pad can isolate pain to the area and can extrude a foreign body such as a thorn. Glass can be more difficult to find but may show up on radiography of the pad and can be dug out using a hypodermic needle; if it is deeply embedded this will require general anaesthesia. All footpad cases require a course of antibiotics.

**Bacterial furunculosis and pyogranulomas**

These present as nodular lesions, often discharging, which can be painful and cause lameness. They are often secondary (e.g. to demodicosis, foreign body, chronic allergy), but no underlying cause can be found in some cases. Certain breeds are over-represented, including English Bulldog, Great Dane, Basset Hound, Mastiff, Bull Terrier, Boxer, Dachshund, Dalmatian, German Shepherd Dog, Labrador and Golden Retrievers, setters and Pekingese. In short-haired breeds, excessive pressure on the foot, especially as a result of being overweight, causes fracture of the hair shafts, with release of keratin into the dermis to act as a nidus for infection.

Affected paws are red and oedematous with nodules, ulcers, fistulas and haemorrhagic bullae with discharge. Nailbed involvement can occur. Diagnosis involves cytology, bacterial culture and sensitivity testing, and biopsy.

Treatment is difficult and includes: prolonged courses (8–12 weeks) of appropriate antibiotics; foot soaks with Epsom salts (magnesium sulphate) for 10–15 minutes; and topical antimicrobial ointments. It is very important to treat until there is total resolution. Following surface healing, regular palpation of the interdigital region facilitates the decision to continue treatment if deep lesions (often painful) can still be palpated. Chronic cases may result in sterile nodules following treatment and may require steroids. Severe cases may require surgical debridement or even podoplasty.

**Neoplasia**

Cases can present with varying sizes of nodular masses, which can be ulcerated. Other signs can include erythema, scale, sometimes depigmented footpads, and variable pruritus. Nailbed carcinoma or keratoacanthoma usually involves a single digit. Neoplasms affecting the foot include mast cell tumour, histiocytoma (Figure 29.12), squamous cell carcinoma, melanoma, epitheliotropic lymphoma, inverted papilloma and eccrine adenocarcinoma. Diagnosis is via biopsy and cytology. Surgical management should be carried out where appropriate, with survey radiographs if any malignancy is suspected.

**Hyperkeratosis, crusting or fissures of the footpad**

Dogs may be presented with footpads that have thickened skin, crusts or fissures. If the condition is severe, the dog may be lame.

Causes of footpad problems include (most common in bold):

- **Idiopathic or age-related hyperkeratosis**
- **Keratoma (corn)**
- **Pemphigus foliaceus**:  
  - Can involve the feet exclusively but most cases involve other areas (see Chapter 27)  
  - Nail lesions also occur (see later).
- **Superficial necrolytic dermatitis (hepatocutaneous syndrome) (see Chapter 27)**
- **Zinc-responsive dermatosis (see Chapter 27)**
- **Breed-specific hyperkeratosis**
- **Lethal acrodermatitis (see Chapter 27)**
- **Erythema multiforme (see Chapter 27)**
- **Drug eruption (see Chapter 27)**
- **Dermatophytosis (see Chapter 27)**
- **Viral: Hyperkeratosis is commonly associated with canine distemper infection, but this is rarely seen due to effective vaccination**
- **Hookworm infestation.**

**Idiopathic or age-related hyperkeratosis**

Excess keratin production with age is commonly seen in spaniels (especially Cocker; Figure 29.13.), Beagles and Basset Hounds. It is often associated with nasal lesions. Diagnosis is via clinical signs and biopsy. Symptomatic treatment is given daily with topical mineral oil or 50% propylene glycol.
Keratoma (corn)

Hard hyperkeratotic nodules that enlarge with time occur on the pad surface of Greyhounds and Lurchers (Figure 29.14a). There are various theories as to the cause, including foreign body injury, trauma, viral or anatomical problems. Lesions are painful, causing lameness. Diagnosis is from clinical signs.

The pad should first be cleaned. Hulling out of corns involves using a scalpel or, as the author prefers, a dental elevator (Figure 29.14b) to pare out the dead tissue. The crevice is cleaned and the pad kept covered for 1–2 weeks with dressings and antiseptic ointment. Recurrence is not uncommon. Some success in preventing recurrence has been claimed when using antiviral ointments after hulling.

Breed-specific hyperkeratosis

A severe hyperkeratosis develops by 6 months of age in certain breeds, including Golden and Labrador Retrievers, Irish, Norfolk and Kerry Blue Terriers, and Dogue de Bordeaux. Diagnosis is by breed and biopsy. Symptomatic therapy, similar to that for idiopathic hyperkeratosis, is appropriate.

Hookworm infestation

Hyperkeratotic paws that are painful and pruritic are associated with migration of hookworm larvae through the palmar/plantar aspect of the paws. This is not commonly seen, as most dogs are regularly wormed.

Ulcerative/sloughing footpads

While various lesions of the footpads can progress to ulceration, the following conditions, all described in Chapter 27, involve ulceration/sloughing as primary signs:

- Epitheliotropic lymphoma (other lesions include hyperkeratosis, depigmentation and crusting)
- Drug eruption
- Immune-mediated diseases (e.g. discoid/systemic lupus erythematosus, dermatomyositis, erythema multiforme, toxic epidermal necrolysis, pemphigus vulgaris, bullous pemphigoid, cold agglutinin disease)
- Ischaemic vasculopathy/vasculitis
- Uveodermatological syndrome
- Squamous cell carcinoma.

Depigmentation

Depigmentation of the skin, hair and nails of the feet occurs in vitiligo (see Chapter 27). This is a hereditary hypopigmentation disorder, which is merely cosmetic and requires no treatment.

Nail disorders

Terminology

- Onychodystrophy: deformity due to abnormal growth
- Onychorrhexis: brittle nails (splitting/breaking)
- Onychomadesis: sloughing of nail
- Onychomalacia: softening of nail
- Onychoclasis: breaking of nail
- Onychoschizia: splitting (+ lamination) of nail
- Onychogryphosis: hypertrophy and abnormal nail curvature
- Onychomycosis: fungal infection of nail
- Onychocryptosis: ingrowing nail
- Paronychia: inflammation of soft tissue around nail
- Pyonychia: purulent infection of nail

Nail disorders may involve just one foot and only a few nails (‘asymmetrical’) or can affect all feet (‘symmetrical’)

Overgrown nails are a common presentation in practice. Care should be taken to try to ascertain whether there is a pathological cause rather than just being due to a lack of exercise. Overweight and certain orthopaedic conditions affecting the flexor tendons can result in overgrown nails; merely clipping the nails will not solve the problem in such cases.

Nail clipping: hints and tips

- Learn the correct anatomy of the nail
- Ensure good quality nail clippers are used
- Cut 3–4 millimetres distal to the visible vasculature of the nail

Pigmented nails are best compared with non-pigmented nails as a guide.
Asymmetrical nail disorders
Causes of asymmetrical nail disorders include (most common in bold):

- Trauma
- Infections
- Neoplasia (e.g. squamous cell carcinoma, melanoma, mast cell tumour, keratoacanthoma)
- Vascular occlusion/ischaemia (uncommon).

Trauma
Trauma is the most common nail problem seen in practice, usually affecting one or a few nails, and showing asymmetry (Figure 29.15). An apparent symmetrical presentation, with all feet involved, can occur if there has been an association with excessive running on hard surfaces, like asphalt, concrete or gravel. There may be secondary bacterial infection. Dogs are often profoundly lame.

Broken nails can be avulsed if they are loose, by grasping with forceps and pulling swiftly. Sedation is often required, especially if the nail is damaged proximally. The exposed quick usually heals, but may occasionally require resection of the nail or, rarely, the nail and 3rd phalanx (see QRG 29.4) under general anaesthesia.

Infections
Infections of the nail often occur following trauma but can also be secondary to hypothyroidism, hyperadrenocorticism, diabetes mellitus, atopy or immune-mediated disease. Onychodystrophy and other conditions can lead to scarring or damage of the coronary band, with resultant defective nail growth and infection. In many cases there is a visible exudate below the nail.

- Fungal infections can occur, with dermatophytes growing into the nail keratin, but other areas of the skin are usually also affected. Nails are brittle, easily broken and powdered.
- Malassezia may affect the nail only, with brown, dry staining of the nail fold and nail (Figure 29.16). Atopy is often an underlying condition in these cases.
- Rarely, parasitic infections can affect the nails: e.g. demodicosis (causing paronychia), hookworm infestation (rapid nail growth), leishmaniosis (onychogryphosis).

Diagnosis: Cytology and culture of the exudate can be performed. Scrapings from the nail can also be cultured for dermatophytes.

Treatment: Detached or loose nails are removed with forceps under general anaesthesia. Antimicrobial medication is prescribed, often for prolonged periods.

Onychectomy
- Indications for nail removal are broken nails, nailbed infections and tumours involving the nail
- If only the nail is to be removed, then the use of bone cutters to section the nail at the level of the nailbed can be employed under general anaesthesia. Digital pressure is applied with a swab following cutting, to slow the bleeding and the area subsequently thermocauterized
- For more extensive lesions, removal of the nail and distal phalangeal bone is required (see QRG 29.4)
Symmetrical nail disorders
Causes of symmetrical nail disorders include:

- Infections (see above for details)
- Immune-mediated disorders (see also Chapter 27):
  - Cases often involve the nail fold, leading to paronychia or onychomadesis
  - Where only the nails are involved, the most likely cause is symmetrical lupoid onychodystrophy (see below), lupus erythematosus, bullous pemphigoid or pemphigus vulgaris
  - If there is paronychia and footpad involvement, pemphigus foliaceus is more likely; affected nails can show onychodystrophy, onychorrhexis and onychogryphosis
  - Cryoglobulinaemia, drug reactions and vasculitis can also cause nail disorders.
- Idiopathic onychodystrophy
- Idiopathic onychomadesis
- Epidermolysis bullosa
dermatomyositis
- Ergotism
- Thallotoxicosis
- Linear epidermal nevi
- Nutritional deficiencies (e.g. zinc)
- Necrolytic migratory erythema
- Disseminated intravascular coagulopathy.

Symmetrical lupoid onychodystrophy
This is the most common immune-mediated condition of the nails, affecting dogs between 3 and 8 years of age. The German Shepherd Dog is predisposed, but cases have been reported in Rottweilers and Schnauzers. Initially there may be a single nail affected on two or more paws, but within 2–9 weeks all nails are affected. There is sloughing of nails, with poor and brittle nail regrowth. Affected dogs are lame. Bacterial secondary infection can occur. The condition is regarded as a reaction pattern with several possible causes (e.g. food hypersensitivity, drug toxicity). Biopsy is required for diagnosis.

Some response has been reported to an elimination diet and antibiotics. Most cases require immunomodulating drugs, e.g. glucocorticoids or the tetracycline/niacinamide combination. Response usually takes 3–4 months, but most cases relapse on cessation of therapy.

Idiopathic onychodystrophy
This features multiple nail and paw involvement but is not secondary to other conditions such as onychomadesis and onycholyis. Secondary infection is seen but there is poor response to antibiotics. Breeds associated with the condition include the Siberian Husky, Dachshund, Rhodesian Ridgeback, Rottweiler and Cocker Spaniel (spaniels can have seborrhoea). Older dogs are more prone. Diagnosis involves biopsy. Some response has been reported to oral treatment with gelatin or biotin; retinoids have also been tried, with variable response.

Idiopathic onychomadesis
This condition is seen in German Shepherd Dogs, Whippets and English Springer Spaniels, and possibly in the Rottweiler. Onychomadesis with secondary infection under the nail plate, onychoschiziasis and onychorrhexis are seen. Changes in the mineral composition of the nail may also occur. Diagnosis involves biopsy. Some cases respond to pentoxifylline (15 mg/kg q8–12h).

References and further reading
Miller WH, Griffin CE and Campbell KL (2013) Muller and Kirk’s Small Animal Dermatology, 7th edn. WB Saunders, Philadelphia
Disorders of the paw
Chapter 29

QUICK REFERENCE GUIDES

QRG 29.1 Applying a foot bandage

1. Trim the nails if overgrown.

2. Apply padding between the toes, and also under the stopper pad and dew claw if present.

Using a layer of cotton wool bandage, commence at the dorsal aspect of the paw and roll the bandage down over the distal aspect of the paw and up to the palmar/plantar aspect. Then roll the bandage back on itself down to the distal aspect of the paw and back up to the dorsal aspect. Continue by wrapping the bandage around the paw in a spiral fashion from the distal aspect to the top, with the bandage overlapping by about half to two-thirds of its width, covering the whole paw.

3. Apply a conforming bandage on top in a similar fashion and secure with tape.

4. Cover again, this time using adhesive bandage.

Bandage care

- A plastic bag can be used (e.g. re-used intravenous drip bags, which are very strong) to protect the bandage when the dog is walking outside. The bag should be removed when indoors to prevent condensation.

- Some dogs may require bitter sprays applied to the dressing to prevent chewing, or in some cases an Elizabethan collar may be necessary.

1. Apply two strips, crossed at right angles, over the distal end and secure them up the sides.

2. Cover the whole foot with the bandage, in a spiral fashion as above, finishing with the adhesive bandage applied to the dog’s hair at the top.
**Disorders of the paw**

### Chapter 29

#### QUICK REFERENCE GUIDES

**QRG 29.2 Toe amputation**

**Patient positioning and preparation**
- Positioning of the dog can vary depending on size and limb shape: dorsal or ventral recumbency may be suitable but often, particularly with long thin legs, it is easier to place the dog in lateral recumbency and use an assistant to support the leg.
- Hair is clipped from the foot and the toe to be removed and the skin prepared aseptically. It is often helpful to soak the foot in a bath of the chlorhexidine scrub solution.

**Equipment**
- A basic surgical kit is required.

**Technique**
1. Make an incision in the interdigital webbing on either side of the digit to be removed, on both the dorsal and plantar/palmar surfaces. The author prefers to make joining incisions at the proximal end of the digit, a few millimetres distal to the metacarpophalangeal or metatarsophalangeal joint, resulting in a skin flap.
2. Dissect free the flexor and extensor tendons, ligaments and joint capsule.
3. Haemorrhage is usually profuse but easily controlled with haemostats, though the digital vessels at the proximal end of the toe usually need ligation.
4. Incise through the metacarpophalangeal or metatarsophalangeal joint with the scalpel blade and dissect the digit free. Scrape the joint surface with a scalpel blade to remove any remaining tissue.
5. Draw the upper and lower skin flaps over the end of the remaining bone and suture in place. Suture the wound edges of the remaining digits as shown, using far–far–near–near sutures (see Figure 29.6) of 3/0 USP polypropylene, creating a U-shaped suture line between the toes.

**Postoperative care**
- Dressings are applied and changed every 3 days until the sutures are removed after 10 days. It is important to stress that dressings must be kept dry and clean.

**QRG 29.3 Dew claw removal under general anaesthesia**

**Patient preparation**
- The region around the dew claw is clipped and prepared aseptically.

**Equipment**
- A basic surgical kit is required.

**Procedure**
1. An elliptical incision is made around the base of the dew claw.
QRG 29.3 continued

2

- Many hindleg dew claws do not possess a proximal phalanx. In this case the digit can be removed by severing the soft tissue attachments with scissors. The blood vessel is then ligated.

- Where this is not the case, the digit is abducted to dissect down to the metacarpophalangeal or metatarsophalangeal joint, and the dorsal common and axial palmar digital blood vessels are ligated. A scalpel blade is used to cut through the tendons, ligaments and joint capsule, and then to disarticulate the joint. The digit is then removed.

3

- The dead space is closed using 2 metric (3/0 USP) polyglactin 910.

4

- Skin closure is routine, using an intradermal suture or skin sutures.

Postoperative care

- A soft padded dressing is applied for 3–5 days. It should be stressed to the owner that this must be kept dry.

- This is a clean elective surgical procedure and should not require antibiotic cover.

- Strict rest is advised.

- Where external skin sutures have been used, they are removed after 10 days.

QRG 29.4 Removal of a nail and distal phalanx

This is indicated where the nail and/or nailbed has been badly traumatized, or where biopsy is required for investigation of nail disease.

Patient preparation and positioning

The toe is shaved, prepared aseptically and draped for surgery.

WARNING

Where histopathology is required, care must be taken not to remove important pathological changes.

Equipment

A basic surgical kit is required.

Technique

1

- Make an elliptical incision around the nailbed.

5

- Remove the nail and phalangeal bone.

2

- Dissect the distal phalangeal bone free, preserving the footpad.

3

- Ligate the digital blood vessels.

4

- Disarticulate the joint with a scalpel blade.

Wound following removal of 3rd phalanx and nail, showing the end of the 2nd phalangeal bone and the footpad flap.
Disorders of the paw

Chapter 29

QUICK REFERENCE GUIDES

**QRG 29.4 continued**

6. Draw the pad over the distal segment of the 2nd phalangeal bone and suture it to the skin to close the defect.

7. Skin sutures (2 metric (3/0 USP) polypropylene) are placed for added security.

Coaptation of wound edges with subcuticular sutures of 2 metric (3/0 USP) polyglactin 910.

Postoperative care

A foot bandage is applied and changed every 3 days until the skin sutures are removed 10 days after the operation. It is very important to stress to the owner that the dressing must be kept clean and dry.

Removed nail and 3rd phalanx. These can be sent for histology.

Skin sutures (2 metric (3/0 USP) polypropylene) are placed for added security.

Draw the pad over the distal segment of the 2nd phalangeal bone and suture it to the skin to close the defect.
There is method in the seeming madness of dealing with the anus and tail in one chapter:

- Similar clinical signs may be seen with disorders of the two structures
- Surgery of the tail is occasionally performed to improve conditions of the anus
- Problems with the tail may occasionally lead to anal problems.

Thus, the two are inextricably linked.

Common presenting signs

- Many dogs with diseases of the tail or anus present with tenesmus and chewing or licking of the tail base, perineum, inguinum or hindlimbs. These signs are not exclusive to specifically anal or tail problems (Figure 30.1); they can also be caused by skin infections or irritations (with fleas being the number one suspect; see Chapter 27), urinary disorders (see Chapter 26) or behavioural problems (see Chapter 12). While many clients will attribute anal irritation to worms, in the majority of cases worms are the least likely cause.
- Irritation of the tail may cause dyschezia and may even result in the passage of faeces, which the owner may perceive as faecal incontinence or a breakdown in house training.
- Pain on sitting or walking may reflect disease in the tail or perineum but could also indicate a locomotory problem (see Chapter 15).
- A reluctance to wag the tail, or miscarriage of the tail, may be due to anal or perineal problems.
- Impacted anal sacs or perineal hernias may present as lumps in the perineal area.
- Owners may have noticed an unusual or unpleasant smell emanating from their dog’s rectum. This may be due to flatulence caused by fermentative processes, or may be a sign of infection of the perineum or impaction of the anal sacs.
- Blood may be present in the faeces: digested blood from the upper gastrointestinal tract makes the faeces dark and tarry (melaena); or fresh blood may be produced either at the end of defecation or mixed in with the faeces (haematochezia).
- Fresh blood coming from the rectum unassociated with defecation is termed rectorrhagia.

History

On initial presentation, a full history should be taken, including signalment. Very young puppies are more likely to have a developmental problem, such as atresia ani; whereas older or mature dogs may have neoplasia or chronic diseases. The duration of signs is important, and whether any particular seasonal or diurnal aspect to the condition has been noticed.

It is important to keep an open mind. For example: the presence of faecal staining around the anus may indicate diarrhoea, or it may be secondary to straining due to anal sac impaction, congenital abnormalities, or tail base pain. Older male dogs may have hyperplasia of the perianal glands that causes the anus to become thickened and irregular and may predispose to perineal faecal soiling.

Physical examination

The skin and fur of the perineum should be examined initially for signs of fur loss, wounds, self-trauma or masses. A gloved hand should be used to examine the anus gently and to gain an appreciation of the level of pain or discomfort the patient may be experiencing. Many dogs find rectal examination threatening and may become aggressive: this is more likely to happen if they are in pain.

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**Table 30.1** Conditions that may cause faecal straining or tenesmus.
1. A lubricant such as K-Y jelly or Vaseline should be used to facilitate insertion of a gloved first finger into the anal ring.

2. If the right hand is used, the thumb may be rotated around the finger on the outside to enable any masses to be palpated.

3. The anal sacs should be felt and assessed for fullness and the presence of any masses. At this stage, light pressure can be used to attempt to empty the sacs (see later). Any discharge should be examined for blood and other abnormal secretions.

4. Progressing the finger deeper, the rectal mucosa should be palpated for any masses or strictures. Strictures will feel like tight bands and may be very painful.

5. The rectum should feel like a symmetrical tube; any deeper recesses laterally may indicate rectal diverticula or perineal hernias.

6. In a male dog, the prostate gland should be palpated on the ventral floor of the pelvis, and assessed for size, symmetry and discomfort.

7. Finally, the dorsal pelvic canal should be palpated carefully to feel for any enlargement of the sublumbar lymph nodes. This is especially important if any masses have been palpated in the anal sacs.

8. Having removed the finger, the glove should be very carefully examined for the presence of blood.

**Common disorders of the anus**

The disorders below are described in approximate order of commonness.

**Anal sac disease**

Anal sac disease is probably the most common perineal problem seen in first-opinion practice, and should be at the top of the differential list for any dog presented for biting the tail base or ‘scooting’. Most cases involve anal sac impaction, although abscessation and neoplasia are also common. Anal sac neoplasia is discussed later.

Diagnosis of the presence of anal sac disease is often evident from the history; however, a careful rectal examination should reveal enlargement of one or both anal sacs, presence of blood in the discharge, or a mass lesion.

**Anal sac impaction**

The anal sacs lie between the external and internal anal sphincter muscles. As the sacs have no muscles themselves, emptying relies on the glands being squeezed between the external sphincter and faeces during defecation, or on sudden firm contraction of the external sphincter (e.g. in a fear response). Although how the sacs become impacted is not completely understood, there are several predisposing factors (Figure 30.2).

In most cases, emptying the sacs is simple and curative. The sacs may be emptied by external or internal compression.

- **External compression** involves placing a gloved hand over the anus, coming up from below, so that the thumb is placed at about the 8 o’clock position and the third finger at about the 4 o’clock position. The fingers and thumb are firmly but gently squeezed together with a slight upwards movement.
  - It is prudent to have some cotton wool or tissue in the hand to catch any fluid.
  - Although better tolerated by most patients, the external method may fail to empty the sacs sufficiently, and does not allow for palpation of the sacs, which may reveal additional disease (e.g. thickening of the sac lining or masses).

- **Internal compression** involves inserting a lubricated and gloved index finger just within the anus, coming up from below; the thumb is then brought towards this on the outside, at around the 8 o’clock position. The sac should be easily palpable. Using moderate pressure, the sac is squeezed from the outer margin towards the anal ring. The process is repeated for the other sac, this time inserting the thumb and using a finger to squeeze from the outside.
  - Provided the digit is inserted gently and relatively slowly, there is rarely a problem with the size of the digit: after all, the faecal girth of even a small dog is usually greater than the thumb.

**PRACTICAL TIP**

Always position the dog with its anus pointing away from the client – and from yourself. Occasionally, the secretion can fire quite a distance!

Depending on the duration of impaction, and the presence of other sac disease, the secretion may appear clear or cloudy and yellow, grey or brown in colour; the consistency may be watery or creamy, have flocculent material within it, or can even be a thick paste. Figure 30.3 demonstrates the variety of anal sac contents that may be found.

**WARNING**

The presence of blood indicates inflammation. Unless a mass is palpable, it is almost certainly indicative of sacculitis.

In some instances it can be difficult to evacuate the sacs; this may be due to the presence of a thickened, inspissated (dried out) secretion, or due to inflammation at the sac opening. Repeating the compression in a day or so may help; if not, flushing the sac under sedation may be necessary (see later). If an individual dog requires its anal sacs emptying frequently, or the process is not well tolerated, then it may be worth considering an anal sacculectomy.
Conditions of the anus, perineum and tail

Chapter 30

Anal sacculitis
Sacculitis may be a sequel to chronic impaction, or may appear acutely. Sedation or anaesthesia is often required to express the sacs, as they may be extremely painful. Having emptied the sacs, they should be cannulated and flushed with enough sterile Hartmann's (lactated Ringer's) solution to result in a clear fluid being expressed (usually flushing with 3–5 ml eight to ten times). Antibiotics may be instilled into the sac, or administered systemically (the latter is generally recommended). There is no clear consensus as to whether steroids are beneficial.

Anal sac abscess
Anal sac abscesses are most likely progressions of anal sacculitis. They are often associated with a marked degree of malaise and discomfort: affected dogs may be reluctant to sit down, and often really resent examination of the perineum and anus. A burst abscess is relatively easy to spot: there is usually a purulent discharge (which may or may not be blood-tinted) lateral to the anus, and the overlying skin is invariably reddened and inflamed. It may be more difficult to identify an anal sac abscess that has not burst, although a painful fluctuant mass adjacent to the anus is strongly suggestive.

Treatment involves lancing and flushing the abscess under sedation or general anaesthetic. Isotonic saline or dilute chlorhexidine solution may be used; however, if the latter is used then it is important to take a swab of the lanced abscess discharge before flushing. A bacteriological swab may be used; or a small nip of anal sac tissue may be placed in a sterile glass bottle and sent for culture. Whilst awaiting the results, a broad-spectrum antibiotic (the author’s preference is either potentiated amoxicillin or clindamycin) should be commenced and non-steroidal anti-inflammatory drugs (NSAIDs) given. If the condition fails to clear completely, or recur, anal sacculectomy should be performed (Figure 30.4). This procedure is described and illustrated in the BSAVA Manual of Canine and Feline Wound Management and Reconstruction.

Trauma
As with any injury, the rest of the animal should be carefully examined for the presence of other injury or illness (see Chapter 10).

Perineal wounds should be flushed with copious amounts of sterile isotonic fluid, and meticulously examined for any tears in the mucosa of the anus or rectum.

- Simple wounds to the rectal mucosa (those not involving the submucosa) may be repaired using absorbable monofilament suture material such as poliglecaprone. Although continuous suture patterns may be used, interrupted sutures may be easier to place and will not cause distortion of the mucosa if they are not tied too tightly.
The skin of the perineum may be sutured with absorbable or non-absorbable monofilament material; monofilament is preferred as there is less risk of capillary tracking of infection. If non-absorbable material is used, the temperament of the patient must be borne in mind: how easy will removal of the sutures be? Deep wounds to the perineum may warrant the placement of surgical drains. Antibiotics are generally advised for 5 days after repair. Analgesics must be used: lack of adequate analgesia may well lead to tenesmus or self-trauma.

Complications such as anal stricture or faecal incontinence can occur with even relatively minor wounds, and clients should therefore be warned as to the potential seriousness. For detailed advice on the management of anal wounds see the BSAVA Manual of Canine and Feline Wound Management and Reconstruction.

Neoplasia

Tumours of the anus and tail may cause many of the clinical signs described above (straining; biting at the rear end; scooting; and tending to sit down suddenly, as if stung). Owners may notice a mass or swelling, or blood in the faeces or bleeding from the anus; they may also notice changes in shape of the faeces, e.g. ribbon-like faeces due to compression from a tumour. Whilst anal sacculitis or abscessation may also present as bulges or perineal swellings, most of these cases are fairly easy to diagnose due to: the presence of blood or pus within the anal sacs; erythema and pain over the swelling; and pyrexia in many cases. Any type of soft tissue tumour may be found in the perineal region, and it is also possible for osteosarcoma of the ischial tuberosity to present as a bulging mass in this area. Another potential differential would be a perineal hernia (see later).

To help distinguish between types of ‘lump’, a careful history should be taken; this should include the signalment and perineal signs, and whether any other clinical signs have been noticed, such as polyuria/polydipsia (PU/PD), weight loss or weakness.

Rectal examination should be carried out to assess the presence of any masses, integrity of the pelvic wall (see Perineal hernia, later) and whether there is any enlargement of the sublumbar lymph nodes.

**WARNING**

Care should be taken during rectal examination, especially if there is a history of straining. Insertion of a finger may cause considerable pain and trigger tenesmus, or even defecation. It may be wise to mention this to the owner prior to the examination, and to withdraw and consider sedation if there are signs of pain.

Fine-needle aspiration (FNA) of the mass and cytology may be carried out (see Chapter 28), although it may be wise to examine the area first using radiography or ultrasonography if a perineal hernia is suspected, to avoid the risk of leakage of bowel flora or of damage to the urinary tract.

Rectal polyps

Rectal polyps may occasionally protrude from the anus during straining. They often bleed and may resemble dark cherries or strawberries (Figure 30.5).

Rectal examination should reveal the presence of a pedunculated mass, although care should be taken as many dogs will find the examination uncomfortable and may try to strain. It is usually possible to remove polyps near the anus by ‘pull-through’ surgical techniques (Figure 30.6; see also BSAVA Manual of Canine and Feline Abdominal Surgery); this is usually curative, although some polyps may undergo malignant transformation (see BSAVA Manual of Canine and Feline Oncology).

![Image](30.5) This 9-year-old neutered Labrador Retriever bitch presented with a history of tenesmus and haematochezia, passing fresh blood from the anus. A rectal polyp was palpable via a rectal examination. The patient has been anaesthetized to allow exteriorization of the polyp, which may be seen as a small, strawberry-like lesion.

Rectal pull-through procedure in a 10-year-old male neutered cross-breed dog with a circumferential mass within the rectal wall. A circumferential incision has been made around the anal ring, and the rectum has been drawn caudally through the anal ring, exteriorizing the mass. The mass was then excised and the rectal mucosa sutured to the anal ring, thus recreating the rectal stoma. In this case, the mass was found to be a leiomyoma. The patient went on to survive for a further 18 months before being euthanased for an unrelated problem.

![Image](30.6) Rectal pull-through procedure in a 10-year-old male neutered cross-breed dog with a circumferential mass within the rectal wall. A circumferential incision has been made around the anal ring, and the rectum has been drawn caudally through the anal ring, exteriorizing the mass. The mass was then excised and the rectal mucosa sutured to the anal ring, thus recreating the rectal stoma. In this case, the mass was found to be a leiomyoma. The patient went on to survive for a further 18 months before being euthanased for an unrelated problem.
Anal sac neoplasia

The presence of an obvious mass within the region of the anal sac should always alert the clinician to the possibility of apocrine gland adenocarcinoma. These highly malignant tumours, which are over-represented in Cocker Spaniels, may present as an obvious mass, noticed by the owners, or as a perineal problem, with scooting, chewing of the rear end or dyschezia. Alternatively, cases may present with PU/PD, due to the production of a protein (similar to parathyroid hormone) that causes hypercalcaemia. Although anal sac adenocarcinoma was previously felt to be more common in bitches, recently it has been found that there is no sex predisposition.

If a mass is felt, blood samples should be taken for a routine biochemical and haematology profile; calcium measurement should be included. Rectal examination should be carried out to check for the presence of enlarged sublumbar or iliac lymph nodes: these may be palpated dorsal to the rectum, as far cranially as possible, although radiography and ultrasonography should be used to investigate the pelvic canal fully.

Lymphadenopathy indicates a poor prognosis, although dogs may have extended survival times after removal of the primary mass and the lymph nodes together with chemotherapy. For a detailed discussion of the stabilization of hypercalcaemia prior to surgery, and of the techniques for excision and chemotherapy for apocrine gland adenocarcinoma, the reader is directed to the BSAVA Manual of Canine and Feline Oncology.

Perianal adenoma

Also known as circumanal adenoma or hepatoid gland adenoma, this is the most common perineal tumour of the dog. Since hepatoid adenomas are predominately androgen-dependent, they tend to occur much more frequently in intact male dogs.

Perianal adenomas can present as rounded or pedunculated masses (Figure 30.7) of variable size, usually on the anal ring, although they can originate from the ventral tail base. They can also present, however, as thickened, irregular tissue, often with bluish inclusions, diffusely spread around the perineal area. These latter lesions may be difficult to remove, although if present in intact males will usually respond to castration.

Although malignant variations exist (perianal adenocarcinoma), these are by far a minority and on the whole the prognosis is good for perianal adenomas. Cytology (e.g. of a fine-needle aspirate) prior to surgery will allow a decision to be made regarding the necessary margin of excision:

- A benign adenoma may be removed with minimal margins
- Adenocarcinomas will require wide margins, with consideration of removal of draining lymph nodes and adjunct chemotherapy.

Castration at the time of mass removal tends to prevent or reduce recurrence. If castration is performed prior to lump removal, even quite large masses may shrink, allowing for easier surgical removal at a later date.

External blockage

Long-haired dogs may develop matting of the hair over the anus (pseudocoprostasis). In the author’s experience, Yorkshire Terriers, Bearded Collies, Shetland Sheepdogs and Cavalier King Charles Spaniels seem to be relatively more prone. The condition tends to occur in these breeds following bouts of diarrhoea. If left unnoticed, severe constipation or obstruction can result. The condition also predisposes to fly strike. Treatment involves clipping the matted hair away and ensuring that no hardened faeces remain in the rectum.

Anal prolapse

Anal prolapse may occur after repeated or prolonged tenesmus. It is more common in young or immature dogs, following gastrointestinal disease, although it can be seen in dogs of any age as a sequel to cystitis, colitis, rectoanal tumours, or other conditions causing straining. The mucosa of the anus is seen to protrude through the anal orifice. Rectal prolapse is a more severe presentation, involving part or all of the rectum.

Diagnosis of anal prolapse is straightforward, based on appearance, although it is important to rule out the presence of anal or rectal tumours, or of intussusception (although that is very uncommon). The anal prolapse is replaced under sedation or general anaesthesia, usually requiring a little lubrication. A purse-string suture may be required to prevent recurrence. Treatment of the inciting cause is required.

Faecal incontinence

Faecal incontinence may occur after surgery of the anus, although it is uncommon (unless surgery is ventral to the anus and risks damaging the pudendal nerve); up to 50% of the external anal sphincter may be removed with no long-term ill effects, although temporary incontinence (lasting several weeks) may be seen. It is more common to see faecal incontinence with neurological disease, or after bilateral perineal hernia repair. Whatever the cause, the prognosis for faecal incontinence is grave. Owners should be carefully counselled on the unlikely chances of recovery, and euthanasia should be offered. It can be a very emotive decision for the client to make, and they may feel that they are being selfish by contemplating euthanasia for a dog that may otherwise be...
well. The hygiene and public health implications of a faecally incontinent dog may be useful considerations in coming to a decision.

**Anal strictures**

Strictures are formed by scar tissue and fibrosis replacing the normal mucosa or submucosal layers of the anus or distal rectum. This may be due to neoplasia, or wounds (surgical or otherwise) affecting the anal ring. The usual signs of straining and dyschezia may be seen, with thin stools typically being produced. Diagnosis is by rectal examination, and treatment is by repeated bougienage of the anus under general anaesthesia. If the stricture fails to improve, or recurs, then surgery such as a rectal pull-through (see above) may be required (see *BSAVA Manual of Canine and Feline Abdominal Surgery*).

**Perianal fistula**

Also termed anal furunculosis, this is a condition typically seen in middle-aged German Shepherd Dogs, although it has been reported in other breeds (especially collies and Irish Setters). The clinical signs are of ulcerated wounds and discharging sinuses in the perianal region (Figure 30.8). Detailed discussion of the aetiology and various treatment options are beyond the scope of this chapter, and the reader is recommended to see the *BSAVA Manual of Canine and Feline Gastroenterology* and the *BSAVA Manual of Canine and Feline Abdominal Surgery* for more information. It seems likely that there is an immune-mediated basis to the disease, possibly akin to Crohn’s disease in humans; certainly most cases will respond to a combination of dietary management and immunosuppressive medication, such as ciclosporin. Surgical excision of recalcitrant lesions may be required, but there is no rationale for performing a high amputation of the tail, which has historically been proposed.

**Perineal hernia**

The pelvic diaphragm essentially supports the rectum and separates the abdominal contents from the pelvic canal. It consists of the levator ani and coccygeus muscles, the external anal sphincter and the perineal fascia. Atrophy of elements of the pelvic diaphragm, under the influence of testosterone, allows the rectum to deviate and dilate into the potential space created; it may also allow caudal abdominal viscera to enter the perineal area.

Affected dogs may present in obvious pain, with a unilateral or bilateral perineal swelling, though more often the presentation revolves around tenesmus and disturbance of normal defecation. If the bladder or prostate gland is involved in the hernia, stranguria may also be present (see Chapter 26). With few exceptions, intact male dogs are affected. Breed predispositions are at present uncertain: historically, docked breeds seemed to be more prone, suggesting a potential aetiology for the condition; however, data are lacking for the incidence of perineal hernias since the ban on docking came into force in the UK in 2007.

Diagnosis of perineal hernia is from clinical presentation and by rectal examination, which will confirm a lack of rectal support on one or both sides, and of dilatation or sacculation of the rectum. Ultrasonography may be useful to look for retroflexion of the bladder or prostate gland. Surgical reconstruction of the pelvic diaphragm through muscle transposition is the treatment of choice (see *BSAVA Manual of Canine and Feline Abdominal Surgery*) and castration is mandatory.

**Disorders of the tail**

The disorders below are described in approximate order of commonness.

**Trauma**

As with any injury, the rest of the animal should be carefully examined for the presence of other injury or illness (see Chapter 10). For detailed advice on the management of tail wounds see the *BSAVA Manual of Canine and Feline Wound Management and Reconstruction*.

Assessment should be made as to the nature and age of the wound, as this will affect the management of the wound and the consideration for antibiotics. The tail should be examined to see whether there is any loss of sensation, or whether any bumps, suggesting fracture, can be palpated. If so, radiographic examination should be performed.

**PRACTICAL TIP**

Tail chasing may occur in some breeds (particularly Staffordshire Bull Terriers) as part of a central neurological dysfunction. Owners may interpret this as a response to pain. There is also a risk of self-trauma.

It is worth noting that even minor lacerations to the tail can be notoriously frustrating to treat: bandaging is difficult; self-trauma is common; and wagging of the tail leads to further haemorrhage and dehiscence. Owners of dogs with tail injuries should be made aware of this at the outset, as many seemingly trivial wounds can result in the need for amputation of all or part of the tail.

Initial wound treatment involves copious flushing to remove as much debris as possible. A fresh wound may then be closed primarily if enough skin is present: however, tension on the wound is to be avoided, as
this will lead to poor wound healing and may result in necrosis of the tail skin. If it is not possible to close a tail wound without tension, management of the wound with dressings to encourage healing by secondary intention (granulation tissue formation) should be performed. Such wounds often heal surprisingly well on the tail, though it is worthwhile mentioning to the owner that it may take 3–4 weeks for healing to occur.

If the tail tip shows signs of chronic trauma (usually evidenced by dried necrotic skin, though in severe cases bone may be visible), it is best to perform an amputation of the tail tip as such wounds rarely heal and are subject to repeated self-trauma. The amount of tail that needs to be removed will depend on the extent of the injury and also on the behaviour of the dog. Removal to a level one to two vertebrae proximal to the injured portion will usually suffice; however, in breeds that wag the tail excessively it may be wiser to remove more to prevent future injury.

Tail gland hypertrophy
Tail gland hypertrophy (‘stud tail’) is a common presentation of older intact male dogs, although it can also be seen in castrated males and occasionally in bitches. The proximal third of the dorsal tail is well imbued with modified sweat glands known as supracaudal glands. Hypertrophy of these glands may occur due to idiopathic causes or hypothyroidism, but the condition is most commonly due to hyperandrogenism and is commonly linked to testicular neoplasia. Dogs present with a chronic history of hair loss along the dorsal base of the tail, and the appearance is typically that of scabby, thickened, irregular skin. There may be secondary inflammation or infection from self-trauma, although any irritation is usually of low grade. An intact male should be carefully examined for testicular causes. Castration will often improve the condition, although in many cases the alopecia and hyperplasia will persist. Antibiotics and regular use of a degreasing shampoo may help improve the condition in idiopathic cases. If no improvement is seen, it may be necessary to perform a biopsy (preferably surgically) to distinguish the condition from hepatoid adenoma or (rarely) adenocarcinoma.

Tail fold intertrigo (corkscrew tail, ingrowing tail)
The foreshortened deformed tail characteristic of certain breeds (English and French Bulldogs, Boston Terrier, Pug) may in some individuals be so deviated that a considerable skin fold exists at the tail base. As with skin folds elsewhere around the body, these are prone to irritation, inflammation and infection. Affected individuals may present with typical signs of anal and tail disease (scooting, biting at the rear, discomfort whilst sitting). Diagnosis is by careful examination of the tail base to find the sore skin fold. There will frequently be a malodorous discharge and there may be a build up of waxy secretions from the supracaudal glands. Treatment involving attention to hygiene (bathing) and topical corticosteroid application may ameliorate mild cases, but definitive treatment of severe cases relies on resection of the skin fold (see BSAVA Manual of Canine and Feline Wound Management and Reconstruction).

Tail paralysis or paresis
There are various potential causes for lowered tail carriage in dogs (Figure 30.9). By far the most common cause in general practice is ‘swimmer’s tail’, a muscular paresis often seen in Labrador Retrievers (whether they have been swimming or not).

### Neurological
- Lumbosacral stenosis
- Degenerative myelopathy
- Disc disease
- Meningitis
- Spinal neoplasia
- Spinal trauma

### Pain
- Tail trauma
- Infection
- Neoplasia
- Perineal and anal disease

### Miscellaneous
- ‘Swimmer’s tail’: primarily in Labrador Retrievers, though can affect Golden and Flat-Coated Retrievers, English Pointers and setters
- Cold bathing: hypothermic neuropaxia
- Conformation

#### 30.9 Causes of poor tail carriage.

A full clinical examination should include obtaining a detailed history regarding any lameness or ataxia. Proprioceptive deficits in the hindlimbs (see Chapter 16) makes a neurological cause more likely. Neurological testing should assess the presence or absence of superficial pain perception; if this is absent, then deep pain perception should be assessed, and the tail should be examined for evidence of perfusion injury (a pulse oximeter is invaluable for this purpose).

**WARNING**

Never test for deep pain sensation if superficial pain is present.

Treatment will depend on the underlying cause. ‘Swimmer’s tail’ usually responds to NSAIDs, although it may take 2 weeks to improve.

### References and further reading


Page numbers in *italics* indicate figures.

Page numbers in **bold** indicate QRGs.

**A**

Abdominal auscultation 276
Abdominal effusion  classification 280–1
diagnostic tests 278–9, 282, 283
Abdominal pain  clinical approach 274–6
diagnostic tests 276–7
differential diagnosis 274
imaging 277–8
treatment 281
Abdominal palpation 96–7, 104, 157, 276
Abdominal percussion 276
Abdominal swelling  clinical approach 279
diagnostic tests 278–9, 282, 283
differential diagnosis 278
effusion 280–1
imaging 278, 282
treatment 281
Abdominocentesis 278, 282
Abrasion 105
Abscess 321
anal sac 341
intraoral 213, 215, 216
prostatic 292
Acephromazine 79, 88, 206, 271
Acral lick dermatitis 302–3
ACTH see Adrenocorticotrophic hormone
Acute collapse  clinical approach 93–7
diagnostic tests 97–9
differential diagnosis 93–4
emergency stabilization 94–5
Acute laryngotracheitis 261
Acute moist dermatitis 302
Addison’s disease see Hypoadrenocorticism
Adenocarcinoma 211, 343
Adenoma 239, 323, 343
Adrenal glands, ultrasonography 175
Adrenaline 91
Adrenocorticotrophic hormone stimulation test  for hypoadrenocorticism 175, 197, 198
for hypoadrenocorticism 198–9

Aggression  clinical approach 132–4
definition 122
and euthanasia 79, 80
‘Ladder of’ 120, 133
and premedication for surgery 72
in trauma patients 100
Aglepristone 50, 293
Alanine aminotransferase 159
Albumin 159
Alkaline phosphatase 159, 196
Alopecia  non-pruritic 330
diffuse/patchy 307–9
localized 307
symmetrical 304–7
pruritic 301, 303
Alopecia areata 307
Alopecia X 306–7
ALP see Alkaline phosphatase
Alpha-2 adrenoceptor agonists 103
ALT see Alanine aminotransferase
American Society of Anesthesiologists (ASA) scale 69, 72
 Amitraz 329
Amoxicillin 103
Ampicillin 103
Amputation  nail and distal phalanx 337–8
tail 344–5
toe 336
Amylase 158
Anaemia 97–8
Anaesthesia, considerations for surgery 68, 69, 72
Anagen defluxion 309
Anal disorders  blockage 343
clinical approach 339–40
faecal incontinence 343–4
neoplasia 342–3
perianal fistula 344
perineal hernia 344
prolapse 343
sac disease 340–1
strictures 344
trauma 104, 341–2
Anal furunculosis 344
Anal prolapse 343
Anal sac disorders  abscess 341
impaction 340–1
Index

neoplasia 343
sacculeitis 341
Anal sacculectomy 341
Anal strictures 344
Analgesia
for acute abdomen 275
for osteoarthritis 183
for spermatic cord torsion 292
in trauma patients 102–3
for urinary tract disorders 289
(see also specific drugs)
Ankylostoma caninum 37
Angiostrongylus vasorum 87, 99, 258, 260, 263, 268
Animal Welfare Act 2006 123
Anterior cruciate ligament 185
Anterior lens luxation 242
Antibacterial drugs 103, 209, 291, 303, 341
(see also specific drugs)
Antidepressant drugs 131
Anti-emetic drugs 163, 172, 248
Anti-epileptic drugs 112–13
Antifungal drugs 304, 308
Appetite stimulants 172
Archeopsylla erinacei 35
Arousal
and body language 121, 122
definition 119–20
and learning 126–8
and stress 128
(see also specific behaviour problems)
Arrhythmia 86, 87, 92, 268–70
Arthroscopy 184
Ascites
definition 278
diagnostic approach 279
differential diagnoses 96
misdiagnosis 281
Aspergillosis 208, 210–11
Assisted feeding 172, 174
Assessing for senior/geriatric dogs 32
Body condition score 40, 41
Body fat index 40, 42
Body language canine 119–23
client 17, 18, 21, 23–4
Body temperature, prior to parturition 57
Bone tumour 177, 178
Bordetella bronchiseptica vaccination 34
Brachycephalic obstructive airway syndrome (BOAS) 260
Brain imaging 111
lesions 110, 186
and proprioceptive deficits 191
Breeding see Reproduction
Bronchi, conditions affecting 259, 262
Bronchoscopy 262
Bullous pemphigoid 312
Calcification 313
Callus 98, 168

Bandages see Dressings
BARF diet 46–7
Barking 121, 122
Bedding 4, 5
Behaviour
advice for owners 123–5
breed differences 121–2
 canine–human communication 120–2
client questionnaire 144–53
clinical approach 129–32
common conditions
agression 132–4
biting 134–5
compulsive behaviour 135
Coprophagia 135–6
destructive behaviour 136
digging 136–7

Cachexia 172
Caesarean section equipment 10
indications 58
surgical technique 67
Cages 4–5, 7
Calcinosis circumscripta 313
Calcinosis cutis 313
Callus 313

Fear 137–8
house soiling 138–9
hyperactivity 139
separation-related problems 140–2
sound sensitivity 139–40
modification therapy 130–2
puppy 123–8
Benign prostatic hyperplasia 291
Bereavement 80–1
Bile acids 159
Bile peritonitis 276, 280
Bilirubin 159
Biopsy
gastrointestinal tract 162
oral cavity 214
skin 299–300, 317
superficial mass 320, 326
Bite wounds 107–8, 254
Biting, clinical approach 134–5
Black hair follicle dysplasia 307
Bladder see Urinary bladder disorders
Blood gas analysis 158
Blood glucose measurement 84–5, 199
Blood screening tests
annual 31
pre-anaesthetic 70–1
for senior/geriatric dogs 32
serological testing 34
Blood urea nitrogen decreased 167
Buprenorphine 79, 102
Burns
affecting feet 328
clinical approach 107
features 105
oral cavity 219
Butoxamine 79, 88
BVA Health Schemes 51
Canine acne 312
Canine adenovirus 210
Canine cognitive dysfunction syndrome 131
Canine herpesvirus 59
vaccination 34
Canine pancreatic lipase immunoreactivity (cPLI) 158–9, 204, 277
Cardiac murmurs 266–8
Cardiac tamponade 85
Cardiogenic shock 85, 86, 96
Cardiomegaly 267–8
Cardiopulmonary resuscitation (CPR) 90–2
Dehydration
in neonates 58, 59
with vomiting and diarrhoea 158, 162–3

Demodex spp. 32, 308, 315, 329, 330

Dental chart 223

Dental disease 215, 216

Dental examination 221–2

Dental formula 222

Dental procedures 225–8

Dermacentor spp. 35

Dermatitis
crural lick 302–3
atopic 300–2, 329
contact 304, 329
of the feet 329–30
lip-fold 218
pyotraumatic 302
superficial necrolytic 311
zinc-responsive 311

Dermatomyositis 309

Dermatophytosis 308, 309, 330

Dermoids 239

descemetocoele 237

Deslorelin 295
for breeding control 50–1

Destructive behaviour 136

Dew claw removal 329, 336–7

Dexmedetomidine 103

Diabetes insipidus 164, 166, 168
treatment 169, 199–200

Diagnostic peritoneal lavage 283

Diaphragmatic hernia 105

Diarrhoea
differential diagnosis 156
exploratory laparotomy 161–2
history 156
imaging 159–61
laboratory tests 158–9
in neonates 59
physical examination 156–7
treatment 162–3

Diazepam 88, 111, 113, 117

Diet/feeding
assisted 172, 174
in behaviour problems 131
bowls 8
choice of food 46–7
in diabetes mellitus 200
food hypersensitivity/intolerance 303–4
for life-stages 31–2, 43–6
nutritional assessment 40–3
and obesity 47
postoperative 73
during pregnancy 45
puppy 28, 44–5
in vomiting and diarrhoea 162

Digging 136–7

Digit amputation 328, 336, 337–8

Dipylidium caninum 35, 37, 304

Direct ophthalmoscopy 229–30

Discoid lupus erythematosus 311–12

Distemper vaccination 34

Distichiasis 234–5

Distributive shock 85, 87

Dog catchers 8

Dog fight injuries see Bite wounds

Dominance 121

Doppler ultrasonography 268

Drains, thoracic placement 273

Dressings 106
burns 107
foot 335
fracture stabilization 108

Dysphagia 173, 212, 214–15

Dyspnoea
clinical approach 87–8, 262–4
diagnostic tests 265–6
imaging 265, 266

Dystocia 58, 284

Dysuria/stranguria 284

E
Ear cleaning 247

Ear disorders
alopecia 307
clinical approach 244–5
cytology 249
foreign bodies 246
haemotoma 245–6, 251
laceration 246
mites 35, 245
otitis externa 246–8
media 248
otoscopy 250

Echinococcus spp. 37, 47

Echocardiography 259, 265, 266, 268

Ectopic cilia 235

Ectopic ureters 295

Ectropion 233

Elbow
assessment 179
conditions 181
effusion 178

Emergency stabilization
in acute abdomen 275
in acute collapse 94–5
in hypoperfusion 85–7
for major body systems 84–5
monitoring 89
in neurological disorders 88–9
secondary 89–90
in trauma 102–3
wounds 101, 105–8
see also Triage

Endoscopy
gastrointestinal 161
vaginal 55

Endothelial dystrophy 238

Energy requirements, for life stages 43–6

Enrofloxacin 103

Entropion 232–3

Epidermal collarettes 299, 309

Epilepsy see Idiopathic epilepsy

Epistaxis 207

Emergency stabilization
in acute abdomen 275
in acute collapse 94–5
in hypoperfusion 85–7
for major body systems 84–5
monitoring 89
in neurological disorders 88–9
secondary 89–90
in trauma 102–3
wounds 101, 105–8

see also Triage

Endoscopy
gastrointestinal 161
vaginal 55

Endothelial dystrophy 238

Energy requirements, for life stages 43–6

Enrofloxacin 103

Entropion 232–3

Epidermal collarettes 299, 309

Epilepsy see Idiopathic epilepsy

Epistaxis 209

emergency stabilization 207

Epithelial dystrophy 237

Epitheliotrophic lymphoma 310

Eulides 216, 217

Erosions/ulceration 310–12

Erythema multiforme 311
Index

Escherichia coli 46, 293

Euthanasia
bereavement 80–1
client communication 76, 78
consent 76–7
decision-making 76–7
decision-making 32
end-of-life examination 32
equipment 10
preparation for 77–8
preparation for 79
techique 79–8
Exercise-induced hyperthermia 202, 205–6
Exocrine pancreatic insufficiency 159, 170, 173
Exploratory laparotomy 161–2

Eyes
conjunctival sac 236
cornea 237–9
diagnosis 229–32
eyelids 232–5
examination 229–32
eyelids 232–5
examination 229–32
examination 232–5
examining 232–5
examining 232–5
eyleids 232–5
examining 232–5
IRIS 239–40
lens 241–2
nasolacrimal system 236
phacoelastic membrane 235
retina 243–3
sclera 236
(see also specific conditions)

F

‘Fading puppy’ syndrome 59
Faecal analysis 158
Faecal incontinence 343–4
FAST scans 278, 282
Fear (objects/people/places) 137–8
Feeding
see Assisted feeding; Diet/feeding
Fenbendazole 36
Fentanyl 102, 103
Fibrosarcoma 217
Fine-needle aspiration
indications for 320
indicators for 320
fine-needle aspiration
indications for 320
fine-needle aspiration
indications for 320
Firocoxib 103
First aid advice for owners 83
Fits see Seizures
Flail chest 104
Fleas 35, 300
Flooding, learning technique 126
Flucloxacillin 103
Fludrocortisone 199
Fluid therapy
in cardiopulmonary resuscitation 91
contraindications 86
and diagnosis of uroabdomen 281
in hyperparathyroidism 201
in hypoadrenocorticism 199
in hypovolaemia 85–6
in neonates 59
pre-anaesthetic 71
in trauma patients 102
in vomiting and diarrhoea 162–3
Flumazenil 91
Follicular casts 310
Follicular dysplasia 308–9
Follicular lipidosis 307
Folliculitis 303
Foot/footpad
alopecia 330
amputation
dew claw 336–7
nail and distal phalanx 337–8

depigmentation 332
dressing 335
foreign bodies 328, 330–1
hyperkeratosis 331–2
injuries 327–9
nail disorders 332–4
neoplasia 331
pruritus/erythema 329–30
ulceration 332

Foreign bodies
aural 246
conjunctival 236
corneal 238–9
foot 328, 330–1
gastrointestinal 160, 162, 278
nasal 210
oesophageal 155
oral cavity 215–16
throat/neck 253–4
vaginal 291
Fractures
emergency stabilization 108
os penis 294
physseal 177, 178
rib 104
Fructosamine 199
Fundus, assessment 232
Furosemide 88, 201, 272
Furunculosis 303, 344
Fusobacterium spp. 108

G

Gabapentin 103, 113
Gagging 255
Gait abnormalities 113–14
see also Lameness
Gallop rhythm 256
Gamma-glutamyl transferase 159
Gastric dilatation–volvulus
and obstructive shock 87
radiographic signs 99, 160, 277
Gastroduodenoscopy 161
Gastrointestinal parasites 36–7
and raw diets 46–7
GDV see Gastric dilatation–volvulus
Generalized progressive retinal atrophy (gPRA) 242
Geriatric vestibular syndrome 248–9
German Shepherd Dog folliculitis, furunculosis and cellulitis 311
GGT see Gamma-glutamyl transferase
Gingival hyperplasia 216
Glaucoma 240–1
Globe/orbit
assessment 231
Horner’s syndrome 115, 188, 243
proptosis 243
retrolubular space-occupying lesions 243
Glucocorticoids
contraindications in shock 87
in hypoadrenocorticism 199
in inflammatory rhinitis 210
in intervertebral disc disease 191
in otitis externa 247
Granuloma 321, 330–1
and acral lick dermatitis 302–3
idopathic sterile 313
Grass awns
as aural foreign bodies 246
as interdigital foreign bodies 330
Gunshot injuries 105
Habituation, learning technique 126
Haemaphysalis 35
Haematomesis 159, 162
Haematochezia 339
Haematomyoma 321
aural 245–6, 251
Haematuria 284–5
Haemobademen 280, 281
Haemoglobinuria 285, 286
Haemoptysis 260
Haemotherax 273
Hallotasis 212, 214–15
Handling and restraint
dog catchers 8
for euthanasia 79
during examination 12
muzzles 11
sedation 11, 79
Harvest mites 36, 330
Head trauma 104
Head tilt see Vestibular disease
Heart see Cardiorespiratory disorders
Heat stroke
clinical approach 202–4
treatment 205–6
Hepatitis vaccination 34
Hernia
diaphragmatic 105
perineal 344
Hip
assessment 180, 185
conditions 181
dysplasia 182, 183
Histiocyctoma 322
History taking
in acute abdomen 275
in acute collapse 95
in behaviour problems 129, 144–53
in cardiac murmurs 267
in cardiorespiratory disease 256, 260, 263
in dysphoea 263
in hyperthermia/pyrexia 202–3
in inappetence 171
in lameness 177
in lethargy/weakness 193
in nasal disease 207
in neurological cases 109–10
in oral cavity disorders 213
in polyuria/polydipsia 165–6
during puppy consultations 29
in skin diseases 297–8, 318
in spinal disorders 186
in superficial masses 319
 technique 16–18
in urogenital problems 285
in vomiting and diarrhoea 156
in weight loss 173–4
Holter monitor 270
Hookworms 32
Horner’s syndrome 115, 188, 243
Hotz–Celsius resection 233
House soiling 138–9
Hyperactivity 139
Hyperadrenocorticism
clinical signs 196, 306
diagnosis 175, 196–7
treatment 198
and urine specific gravity 168
Hypercalcaemia
causes 201
paraneoplastic 201, 324–5, 343
and polyuria/polydipsia 166, 167, 168
treatment 169
Hypercholesterolaemia 167, 171
Hyperglycaemia
and diabetes mellitus 199–200
differential diagnosis 84–5
and polyuria/polydipsia 167
in vomiting and diarrhoea 158
Hyperkalaemia 167, 198
Hyperkeratosis 310, 331–2
Hyperparathyroidism 200–1
Hyperphosphataemia 200, 201
Hyperthermia/pyrexia
clinical approach 202–4
diagnostic tests 204–5
pyrexia of unknown origin 205
treatment 205–6
Hypoadrenocorticism
diagnosis 159, 198–9
treatment 199
Hypoalbuninaemia 158, 167, 171
Hypocalcaemia 200
Hypoglycaemia
differential diagnosis 84–5
in neonates 59–60
in polyphagia 171
in vomiting and diarrhoea 158
Hyponatraemia 167
Hypoparathyroidism 200
Hypoperoxidation 298
Hypotherrura 287
Hypothermia, in neonates 59
Hypothyroidism
clinical approach 195–6, 306
treatment 196, 306
and vestibular dysfunction 249
Hypovolaemia, in neonates 59
Hypovolaemic shock 85–6, 96

I
Icterus see Jaundice
Idiopathic epilepsy
 diagnosis 111
 treatment 111–13
Idiopathic nasodigital hyperkeratosis 310
Idiopathic onychodystrophy 334
Idiopathic onychomadesis 334
Idiopathic sterile granuloma 313
Imepitoin 112
Immune-mediated haemolytic anaemia 97–8
Immune-mediated polyarthritis 98–9
Inappetence 171–2
Indirect ophthalmoscopy 230
Infection control 6–7
Inflammatory hyperpigmentation 314
Inflammatory rhinitis 210
Injection site reactions 321
Insulin therapy
in diabetes mellitus 169, 199–200
in hyperkalaemia 199
Insulina 170
Interstitial cell tumours 294
Intervertebral disc disease 191
Intracranial hypertension 89
Intracocular pressure (IOP) and glaucoma 240–1
Intraoral abscesses 213, 215, 216
Iris
assessment 231
atrophy 239
Index

cysts 239
neoplasia 239
uvelitis 239–40
Ischaemic folliculopathy 330
Isolation 6–7
Isosthenuria 287
Itraconazole 304, 308
Ivermectin 308
Ixodes spp. 35
Jaundice 219, 220
Joint disorders
  assessment 179–80
  differential diagnosis 181–2
  effusion 178
  hip dysplasia 183
  imaging 182–3
  osteoarthritis 183–4
Juvenile cellulitis 312–13
Juvenile vaginitis 292
Juvenile/adolescent health checks 30
K
Kennel cough 261
Kennels 4, 5, 7
Keratinization disorders 310
Keratoconjunctivitis sicca (KCS) 236
Keratomalacia 238
Keratoma 332
Ketamine 103
Ketoconazole 304, 308
Klebsiella 247
L
Lacerations 105
  footpad 328
  pinna 246
Lactation
  and associated endocrinological changes 57
  and neonatal feeding behaviour 58
  nutritional requirements 45
Ladder of aggression 120, 133
Lameness
  differential diagnosis 181–2
  history 177
  observation 176–7
  physical examination 177–80
  radiography 182–3
  treatment 183–4
  see also Foot/footpad: Gait abnormalities
Larynx, conditions affecting
  Leishmania vaccination 34
Lips
  assessment 231
  cataracts 241
  luxation 241–2
Leptospirosis vaccination 34
Lethargy/weakness
  clinical approach 193–4
  in diabetes mellitus 199–200
  diagnostic tests 195
  differential diagnosis 114, 194–5
  in hyperadrenocorticism 196–8
  in hyperparathyroidism 200–1
  in hypoadrenocorticism 198–9
  in hypoparathyroidism 200
  in hypothyroidism 195–6
Levetiracetam 113, 117
Levothyroxine 196, 306
Lice 35, 304
Lichenification 299
Lick granuloma 302–3
Lidocaine 91, 102
Life-stage healthcare
diet/feeding
  adult maintenance 43–4
  during pregnancy/lactation 45
  puppy 28, 44–5
  senior/geriatric dogs 31–2, 45–6
health checks
  adult, routine 30–1
  juvenile/adolescent 30
  post-parturition 26–7
  pregnancy/pre-whelping 25–6
  puppy 27–9
  senior/geriatric dogs 31–2
vaccination 33–4
Limbal melanoma 236
Lincomycin 103
Linognathus setosus 35, 304
Linoleic acid 310
Lipase 158
Lip-fold dermatitis 218
Lipid keratopathy 238
Lipoma 322
Liver enzymes
  in liver disease 159
  in polyphagia 171
  in polyuria/polydipsia 167
Lomustine 310
Low-dose dexamethasone suppression (LDDS) test 175, 197
Lower motor neuron (LMN) lesions 188, 189
Lumbosacral pain assessment 188
Lumps see Superficial masses
Lungs see Cardiorespiratory disorders
Lungworm 37, 260
Luteinizing hormone 57
Lymphadenopathy 253, 322
Lymphocytic/plasmacytic rhinitis 210
Lymphoma 310, 324–5
Magnetic resonance imaging
  hydrocephalus 111
  intracranial mass 111
  spinal disorders 190
Malassezia
  affecting nails 333
  affecting skin 304, 316
  otitis 247
  pododermatitis 329
Malignant effusion 281
Malignant histiocytosis 323
Malignant hyperthermia 202, 205–6
Mammary gland tumour 323
Marbofloxacin 103
Mast cell tumour 324
Masticatory muscle myositis 115, 218
Mating see Reproduction
Medetomidine 79, 103
Mediastinum, conditions affecting 262
Megaesophagus 154, 261–2
Meibomian gland tumour 322
Melaena 339
Melanoma 216–17, 236, 239
Melatonin 307
Meloxicam 102
Melting corneal ulcers 238
Menace response 230
Methadone 102
Metronidazole 103
Microcardia 264
Microsporum spp. 299, 308
Milbemycin 308
Minimum database 84–5, 93–4, 97–8, 158, 276–7
Muscle condition score 40, 42
Muzzles 11
Myasthenia gravis 115
Mydriasis
therapeutic 240
Myelography, in spinal disorders 190
Myoglobinuria 285
Nail clipping, technique 332–3
Nail disorders 332–4
Naloxone 91
Nasal disease
aspergillosis 210–11
clinical approach 207–9
differential diagnosis 207
epistaxis 209
emergency stabilization 207
foreign bodies 210
imaging 209
neoplasia 211
rhinitis 209–10
rhinoscopy 209
Nasal polyps 209
Nasolacrimal system, disorders of 236
Naso-oesophageal feeding tube 172
Neck pain assessment 188
Negative punishment, learning technique 128
Negative reinforcement, learning technique 127
Nematodes
assessment 26, 58
cleft palate 58, 217
dew claw removal 329
feeding behaviour 58
hypoglycaemia 59–60
hypothermia 59
infection 59
innocent cardiac murmurs 266
trauma 59
Neoplasia
anus/perineum 343–3
aural 249
bone 178
cytological features of malignancy 320
eyelid 234
foot/footpad 331
iris 239
limbal 236
malignant effusion 281
nasal 211
oral cavity 216–17
paraneoplastic syndromes 325
and pre-anaesthetic tests 71
prostatic 292
retrobulbar 243
superficial masses 322–5
testicular 293–4
thyroid 253
urinary tract 290
vaginal/vulvar 291
(see also individual neoplasms)
Neotrombiculosis 304, 330
Nephrogenic diabetes insipidus 164, 166, 168
Neurological examination
in acute collapse 97
in emergencies 88–9
forms 118
screening 110, 116
in spinal disorders 186–9
Neuromuscular disease 115
Neutering techniques
castration 64–6
ovariophysterectomy 60–4
Nictitating membrane, disorders of 235
Nodular granulomatous episcerokeratitis 236
Non-associative learning techniques 126
Non-steroidal anti-inflammatory drugs (NSAIDs)
in acute abdomen 275
in burns patients 107
in heat stroke 206
in oesteoarthritis 183
in trauma patients 102, 103
(see also specific drugs)
Nuclear sclerosis 241
Nutrition see Assisted feeding; Diet/feeding
Nystagmus 114, 248
Obesity 31–2, 47
Obstacle courses 230
Obstructive shock 85, 87, 96
Oclacitinib 302
Odour signalling 121
Oesophagitis 155
Oestrous cycle
and diabetes mellitus 200
stages 52–3
suppression 49
vaginal cytology 54
vaginal discharge 292
vaginal hyperplasia 291
Onychectomy 333
Onychodystrophy 334
Onychomadesis 334
Operant conditioning, learning technique 127–8
Ophthalmic examination 229–32
Ophthalmoscopy 229–30
Opioids 102, 103
(see also specific drugs)
Oral cavity
biopsy 214
burns 219
dental disease 215
examination 213–14, 221–2
foreign bodies 215–6
history taking 213
imaging 214
and lip-fold dermatitis 218
masticatory muscle myositis 218
mucous membranes 219–20
neoplasia 216–17
palate defects 217
Index
Index

Index Canine.indd   354
17/06/2015   15:47
Polyuria/polydipsia

clinical approach 165–6
definition 164
diagnostic tests 166–8
differential diagnoses 164
treatment 169

Positioning aids 9
Positive punishment, learning technique 127–8
Positive reinforcement, learning technique 123–4, 127
Potassium bromide 113
Potassium supplementation, for vomiting and diarrhea 163
Posterior lens luxation 242
Prednisolone 199, 210, 243, 302, 309, 313
Pregnancy
abnormal 293
diagnosis 56
health checks 25–6
normal 56, 57
nutritional requirements 45
parturition 67–8
pseudopregnancy 52
termination 50
Preventive healthcare
castration 30, 51, 64–6
clinical examination 32–3, 38–9
life-stages
adult 30–1
delivery of life 32
juvenile 30
neonatal 26–7
post-parturition 26–7
pregnancy/pre-whelping 25–6
puppy 27–9
senior/geriatric 31–2
ovariohysterectomy 49–50, 60–4
parasite control 35–7
vaccination 33–4
weight management 47
Primary keratinization disorders 310
Primary lens luxation 241–2
Progesterone assay 55, 57
Progestogens, for oestrus suppression 49
Propofol 117
Proprioception testing 97, 187
Propulsos 243
Prostatic abscess 292
Prostatic cysts 291–2
Prostatic neoplasia 292
Prostatectomy 291
Protein-losing nephropathy 168
Proteinuria 168
Proteus 247, 329
Pruritus 300–4, 329–30
Pseudomonas 238, 247, 329
Pseudopregnancy 52
Psychogenic polydipsia 164, 166, 169
Psychotropic drugs 131
Pulmonary oedema 261, 268
Pulmonary thromboembolism 264–5
Puncture wounds 105
Pupil, assessment 231
Pupillary light reflex 231
Puppies
behavioural development 123–8
cleft palate 58, 217
coprophagia 135
destructive behaviour 136
developmental orthopaedic conditions 181
dew claw removal 329
health checks 27–9
innocent cardiac murmurs 266
nutritional requirements 44–5
presubpubertal neutering 49–50, 51
socialization classes 12, 123, 125
Pyelonephritis 164, 168
Pyoderma 303, 309, 311, 316
Pyogranuloma 331
Pyometra 166, 288, 293
Pyothorax 265, 273
Pyotraumatic dermatitis 302
Pyrexia of unknown origin 205
see also Hyperthermia/pyrexia

Q

Quick reference guides (QRGs)
abdominocentesis 282
ACTH stimulation test 175
adrenal gland, ultrasonography 175
amputation
dew claw 336
nail and distal phalanx 337–8
toe 336
anterior cruciate ligament assessment 185
aural haematoma, surgical treatment 251
cardiopulmonary resuscitation 90–2
diagnostic peritoneal lavage 283
ear cytology 249
FAST scan 282
foot bandages 335
hip laxity assessment 185
low-dose dexamethasone suppression (LDDS) test 175
neurological examination 116
oral cavity examination 221–2
otooscopy 250
pericardiocentesis 271–2
physical examination 38–9
skin biopsy 317
skin cytology 315–16
skin scrapes 314–15
status epilepticus, treatment 117
superficial masses
biopsy 326
fine-needle aspiration 326
teeth examination 221–2
traction 225–8
scaling and polishing 222–4
thoracocentesis and thoracic drain placement 273
trichogram 316

R

Rabies vaccination 34
Radiography
in acute abdomen 277–8
aspergillosis 211
in cardiorespiratory disorders 257–8, 261–2, 264–5, 267–8
in nasal disease 209
oral cavity 214
in orthopaedic disease 182–3
during pregnancy 56
small intestine 160, 278
in spinal disorders 190
urogenital system 287–8
in vomiting and diarrhea 159–60
Rectal examination 339–40
Rectal polyps 342
Reflex dysynergia 294
Regurgitation 154–5, 260
Relaxin assay 56

Reproduction
fertility assessment 53–4
oestrous cycle 52–3
optimum mating time 54–5

parturition
advice for owners 26
caesarean section 58, 67
postpartum health checks 26–7, 58
stages 57–8
subinvolution of placental sites 293

pregnancy
abnormal 293
diagnosis 56
health checks 25–6
normal 56, 57

nutritional requirements 45
pseudopregnancy 52
termination 50

prevention 49–51
castration 64–6
ovariohysterectomy 60–4

puberty 51–2

Reproductive tract disorders
anatomical abnormalities 290–1
benign prostatic hyperplasia 291
clinical approach 284–6
cystic endometrial hyperplasia 293
cytology 288
imaging 287–8
neoplasia 291, 292, 293–4
phimosis/paraphimosis 294
prostatic abscess 292
prostatic cysts 291–2
prostatitis 291
pyometra 293
spermatic cord torsion 292
trauma 291, 294
vaginal hyperplasia 291
vaginitis 292–3

Respiratory disorders see Cardiorespiratory disorders
Restraint see Handling and restraint
Retching 255
Retina
Collie eye anomaly 242
detachment 242–3
generalized progressive retinal atrophy 242
Retrolubar space-occupying lesions 243
Rhinitis 209–10
Rhinoscopy 209, 211
Road traffic accidents 104–5

S
Salivary gland disease 252–3
Salmonella 46–7, 158
Salter–Harris type II fractures 178
Sarcopostes scabiei 36, 245, 303, 315
Scaling/crusting 298, 299, 303, 309–10
Schiff–Sherrington phenomenon 188, 189
Schirmer tear test 231, 236
Schnauzer comedone syndrome 313
Sclera, disorders of 236
Scrolled third eyelid cartilage 235
Seasonal allergic rhinitis 209–10
Seasonal flank alopecia 308
Sebaceous adenitis 309–10
Sebaceous gland tumours 323
Sedation
in dyspnoea 88
for euthanasia 79
for handling 11, 72

Seizures
advice for owners 112
clinical approach 109–10
diagnosis 111
treatment
emergency stabilization 88, 111–12, 117
long-term management 112–13

Semen collection/evaluation 53–4
Seminoma 294
Senior/geriatric dogs
health checks 31–2
nutritional requirements 45–6
re-anaesthetic testing 71
vestibular syndrome 248–9
Sensory ataxia 113–14
Separation-related problems 140–2
Septic peritonitis 276–7
Seroma 321–2
Sertoli cell tumour 293–4
Sex hormone-related alopecia 308
Sézary syndrome 310
Shock 85–7, 96
Shoulder
assessment 179–80
conditions 181
Sialocele 252–3
Sick sinus syndrome 270
Sinus arrhythmia 269
Sinus draining tract 254
Sinus tachycardia 270

Skin
biopsy 299–300, 317
client questionnaire 318
cytology 299, 315–16

don-pruritic conditions affecting feet 330–2
alopecia 299, 304–9
erosions/ulceration 310–12
lumps/nodules 299, 313
papules/pustules/vesicles 298, 312–13
pigmentation disorders 298, 314
scaling/crusting 298–9, 309–10
(parasites 35–6
pruritic conditions
acral lick dermatitis 302–3
affecting feet 329, 332
atopic dermatitis 300–2
cheyletiellosis 304
contact dermatitis 304
flea hypersensitivity 300
food hypersensitivity 303–4
Malassezia 304
neotrombiculosis 304
pediculosis 304
pyotraumatic dermatitis 302
scabies 299, 314–15
sarcotic mange 303
scrapes 299, 314–15
trichogram 299, 316
Wood’s lamp examination 299
Slide agglutination test 98
Soft tissue sarcoma 324
Sound sensitivity 139–40
Spermatic cord torsion 292
Spermatogenesis 53
Spinal disorders
clinical approach 186–9
diagnostic tests 190–1
differential diagnoses 189
disc disease 191
emergency stabilization 89
lesion localization 188–9
pain assessment 188
paralysis/paresis, non-spinal causes 191–2
proprioception testing 187
spinal reflexes 187–8
Spinal reflexes 187–8
Spontaneous chronic corneal epithelial defect (SCCED) 237
Squamous cell carcinoma 217
Staphylococcus spp. 108, 247, 303, 329
Status epilepticus 111–12, 117
Sterile nodular panniculitis 313
Steroid-responsive meningitis–arteritis 190, 204
Stertor 260
Stick injuries see Pharyngeal stick injuries
Stifle
assessment 180, 185
conditions 181
effusion 178
Stranguria see Dysuria/stranguria
Streptococcus spp. 247
Stress
and arousal 128
and body language 121
definition 120
and fear 137–8
and learning 126–8
in puppies 125
Stress leucogram 167, 171
Stridor 260
'Stud tail' 345
Submandibular lymphadenopathy 253
Superficial masses
clinical approach 319–20
diagnostic tests 320, 326
foot nodules 330–1
simple 321–2
tumours
benign 322–3
malignant 323–5
Superficial necrolytic dermatitis 311
Superficial pyoderma 303
Supraventricular premature complexes (SVPCs) 269
Surgical cases
anaesthetic considerations 68, 69, 72
consent 19–20, 68–9
intraoperative euthanasia 77
patient preparation 71–2
postoperative care 72–5
preoperative assessment 69–71
'Swimmer's tail' 345
Swinging flashlight test 231
Symmetrical lupoid onychodystrophy 334
Systemic lupus erythematosus 204, 311–12

T3 195
T4 195, 196
Tachyarrhythmias 269–70
Tail disorders
clinical approach 339–40
neurological signs 104–5, 345
paralysis/paresis 345
tail fold intertrigo 345
tail gland hypertrophy 345
trauma 344–5
Tail docking regulations 29
tail fold intertrigo 345
tail gland hypertrophy 345
Taenia spp. 37, 47
Tapeworms 37

Tarsus
assessment 180
conditions 181

Teeth
dental disease 215
examination 213, 221–2
extraction 225–8
calculi 345

Thalidomide 309
Temporal mandibular joint disease 218
Tenesmus 339
Testicular disorders
neoplasia 293–4
retention 66
spermatic cord torsion 292
Tetracycline/niacinamide 310
Thermometer injuries see Burns
Third eyelid, disorders of 235
Thoracic auscultation 87, 96, 256–7, 260–1, 263–4
Thoracocentesis 265, 273
Throat/neck disorders
foreign bodies 253–4
gagging/retching 255
neoplasia 253
sialocele 252–3
submandibular lymphadenopathy 253
Thyroid gland disorders
hypothyroidism 195–6
and vestibular dysfunction 249
neoplasia 253
Thyroid releasing hormone (TRH) 195, 196
Thyroid stimulating hormone (TSH) 195, 196
Thyroxine see T4
Tibial thrust test 185
Tibial tuberosity fracture 260
Ticarcillin 103
Ticks 35
Tobramycin 103
Tolenuamic acid 102
Tongue lacerations 218
Total solids 84, 276–7
Toxascaris leonina 36
Toxocara canis 27, 36, 47
Toxoplasma gondii 47
Trachea, conditions affecting 259, 262
Tramadol 103
Transitional cell carcinoma 290
Trauma
anal/perineal 104, 341–2
ears 246
evacuation 234
foot/footpad 327–9
globe 243
nail 333
oral cavity 212, 218
spinal 89
tail 344–5
wound 50–1
vaginal 291
Trauma
hospital 83–5, 100–2
telephone 82–3
Trichodectes canis 35, 304
Trichoepithelioma 323
Trichogram 299, 316
Trichophyton mentagrophytes 308
Trichuris vulpis 37
Triiodothyronine see T3
Trilostane 198, 307
Index

Trombicula (subgen. Neotrombicula) autumnalis 36, 304, 330
Trypsin-like immunoreactivity 159, 170, 174
Tumours see Neoplasia
Tympanic membrane rupture 246

U
Ulceration
corneal 237–8
footpads 332
Ultrasoundography
in acute abdomen 278, 282
adrenal glands 175
in cardiorespiratory disease 265, 266, 268
Doppler 268
FAST scan 278, 282
urogenital system 286
in vomiting and diarrhoea 160–1

Uncinaria stenocephala 37
Upper motor neuron (UMN) lesions 188–9
Ureters, ectopic 295
Urethral catheterization 286, 289
Urethral retrograde hydropulsion 289
Urethral sphincter mechanism incompetence (USMI) 295
Urinalysis 286–7
in polyuria/polydipsia 166–8
in senior/geriatric dogs 32
Urinary bladder disorders
detrusor muscle hyper-reflexivity 295
neoplasia 290
neurogenic dysfunction 294
urooliths 277, 289
Urinary incontinence 294–5
Urinary tract disorders
clinical approach 284–6
congenital abnormalities 295
diagnostic tests 286–7
imaging 287–8
infection 290
neoplasia 290
obstruction 289, 295
rupture 266
Urine
abdominal effusion 280–1
appearance 286
collection 286
cortisol:creatinine ratio 197
culture 287
dipstick tests 167, 286–7
output, normal range 164
overflow 294–5
protein:creatinine ratio 167, 168
retention 295
scalding 294
specific gravity
measurement 287
in polyuria/polydipsia 165, 168
Urinary scalding 294
Uroabdomen 280–1
Urolithiasis 277, 289
USMI see Urethral sphincter mechanism incompetence
Utero verdin 293
Uterus, disorders of 293
Uveitis 239–40
Uveodermatological syndrome 314

V
Vaccination guidelines 33–4
Vaginal disorders
cytology 54, 288
hyperplasia 291
neoplasia 291
strictures 290–1
trauma 291
vaginitis 292–3, 294
Vaginal strictures 290–1
Vaginitis 292–3, 294
Vasculitis 312
Ventricular fibrillation 91
Ventricular premature complexes (VPCs) 269
Vestibular disease 248–9
central versus peripheral 113–14
Veterinary surgery/clinic, making dog-friendly
equipment 7–10
handling and restraint 11–12
nurse-led clinics 12–13
practice design 1–7
Viral rhinitis 210
Vision, assessment of 230–1
Vitiligo 314
Vomiting
differential diagnosis 156
exploratory laparotomy 161–2
gagging/retching 255
history 156
imaging 159–61
laboratory tests 158–9
physical examination 156–7
physiology 155
versus regurgitation 154
treatment 162–3
Vulvar disorders
anatomical abnormalities 290
neoplasia 291
Waiting areas, dog-friendly 2–3
Wards, dog-friendly 4–5
Warming devices 10
and neonates 59
Waste disposal 1, 2, 7
Water
bowls 8
deprivation test 168
intake, measurement 164
Weakness see Lethargy/weakness
Web resection 328
Weight loss
clinical approach 172–4
treatment 174
Weight management 47
Wood’s lamp examination 299
Working dogs, nutritional requirements 46
Wounds
classification 105–6
dog bite 107–8, 254
drainage sinus tracts 254
dressings 106
emergency stabilization 101, 105–8
postoperative 73–4, 75

Z
Zinc-responsive dermatosis 310, 311
Zoonosis 35–7, 158, 303, 308
The past 20 years has seen a remarkable growth in the knowledge base and skillset available in small animal practice – the range of specialist information now available may appear daunting to the relatively inexperienced vet looking for a concise answer to one of the many common problems presented in the consulting room. The BSAVA Manual of Canine Practice condenses the information from many important areas into a single volume.

Written by vets with many years’ experience in general practice, this new Foundation Manual aims to provide the first port of call for the busy practitioner faced with uncertainty over a new case. Common sense, first line approaches are given in a problem-oriented setting stemming from the nose-to-tail examination.

The BSAVA Manual of Canine Practice is divided into three sections:

■ The ‘art’ of canine practice
■ Common consultations
■ Common clinical presentations

Quick Reference Guides are provided throughout the Manual highlighting practical treatments or techniques.

CONTENTS: The dog-friendly practice; Consultation technique; Preventive healthcare: a life-stage approach; Nutrition; Reproductive management; Considerations for surgical cases; Euthanasia: considerations for canine practice; Dealing with emergency cases; Acute collapse; The trauma patient: assessment, emergency management and wound care; Seizures, ataxia and other neurological presentations; Behaviour problems: a brief guide; Regurgitation, vomiting and diarrhoea; Abnormalities of eating and drinking; Lameness; Paralysis and spinal pain; Lethargy and weakness in endocrine disease; Hyperthermia and pyrexia; Epistaxis, sneezing and nasal discharge; Oral and dental problems; Ocular problems; Ear problems and head tilt; Abnormalities of the throat and neck; Cardiorespiratory problems; Abdominal pain and swelling; Urination problems; genital discharge; Skin problems: a clinical approach; Lumps and bumps; Disorders of the paw; Conditions of the anus, perineum and tail; Index

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