Guide to Bovine Clinics

4th Edition

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Lynn Lanessa
Jasmin Stelvio
Jackie Harvey
Trish Caham
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to

Butch Ketel

one of the few down to earth veterinary teachers,
always having the most fun,
and a true friend
The C-Section

The phone rang. It was four o'clock... the other four o'clock.
A worried voice came on the line, "Sorry to wake ya, Doc,
But I've got a calvy heifer I think's in trouble, some.
I can't see nothin' but the tail. I'm wonderin',
could ya come?"

Next thing I know I'm in his barn and starin' at this beast.
Ten feet tall, she was, I swear, and big as a bus, at least.
I laid a ladder 'gainst her flank. A C-section, I decide.
After proper preparations there's a window in her side.

I poke my head inside the hole to have a look around
A pair of parakeets fly out and flutter to the ground.

Followed by a barkin' dog and blur of Gambel's quail.
A hunter in fluorescent orange, hot on the covey' tail.

I climbed on in and smelled the air. No doubt, Progesterone.
I leaned against the rumen wall and heard a slide trombone!
A corps of cuds came chomping by in step with a marching band
All tooting on a catheter. I was Alice in Kidneyland.

A school of pies came slicing by: meringues, mangos and minces
And dignitaries like the Queen and Michigan Pork Princess.
A set of Holstein heifers with their tassels all a'twirl.
The Sheep Producer's lobbyist and Snap On calendar girl.
On they came, the A.I. techs with pipette fife and drum,
A pair of unborn senators, Fetaldee and Fetaldum.
This entire cast of characters was headed for the womb.
And ridin' drag in this parade was me behind a broom.
I passed a Winchell's Donut Shop at Pancreas and Colon
And saw a New Ages singles group reliving lives and trollin'
Then took a left on Ileum and asked the Pelvic Nerve
Where I could find the Uterus, His Dendrite made a curve.

And pointed to the Oviduct that seemed to swing and sway.
I saw a blinking neon sign, said BABY CALF THIS WAY.
The cotyledons bumped my head and as I went sliding' down
"There he is," I said, at last. The calf had run, aground.

I hefted up a cloven hoof and started for the door.
Then like a flash the lights came on! I slipped upon the floor,
A scream like I ain't never heard was ringin' in my head.
I opened up my eyes and saw me standing' by my bed.

My wife was clingin' to the post and tangled in the sheets.
The slide trombone had died away as had the parakeets.
I slowly came awake to find my dream had gone kaput.
I looked down at her layin' there and let go of her foot!

By Baxter Black

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Brighton, CO 80601
Quick Reference:

Each condition is keyed by abbreviations and page number to the below commonly used reference books:


Br: *Bovine Medicine, Diseases & Husbandry of Cattle*, AH Andrew, Blackwell Scientific Publ, 1992

BR-hb: *Pocket Companion to Veterinary Medicine*, DC Blood, Bailliere Tindall, 1994


C3T: *Current Veterinary Therapy 3, Food Animal Practice*, JL Howard, WB Saunders Co, 1993

C2T: *Current Veterinary Therapy 2, Food Animal Practice*, JL Howard, WB Saunders Co, 1986


DC: *Diseases of Dairy Cattle*, SC Rebhun, Williams & Wilkins, 1995


Derm: *Large Animal Dermatology*, DW Scott, WB Saunders, 1988


GI: *Veterinary Gastroenterology*, NV Anderson, Lea & Febiger, 1992

IM: *Large Animal Internal Medicine- 2nd*, BP Smith, Mosby, 1996


Pa: *Thompson's Special Veterinary Pathology - 2nd*, WW Carlton, MD McGavin, Mosby, 1995


PP/USA/C: *Poisonous Plants of the United States & Canada*, JM Kingsbury, Prentis Hall, 1964

PP/Mt, PP/O, PP/A: *Poisonous Plants/Montana, Oklahoma or Alabama*, printed by Extension Service of each state

R-M: *Current Therapy in Theriogenology 2*, DA Marrow, WB Saunders, 1986

S-O: *Textbook of Large Animal Surgery*, F Oehme, Williams & Wilkins, 1988


Tox: *Clinical and Diagnostic Veterinary Toxicology*, Osweiler, Kendal/Hunt Publ Co, 1985

VC/T: *Vet Clinics of N Amer (VCNA), Food Animal Practice, Female Bovine Infertility*, SF Braun, 9(2) 1993

VC/S: *VCNA, Surgery of the Bovine Digestive Tract*, DG Bristol, WB Saunders, 6(2) 1990

VC/F: *VCNA, Metabolic Dizs*, TH Herdt, WB Saunders, 4(2) 1988

VC/L: *VCNA, Bovine Lameness and Orthopedics*, JG Ferguson, WB Saunders, 1(1) 1985

VC/M: *VCNA, Update on Bovine Mastitis*, KL Anderson, 9(3) 1993

VC/N: *VCNA, Bovine Neurologic Diseases*, JC Backer, 3(1) 1987
Introduction - 3rd & 4th Editions

Like all infants, this book has grown into a more complete and usable clinical reference. Most of the changes made to the 3rd and 4th editions were of the "editing" kind. New references were added and updated, along with a few conditions not included in the second edition. "Student's" was dropped from the original title as practitioners have found it a useful addition to their clinic; those initially using it now practicing what they learned. It is hoped that it will be useful to all who endeavor to do just that, practice.

Susan Pasquini

Introduction - 2nd Edition

This second edition is the result of pretending to be a senior vet student and using the first edition. Obvious holes became evident and the other students preferred the more completeness of the "Equine Guide". New Additions:

- Over 360 conditions have been added to the first edition
- A toxicology chapter and a differential diagnosis chapter have been added
- New references have been added under each new condition
- A new summary box in the lower left corner has been added to important conditions, for a qui
- Stars have been added under the references to indicate prevalence of each condition
  - *** = seen once a month
  - ** = seen once a year
  - * = maybe once a lifetime. This will vary depending on region of the country

Chapter index on first page of each chapter

Dr. John Kirkpatrick and I read through the whole text. He added his practical knowledge and the "stars" for prevalence of each condition. Dr. Gregor Morgan read the reproduction section.

The mass of information is overwhelming and this is only one of the many species you are expected to know. Who's kidding who? Veterinary schools are trying, but coming far short of helping the student get a handle on all this material. Traditionally the first 3 years are spent in classrooms cramming information. It is said that these years are to teach students how to look up information; you learn when you get out in practice. The student would be better served by exposure to the clinics at least part time all four years. If your school doesn't do this formally, take it upon yourselves. This guide will hopefully help you do this. Spend time in the clinics so that the different conditions have a "face". You need to see the conditions, not just copy down a list of symptoms to learn. Blowey & Weaver's Color Atlas of Diseases & Disorders of Cattle is a way to put pictures to the conditions. Hopefully this guide will open up the clinics for the lower classmen without trying to read an incomprehensible 200
### Condition: Tetanus, Lockjaw

**Mk 330; IM 1023; C3T 567; BR 677; Br 567; VN/N 89; Pic 205**

#### Facts/Cause:
- *Clostridium tetani*
  - Toxin producing, Spore in soil/feces
  - World wide distribution
  - All species susceptible
  - Gen. indiv. cattle, not herd outbreak
  - IP 10-14 d (wk - wks)
  - Transm.: Contamination of uterus
  - Deep puncture wounds
  - Toxin ascends nerves to spinal cord, causing ascending paralysis,
  - Reduce inhibition to motor nerves, causing hypertonia & spasms

#### Presentation/CS:
- Initially muscle spasms
  - Masseter, neck, hindlimb
  - General stiffness
  - Tonic spasms & hyperesthesia
  - Sound & tactile stimuli
  - Muscular rigidity
    - "Lockjaw" (masseter)
    - Prolapse of 3rd eyelid
    - Erect ears
    - Retracted eyelids
    - "Pump handle" tail
    - Sawhorse stance
    - Bloat
    - Excess salivation
    - Regurgitation of feed & water
    - Convulsion - recumbency

#### Diagnosis:
- Usually presumptive Dx: Hx & CS
- No reliable clinical test for Dx

#### Treatment:
1. Remove source
2. High levels of penicillin
3. Antitoxin if early
4. Muscle relaxation
5. Support
   - Quiet, dark stall
   - Good footing
   - Good nutrition

- Px: Good, if can make stand, better than horses; If survive 7 ds - fair to good;
- Long recovery, 3-4 wks

#### DDx:
- Polioencephalomalacia
- Enterotoxemia
- Lead toxicity
- Salt poisoning
- Bact. & viral encephalitis

### References: See inside front cover

### Treatment:

#### Prevalence:
- *** = See once a month
- ** = See once a year
- * = Maybe once a lifetime

### Summary Box: Key words

- Toxin - Inhib. on motor nerves
- CS: Muscular rigidity - "Sawhorse"
- Tx: Penicillin, Muscle relaxants, Quiet
- Px: Good if standing; Long recovery

### Prognosis (Px):
- Good
- Guarded
- Poor
- Grave
page chart. Examine an animal in the clinic at your level of knowledge. Pretend you are the veterinarian in charge. Find in the animal's chart the physical exam finding and the differential diagnosis. Think about these. Check the diagnosis and look up the condition in this guide. Then see if you can detect any of the clinical signs. Hold the medicine being used and imagine yourself administering it. Guess if the animal will survive. Check on its progress over time, refreshing your memory with the guide and other texts if you have the time, over and over. Later in lectures, when a condition comes up, you will have a specific animal that relates to it. Then read about each condition over and over again, even if you just scan the texts.

Introduction - 1st Edition

Student’s Guide to Bovine Clinics is a quick reference guide for veterinary students. It should be especially helpful during the senior year in clinics.

The idea for this guide comes directly from Heidi Tschauner’s Senior Veterinary Student’s Guide to Small Animal Clinics. Dr. Tschauner compiled her guide as a senior veterinary student to help her assess cases quickly until a more thorough reference could be located. These pocket-sized guides are compiled by many senior students to provide quick references for pertinent veterinary facts. Heidi’s idea was for seniors to help revise her book to help other veterinary students. Once Heidi put all the information in the computer, Susan Pasquini (my wife) and I arranged it into charts and Sudz Publishing published it. Its instant success has been exciting.

For the last two semesters Susan has been in her junior year of veterinary school. She brought her portable computer to class and typed the large animal medicine and surgery lectures. I then tightened them using the Merck Manual, Smith’s Large Animal Internal Medicine and a number of surgery texts, and put them into chart form. Susan would proof read and correct the charts. Then before her tests we would study from them, correcting and clarifying as we did so. This coming year I am going to pretend to be a senior again (most fun year in veterinary school!) and wander around the clinics with Susan to judge and revise the guides.

This deviates from Heidi’s idea of seniors making life easier for other seniors. Our rationalization is, having been out of veterinary school for thirteen years making anatomy books, I’ve forgotten most of this information, thus the guide will give a quick and complete review. The Student’s Guide to Bovine Clinics also goes into more detail than Heidi’s, which was a concern, changing something that works. To compensate, different sized type and bolding important information was used. The key words in the shaded box provide a handle on each condition. Bold type allows skimming facts/causes, clinical signs, diagnosis and treatment. More in-depth information is given in light type and small type. Other texts keyed under the condition allow for quick references. John Roberts did many of the cartoons. Those done by me tried to follow his style. The cartoons add life and help page recognition.
In Veterinary school I had trouble with many of the methods and attitudes of some of my professors. Many seemed to expect me to remember everything I had ever been told in classes semesters earlier. I usually didn’t! If as a child I had been lectured on the ABCs, tested two weeks later and expected to remember forever, I probably wouldn’t be able to use a keyboard today. The key to learning all this information is seeing as many patients as possible and reading as many texts on each condition over and over to supplement veterinary classes. Then go back to the guide and try to organize all the facts in your mind over and over again. Differential diagnoses, the key to diagnosis, are highlighted in a shaded box.

In the senior year many teachers embarrass students with how little they remember. When in a panic, slide around the corner and quickly read through a condition in the guide. Short term memory may allow an intelligent answer to the teacher in front of your peers.

During under class years, this may be the book to keep the forest in focus while dealing with all the trees. Classes such as pathology, clinical pathology, parasitology, virology, bacteriology, neurology, etc. deal with conditions not fully discussed until later in medicine and surgery classes. Read about them in this guide to get an overview of facts, clinical signs, diagnosis and treatment. This should make these conditions less disconnected, thus more meaningful, and easier to learn.

This Guide is incomplete, but with continued work and the help from other seniors and faculty members it may turn into the key to Bovine Clinics. Please send any ideas, criticisms, praise, corrections or charts to: Sudz Publishing
1222 S. Hwy. 377.
P.O. Box 1199
Pilot Point, Tx 76258
(940) 686-9208

Most of all, as you go through veterinary school remember the feeling on finding out that you had been accepted to veterinary school and that you would one day be a veterinarian. Veterinary school seems to kill this excitement, don't let it!

Chris Pasquini

Disclaimer: the authors do not assume any responsibility for any results obtained from the procedures, treatment, drugs, and dosages used; nor shall the author be held liable for any misinformation or errors that may have been obtained by any persons or organization using this book.

Acknowledgments: Susan Pasquini's work makes up the heart of this book, her revisions and corrections make up its complexion. John Robert's illustrations give it personality. Tory Yaphé gave it its index. I would like to thank Lynn Lankes, DaLee Caryl, Jason Steinle and other Oklahoma State University students of the class of '95 for editing. Thanks to Anne Cougar and Nancy Cathey, librarians at OSU. Thanks goes to Dr. Kerstin Thorén-Tolling for the Clinical Pathology Chart. And lastly the Students of Ross University who made my three years in paradise just that.
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Internal Parasite Control

Deworm (Spring calving)
- Cow: After calving; Before pasture
- All stock in Fall
- All stock in Spring
- As enter feedlot

Deworming program (no single program fits all area & climate conditions, below is a starting point to greatly reduce Ostertagia problems, including inhibited larvae)
- Spring calving
  - Deworm cows at end of calving season, right before turnout to summer pasture
  - Deworm spring calves by midsummer (ideal [supplement blocks, top dressing])
  - Deworm all stock in late fall (at weaning in beef calves)
  - Move to clean pasture that day
- Fall calving
  - Deworm cows before overwintering
  - Deworm all stock in Spring, before Summer pasture
- Yearling Spring calves & Fall calves
  - Deworm in late Spring
  - Deworm in Summer if intensively grazed on Summer pasture
- Beef entering feedlot
  - Deworm
- All adult
  - Spring & Fall minimum, coincide w/ management practice

Anthelmintics
- **Beef cows**
  - Ivermectin, Valbazen® (albendazole), Synanthic® (oxybendazole) or high-dose Panacur® (fenbendazole) will get inhibited Ostertagia larvae
  - TBZ® (thiabendazole), Panacur® (fenbendazole) or Levamisole will get all important GI worms, except inhibited Ostertagia larvae
- **Dairy cows**
  - Rumate® (morantel tartrate) or Baymix® (coumaphos) at any time (dry or lactating) because they have no milk withdrawal time, TBZ has 96 hr withdrawal & the rest are not recommended for dairy cows of breeding age
- **Fluke area**
  - Clorsulon or albendazole
- **Miscellaneous:** many anthelmintics used in past are infrequently used or not at all
  - Phenothiazine & hygromycin
  - Piperazine: Lungworm Tx, replaced by others because requires 3 day treatment
<table>
<thead>
<tr>
<th>Anthelmintic</th>
<th>Dose (mg/kg)</th>
<th>Gut Adult Larvae</th>
<th>Lung</th>
<th>Tape</th>
<th>Flukes Adult Immature</th>
<th>Comments</th>
<th>Withdrawal time</th>
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<td><strong>Benzimidazoles</strong></td>
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<td>Thiabendazole</td>
<td>66</td>
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<td>Mech: starve worms, Carbamate anthelmintic, Low toxicity</td>
<td>3d 96 hrs</td>
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<td>(TBZ®)</td>
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<td>• Thiabendazole (Rx 861)</td>
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<td>- Preparations: 43% oral paste, 2 or 15 g boluses, 3.3% cubes &amp; suspension</td>
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<td>- 110 mg/kg recommended for severe infections, Tx may be repeated in 2-3 wks</td>
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<td>Fenbendazole</td>
<td>5</td>
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<td>Mech: starve worms, Carbamate anthelmintic, Low toxicity</td>
<td>3-13d</td>
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<td>(Panacur®)</td>
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<td>• Fenbendazole (Rx 662)</td>
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<td>- 2X dose for hypobiotic larvae (very safe 100 X dose)</td>
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<td>- Preparations: suspension, paste, supplemental block, Premix for 1 days</td>
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<td>(crumbles, pellets &amp; cubes), Free choice mineral mix over 3-6 ds</td>
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<td>Albendazole</td>
<td>7.5</td>
<td>+</td>
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<td>±</td>
<td>Mech: starve worms, Carbamate anthelmintic, Low toxicity</td>
<td>27d</td>
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<td>(Valbendazole®)</td>
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<td>- Kills adult flukes &amp; all nematodes, including hypobiotic larvae (Ostertagia)</td>
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<td>- Oral drench (11%), Not 1st 45 ds of gestation</td>
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<td>Oxyfenbendazole</td>
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<td>• Oxyfenbendazole (Rx 851)</td>
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<td>(Synathic®)</td>
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<td>- Preparation: rumen injection, drench suspension, not for breeding age dairy cows</td>
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<td><strong>Imidazothiazoles</strong></td>
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<td>• Albendazole</td>
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<td>Levamisole</td>
<td>8</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>Mech: starve worms, Carbamate anthelmintic, Low toxicity</td>
<td>7d</td>
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<td>(Tramisol®, Levamisol®)</td>
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<td>- Non teratogenic, can use in pregnant cattle; Mech: paralyze worms (cholinergic agonist)</td>
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<td>- Preparation: SQ injection, oral gel, oral boluses, soluble powder drench, pour-on</td>
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<td>- Less effective against inhibited larva, Not for dairy cows of breeding age</td>
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<td>- Narrow margin of safety, toxic signs, injection site reaction so not near slaughter</td>
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<td><strong>Tetrahydropyrimidines</strong></td>
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<td>• Morantel tartrate (Rx 792)</td>
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<td>Morantel tartrate</td>
<td>9.7</td>
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<td>Mech: starve worms, Carbamate anthelmintic, Low toxicity</td>
<td>14 d 0d</td>
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<td>(Rumantel®)</td>
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<td>• Morantel tartrate (Rx 792)</td>
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<td>- Nontoxic, safe in young &amp; pregnant animals, can be fed to lactating dairy cows</td>
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<td>- Preparation: Oral bolus, medicated premix, Mech: paralysis of worms</td>
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<td><strong>Avermectin</strong></td>
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<td>• Ivermectin (Rx 518)</td>
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<td>Ivermectin</td>
<td>0.2</td>
<td>+</td>
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<td>Mech: starve worms, Carbamate anthelmintic, Low toxicity</td>
<td>35d</td>
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<td>(Ivomec®)</td>
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<td>- HI activity against nematodes &amp; some ectoparasites (warbles, lice, mange mites &amp; ticks), Hi safety</td>
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<td>- Preparations: SQ injection not IV or IM (1% solution - 1 ml /100 lbs), Pour-ons, or drench</td>
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<td>- Mech: flaccid paralysis of parasite (Stimulate GABA [Inhibitory transmitter]), not for dairy cows</td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td>- NO effect on nematodes (flukes), cestodes (tapeworms), or protozoa (coccidia) bec. they don’t have GABA</td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td>- Persists in tissue for 2 wks (don’t need to move to clean pasture right away &amp; reduces frequency of Tx)</td>
<td></td>
</tr>
<tr>
<td><strong>Sulphonamide</strong></td>
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<td></td>
<td></td>
<td>• Coumaphos (Rx 178)</td>
<td></td>
</tr>
<tr>
<td>Clorsulon</td>
<td>7</td>
<td>+</td>
<td>±</td>
<td>-</td>
<td></td>
<td>Mech: starve worms, Carbamate anthelmintic, Low toxicity</td>
<td>89 0d</td>
</tr>
<tr>
<td>(Curatrem®)</td>
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<td></td>
<td></td>
<td></td>
<td>• Coumaphos (Rx 178)</td>
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<td></td>
<td></td>
<td>- Preparation: Premix (mix so 2 mg/kg for consecutive days) repeat at 30 d intervals</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>- Mech: cholinesterase inhibitor, Atropine &amp; 2-PAM antidote</td>
<td></td>
</tr>
<tr>
<td><strong>Anticholinesterase</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Coumaphos (Rx 178)</td>
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</tr>
<tr>
<td>Coumaphos</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- Only flukicide cleared in USA, effective against flukes 8 wks or older</td>
<td></td>
</tr>
<tr>
<td>(Baymix®)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- Preparation: oral drench (1-qt containers), can be used w/ other anthelmintics</td>
<td></td>
</tr>
</tbody>
</table>
## Vaccinations

<table>
<thead>
<tr>
<th>All Cattle</th>
<th>Highly recommended</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• IBR (pg 252)</td>
</tr>
<tr>
<td></td>
<td>• BVD (pg 253)</td>
</tr>
<tr>
<td></td>
<td>• Leptospira bacterin (5 serotypes) (pg 257)</td>
</tr>
</tbody>
</table>

### 8 wk-old Calves
- Above (IBR, BVD, Lepto bacterin) +
- PI3 (Parainfluenza) (pg 65)
- Clostridial bacterin (pg 250)

### 6 mo-old Calves
- Above (IBR, BVD [MLV], Lepto bacterin) +
- Bov. resp. syncytial virus (pg 64)
- PI3 (Parainfluenza) (pg 65)
- Brucellosis (heifer replacements only) (pg 122)
- Clostridial bacterin (pg 250)

### Adult Beef Cattle (bulls, cows & replacement heifers)
- Above (IBR, BVD [MLV], Lepto bacterin) +
- Campylobacteriosis bacterin (pg 119)

### Adult Dairy Cows
- Above (IBR, BVD [MLV], Lepto bacterin) +
- No Campylobacteriosis if artificial insemination (AI)

### On Entering Feedlot & Stocker Cattle
- Above (IBR, BVD [MLV], Lepto bacterin) +
- Bov. resp. syncytial virus (pg 64)
- PI3 (Parainfluenza) (pg 65)
- Pasteurella vaccines (pg 255)

### Specific herds &/or in specific geographic areas
- Trichomonas fetus
- Anaplasmosis (inactivated)
- Clostridium hemolyticum bacterins
- Anthrax vaccines
- Clostridium novyi bacterins
- Rotavirus-coronavirus (inactivated)
- E. coli bacterins
- Leptospirosis hardjo bacterins
- Staphylococcus aureus bacterin-toxoid
- Moraxella bovis bacterins (more common in young)
- Campylobacteriosis bacterin
- Malignant edema (Cl. sapticum)
- Hemophilus somnus bacterin (calves)
- Pasteurella bacterins (not in adults)
- Moraxella bovis bacterins (yearling dairy heifer replacements)
- Hemophilus somnus bacterin (yearling dairy heifer replacements)
- Blackleg (Cl. chauvoei) (196) (yearling dairy heifer replacements)
<table>
<thead>
<tr>
<th>Condition</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abomasal impaction</td>
<td>30</td>
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<tr>
<td>Abomasal ulcer</td>
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<tr>
<td>Abomasal volvulus</td>
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<tr>
<td>Acetonemia</td>
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<td>Acidosis</td>
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<tr>
<td>Actinobacillosis</td>
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<td>Actinomycosis</td>
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</tr>
<tr>
<td>Aging by incisors</td>
<td>7</td>
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<tr>
<td>Alkalos</td>
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<tr>
<td>Amyloidosis</td>
<td>24</td>
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<tr>
<td>Anatomy of GI</td>
<td>6</td>
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<tr>
<td>Anomalous milk suckling</td>
<td>14</td>
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<tr>
<td>Arsenic</td>
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<td>Atresia ani</td>
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<tr>
<td>Atrial fibrillation</td>
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<td>Bacillary hemoglobinuria</td>
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<td>Bile stones</td>
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<tr>
<td>Black diz</td>
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<td>Bloat</td>
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<td>Bluetongue</td>
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<td>Bovine viral diarrhea</td>
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<td>Bovine poplar stomatitis</td>
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<td>BVD</td>
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<td>Calf diphtheria</td>
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<td>Calf scours</td>
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<td>Candidias</td>
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<td>Cattle plague</td>
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<tr>
<td>Cecal dilation &amp; volvulus</td>
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<tr>
<td>Choke</td>
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<tr>
<td>Cholangitis</td>
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<td>Cholelithias</td>
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<td>Chronic rumen acidosis</td>
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<td>Cleft palate</td>
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<tr>
<td>Clostridium perfringens</td>
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<td>Cobalt defc</td>
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<td>Colic DDx</td>
<td>278</td>
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<tr>
<td>Colonic atresia</td>
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<td>Colonic obstruction</td>
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<td>Cryptosporidia</td>
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<tr>
<td>Dental disorders</td>
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<tr>
<td>Diarrhea</td>
<td>16-23, 279</td>
</tr>
<tr>
<td>Displacement - abomasum</td>
<td>40</td>
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<tr>
<td>Diphtheria</td>
<td>9</td>
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<tr>
<td>Distended abdomen, neonate</td>
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<tr>
<td>Adult, DDx</td>
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<td>E. coli</td>
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<td>Fat cow/liver syndrome</td>
<td>32</td>
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<td>Fat necrosis</td>
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<td>Feces</td>
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<td>Foot-&amp;-Mouth diz</td>
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<td>Hardware diz</td>
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<td>Heart failure</td>
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<td>Icterus DDx</td>
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<td>Infectious necrotic hepatitis</td>
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<td>Intestinal incarceration</td>
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<td>Intussusception</td>
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<td>Jaw Fx</td>
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<td>Johne's disease</td>
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<td>Lt. displaced abomasum</td>
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<td>Lumpy jaw</td>
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<td>Malignant catarrhal fever</td>
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<td>Mucoeryosol</td>
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<tr>
<td>Neonatal diarrhea</td>
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<td>Obstructive intestinal diz</td>
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<td>Oral necrobacillosial</td>
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<td>Ostertagias</td>
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<td>Pancreatitis</td>
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<td>Parasitism - diarrhea</td>
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<td>Peritonitis</td>
<td>53</td>
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<td>Pharyngeal abscesses</td>
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<td>Pregnancy toxemia</td>
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<tr>
<td>Proctitis</td>
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<tr>
<td>Pyrrolizidine alkaloid</td>
<td>35, 233</td>
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<td>Ragwort poisoning</td>
<td>35, 233</td>
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<tr>
<td>Regurgitation DDx</td>
<td>280</td>
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<td>RDA</td>
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<td>Rectal problems</td>
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<td>Rinderpest</td>
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<tr>
<td>Rotavirus</td>
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<td>Rumen alkalosis</td>
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<td>Rumen impaction</td>
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<td>Rumenitis</td>
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<td>Ruminant indigestion</td>
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<td>Rt. displaced abomasum</td>
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<td>Salivary glans</td>
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<td>Salmonellosis</td>
<td>20, 21</td>
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<td>Strangulation</td>
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<td>Teeth, Ddx</td>
<td>7, 281</td>
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<td>Telangiectasia</td>
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<td>Tongue trauma</td>
<td>14</td>
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<tr>
<td>Traumatic reticuloperitonitis</td>
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<tr>
<td>Tympany</td>
<td>26</td>
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<td>Ulcers</td>
<td>31</td>
</tr>
<tr>
<td>Umbilical hernia</td>
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<td>Vagal indigestion</td>
<td>29</td>
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<tr>
<td>Vesicular stomatitis</td>
<td>11</td>
</tr>
<tr>
<td>Virus diarrhea</td>
<td>18</td>
</tr>
<tr>
<td>Volvulus</td>
<td>44</td>
</tr>
<tr>
<td>Volvulus - root of mesentery</td>
<td>45</td>
</tr>
<tr>
<td>Vomiting, DDx</td>
<td>7, 280</td>
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<tr>
<td>Waste oil</td>
<td>35</td>
</tr>
<tr>
<td>Winter dysentery/scours</td>
<td>23</td>
</tr>
<tr>
<td>Wooden tongue</td>
<td>13</td>
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</tbody>
</table>
GI Anatomy - Mouth

GI Anatomy

- Salivary glands
- Pharynx
- Mouth
- Esophagus
- Liver
- Rumin
- Omasum
- Abomasum
- Reticulum
- Dist. loop
- Prox. loop
- Cecum
- Spiral colon
- Ileum
- Jejunum
- Flange
### Dental disorders

**Mk 115; C2T 719; IM 789; BR-hb 64, 67; BH 174; BM&S 658; Br 629; S-J 498; S-O 399; S-N 83; Pic 55; GI 705

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teeth problems: horses &gt;&gt; cattle</td>
<td></td>
<td></td>
<td>Rough aging by incisors</td>
<td>Eruption of incisors</td>
</tr>
<tr>
<td>Dental caries: older animals, black pigment, usually doesn't cause interference w/ eating, m/ lead to periodontal diz</td>
<td></td>
<td></td>
<td>11 - 2 yrs</td>
<td>12 - 3 yrs</td>
</tr>
<tr>
<td>Premature dental attrition: &gt; 5 yrs old, due to grazing sparse vegetation on sandy soil, or mineral imbalances (Ca or Ca:P ratio); CS: unthriftiness &amp; weight loss</td>
<td>Tx: balanced rations &amp; don't overgraze</td>
<td></td>
<td>13 - 4 yrs</td>
<td>14 - 5 yrs</td>
</tr>
<tr>
<td>Fractured teeth: usually cheek teeth; CS: most asymptomatic; Tx: remove w/ molar forceps if painful</td>
<td></td>
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</tr>
<tr>
<td>Osteodystrophy fibrosa: goats &gt; sheep &amp; cow; resorption of Ca from bone &amp; replacement w/ fibrous tissue</td>
<td></td>
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</tr>
<tr>
<td>Periodontal diz (periodontitis, broken mouth, alveolar periostitis): Sheep &gt; cattle; chronic bacter. infec. of periodontal membrane which holds tooth in alveoli; CS: loss of teeth, mastication problems, weight loss</td>
<td>Tx: Broad spectrum ABs (oxytetracycline), extraction of abscessed tooth</td>
<td></td>
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</table>

**Jaw Fx

**Pic 56

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symphysal fxs: isolate &amp; bring cut food to animal, heals in 3 wks; Other fxs: more difficult, but if no displacement, Tx the same or wire together; If displacement slaughter</td>
<td></td>
<td></td>
<td></td>
<td>Euthanasia if gross defect</td>
</tr>
</tbody>
</table>

**Cleft palate, Palatoschisis

**Mk 109, IM 1725; BR-hb 89; Br 231; Br 146; S-O 422; GI 705

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palate closes from rostr. to caud., - Defect always at back</td>
<td>Nurses, then stops</td>
<td>Oral exam - M/b difficult if just in soft palate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inherited in Charolais cattle</td>
<td>Milk comes out nose when head is down</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Commonly occurs w/ other defects such as arthrogryposis</td>
<td>Dies of starvation if gross defect</td>
<td></td>
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</tr>
</tbody>
</table>

**Emesis or vomiting **

**C1T 869; BR-hb 65; Br 111, 630; DC 122

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>See DDx pg 280</td>
<td>Regurgitation (reverse peristalsis) is normal (chewing cud) in ruminants</td>
<td>Causes - Papillomas of esophageal groove, Megasophagus, Actinobacillosis of esophageal groove, Painful teeth eruptions, Terminal stages of milk fever, Other causes reported (bloat)</td>
<td>Papillomas of esophageal groove, Megasophagus, Actinobacillosis of esophageal groove, Painful teeth eruptions, Terminal stages of milk fever, Other causes reported (bloat)</td>
<td></td>
</tr>
<tr>
<td>Vomition: uncommon sign in ruminants</td>
<td></td>
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</table>

**Salivary glands

**IM 793; BM&S 658; Br-hb 68, 89; Br 175, 231; S-O 425

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sialadenitis (inflam. of salivary gland)</td>
<td>Tx: reduce swelling, drain abscesses &amp; broad spec. ABs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wounds &amp; infections of glands usually heal well by 2º intention</td>
<td>Wounds or blockage of salivary ducts m/ cause fistulae or mucoceles (salivary cysts) or ranula: cystic dilatation in mouth</td>
<td></td>
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</tbody>
</table>

**Salivary tumors

**Rare: pleomorphic carcinomas & squamous cell carcinoma *

**Ptyalism

**Br 110

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excessive salivation</td>
<td>Cause: 2º to choke; pain in mouth ( stomatitis), pharynx or esophagus, calf diphtheria, FB, abomasal impaction, ruminal disorders, spoiled silage; heavy metals, rables &amp; pseudorabies, slaframine, swallowing problems (choke, CNS)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Mouth

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stomatitis</strong></td>
<td>• Inflam. of oral cavity - Gingivitis (gums) - Glositis (tongue) - Palatitis (palate) • 1° condition - Trauma • Plant awns • Foreign bodies • Malocclusion of teeth • Chemical (see box) • 2° to several diseases (see DDX)</td>
<td>• Excessive salivation • Altered chewing • If severe, ∆ appetite • Local or general areas of acute inflam. • + Bacteria - necrosis, halitosis • Swelling of local lymph nodes • Swelling of face in assoc. w/ cellulitis</td>
<td><strong>DDx &amp; Causes</strong> • History (Hx), CS • <strong>Significance</strong>: confusion w/ DDX of other forms of stomatitis • <strong>Calves 100% infection rate</strong> • Papules: characteristic lesions • Virus isolation</td>
<td>• Most recover rapidly &amp; uneventfully once cause is removed • Severe cases - treat - Broad spectrum ABs • Mouth wash - mild antiseptics (0.5% hydrogen peroxide, 5% sodium bicarbonate, 1-3% potassium chloride)</td>
</tr>
<tr>
<td><strong>Bovine papular stomatitis (BPS)</strong></td>
<td>• Calves (2 wks - 1 yr) • Parapoxvirus - related to pseudocowpox • Transmission - direct contact • 10-100% infected (young calves in close contact) • Not seen in small ruminants</td>
<td>• Mild in cattle w/o systemic signs • Reddish, raised papules (0.5-1 cm) - Active for a week, then regresses - On muzzle, lips, oral mucosa, esp. hard palate, inside nostrils, esophagus - Increase in size, then central necrosis • Salivation • Loss of appetite (pain) • Nasal &amp; oral secretions • Self-limiting, short lived • Recurrence in few cases, esp. if stressed • Teats not affected</td>
<td><strong>DDx</strong>: • Vesicular stomatitis (p 11) • FMD/MD (p 11) • Rinderpest (p 9) • BVD (p 9)</td>
<td><strong>Self limiting</strong> • Palliative - Soft food (mash) • Nasogastric tube feeding, if severe • Mild astringent rinse, removes necrotic debris • Antibiotics (ABs) for 2° infections <strong>Prognosis</strong>: Good <strong>Prevention</strong> • NO vaccine • Reduce stress</td>
</tr>
</tbody>
</table>
Rinderpest, RP
"Cattle plague"
Mk 404, C3T 444, 899; C2T 497; IM 820; BM&S 142; Br 543; BR-hb 384; BR 980; Derm 113; Pa 5; Pic 151
USA FREE

Never occurred in N. Amer.
- Rinderpest virus (Paramyxovirus)
- Most severe infec. diz of cattle
- Highly contagious (morbidity 99%)
- Fatal (mortality 25-90%)
- Cattle & water buffalo >> sheep & goats
- Reportable

USA FREE

Not in USA; Severe; Contagious (99%)
CS: Fever, Gl (Necrotic Stomatitis)
Tx: Has never occurred in N. America
Px: Grave - 25-90% Die

Mucosal disease,
Chronic BVD,
BVD/MD
Bovine viral diarrhea/ Mucosal disease
Mk 166; IM 806; Gl 707; DC 230; L 115; Pa 5

- See GEN pg 253
- Togavirus
  - Cytopathic & noncytopathic biotypes
  - Immunosuppressive
  - Mucosal diz requires both biotypes to develop
  - Transmission: Direct or indirect
  - Transplacentally
  - Incubation: 5-10 day
  - 8-24 mo, all ages

USA FREE

May require both non- & cytopathic biotypes
CS: Oral lesions, Cachexia, Lameness, Death
DDx: Rinderpest & FMD
Tx: Cull

USA FREE

BVD/MD - cull
- Persistently infected cows - sold to slaughter

Prognosis (Px): Grave
- Virtually 100% die, low mortality

Prognosis (Px): Grave
- Death 25-90%

DDx: Rinderpest (p 9)
FMD (p 11)

- Tx unrewarding
- Quarantine
- Slaughter affected animals & exposed ruminants & swine
- Disinfect area
Oral Cavity

**Malignant catarrhal fever**
- **Facts/Cause**: Herpesvirus - 2 strains
  - In Africa & in zoos assoc. w/ Wildebeest
  - "Sheep assoc. agent" (doesn't cause diz in sheep)
- **Presentation/CS**: Peracute generalized diz
  - Fever, depression, anorexia
  - Sudden death
  - Enlarged lymph nodes
- **Diagnosis**: History (sheep), CS
- **Treatment**: Unsuccessful

**Bluetongue**
- **Facts/Cause**: Mainly a sheep diz > cattle
  - Culicoides, Arthropods - Bliting midge
  - Orbivirus
  - Reportable
- **Presentation/CS**: Oral & upper resp. ulcers (buccal papillae)
  - Ophthalmia & corneal opacity, hypopyon (pus in ante
  - nychial chamber of eye)
  - Encrustation of muzzle
- **Diagnosis**: History, CS
- **Treatment**: REPORT to Feds - cattle

**Sheep > Cattle**
- **Facts/Cause**: indistinguishable from FMD or VS
- **Presentation/CS**: Oral & upper resp. ulcers (buccal papillae)
  - Ophthalmia & corneal opacity, hypopyon (pus in ante
  - nychial chamber of eye)
- **Diagnosis**: Virus isolation
- **Treatment**: ABs for 2^ infection

**Sheep -** fever, edema of head, salivation, nasal discharge, oral ulcers, pulmonary edema, 2^ bronchopneum., lameness, diarrhea, death
  - Cyanotic tongue (hence name)
  - Teratogenic effects ("dummy lamb")

**Digestive System**

**Malignant catarrhal fever (MCF)**
- **Facts/Cause**: Malignant head catarrh, Snorts and coryza
- **Presentation/CS**: General, Skin, GI or CNS forms
  - > 1 yr. old (all ages of cattle)
  - P 3-10 wk
  - Course 3-7 ds
- **Diagnosis**: Serology not very reliable
- **Treatment**: Unsuccessful

**Bluetongue**
- **Facts/Cause**: Association w/ Sheep, Fatal vasculitis
- **Presentation/CS**: Head & Eye, Skin, GI, CNS - Death
- **Diagnosis**: Serology not very reliable
- **Treatment**: Unsuccessful
Vesicular stomatitis, VS

Identical to FMD

Dx: Viral isolation, Serology

Tx: Reportable

Foot-&-Mouth disease (FMD), Aphthous fever

Identical to FMD, 6-8 yr-olds

CS: Identical to FMD: Ulcers - Mouth, Teats, Digits

DDx:
- FMD (p 11)
- BVD (single animal) (p 9)
- Rinderpest (single animal) (p 9)
- BPS (single animal) (p 8)
- Bristle grass (p 240)
- IBR (p 252)

USA Free

Prevention & Control
- Notify Federal agents, they take over
- Disinfect the environment - 10% formalin or iodides
- Two vaccines, rarely used, except where recurring epidemics on same farm yearly
- Adm. under fed. agent supervision. Vaccine interferes w/ serological testing

REPORT to Feds
- Supportive therapy & isolation
- Soft feeds & fresh water & shade
- ABs in severely debilitated - 2° infection
- Teat lesions
- Milk infected cows last
- Ointments to protect from flies, etc.

Px: Good, Death uncommon (high morbidity, low mortality)

Recovery 2-21 d

M/ not regain milk production

CS, Hx (6-8 yrs-old)

Viral isolation from lesions

Sequela
- M/ not regain milk production
- Milk infected cows last
- Ointments to protect from flies, etc.

Identical to vesicular stomatitis (see above)
- Blisters & vesicles on mouth, teats & feet
- Ulcers, reluctance to move
- Rapid spread
- Mastitis
- Weight loss
- Milk production
- Freq. abortions

Prevention
- Vaccines used in countries where enzootic, not USA
<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Necrotic stomatitis, Oral necrobacillosis</td>
<td><em>Fusobacterium necrophorum</em> invades broken skin &amp; laryngeal cartilage</td>
<td>Necrotic STOMATITIS - Deep, necrotic ulcers, oral &amp; pharyngeal cavity</td>
<td>History (trauma), CS</td>
<td>Isolate from healthy calves</td>
</tr>
<tr>
<td>Oral necrobacillosis, Necrotic laryngitis</td>
<td>• Necrotizing endotoxin</td>
<td>• Necrotic laryngitis</td>
<td>Necrotic ulcers</td>
<td>Debride ulcers</td>
</tr>
<tr>
<td>Mk 719, IM 627; BR-hb 346; BR 879; Br 214, 626, 635; BMS 652, 200; Br 626; BA 214; Pa 7</td>
<td>• Normal inhabitant of oral cavity</td>
<td>• Necrotic ulcers of larynx (directly behind vocal cords on vocal process of arytenoid)</td>
<td>• History (CS (inspiratory dyspnea, Smell))</td>
<td>Topical diluted iodine sol. to swab ulcerated areas</td>
</tr>
<tr>
<td></td>
<td>• Predisposing factor</td>
<td>• Necrotic laryngitis</td>
<td>• Laryngoscope</td>
<td>Flush mouth with K+ permanganate</td>
</tr>
<tr>
<td></td>
<td>- Trauma to oral mucosa (erupting teeth, coarse feed, or other infections)</td>
<td>- Older calves, 6-18 months</td>
<td>• Diphtheritic material on arytenoid cartilages</td>
<td>Force feed</td>
</tr>
<tr>
<td></td>
<td>• Necrotic stomatitis</td>
<td>• Necrotic ulcers of larynx</td>
<td>• History</td>
<td>• Starts to resolve in 3-5 days, deep ulcers fill in &amp; granulate</td>
</tr>
<tr>
<td></td>
<td>- Calves &lt; 3 mo (2 wks - 6 mos)</td>
<td></td>
<td></td>
<td>Rumenotomy to feed m/b</td>
</tr>
<tr>
<td>Bact. <em>Fusobacterium necrophorum</em></td>
<td></td>
<td>Sequela:</td>
<td></td>
<td>Control:</td>
</tr>
<tr>
<td>CS: Necrotic ulcers</td>
<td>- Necrotizing pneumonia</td>
<td>• Necrotizing pneumonia</td>
<td></td>
<td>• Clean &amp; disinfect feeding &amp; drinking areas</td>
</tr>
<tr>
<td>Tx: Debride, topical iodine</td>
<td>- Acute (sequela due to aspiration of infected tissue)</td>
<td>• Death</td>
<td>• Daily PE all calves to find new cases</td>
<td></td>
</tr>
<tr>
<td>Calf *** diphtheria, Laryngeal necrobacillosis, Necrotic laryngitis</td>
<td><em>Fusobacterium necrophorum</em> invades broken skin &amp; laryngeal cartilage</td>
<td>Necrotic LARYNGITIS - Moist, painful cough</td>
<td>History</td>
<td>Treat early &amp; aggressively</td>
</tr>
<tr>
<td>Mk 719, IM 627; BR-hb 346; BR 879; Br 214, 626, 635; BMS 652, 200; DC 69; Pa 132</td>
<td>• Necrotizing endotoxin</td>
<td>• 1° loud inspiratory dyspnea</td>
<td>CS (inspiratory dyspnea, Smell)</td>
<td>• ABs (Micotil®, Naxcel®, Tetracycline, Penicillin)</td>
</tr>
<tr>
<td></td>
<td>• Normal inhabitant of oral cavity</td>
<td>• Obstruction of airway</td>
<td></td>
<td>• Isolate from healthy calves</td>
</tr>
<tr>
<td></td>
<td>• Necrotic laryngitis</td>
<td>• Fetid breath</td>
<td>• Laryngoscope</td>
<td>Supportive</td>
</tr>
<tr>
<td></td>
<td>- Older calves, 6-18 months</td>
<td>• Salivation</td>
<td>• Diphtheritic material on arytenoid cartilages</td>
<td>• Tracheostomy if airway obstruction (last resort)</td>
</tr>
<tr>
<td></td>
<td><em>Necrotic ulcers of larynx</em> (directly behind vocal cords on vocal process of arytenoid)</td>
<td>• Nasal discharge, often mucopurulent</td>
<td></td>
<td>• NSAIDs, incl. aspirin, Banamine® (flunixin meglamine), &quot;bute&quot;</td>
</tr>
<tr>
<td></td>
<td>- Diphtheritic membrane</td>
<td>• No stromatic lesions</td>
<td></td>
<td>Control:</td>
</tr>
<tr>
<td></td>
<td>- Scar on healing - permanent stricture of airway</td>
<td>• Dysphagia, 106° F., tachypnea</td>
<td>• Pharyngeal trauma (p 14)</td>
<td>• Clean &amp; disinfect feeding &amp; drinking areas</td>
</tr>
<tr>
<td>Bact. <em>Fusobacterium necrophorum</em></td>
<td></td>
<td>• Untreated some die in 2-7 days due to toxemia &amp; upper airway obstruction</td>
<td>• Paralysis</td>
<td>• Daily PE all calves to find new cases</td>
</tr>
<tr>
<td>CS: Necrotic ulcers</td>
<td></td>
<td>• Sequela:</td>
<td>• Viral laryngitis (IBR) (p 152)</td>
<td></td>
</tr>
</tbody>
</table>
Actinobacillosis
“Wooden Tongue”
Mk 317; CST 534; C2T 606; IM 794; BR-hb 333; BR 682; Br 627; BM & S 259; DC 184; Gi 706; N-L 177; Pa 8; Pic 57

- Actinobacillus lignieresi
- Gram neg. saprophyte
- Inhabitant of mouth
- Enters through abrasions
- Coarse feed, straw or fibrous feed
- Cattle, occasionally sheep
- Normally sporadic, m/b herd problem - coarse feed

- Soft tissue diz
- Stomatitis
- Hard & swollen tongue (m/ protrude from the mouth)
- Painful
- Dropping food, prehension problems, m/not be able to move to back of pharynx
- Granuloma formation on other parts of body by licking broken skin
- Stridor or noise (respiratory)
- Lymphadenitis of head & neck
- Dehydration, weight loss
- Chronically see tongue scarred, smaller & less motile

DDx:
- Dental diz (p 7)
- Oral foreign bodies
- Pharyngeal trauma (p 17)
- Dizs causing oral pain, vesicular dizs (p 8-12)
- Granulomas
- Tumors
- Polyps
- Cysts

Actinomycosis, “Lumpy jaw”
Mk 318; C3T 536; C2T 607; IM 796; BR-hb 333, BR 651; BM & S 259; Br 629; DC 184; Derr 148; Gi 706; Pa 8; Pic 58

- Actinomyces bovis (bacteria)
- Gram +, branching filamentous
- Normal inhabitant of mouth
- Chronic bacterial diz of cattle > sheep & goats
- Invades abrasions into bone - Teeth eruptions, coarse feed

- Osteomyelitis of jaw
- Mandible > maxilla
- Non-painful swelling
- Can rupture & drain fetid fluid
- Contaminates environment

- Hard, immovable, bony mass of mandible
- Later fistulous tracts
- Lymphadenitis
- Swelling of the pharynx - Bloat
- Excess salivation
- Dysphagia
- Quidding (dropping feed)
- Early fever, resolves
- Occasional granulomas in other tissues

DDx:
- History (trauma)
- Palpation
- Culturing the exudate
- Rads
- Check for pathological fractures or tooth involvement
- Mandible & maxilla, radiolucent areas, abnormel remodelling

Actinomycosis, “Lumpy jaw”

- Cull (normally)
- Iodides
- Penicillin & streptomycin
- Curette out bone, remove affected teeth (careful or fracture)

Prognosis (Px):
- Poor
- Generally animals do not recover

Prevention: avoid traumatic feed (stems, grass awns)

**lodides do not cause abortions, but questioned by some**
<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tongue trauma</strong></td>
<td>• Cattle eat wires, nails, etc.</td>
<td>• Anorexia</td>
<td>• Think rabies (salivation)</td>
<td>• Remove foreign body</td>
</tr>
<tr>
<td></td>
<td>• Torus lingua (dors. swelling at base of tongue)</td>
<td>• Reluctance to protrude tongue</td>
<td>• Oral exam (good restraint, nose, tongue, speculum, gags)</td>
<td>• Clean &amp; antiseptics</td>
</tr>
<tr>
<td></td>
<td>• Transverse groove in front of torus lingua</td>
<td>• Salivation</td>
<td>• Pull tongue out one side</td>
<td>• ABs (antibiotics)</td>
</tr>
<tr>
<td></td>
<td>- Common site for FB (foreign body)</td>
<td>• Halitosis (bad breath)</td>
<td></td>
<td>• Laceration of tongue</td>
</tr>
<tr>
<td></td>
<td>• Tongue prehensile organ in cattle</td>
<td></td>
<td></td>
<td>- Suture under general anesthesia</td>
</tr>
<tr>
<td><strong>Transverse groove</strong></td>
<td></td>
<td></td>
<td></td>
<td>- Avoid amputation of cattle tongues because of prehensile function</td>
</tr>
<tr>
<td><strong>Avoid amputation</strong></td>
<td></td>
<td></td>
<td></td>
<td>- Feed gruel or green feed</td>
</tr>
<tr>
<td><strong>Anomalous milk suckling,</strong></td>
<td>• Vice - suckling as adult</td>
<td></td>
<td><strong>Diagnosis</strong></td>
<td><strong>Treatment</strong></td>
</tr>
<tr>
<td>Galactophagia</td>
<td>• Weaned too early or orphaned</td>
<td></td>
<td>• History, CS</td>
<td>• Broad spectrum ABs 7-14 days</td>
</tr>
<tr>
<td></td>
<td>• Nuisance</td>
<td></td>
<td>• Endoscope</td>
<td>- Tetracyclines, sulfas, ampicillin, trimethoprim sulfa or pen.+ aminoglycosides</td>
</tr>
<tr>
<td></td>
<td>• Predisposes to mastitis</td>
<td></td>
<td>• Pharyngeal palpation (think rabies)</td>
<td>• NSAIDs - analgesia &amp; reduce inflam.</td>
</tr>
<tr>
<td></td>
<td>• Others mimic (epidemic of suckling)</td>
<td></td>
<td></td>
<td>• Access to water*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(If not drinking gently stomach tube several times 8-13 gal/d water+ electrolytes, esp. 60-100 g of KCl/d)</td>
</tr>
<tr>
<td><strong>Pharyngeal trauma/abscesses</strong></td>
<td>• Trauma - freq. (near esophagus)</td>
<td>• Coughing</td>
<td>• Rabies (p 144)</td>
<td>• Soft green grass or feed mash 2 week</td>
</tr>
<tr>
<td></td>
<td>• Iatrogenic (bailing gun, long dose syringe, paste dewormer gun, rigid stomach tube - causing trauma)</td>
<td>• Painful swallowing (dysphagia)</td>
<td></td>
<td>(when drinking w/o coughing or nasal reflux)</td>
</tr>
<tr>
<td></td>
<td>• Retropharyngeal abscesses</td>
<td>• Anorexia</td>
<td></td>
<td>• Gradually onto green leafy alfalfa hay</td>
</tr>
<tr>
<td></td>
<td>• Cellulitis</td>
<td>• Salivation - mimics other diz (stomatitis)</td>
<td></td>
<td>• Temporary tracheostomy if dyspnic</td>
</tr>
<tr>
<td></td>
<td>• Accidental adm. &amp;/or ingestion of irritants - pharyngitis</td>
<td>• Feed out nose</td>
<td></td>
<td>• Surgery - Drains into pharynx through original laceration (push finger in) or</td>
</tr>
<tr>
<td></td>
<td>• Infections (see DDx)</td>
<td>• Rumen stasis &amp; mild bloat</td>
<td></td>
<td>• Go through neck (needle into abscess &amp; cut along needle)</td>
</tr>
<tr>
<td></td>
<td>• May affect vagus nerve (swallowing &amp; eructation)</td>
<td>• Pharyngeal obstruction</td>
<td></td>
<td>Prevention when using bailing gun</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Swelling of retropharyngeal inn.</td>
<td></td>
<td>• Head restraint, go only over torus lingua (base of tongue)</td>
</tr>
<tr>
<td><strong>Balling gun trauma, Head restraint</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CS: Salivation, Aspiration</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dx: Endoscope, Palpation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tx: Antibiotics, Drain</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
Esophageal obstruction, Choke

Mk 173; C3T 712; C2T 714; IM 822; BR-hb 71; BR 180; BM&S 659; Br 631; GI 707; S-J 804; S-O 430; VC/S 560; Pa 20; Pic 61

- Greedy eating
  - History - eating beets, apples, other large, solid objects
- Dry ingesta - poor quality roughage: if not enough water, dry ingesta forms into a ball
- Treated Hypoderma lineatum, dead larvae, severe reaction
- Complete or partial obstruction

- Acute
  - Bloat, possibly rapidly fatal
  - Difficult swallowing (retching)
  - Salivation
  - Feed stuff in both nostrils
  - Acute coughs
  - Rapid, shallow breathing (head & neck extended, may swing from side to side)
  - Cellulitis around obstruction (painful, hot swelling)
  - Chewing movements
  - Protrusion of tongue
  - Anxious, go off feed

Complications:
- Aspiration pneumonia
- Esophageal rupture
- Esophageal stricture

DDx
- Rabies (can’t swallow) (p 144)
- Botulism (p 145)
- Tetanus (p 145)

Remove object
- Pharyngeal inlet - massage out mouth, or #9 wire loop through mouth speculum, past object, pull out mouth - may use tranquilizer or muscle relaxer (succinyl choline)
- Thoracic - push into rumen w/ stomach tube (be sure its not sharp)
- Near diaphragm - rumenotomy, then pass a tube retrograde

Feed ball: lavage gently with water to break it up

Esophagostomy last resort, problem w/ stricture & poor healing, give
ABs, let heal by 2nd intention, 2nd incision distally to feed by stomach tube

Four primary locations:
1. Pharyngeal inlet, #1
2. Thoracic inlet
3. Base of heart
4. Cardia of rumen

DDx
- Rabies (can’t swallow) (p 144)
- Botulism (p 145)
- Tetanus (p 145)

Prognosis: Good if no damage or stricture

Esophageal trauma/rupture: Uncommon • Cause: choke, stomach tube or probang. If suspect rupture - immediate slaughter

Esophageal stenosis • Causes: healed trauma, persistent rt. aortic arch, swollen mediastinal lymph nodes, tuberculosis, lymphosarcoma, pneumonia • CS: bloat

Dead cattle grubs (H. lineatum) from OPs, see Skin pg 182

Esophageal dilation (megaesophagus) & hiatal hernia: Rare, assoc. w/ pharyngeal trauma, inflam. of vagus nerve & hiatal hernia (hiaphragmatic hernia) & persistent right aortic arch • CS: regurgitation or vomiting after eating, bloat
- Dx: pass stomach tube to R/O choke, contrast radiographs • Sx: exploration • Rabies must always be R/O in esophageal dysfunction
- Tx: fluid by stomach tube 1-2 wks mb, Sx - hiatal hernia in valuable animal

Esophageal diverticula: rare outpocketing
## Neonatal Diarrhea

### Facts/Cause
- See DDx pg 279
- Economic loss $50-120 mil/yr USA
- #1 killer of neonatal cattle

### Cause:
- ↑ Secretion
  - Enterotoxins (E. coli, Salm., Campylobacter)
- ↑ Absorption
  - Destruction of absorptive villus epithelial cells (protozoa & enteric viruses)
  - Secretions continue & absorption decr., + osmotic effect of unabsorbed substances
  - Inflammation (Salmonella & Clostridial di) incr. secretions & decr. absorption
- Fluid & electrolyte losses leading to dehydration & acidosis
- Diarrhea contaminates environ.
- Predisposition
  - FPT (failure of passive transfer)
  - Filthy environment, Overcrowding

### Presentation/CS
- Diarrhea
- Dehydration - cardiovascular collapse
- Acidosis - impair cardiac function
- Depressed & weak
- Lose suckle reflex
- Recumbency & coma
- Hypothermia
- Death - heart failure due to K+ imbalance & hypothermia
- Cachexia (especially if milk withheld)
- Death - malnutrition or hypoglycemia

### Prevention:
- Environmental hygiene - Disinfection
- Dairy - calf hutches
- No nose to nose contact
- Handle sick animals last, wear gloves, disinfect boots, have feed buckets disinfected
- Bacterin vac. cows prepurchase (4-6 weeks)
- Colostrum very important (see box)

### Colostrum:
- Colostrum w/in first 2 hours of life (from dam)
  - 10% of BW w/in 12 hours
- Local (enteric) immunity: important
- Colostrum deprivation in 25-50% of dairy calves (due to colostrum deprivation, poor mother, early separation from dam) - Beef calves less common
- Assist suckling or hand feed
- Adequate nutrition during late pregnancy in beef cattle important
- High quality colostrum; IgG 1500 mg/dl
- Colostrometer, a tubular device, measures specific gravity & thus immunoglobulins in milk

### Necropsy for Neonatal Diarrhea:
- Identify agent assoc. w/ damage to intestine + CS caused by agent
- Examine several calves, early in dx, euthanatize just before necropsy
- Lay a square of gut, mucosal side down, on paper & drop in fixative, or
- Tie off a segment of gut, inject w/ fixative & then drop in fixative
- Tissue examined w/ light or electron microscope for bact. adhering to mucosa or cryptosporidiosis assoc. w/ brush border
- FA for K99 E. coli or viruses, Clostridium perfringens

### Treatment
- Isolate
- Fluid & electrolytes
  - Dehydration & acidosis
  - BW (kg) x % dehydration = L
- Broad spec. ABs (Naxcel®) prevent septicemia
- Check for FPT (failure of passive trans.) - Plasma or blood transfusion

### Causes (see p 279):
- E. coli (p 18)
- Rotavirus (p 18)
- Coronavirus (p 19)
- Coccidia (p 21)
- Cryptosporidia (p 19)
- Salmonella (p 20)
- BVD (p 22)
- Milk replacer

### Public Health
- Salmonellosis
- Cryptosporidiosis
Treatment of neonatal diarrhea

Correct dehydration & acidosis (common causes of death)
- Depressed calves that don't suckle (no milk)
  - IV fluids (saline based) + bicarbonate (see below)
  - Hypoglycemia - add 5% glucose to IV fluids
  - Should be up & suckling after 24 hours of Tx

Nursing calves & mildly affected calves (milk in diet)
- High energy oral electrolytes, or tube feeding
  - Milk + nonbicarbonate electrolytes
  - Multiple feedings 4-6/d better than 2 x/d - better absorption

Colostrum/failure of passive transfer (see box)
- Give colostrum if less than 18 hours of age
  - > 36 hours can't use colostrum, must give plasma

Fluids & maintenance 50-100 ml/d & anticipate fluid loss
(up to 4 L/day)
- Fluid needed - degree of dehydration (gauged by degree eyeball is sunken & skin tents)

BW (kg) x % dehydration = amt. given (liters)
(e.g., 50 kg x 10% = 5 L needed to rehydrate, given over 4-6 hours)
- Isotonic fluids (Lactated Ringer's)

BW x % dehydration = liters

Acidosis - Bicarbonate requirement
- Alert, sucking calves do not need bicarbonate
- Comatose calves require more than depressed calves
- Dehydration has no correlation w/ acidosis
- Ideally give over a 24 hour period, but 4 to 8 hours OK
- Not necessary to completely correct acidosis, gc. close to normal
- After 24 hrs. calf should be up suckling; if still depressed sign of incorrect metabolic problems or toxemia

Antimicrobial - frequently used
- E. coli & Salmonella only org. that respond
  - Cult./sens. important (resistance high in both; improper ABs select for resistant strains)
  - Viral & protozoa not affected directly, but 2nd infection, so ABs
  - Prolonged oral ABs m/ cause diarrhea, so don't use on calves older than 5d, unless evidence of Salmonella or gardasilis
  - Oral ABs effective for E. coli, 3 days usually sufficient

Energy in chronically scouring suckling calf (so kg/calf requires 2000 kcal & 3500 kcal for weight gain of 0.5 kg/d)
- 3-6 L of whole cow's milk/day
  - If no milk being ingested give:
    - High energy oral electrolyte (Lifeguard HE®), Biolyte 50% energy needed if BiD 4 L total, 75% if TID 8 L (Lifeguard HE® only 25%)

Milk withdrawal? (take off all milk?) - can reduce severity of diarrhea & depression (milk osmotically pulls water into GI)
- ≤ 1-3 day withdrawal in depressed calves that don't suckle
- > 3 d no benefit even if diarrhea persists, so reintroduce to milk
- Do not withdraw from alert calves that suckle
- Lactate is lost during withdrawal so reintroduce milk slowly
- Reintroduce milk when diarrhea is resolved
  - To restart induction of lactase (inducing enzyme)
    Day 1-2 - 2.5 parts milk + 2.5 parts electrolytes (QID)

Catheterization of calf's jugular vein
- Clip & prepare skin
- Nick skin w/ #15 scalpel blade (skin thick in dehydrated calves)
- If can't find jugular, suspend calf upside-down so blood will pool
- Lay animal flat after catheter placed
- Warm fluids, especially in hypothermic calves
# Neonatal Diarrhea

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>E. coli</em></td>
<td><strong>Colibacillosis,</strong> Enteric <em>E. coli,</em> Enterotoxigenic colibacillosis</td>
<td>- Found dead w/o diarrhea</td>
<td>History (&lt; 4 days), CS</td>
<td>Aggressive Tx</td>
</tr>
<tr>
<td></td>
<td><em>Escherichia coli</em></td>
<td>- Profuse watery diarrhea, white to yellow</td>
<td><em>Culture</em> faces, looking for K99 pill by indirect immunofluorescence of smears</td>
<td></td>
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<tr>
<td></td>
<td><em>Enterotoxigenic K99</em></td>
<td>- Dehydration</td>
<td>- In huge outbreak, sacrifice calf to Dx</td>
<td>- Isolate</td>
</tr>
<tr>
<td></td>
<td><em>Enterotoxins/septicemia</em></td>
<td>- Acidosis</td>
<td>- 1st place - ileum &amp; jejunum</td>
<td>- Fluid &amp; electrolytes to restore hydration &amp; vigor</td>
</tr>
<tr>
<td></td>
<td><em>Ent. Flora, in GI soon after birth</em></td>
<td>- Weakness</td>
<td>- More than 1 organism m/b causing diarrhea</td>
<td>- Broad spectrum ABs (Naxcel®)</td>
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<td></td>
<td><em>Adhere &amp; colonize gut wall (pili -K99, F5)</em></td>
<td>- Death in 6-12 hours (1-4 days)</td>
<td><em>Lab</em>:</td>
<td></td>
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<td></td>
<td><em>May enter through umbilicus, or orally</em></td>
<td>- Milder forms can't be differentiated from other causes</td>
<td>- Total volume K⁻ deficient</td>
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<td><em>&lt; 4 day-old (occasionally older)</em></td>
<td>- Sequelea</td>
<td>- Metabolic acidosis</td>
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<tr>
<td></td>
<td><em>FPT (failure of passive transfer)</em></td>
<td>- Iritis, hypopyon</td>
<td>- Low bicarbonate</td>
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<td></td>
<td><em>Septicemia - bacteria &amp; their toxins in blood stream, fever not consistent feature of septicemia in neonates</em></td>
<td>- Pneumonia</td>
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<td>- Joints/arthritus</td>
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<td>- Meningitis - neck rigidity</td>
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<td>Devastating losses in 1-2 d-old calves</td>
<td>CS: Diarrhea/Dehyd, Septicemia, Death &lt; 4 d</td>
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<tr>
<td>Dx: Hx, CS, Culture</td>
<td>Tx: Aggressive: Fluids, ABs</td>
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<tr>
<td>Parvo virus</td>
<td>Isolated from calves w/ enteritis</td>
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<tr>
<td>(C3T 431)</td>
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<tr>
<td><strong>Rotaviruses</strong></td>
<td><em>Mk 181, C3T 105, C1T 118, C2T 105, IM 399, BR-hb 298, BR 707, Br 167, DC 168, GI 755, Pa 86, Pic 22</em>**</td>
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<td>25% of diarrhea cases, usu. in combo w/ others (<em>E. coli, corona, etc.</em>)</td>
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<td>5 d to 2 wks (commonly)</td>
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<td></td>
<td>Malabsorptive diarrhea (unlike <em>E. coli</em>)</td>
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<td></td>
<td>- Attacks villus of small intestine, large intestine spared</td>
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<td>- Epithelial cells destroyed, can't absorb</td>
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<td>- Self limiting when runs out of epith. cells, takes time to regenerate</td>
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<tr>
<td>Common</td>
<td>In combo w/ others</td>
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<tr>
<td>Malab./villus</td>
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<tr>
<td><strong>Diarrhea</strong></td>
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<tr>
<td><strong>Anorexic</strong></td>
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<tr>
<td><strong>Depressed</strong></td>
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<tr>
<td><strong>Fever</strong></td>
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<td><strong>Aged animals can shed virus w/out CS</strong></td>
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<tr>
<td><strong>Difficult</strong></td>
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<tr>
<td><strong>FA</strong></td>
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<tr>
<td><strong>ELISA</strong></td>
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<tr>
<td><strong>Electron microscope</strong></td>
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<tr>
<td><strong>DDx:</strong></td>
<td><em>Rotavirus (p 18)</em></td>
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<tr>
<td></td>
<td><em>Coronavirus (p 19)</em></td>
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<td></td>
<td><em>Cryptosporidia (p 19)</em></td>
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<td></td>
<td><em>Salmonella (p 20)</em></td>
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<td><em>BVD (p 22)</em></td>
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<td><strong>Prevention:</strong></td>
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<td></td>
<td><em>Hygiene</em></td>
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<td></td>
<td><em>Colostrum (see above)</em></td>
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<td></td>
<td>*Bacterin (K99 + <em>E. coli</em>)</td>
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<td></td>
<td>6 &amp; 3 weeks before calving to be effective</td>
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<td><strong>Control:</strong></td>
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<td>*Hygiene - disinfect environment</td>
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<td></td>
<td><em>Isolation of shedders</em></td>
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<td></td>
<td><em>Virus survives for months in cool environment</em></td>
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<td></td>
<td><em>Vaccine questionable</em></td>
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<tr>
<td></td>
<td><em>Colostrum for longer than normal</em></td>
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<td><strong>Prognosis:</strong></td>
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<tr>
<td></td>
<td>Once in blood stream - Poor</td>
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<td><strong>Treatment:</strong></td>
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</table>

**Digestive System**

- **Vaccines**
  - New vaccines m/ help control rota & corona infections
  - Checkered past

---

**Naxcel**

**Prognosis:** Once in blood stream - Poor

**Prevention:**

- Hygiene
- Colostrum (see above)
- Bacterin (K99 + *E. coli*) 6 & 3 weeks before calving to be effective

**Control:**

- Hygiene - disinfect environment
- Isolation of shedders
- Virus survives for months in cool environment
- Vaccine questionable
- Colostrum for longer than normal

**Vaccines**

- New vaccines m/ help control rota & corona infections
- Checkered past
### Corona virus

**Mk 181; C3T 106; IM 399; Br 184; DC 167; GI 763; Pa 53***

- Transm. - Fecal/oral route & air
- 4-30 days, IP longer than rotavirus
- Attacks small & large intestine
- Malabsorptive, maldigestive diarrhea
- Milk in large intestine = diarrhea
- More virulent than rota, bacteria attacks both tips & crypts of villi

**Diarrhea**
- Nonspecific, similar to rotavirus
- Mucus present in diarrhea
- Due to large intestinal involvement
- Pneumonia

**Difficult**
- FA
- ELISA
- Elect. microscope
- Postmortem
- No gross findings, except fluid-filled intestine
- Histo. - more severe villus blunting & fusion than rota

**Dx: PM • Tx: Serum, fluids & ABs
Prevention: Vaccinate dam
Control: Same as rotavirus
“Calf-Guard®” vaccine for coronavirus, doesn’t provide good antibodies

### Enterotoxemia, Clostridium perfringens, Hemorrhagic enteritis

**Worse than rota Malabsorption Villus & crypts***

- See Gen pg 250
- Acute noncontagious diz
- Effects the healthiest, fastest growing calves
- Easily & cheaply prevented
- 2 wk-olds
- Clostridium perfringens type C

**Healthiest calves
CS: Fatal hemorrhagic enteritis
Dx: PM • Tx: Serum, fluids, ABs
Prevention: Vaccinate dam**

**Cryptosporidium**

**Mk 108.181, C3T 107; IM 400; BR-hb 458; BR 1194; Br 170; DC 168, 183; GI 765; Pa 45; Pic 21***

- Cryptosporidium spp, Protozoa
- 1-4 weeks
- Individual calf problem
- Fecal/oral route
- Oocysts immediately infective
- Malabsorptive
- Lower small & large intestine
- Villus atrophy & fusion
- Auto infect. - relapses & protracted infect.
- Low mortality
- Winter more prevalent
- Affects multiple species
- Mice, man, lambs & pigs

**Diarrhea, soft foamy to watery, m/ contain milk, blood, mucus & bile
Tenesmus
Dehydration
Mnchronic diarrhea & cachexia (auto infection)**

**Pathological oocysts in feces (m/ require multiple samples)
Fecal flotation w/ Sheather's sol. (sucrose)
Stain w/ Ziehl-Neilsen (turns organism red)
Small & easily missed
PM: emaciation**

**Supportive Tx
- Protraced fluids, elec., acid base
- Milk - to fight emaciation**

**Prognosis: Guarded**

**Giardia: newly recognized; nonresponsive, chronic, pasty diarrhea, wt. loss.
Dx: Lugol's stained smear
Tx: Dimetridazole (50 mg/kg 5 d)**

**Public health: man**
## Diarrhea

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
</tr>
</thead>
</table>
| **Neonatal salmonellosis** | • See GEN pg 259  
• #2 economic GI bact (> $50 mil/yr)  
• > 2000 serotypes  
• *S. dublin*, host specific to cattle, therefore  
  long carriers, Western USA  
• *S. typhimurium*, *S. montevideo*, *S. newport*,  
  & *S. anatum* Eastern USA  
• Invasive organism  
  • Attach to mucous membranes  
  • Destroy cells & pass through GI wall  
  • Move to regional ln (Peyer's patches &  
    mesenteric ln)  
  • Live in cells, protected from ABs & disseminate  
    throughout body  
• Endotoxins through damaged mucous membr.  
• Acute protein losing enteropathy  
• Calves 1-2 months (range 1 wk-6 months,  
  peak 6 weeks) (bacteremia)  
  • Transmission via fecal/oral route  
  • Contaminated animal by-product, feeds, milk  
  • Birds, rodents, cats  
  • Stress m/ cause recrudescence & shedding in  
    feces & milk  
  • IP: 1-4 ds or recrudescence from carrier state  
• Predisposition:  
  - Crowded conditions/stress/hygiene  
  - High protein diet  
  - FPT (failure of passive transfer)  
  - Newly purchased calves  
| **Presentation/CS**        | • Enteric  
• Initial fever  
• Intractable diarrhea,  
  brownish, watery to mucoid  
  w/fibrin & blood, "septic  
  tank odor" (protein)  
• Extreme weakness  
• Dehydration  
• Terminal septicemia  
• Enterotoxemia/septicemia  
• Fever, anorexia, depression  
• Meningitis  
• Endotoxic shock  
• Polyarthitis  
• Pneumonia (dyspnea)  
• Sudden death (12 - 24 hours circulatory collapse) w/ or w/o diarrhea  
| **Diagnosis**              | • Difficult  
• PM culture of organism  
  from feces, blood or tissue: Definitive Dx  
• Lab m/ or m/not be able to isolate  
• Culture - need lots of feces  
  • Not easy to grow  
  • Rule: 5 reactive cultures, not  
    economically feasible in cattle  
• Postmortem (PM):  
  • Emaciated  
  • Pseudodiphtheritic mem-  
    brand lining dist. small bowel &  
    large bowel  
  • Isolation from mesenteric  
    lymph node, lung & colon  
• DDx from others  
  • Higher death rate if not treated  
  • Dehydrated more quickly  
  • Feces more fluid due to protein loss  
  • Fibrous casts: blood &/or mucous  
  • Shreds  
  • Abomasum to colon m/t infected  

---

### Incr. in prevalence, Endotoxins
CS: 1 Enteric 2 Septicemic  
Dx: CS, Hx, Fecal cultures  
Tx: Isolate, ABs, Hygiene

---

**Diogosis**

- Isolate sick (noncontact pens)  
- Nibiotics controversial  
  - Clinically ill calves (oral & systemic)  
  - Culture & sensitivity (resistance to many)  
- Oral ABs rapidly become ineffective against enteric dz  
- Systemic ABs prolong recovery & carrier state  
- Trimethoprim/sulfate inexpensive  
- Resistant to pen, strep, erythromycin & tylsin  
- Valuable septicemic animals  
  - IV Banamine®  
  - Intensive IV & oral fluids  
  - Freq. feedings of milk (emaciation)  
  - Bacterin - problems w/ adverse reactions & lack of efficacy

**Prognosis**: Poor, deaths m/ approach 100% in calves

**Control**

- Difficult bec. of carriers  
- #1 adequate colostrum intake  
- Environmental hygiene, constantly clean  
  & disinfect betw. calving (carriers shedding)  
- One-Stroke®, Environ (difficult to eliminate)  
- Culture animal by-product feeds  
  (40% contaminated in USA)  
- Controlling *S. dublin* (chronic carriers)  
  • ID carriers & calves (multiple fecal & milk  
    cultures)  
  • Cull all positive animals

---

**DDx (see p 279):**

- Colibacillosis  
- Rotavirus  
- Coronavirus
Coccidiosis
(Eimeria)  
***  
- See GEN pg 260  
- All ages  
  - Calves > 21 days (life cycle)  
  - Young & stressed animals  
  - Transient partial immunity  
- Eimeria bovis, E. zuernii  
- 5th most important diaz of cattle  
- Life cycle (see Gen)  
- Pathogenesis  
  - Destruction of intestinal epithelium  

Eimeria - #5 - Intest. epith. destruction  
CS: Hemorrhagic diarrhea  
Tx: Difficult, Amprolium, Support  
Prevention: Hygiene, Monensin  

Salmonellosis, adult  
(see GEN pg 259)  
- Most common cause of adult diarrhea  
- Salmonella typhimurium (see DDx p 279)  
- S. dublin (host specific to cattle - longer carrier)  
- Occurs throughout USA, IP: 1-4 ds  
- Stress (intensive management, crowding), parturition  
- Transmission:  
  - Fecal/oral  
  - Contaminated high protein diets (fish meal, fish meal)  
- Milk  
- Penetrates gut wall to mesenteric lymph nodes  

- Acute  
  - Fever  
  - Severe diarrhea (distinctive smell)  
  - Mucoid - watery w fibrin & blood  
- Chronic  
  - Persistent diarrhea  
  - Unthriftiness  
- Endotoxins  
  - Anorexia, depression  
  - Shock  
- Abortion  
- Feedlot (anytime), most common soon after calves arrive  

- Fever & diarrhea  
  - Defin. Dx: PM cultures of organisms from feces, blood or tissue  
  - Lab: No consistent values  
  - Leukopenia often  
  - Metabolic acidosis  

DDx (see pg 279):  
- BVD  
- Johne's dz (p 23)  
- Coccidiosis (p 260)  
- Parasitism (p 54)  
- Poisons (e.g., arsenic)  
- Winter dysentery (p 23)  
- Feed indigestion (p 25)  

- Antibiotics  
  - Amprolium (TOC)  
  - Sulfonamides only partial effective  
  - Nitrofurazone (not approved in USA)  
  - Supportive (Fluids, Isolate)  
  - Treat exposed nonclinical calves  

Ostertagiasis, Parasitism - diarrhea  
- See GI pg 55; Ostertagia ostertagi  
- #1 nematode of cattle, Type I & Type II ostertagiasis - type II overwinters (hypobiosis) in abomasal gastric glands  
- CS: Type I - Anorexia, Poor growth, Diarrhea  
- Type II ostertagiasis (emergence of arrested larvae)  
  - Hypoproteinemia, Diarrhea, Anemia, Fever  
- Dx: Hx, CS, Egg counts misleading  
  - PM: "Moroccan leather" - pathognomonic  
- Tx: Anthelmintics: Adult ostertagia, Give before hypobiosis, Ivermectin, Hi dose of fenbendazole, albendazole  
- Px: Type I - good  
  - Type II - damaged mucosa, unlikely to recover  

- Prevention:  
  - Hygiene  
  - Coccidiostats in feed  
  - (Monensin, Lasalocid, Amprolium, DecoX, Sulfas)  

S. typhimurium  
#1 diarrhea  
Hi protein feed  
Trimeth/Sulfa  

- Most common cause of adult diarrhea (see GEN pg 259)  
- Salmonella typhimurium (see DDx p 279)  
- S. dublin (host specific to cattle - longer carrier)  
- Occurs throughout USA, IP: 1-4 ds  
- Stress (intensive management, crowding), parturition  
- Transmission:  
  - Fecal/oral  
  - Contaminated high protein diets (fish meal, fish meal)  
- Milk  
- Penetrates gut wall to mesenteric lymph nodes  

- Acute  
  - Fever  
  - Severe diarrhea (distinctive smell)  
  - Mucoid - watery w fibrin & blood  
- Chronic  
  - Persistent diarrhea  
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  - Anorexia, depression  
  - Shock  
- Abortion  
- Feedlot (anytime), most common soon after calves arrive  

- Fever & diarrhea  
  - Defin. Dx: PM cultures of organisms from feces, blood or tissue  
  - Lab: No consistent values  
  - Leukopenia often  
  - Metabolic acidosis  

DDx (see pg 279):  
- BVD  
- Johne's dz (p 23)  
- Coccidiosis (p 260)  
- Parasitism (p 54)  
- Poisons (e.g., arsenic)  
- Winter dysentery (p 23)  
- Feed indigestion (p 25)  

- Antibiotics  
  - Amprolium (TOC)  
  - Sulfonamides only partial effective  
  - Nitrofurazone (not approved in USA)  
  - Supportive (Fluids, Isolate)  
  - Treat exposed nonclinical calves  

- Prevention:  
  - Hygiene  
  - Coccidiostats in feed  
  - (Monensin, Lasalocid, Amprolium, DecoX, Sulfas)  

- Prevention:  
  - Hygiene  
  - Coccidiostats in feed  
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- Prevention:  
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  - Coccidiostats in feed  
  - (Monensa...
## Adult Diarrhea

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bovine viral diarrhea (BVD)</td>
<td>• See GEN pg 253</td>
</tr>
<tr>
<td>/Mucosal disease</td>
<td>• Togavirus (pestivirus) - Cytopathic &amp; noncytopathic biotypes</td>
</tr>
<tr>
<td></td>
<td>• Immunosuppressive - m/ predispose to other dis</td>
</tr>
<tr>
<td></td>
<td>• Transmission: Direct contact w/ sick or carriers</td>
</tr>
<tr>
<td></td>
<td>• Indirect from contaminated matter (feces, saliva, semen, uterine discharge, aborted fetuses, placetas)</td>
</tr>
<tr>
<td></td>
<td>• Transplacentally</td>
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<tr>
<td></td>
<td>• Incubation period: 5-10 days</td>
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<td></td>
<td>• Worldwide</td>
</tr>
<tr>
<td></td>
<td>• 1° yearlings, up to 2-3 years</td>
</tr>
<tr>
<td></td>
<td>'Young most common, 8-24 months; all ages susceptible</td>
</tr>
</tbody>
</table>

### Presentation/CS

2. Classical BVD
   - Gastroenteritis
   - Diarrhea - explosive, watery, m/b blood & mucus
   - Dull, depressed, anorexic w/ fever,↑ HR, RR
   - Rumen stasis, m/b mild bloat
   - Rt. flank splashing sounds (intestinal dilatation & fluid)
   - Rapid dehydration - elect. & acid base abnormal
   - Oral erosions - 75%, m/not develop for 10 days
   - Necrotic tongue - blunting of oral papillae & hyperemic
   - Most recover in 10 days
   - If profuse diarrhea m/die w/in 48 hours
3. Respiratory signs
4. Abortion, "Weak calf" syndrome
5. Cerebellar hypoplasia
6. Mucosal diz (chronic BVD, BVD/MD)
   - 100% fatal, but low morbidity
   - Oral erosion, also nares, teats & vulva
   - Total anorexia - cachexia
   - Diarrhea - if persistent & severe, die acutely
   - Lameness: erosive coronary band & interdigital space
   - Majority die w/in 2 mos
7. Persistent infections

### Diagnosis

- Presumptive - PE & PM
- Definit. Dx requires 2-3 weeks
  - Serum neutralization test
    - Persistently infected - m/sero-negative, so viral isolation
    - Viral isolation blood buffy coat
- Leukopenia
  - Dx important to DDx from similar sign in Rinderpest & FMD in countries other than USA
- Postmortem:
  - Degenerative epith. cells (GI)
  - Erosion from mouth through intestine
  - Necrosis of lymphoid tissue
  - Peyer's patches (dark red necrotic foci in ileum)

### BVD/MD

#### DDx (See pg 279):
- Infect. diz w/ oral lesions, diarrhea, fever
- Salmonellosis (p 259)
- Blue tongue (p 10)
- Malig. catarhal fever (p 10)
- Rinderpest (p 9)
- Winter dysentery (p 23)
- Poplar stomatitis (p 8)
- Vesicular stomatitis (p 11)
- IBR in neonates

#### Treatment
- Fluids (for dehydration)
- Prophylactic ABs (immunosuppression of BVD)
- Good husbandry (fresh water, feed & salt available)
- BVD/MD - cull
- Persistently infected cows - sold to slaughter

### Prognosis:
- BVD - guarded to fair
- Cow that aborts, breeding back - good to excellent
- Mucosal diz - grave, euthanasia
  - 100% fatal
- Persistent infection - sold for slaughter

### Prevention & Control
- Vaccination schedule:
  - 1° immunization
  - 2 weeks - booster
  - Annual revaccination
- Eliminate persistent infection & clean up a herd, see Gen pg 253

### Togavirus - Non- & cytotoxic biotypes
- CS: Multisystem viral disease
- Dx: PE, Hx, CS, PM, Isolation
- Tx: Fluids, ABs; BVD/MD: cull
- Px: BVD: guarded to fair; BVD/MD: Grave
- Vaccination: 2 injections w/ annual booster

### Caustic substances in neonates
- Pneumonia (p 62)
- Persistent infection
  - Rinderpest & FMD in countries other than USA
- Heavy metals (p 202)
- Papular stomatitis (p 8)
- Nitrates (p 231)
- Vesicular stomatitis (p 11)
- Caustic substances (p 62)
**Winter dysentery, Winter scours**

**Mk 226; IM 892; BM&S 679; Br 659; BR-hb 396; BR 1026; DC 213; GI 776; Pa 69; Pic 53**

- Acute infection, endemic dys of stabled cattle
- All ages (calves & yearlings least susceptible)
- Winter months
- Herd outbreaks
- Unknown agent probably infect. agent bec. of spreading, m/b coronavirus
- Incubation period 3-5 days
- Sudden onset (1 w/ diarrhea, then rest of herd)

---

**Mycobacterium paratuberculosis**

- Acid fast bact. Survives in soil for one year
- Adult onset 2-5 years
- Subclinical carriers
- Granulomatous enteritis (multiplies in cells of ileum, cecum & associated lymph nodes)
- Malabsorption - protein
- Protein losing enteropathy
- Transmission:
  - Fecal/oral route (so dairy >> beef, due to concentration of animals)
  - Intrauterine
  - Milk
  - Usually introduced into herd by a subclinical carrier

---

**History,** CS: Asymptomatic, Chronic wasting & diarrhea, Fatal

Dx: Isolate org. (12 wks) • PM: granulomatous enteritis

Tx: None - Die if CS; Certify free, Test & Cull

---

**M. paratuberculosis, Adults, Chronic malabs./hypoprot.**

Dx: Isolate org. (12 wks) • PM: granulomatous enteritis

Tx: None - Die if CS; Certify free, Test & Cull

---

**CONTROL & PREVENTION**

Stop introduction into free herd

- Replacements from certified free herds
- Semen from Johnes-free bulls

Infected herds - test & cull

- Adults w/ chronic diarrhea, isolate, test & cull if positive
- Fecal culture all adults at 6 mo intervals, cull positives
- Calves of infected cows, cull
- Separate calves at birth from cows & feces
- Colostrum from negative cows or pasteurized

- Vaccinations of value, but interfere w/ TB tests, need state authorization
- Vaccinate animals that are sold, need a health certificate saying from a Johnes’s infected herd

---

**DDx (See pg 279):**

- Bovine viral diarrhea
- Salmonellosis (p 259)
- Johnes’s disease
- Dietary gastroenteritis
- Coccidiosis (oocysts in feces)
- Toxic agents

---

**DDx:**

- Chronic diarrhea
  - Parasitism (p 54)
  - Chronic BVD (p 9)
  - Salmonellosis (p 259)
  - Renal amyloidosis (p 95)
  - CHF (p 76)
  - Intest. neoplasia (p 51)
  - Fat necrosis (p 50)
  - Chronic pancreatitis (p 53)
  - Weight loss
  - Malnutrition
  - Starvation (p 189)
  - Cobalt or Cu defc (p 87)

---

**Prognosis:**

- None, death if CS
- Subclinical cases often culled for 2.5 problems: poor fertility, mastitis, milk production or other 2.5 dizz
- Reportable, depending on state
Grain Overload

### Digestive System

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amyloidosis</td>
<td>See pg 94. Rare, Urinary system; Twisted sheets of protein that accumulate due to chronic inflammation. Deposited in glomeruli &amp; GI (malabsorption).</td>
<td>CS: Intractable diarrhea, ventral edema, Weight loss, oral lesions</td>
<td>Diet &amp; off feed suggests</td>
<td>Nothing individually</td>
</tr>
<tr>
<td></td>
<td>Dx: CS, Hx, Hypoprothrombinemia, PM: kidney</td>
<td>Tx: Salvage • Px: Grave</td>
<td>Condemnation of rumen (tripe) &amp; liver at necropsy</td>
<td>Send to slaughter</td>
</tr>
<tr>
<td>Parakeratosis,</td>
<td>Feedlot cattle</td>
<td>Not clinically ill usually (good weight gain &amp; food consumption OK)</td>
<td>Diet &amp; off feed suggests</td>
<td>Prevention: Add roughage ration, at least 10% dry matter</td>
</tr>
<tr>
<td>Chronic Rumen</td>
<td>Hi-concentrated ration during finishing w/ inadequate roughage (100% concentrate feed)</td>
<td>Advanced rumenitis or liver abscesses</td>
<td>Condemnation of rumen (tripe) &amp; liver at necropsy</td>
<td>Prevention: Add roughage ration, at least 10% dry matter</td>
</tr>
<tr>
<td>Acidosis, Rumen</td>
<td>Heat treated alfalfa pellets</td>
<td>Anorexia &amp; weight gain</td>
<td>Prognosis: Good: not life threatening, tripe condemned</td>
<td></td>
</tr>
<tr>
<td>itis</td>
<td>Incidence in group as high as 40%</td>
<td>Gaunt abdomen (rumenal fill)</td>
<td></td>
<td>Restore rumen environment</td>
</tr>
<tr>
<td></td>
<td>Also 2nd to acute lactic acidosis</td>
<td>Condemnation of rumen so can’t be used for tripe</td>
<td></td>
<td>Feeding: correct feeding error, fresh green grass</td>
</tr>
<tr>
<td></td>
<td>Hardening &amp; enlargement of the papillae of the rumen (rumenitis)</td>
<td>Sequela: Liver abscesses</td>
<td></td>
<td>Transfaunation</td>
</tr>
<tr>
<td></td>
<td>Bact. through wall to liver = liver abscesses</td>
<td>Chronic laminitis</td>
<td></td>
<td>Oral fluids (to distend &amp; stimulate rumen)</td>
</tr>
<tr>
<td>Prolonged Hi-conc.</td>
<td>Feeding: correct feeding error, fresh green grass</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Finishing, Little</td>
<td>Microfloral inactivity (due to microbial nutrition defc or disruption)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roughage</td>
<td>Causes: Poor quality roughage diet (defc in protein, CHOes) (late hay, lignified hay or straw)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CS: Not clinically</td>
<td>ABs or plant poisons foul up microbes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ill, Economic loss</td>
<td>Prolonged anorexia (#1 cause) Simple indigestion</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(No wt. gain)</td>
<td>Results in break down &amp; impaction of rumen w/ feedstuff</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tx: Nothing</td>
<td>Rumen distention</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prevention: Roughage</td>
<td>Rumen distention</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>10% of dry matter</td>
<td>4 Feces (dry, undigested feedstuff)</td>
<td></td>
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<tr>
<td>Rumen impaction</td>
<td>4 Growth</td>
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<tr>
<td></td>
<td>Ketosis</td>
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<tr>
<td></td>
<td>Emaciation</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Poor hair coat</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>History, CS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Palpate hard rumen</td>
<td></td>
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<tr>
<td></td>
<td>Decreased ruminal motility</td>
<td></td>
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<tr>
<td></td>
<td>Dry feces w/ undigested feedstuff</td>
<td></td>
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<tr>
<td></td>
<td>Inactive microflora, Poor hay, Prolonged anorexia</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CS: Distention,</td>
<td>Feeding: correct feeding error, fresh green grass</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emaciation, Poor hair</td>
<td>Oral fluids</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>coat</td>
<td>Tx: Transfaunation</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Conditions

- **Amyloidosis**
  - See pg 94. Rare, Urinary system; Twisted sheets of protein that accumulate due to chronic inflammation. Deposited in glomeruli & GI (malabsorption).
  - CS: Intractable diarrhea, ventral edema, Weight loss, oral lesions
  - Dx: CS, Hx, Hypoprothrombinemia, PM: kidney
  - Tx: Salvage • Px: Grave

- **Parakeratosis, Chronic Rumen Acidosis, Rumenitis**
  - Feedlot cattle
  - Hi-concentrated ration during finishing w/ inadequate roughage (100% concentrate feed)
  - Heat treated alfalfa pellets
  - Incidence in group as high as 40%
  - Lowers pH & VFA (volatile fatty acids)
  - Also 2nd to acute lactic acidosis
  - Hardening & enlargement of the papillae of the rumen (rumenitis)
  - Bact. through wall to liver = liver abscesses

- **Prolonged Hi-conc. feeds (finishing), Little roughage**
  - Microfloral inactivity (due to microbial nutrition defc or disruption)
  - Causes: Poor quality roughage diet (defc in protein, CHOes) (late hay, lignified hay or straw)
  - ABs or plant poisons foul up microbes
  - Prolonged anorexia (#1 cause) Simple indigestion
  - Results in break down & impaction of rumen w/ feedstuff

- **Rumen impaction**
  - Microfloral inactivity (due to microbial nutrition defc or disruption)
  - Causes: Poor quality roughage diet (defc in protein, CHOes) (late hay, lignified hay or straw)
  - ABs or plant poisons foul up microbes
  - Prolonged anorexia (#1 cause) Simple indigestion
  - Results in break down & impaction of rumen w/ feedstuff

- **Rumen distention**
  - 4 Feces (dry, undigested feedstuff)
  - 4 Growth
  - Ketosis
  - Emaciation
  - Poor hair coat

- **History, CS**
  - Palpate hard rumen
  - Decreased ruminal motility
  - Dry feces w/ undigested feedstuff

- **Inactive microflora, Poor hay, Prolonged anorexia**
  - Feeding: correct feeding error, fresh green grass
  - Transfaunation
  - Oral fluids (to distend & stimulate rumen)
**Grain overload, Lactic acidosis, Ruminal impaction, Acid indigestion, Toxic indigestion, Grain engorgement, D-lactic acidosis**

- **Dramatic acute diz. m/b lethal 24 hrs**
- **Cause:**
  - Engorge on fermentable CHO (carbohydrates)
  - Feedlot: introduction to grain
  - Accidental access to grain
  - Cereal grains w/o sufficient roughage, also fruits & root crops (beets, sugar beets, potatoes), salage
    - Roughage incr. buffering saliva
  - Fermentation of CHO to lactic acid (rumen pH ≤ 5)
  - Disrupts flora: kills lactate-utilizing org. (protozoa & bacteria) & lactate acid producing organisms (Gram positive bacteria [Strep. bovis & Lactobacilli])
  - Systemic acidosis
  - Dehydration: osmotic pressure rises & pulls fluid into rumen from circulation
  - Diarrhea: osmotic press. rise in intestine
    - Liver, cardiac & renal function
  - Severity: depends on adaptation to grain, 20 lb m/ cause death if unaccustomed to grain
  - Groups > single (competitive gluttony!)

- **CS in 12:36 hours**
- **Simple indigestion**
  - Full rumen
  - Bloat (rumen atony)
  - Colic (kicking lethly)
  - Anorexia, BAR
  - Diarrhea common
  - Reduced rumenal movements
  - Returns to eating 3-4 days
- **Fatal toxemic acidosis**
  - Complete anorexia, depression
  - Recumbency w/ head to flank
  - Temp. below normal 98-101°F
  - Resp. shallow & rapid 60-90/min (acidosis)
  - Elevated HR
  - Profuse, wet diarrhea (sweet odor)
  - Dehydration
    - CNS: ataxia, stagger
    - ± Anuria due to dehydration
    - ± Die in 24-72 hours
- **Sequela to recovery**
  - Chronic poor doers (rumenitis, liver abscesses)
  - Laminitis (histamine release?)
  - Metabolic alkalosis
  - Fungal rumenitis, abscesses
  - Hepatic abscesses, peritonitis
  - Abortion (days - weeks later)

**† Lactic acid, Rumenal flora**

**CS: Indigestion; Toxemia**

**Dx: CS, Hx, Rumen atony, Lab: pH < 5**

**Tx: Empty rumen, Fluids**

**Rumen alkalosis**

- Uncommon, Rumen pH 7-7.5
- 1° in poor digestible roughage
- Soya bean or high protein engorgement
- Fermentation reduced & saliva continues
  - Prolonged anorexia
  - Poorly digestable roughage
  - Simple indigestion
  - Excess ammonia NPN (nonprotein nitrogen)

**Poor doing animal**

- Excitement & hyperventilation
- Muscle tremors, Convulsions
- Slow, shallow breathing
- Dyspnea & hypervent in later stages

**History, CS**

- Ruminal atony w/ gurgling sounds
- Dehydration, † PCV
- Lab:
  - Low ruminal pH < 5 (severe acidosis)
  - Ruminal flora (no protozoa)
  - Gram stain change from Gr neg to Gr + bac
  - ± Urine pH 5
  - Blood pH < 7.2

**Mild to moderate**

- Restrict grain & water
- Provide hay & exercise
- Activated charcoal (1 lb/1000 lb) + mineral oil (1 gal/1000 lb)
- Magnesium hydroxide (500 g/1000 lb) into rumen antacid early

**Toxic - emergency**

- Consider slaughter if serious CS
- Restrict water 18-24 hours
- Empty rumen
  - Large stomach tube (add water & gravity drain) 15-20 times
  - Rumenotomy & alphon
- Transfaunation
- Fluid therapy
- Good quality hay during recovery
- Thiabendazole (anthelmintic) helpful to control 2° mycotic infection

**Prevention:**

- Avoid sudden changes in diet
- Adequate roughage
- Bring onto full feed gradually

**Prognosis (Px):**

- Poor: peracute recumbency
- Good: less acute standing cases
- Good: if pH > 5, HR 70-85, ruminal contractions, & willingness to eat win 3 ds
- Poor: HR 120/140 poor
- Grave: Mycotic infection w/ relapse

**Electrolyte w/ excess chloride (Ringer's) 30-50 L over 24 hours**

- Concentrate feeds
- Good quality hay
- Transfaunation
**Bloat**

- Excessive accumulation of gas in rumen & reticulum
- CS of underlying disorder
- Not a diagnosis
- Common in cattle, all ruminants

**Frothy Bloat**
- CS & Hx - bloat, new pasture
- Stomach tube doesn’t relieve

**Free Gas Bloat**
- Determine underlying cause of failure to eructate
- Stomach tube relieves

**Chronic Bloat**
- Repeated bloating

**Presentation/CS**

- Distension of left side of abdomen, especially paralumbar fossa
- Mild distention, clinically insignificant
- Severe:
  - Labored breathing
  - Excessive salivation
  - Anorexia, m/ cease eructation
  - Colic
  - Cyanotic mucous membranes
  - Staggering
  - ± Vomiting
  - Collapse, death

**Postmortem:**

- "Bloatline" of esophagus, cervical portion congested, thoracic portion pale
- Frothy bloat: uniform consistency to rumenal contents, less frothy than before death

**Diagnosis**

- Frothy Bloat
- Free gas bloat
- Chronic Bloat

**Treatment**

- TX - FREE GAS BLOAT
  - Emergency if life threatening - severe compromise to resp.; remove gas
    - Try endogastric tube
    - Trocarize - (nick in skin 1st, relieves immediate problem, peritonitis sequela)
  - Exploratory - to understand cause
  - Mineral oil to relieve gas, Carmelax®
  - ABS if 1st infection or if emergency trocarization
  - Naxcel® (celitofur)
  - NSAIDs - aspirin - for underlying cause such as fever, pneumonia, abscesses, endotoxemia
  - Disruption of rumenal flora
    - Transfaunaition - repeated until establish normal situation, or
    - Probiotics (poor 2nd choice to transfaunaition)

- TX - FROTHY BLOAT
  - Relieve bloat, Emergency if life threatening
    - Rumenotomy (uneventful recovery)
      - Large bore trocar & cannula (1") (regular not big enough to relieve quickly) or large knife
      - Stomach tube - if doesn’t relieve, use tube for defoaming agent
    - Proloxeal® (therabloat®) - defoaming agent/nonionic surfactants - most effective, m/b several times, use early
      - Box of "Tide" detergent
    - Empty rumen completely m/b, transfaunaition + Bicarbonate to alkaline the pH (pH in low 5s)
    - Consider diet

- TX - CHRONIC BLOAT
  - Temporary/permanent rumenal fistula (see box)
Pasture frothy bloat
- Predispersed in some animals
- Feedstuff - protein content & rate of digestion
- Legumes (high prot. & ground quickly to fine particles)
- Lush pastures w/ high % of rapid growth

Feedlot frothy bloat
- Uncertain, m/b species of bacteria producing insoluble slime (trans bubbles)
- Finely ground feed - promotes stable foam

2° Free gas bloat
- Related to failure to eructate
- Rarely due to excessive gas production, but 2° to problem with eructation

Diagnostic approaches to bloat
- History is very important
  - Sternal or lateral recumbency?
  - Acute vs chronic
  - Diet: sudden changes?
  - Other diz problems? toxic mastitis? endotoxemia?
  - Pressure on esophagus due to enlarged Inn.?
- Vital signs
  - Evidence of colic or abd. pain?
  - Rumenal contractions, strength & how often
  - Acute severe bloat is an emergency!
  - Frothy bloat puts pressure on resp. tract. Also an emergency!
- Rumen intubation - treats & identifies problem
  - If can't open mouth, think tetanus
  - Stomach tube
    - If doesn't pass = esophageal obstruction
    - If passes easily, but doesn't relieve gas = frothy bloat
    - If passes, resistance, then sudden release of gas = blocked cardia &/or pressure on esophagus
    - If passes easily & releases gas - rumenal stasis where gas can't get to cardia
  - Palpation & ballottement - consistency of rumen
    - Frothy bloat is one consistency throughout
    - Free gas bloat is like punching a balloon

Rumen fistula
- Rumenostomy, in left flank, high so in dorsal sac (not at fluid line)
  - 2° skin incision
  - Grid muscle layers & incise peritoneum
  - Grasp rumen w/ towel clamps
  - Incise rumen & suture edge to skin edges w/ simple continuous suture
  - Opening should be able to accept a quarter
  - Gridded muscles act as valve, opening when distended, closing when relaxed
  - Can lose large amounts of heat in cold climate through fistula
  - Fistula routinely heals if cause of bloat is corrected
- Ranchers often use a large knife to relieve bloat
  - The vet then later sees the animal

Prevent FREE GAS BLOAT
- 1° underlying diz
- Get in sternal recumbency if on side
- Fast animal prior to any surgery to reduce substrate

Prevent FROTHY BLOAT
- Prolozaline blocks (Bloat guard®, Therabloate®)
- Prolozaline feed mix (must be given daily)
- Added prevention for pasture frothy bloat
  - Difficult - management
  - Hay before pasture
  - Restrict grazing to 20 min. 1st few days
  - Strip grazing
  - Pre-bloom pastures most dangerous
  - Antifoaming agents - oils, fats & nonionic surfactants (automatic dosing syringe, in water or feed, painted on flank)
- Added prevention for feedlot frothy bloat
  - 10-15% chopped roughage
  - Rolled or cracked grain, not finely ground
Ruminant Indigestion

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment - Prognosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ruminant indigestion</td>
<td>• Common group of dizs of dysfunction of the reticulorumen</td>
<td>• Inappetence</td>
<td>• Easy if herd &amp; recent feed change</td>
<td>• Feed change - herd</td>
</tr>
<tr>
<td></td>
<td>• Commonly caused by feed change</td>
<td>• Reticulorumenal motility usually, rumination ceases</td>
<td>• Difficult if single animal affected</td>
<td>- Transfaunation</td>
</tr>
<tr>
<td></td>
<td>• Nongrazing cattle, intermittently fed</td>
<td>• Milk production</td>
<td>- History, CS</td>
<td>- Oral alkalizing (Mg hydroxide)</td>
</tr>
<tr>
<td></td>
<td>• Pathogenesis</td>
<td>• Abnormal feces, malodorous loose stool 12-24 hours after CS</td>
<td>- Abn. forestomach motility</td>
<td>or acidifying agents (vinegar)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• No systemic illness</td>
<td>- Abnormal rumen contents</td>
<td>• Single animal</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- R/O all other diz affecting GI</td>
<td>- Correct problem</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Rumen fluid analysis</td>
<td>- Relieve distention</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Exploratory for cause</td>
<td>- Transfaunation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- Limit feed &amp; water</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Rumen fistula if chronic bloat</td>
</tr>
<tr>
<td></td>
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</tr>
</tbody>
</table>

DDx if single animal
1° Indigestion
- Vagal indigestion (p 29)
- Hardware diz (p 38)
- Frosty bloat (p 28)
- Free gas bloating (p 28)
- Reticulitis/rumenitis (p 29)
- Obstruction of cardia
- Diaphragmatic hernia (p 48)

1° Fermentative disorders
- Rumen impaction (p 25)
- Simple indigestion (p 28)
- Lactic acidosis (p 25)
- Rumen alkalosis (p 25)
- Putrefaction of rumen ingesta

2° Indigestion
- Reticulorumenal motor activity
- Reticulorumenal microflora inactivity
- Abomasal reflux

Nervous control of motor activity
- Sensory: tension sensory receptors in rt. medial wall of reticulum, buccal receptors & acid receptors in abomasum
- Gastric motor centers in medulla, integrate sensory input & generate motor impulses
- Motor:
  - Parasympathetic: vagus n. causes contractions of reticulorumen
  - Sympathetic: splanchnic nn. & adrenal gland, inhibit reticulorumenal contractions, do not initiate them (gastric dilatation or surgical manipulation of gut can cause splanchnic inhibition of reticulorumen)

Motor Activity - Reticulorumen
- 1st cycle (biphasic reticular contraction w/ rumen contraction in between)
  - Reticulum contracts & wave passes caudally across dorsal sac of rumen, then cranially over ventr. sac (mixes ingesta & saliva)
  - Reticulum contracts again, reticulo- omasal orifice relaxes & reticular ingesta passes into omasum
- 2nd cycle follows two 1st cycles
  - Caud. dors. blind sac contracts & wave moves across the dorsal sac of rumen (pushes gas to cardia for eructation)

Reticulorumenal dysfunction; #1 Feed change (herd)
CS: Inappetence, Loose stool, Milk, Rumen atony
Dx: Herd (feed change); Individual (Hx, CS, Rumen fluid, Exploratory)
Tx: Transfaunation
**Vagal indigestion**

**Hoflund's syndrome**

Abomasal reflux

Mk 179; CST 730; IM 830, 834; VC/S 382, 412; BR-225; 105, 106; BR 284, 292; Br 640, DC 116; GI 725; S-J 527; Pw 65

- **Group of dizs impeding passage of ingesta from reticulum &/or abomasum**
- **Mimics transection of vagus n. innervation to forestomachs & abomasum**
- **Paralysis of rumenal stomach**
- **Delayed passage of ingesta, two 1st syndromes (some divide into four)**
  - Adults, rarely in cattle < 2 yrs old

**CS Both types**

- **Anorexia/indigestion**
- **Dehydration**
- **Papple bloat (filling, not gas)**
- **Loss of weight**
  - Starvation, missed b. of abd. distention
- **Little feces**
  - ↑ Ruminal motility or atony
  - Rumen contents homogenous, not stratified

**Type 1 • Omasal transport failure**

- **Paralysis of reticulo-omasal orifice**
- **Accumulation of ingesta in reticulum & rumen**
- **Omasum/abomasum empty (relatively)**
  - Mimics cutting the ventr. & dors. vagal n. trunks
  - Rt. med. wall of reticulum tension sensory receptors (vagus n.) damaged

**CS Omasal transport failure:**

- Adult cows > 2 years
- **Indigestion**
- ↓ Milk production
- **Will drink water**
- Mild to moderate dehydration
- Electrolytes normal, serum & rumen

**Causes of Type 1**

- **1st hardware disease**
  - Adhesions in omasum
  - Abscesses
  - Liver abscesses (p 36)
  - Diffuse peritonitis (p 53)
  - Reticulitis
  - Obstruction of reticulo-omasal orifice (neoplasia, FB, papilloma, ingested placenta, Actinomyces granuloma)
  - Leakage from abd. viscera
  - Adhesion on rt. med. wall

**CS pyloric outflow failure:**

- **Marked dehydration**
- **Hyperchloremic metabolic alkalosis**
- ↓ Cl in rumen

**Causes of Type 2**

- **Volvulus of abomasum** (p 40)
  - (most common)
- **Displaced abomasum** (p 40)
- **Sx correction of above, abomasum atonia**
- **Abomasal ulceration - leakage into peritoneum w/ adhesion or abscess formation** (p 31)
- **2nd to advanced pregnancy, large fetus compressing pylorus**

**Type 2 • Pyloric outflow failure**

- **Paralysis of pylorus (outflow of abomasum, not stenosis, but rimmers)**
- **Ingesta accumulates in abomasum, omasum & reticulum**
- **Internal vomiting into reticulum (distention)**
  - ↓ Cl in rumen (peripheral Cl decr.)
- **Cause: disruption of vagus to pylorus?**

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**Slaughter; or**

- **Slow response to Tx**, depends on status of animal & if rumenal motility

**Exploratory laparotomy for cause**

- (most cases)

- **Correct underlying problem**

- **Relieve distention, critical**
  - Large bore stomach tube
  - Sx remove rumenal fluid

- **IV fluids (40 L m/b necessary)**

- **Transfaunation**

- **Limit feed & water** (palatable, hi-fiber)

- **Poor doesers if from hardware diz or persists after calving**

- **Large fetus causing obstruction**

- **Remove fetus, resolves C-section**

- **Dexamethasone to induce labor**

**Px: guarded to poor**

- **Favorable signs - normal 1st & 2nd contractions, incr. appetite, no bloat, weight gain, incr. fecal production**

- **Unfavorable CS: repeated bloat, scant feces, poor rumenal motility, recurrent bloat - grave**

**"Papple" - distention**

- **Apple shape to lt. side of abd. (rumen, ventral & dorsal sac)**

- **Pear shape to rt. side (ventral sac)**
## Abomasal Impaction/Obstruction

<table>
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<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
</table>
| Abomasal impaction/obstruction | • Accumulation in abomasum w/ failure to transport  
• Winter, pregnant beef cattle, & calves  
• Causes - #1 poor quality roughage as sole feed + dehydration  
- Common - overwintering beef cows  
- Severely cold weather  
- Mechanical obstruction of pylorus  
. Calves eating bedding  
. Calves - hair balls  
. Lymphosarcoma  
. Lodging of ingested placenta  
. Vagal nerve damage or stretching of musculature  
. Lack of motility of abomasum  
. Sx for abomasal volvulus | • "Papple"-shaped abdomen (gradual abomasal & rumenal enlargement)  
• Thin (neg. energy balance), but bloated  
• Reduced feed intake  
• ↑ & firmer feces  
• Severe: recumbent & groaning | • Palpation of firm mass of abomasum following costal arch | • Salvage by slaughter (usually has presented in advanced stages & Tx unrewarding)  
- If Tx doesn't work, death usually follows a few days after onset of CS |

### Winter, Pregnant beef, Dry roughage

CS: "Papple", Thin  
Dx: CS, Hx, "Papple", Metabolic alkalosis  
Tx: Salvage  
Px: Poor

---

### DDx:

- Hydrops (allantois) (p 113)  
- Chronic peritonitis (p 53)  
- Vagal indigestion (forestomach outflow problems) - no impaction (p 29)  
- Intestinal obstruction (palpable loops) (p 44)  
- Volvulus of abomasum (p 40)
Abomasal ulcer diz

- Adult dairy cows & calves (rare in small ruminants)
- Specific cause unknown
  - Assoc. w/ stress
  - Intensive management & high grain (starch) diets
  - Calves - parturition, onset of lactation & grain fed
- Calves (dairy, veal & feedlot) pushed for weight gain, sudden dietary changes (milk to solid diet)
- Clostridium perfringens
- Hair balls (trichobezoars) commonly present in calves
- Lymphosarcoma assoc.
- Viral erosion of mucosa (BVD, Rinderpest)
- Ulcer - full thickness erosion of mucosa

Type I - nonperforating
Type II - non-perf., but significant bleeding
Type III - perf. ulcers w/ localized peritonitis
Type IV - perf. ulcers w/ diffuse peritonitis

#1 GI bleeding, Adult & calves, Stress
CS: Melena, Peritonitis - Perforation
Dx: Occult blood, Exploratory
Tx: Salvage, Diet, Stress, ABs, Fluids

Varies, dep. if complicated by hemorrhage or perforation - mild indigestion to death

ADULT DAIRY COWS
- Type I (nonperforating or bleeding)
  - Mild abd. pain (shown by anorexia, decr. rumenal motility & mild rumen tympany)
- Type II (Bleeding ulcers)
  - Acute anorexia
  - Mild abdominal pain
  - Rumen stasis
  - Tachycardia (90-100 min)
  - Milk production
  - Melena (scant, dark, tarry, bloody stool)
  - ± Anemia, hemorrhage, shock, death in < 24 hours or subacute bleeding to hemorrhagic anemia, w/o melena (more common)

Types III & IV (Perforating)
- Local peritonitis - similar to Hardware diz
  - Fever, anorexia, milk production
  - Intermittent diarrhea
  - Pain in right cranial quadrant
  - Abates in 2 days (like hardware diz)
  - Diffuse peritonitis (rupture)
  - Shock & death in a few hours

CALVES (no categories)
- Acute abdominal tympany
- Colic, general peritonitis w/ assoc. CS
- Often die

CS, History
- Fecal occult blood test (inexpensive & done during PE)
- Grunt test - palpation behind xiphoid on right
- W/o melena difficult
- Exploratory laparotomy
- Lab:
  - Fecal occult blood test
    - Several samples
    - Adult - hemorrhagic anemia
    - Bovine leukemia virus titers, if positive - cull
  - Single or multiple ulcers in fundic part of greater curvature

DDx:
- Distended abomasum
- Rt. displaced abomasum (p 40)
- Melena
- Duodenal ulcers (identical) (p 31)
- Hematemesis
- Abomasal torsion (p 40)
- Intestinal obstruction (p 44)
- Intussusception (p 45)
- Blood sucking parasites (p 56)

Perforation
- Peritonitis (p 53)
  - Chronic Hardware diz (p 38)
  - Uterine rupture (p 113)
  - Cecal rupture
- Calves
  - Chronic abomasitis (identical)

Salvage for slaughter (since most occur 1st month post calving, most common Tx because don't come back into lactation until next year)

Correct dietary problems
- Calves - feed small amounts freq. instead of DID
- Adults, trade starch w/ good quality hay & confinement

Alleviate stress
- Tx ulcer problems
  - Whole blood transfusions - PCV < 14% (4 L once usually enough, Sx unrewarding for bleeding ulcers)
  - ABs - broad spectrum for peritonitis
  - Antacids (magnesium oxide following copper sulfate sol. to close gastric groove into abomasum)
  - IV fluids in animals not eating & drinking (careful in diffuse peritonitis because of pulmonary edema due to hypoproteinemia)

Bovine leukemia virus titers + ulcers = cull

Surgery for perforation (carefully break adhesions so don't get spillage. Exteriorize to resect, oversew & replace)

Prognosis:
- Nonbleeding/ nonperforating - good
- Stop bleeding & local peritonitis - guarded
- Chronic ulcers - poor
- Diffuse peritonitis - death

Control:
- Change dietary management
  - Avoid sudden changes in diet
  - Include adequate roughage
- Minimize stress
**Ketosis**

**Digestive System**

<table>
<thead>
<tr>
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<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
</table>
| Fat cow syndrome, Fatty liver | - Similar to pregnancy toxemia but different cause | - Hi-production dairy cows postparturient
  - Common in loose housing where all cattle fed same diet
  - Adults > heifers
  - 1st 2 wks of lactation (up to 1 month) | - Herd
  - Obese cows in dry period
  - Subclinical cases
  - Clinical cases
    - Anorexia, depression
    - Rapid weight/condition loss
  - Milk production
  - Weakness, recumbency
  - Terminal tachycardia & coma
  - Death in 7-10 days
  - CNS problems (ketosis) | - History (fat cows in dry period)
  - Palpate enlarged liver on rt. (paralumbar)
  - Lab: m/ or m/not be changed
  - Ketonuria
    - Decreased potassium, Ca, Mg, WBCs, Glucose, Cholesterol
    - Increased Bilirubin, AST, GGT
  - Liver biopsy for subclinical cases
    - If > 35% fat (will float) bad sign
  - Postmortem:
    - Fat, enlarged liver that floats | - Return to positive energy balance
  - Force feed high quality, palatable roughage
  - IV glucose initially until begins to eat
  - Oral propylene glycol working up to 6-8 oz BID (too much forces off feed)
  - Transfaunation
  - Fluid & electrolyte balance |
| Overfed in dry period, Just calved, Anorexia/Neg. energy balance | - Overfeeding (lactation diet) in late pregnancy/dry period
  - Obese cow at calving
  - Anorexia of calving (neg. energy balance)
  - Sudden energy demand of lactation
  - Mobilizes fat deposits of body
    - Rapid weight, loss
    - Fat deposited in liver & other organs
    - Liver dysfunction - hypoglycemia
    - Lipids into Kreb's cycle w/ no acetyl-CoA = ketone bodies
  - Spilled ketones into urine & ketosis | - Sequelae &/or cause
  - Milk fever
  - Mastitis
  - Salmonellosis
  - Retained placenta
  - Metritis
  - Indigestion | - DDx Fatty liver from Ketosis
  - Fatty liver
  - Fat cows
  - 1st weeks postcalving
  - Poor response to Tx
  - Ketosis
  - Fat or thin
  - At peak lactation 3 weeks (usually)
  - Good response to Tx | - Dx: Hx, CS, Ketones, Floating fatty liver (> 35%)
  - Tx: Energy (IV Glucose, Propylene glycol)
  - Prevent obesity precalving & maximize energy intake post-calving
  - Dry out cows on pasture & maintain, but do not incr. body condition
  - Concentrates can be used to maintain body condition
  - Minimize calving intervals so they don't have a prolonged dry period (not over 2 mo)
  - Generally dry at 300 d of gestation |

**Diagnosis**

**Prevention**

- Rare/sporadic in fat beef cows (more common in sheep). Heavily fed in early pregnancy, Nutritional stress 2 months before calving (i.e., run out of pasture), Predisposing: Twins, Cold weather
- CS: Fat, pregnant beef cow, Anorectic, Transitory restlessness & incoordination, Sternal recumbency, Clear nasal discharge, Dry, cracked muzzle, Rapid respiration & grunting, 7-10 days comatose & death
- Dx: Hc, CS, Lab: Ketonemia, ketonuria, hypoglycemia & proteinuria, Elev. liver enzyme GOT, PM, Enlarged fatty liver
- DDx: Johne's dis (pg 23), Lymphosarcoma (pg 268), Parasitism, Chronic pulmonary dis, Other deficiencies, Debilitating dis, Fat cow syndrome (above), Lead poisoning (pg 152), Pyelonephritis (pg 98), Empyemeral fever, Traumatic reticulitis (pg 36)
- Tx: Generally ineffective, esp. if recurrent, Anabolic steroids (Vebonol®, Finajel®), Glucose, fluids, propylene glycol, Induce purgation (corticosteroids or X-section) m/ save cow, Supplement rest of herd w/ good quality hay • Px: Grave: most die

**Prognosis**

- Variable to poor, if floats (fat > 35%) poor
  - 25% fatal

**Treatment**

- beef cows before calving
Ketosis, Acetonemia, Ketonemia
Nervous ketosis

- Metabolic diz of lactating cows
  - Ds to few wks postcalving (w/in 6 wks)
  - Economic loss - decr. milk production & return to full prod.
- Fat or thin, housed dairy cows (pasture cows in Southern hemisphere)
- Cause
  - Subclinical
    - Anorexia (don't eat conc. but continue to eat roughage)
    - Weight/condition loss
      - Drop in milk production
      - Constipation
      - Mucus-covered feces
      - "Glazed" eyes
      - Humpback m/b (colic)
    - CNS CS: circling, staggering, licking, bellowing, hyperesthesia, head pressing, apparently blind, trembling
    - Acetone breath
    - Subclinical: no CS, but excrete ketones
    - CS of other dizs
    - Self limiting

- History, CS
- CS or other dizs
- Smell breath (acetone)
- Lab
  - Hypoglycemia (< 25 mg/dl, norm > 40-50)
  - Ketonemia (> 30 mg/dl, norm < 10)
  - Ketonuria not definitive
  - Acetest®, Ketostix® urine or milk to rule out ketosis if neg.
- Response to Tx

- Prevention
  - No overly fat or thin cows
  - Plane of nutrition started 2 weeks before calving (reduced lactation diet) to allow microflora to adjust to lactation diet
  - Increase energy after parturition
    - Maximum glucose precursors
    - Minimize hay crops or silage hi in butyric acid precursors
    - Good quality roughage minimum of 1/3rd of ration
      . Alfalfa hay, 3 kg/100 kg body weight
    - If concentrates used - readily digested carbohydrates
    - Adequate vitamins & minerals
    - If high concentrate diets, divide into 4 feedings/day
  - Daily exercise
  - Problem herds: monitor ketone levels in milk & urine
  - Supplement susceptible cows w/ oral propylene glycol

Prognosis:
- Rarely fatal, self limiting, once lactation stops, glucose demand stops
- Return to milk production important

Fat or thin - Lactation peaks before intake = Mobilizes fat (Ketosis)
CS: Weight/Condition loss & CNS
Dx: Hx, CS, Acetone breath, Ketones & Hypoglycemia, Tx response
Tx: Glucose + Steroids + Propylene glycol + Feed

Glucose IV (500 ml 40% sol) alleviates, lasts 2 hrs
- Glucocorticoids IV (prednisolone 100 mg, dexamethasone 10 mg)
- Propylene glycol PO (glucose precursor bid)
  - Add cobalt salt in deficient areas
  - Rapid return to full nutrition (hay & whole cats)
  - Other treatments
    - Chloral hydrate if nervous form (PO bid 3-5 d)

---

DDx:
- Fat cow syndrome (p 32)
- Listeriosis (CNS not transient) (p 143)
- Rabies (always fatal) (p 144)
- Tetanus (p 145)
# Liver Disease

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</table>
| Liver disease, Hepatitis | • Liver m/b diseased long before it fails to function  
• CS not seen in early stages  
• Loss of 80% of liver before regeneration & recovery impossible  
• Remarkable ability to regenerate | • No pathognomonic CS for liver diz  
• No CS of liver diz consistently present  
• Most signs related to failure of liver function (except pain)  
• Icterus uncommon unless biliary obstruction  
• Hemolysis can also cause incr. bilirubin  
• Failure of uptake, conjugation or excretion of bilirubin  
• Wt. loss common, but not specific in chronic diz  
• Diarrhea possible in chronic liver diz  
• Dermatitis (hepatic photosensitization) due to phylloerythrin accumulating in skin  
• Ascites common in calves w/ liver cirrhosis  
• Lighter colored feces in calves (decr. bilirubin)  
• Hemorrhage terminally (decr. clotting factors)  
• 2° Hepatomegaly, encephalopathy  
• Behavioral changes  
  • Docile animal becomes aggressive, aggressive becomes docile  
• Depression, incoordination, aimless walking, head pressing, vocalization  
• Multiple causes: low blood glucose levels, incr. ammonia  | • Hx, CS  
• Lab:  
  - Slightly ↓ blood glucose  
  - Ammonia (4x)  
  - BUN (urease needed)  
  - Terminally ↓ serum albumin  
• Enzymes  
  • ↑ GGT in biliary infections  
  • ↑ ALP in chronic - also in bone, intestine, placenta & macrophages  
  • SDH, LDH & GDH  
  - ↑ in acute diz, normal or ↓ in chronic  
  • SDH: active hepatocellular necrosis  
• Excretion tests:  
  • Bilirubin: elevation indicates liver diz, bile blockage, hemolysis  
  • Eile acids (BA)  
  • Liver biopsy - safe & simple, but expensive & avoid if liver abscesses if suspected  
  - Useful in generalized not localized problems  | • Slaughter if severe fibrosis & failure  
• Acute liver failure  
  - 1st sedate (xylazine)  
  - 10% glucose IV  
• Correct any acidosis slowly  
• Slow 5-10% dextrose drip  
• Low protein diets  
• Vit. B1, folic acid & Vit. K1 weekly  
• Fresh plasma transfusions  
• Corticosteroids: if not infectious  
• Protect from sun when grazing  
• Colchicine  
• Antibiotics  
  • Avoid those metabolized by liver such as tetracycline & chloramphenicol  |

** Liver biopsy site   
• Rt. 11th ICS (intercostal space) on line from tuber coxae to shoulder joint   

## Poor Prognosis indicators   
• Prothrombin time > 30% of normal   
• Greatly ↑ GGT & ALP w/ normal or ↓ SDH or LDH   
• Marked fibrosis   
• Grave w/ pyrrolizidine alkaloid toxicosis   

↑ GGT - Biliary   
↑ SDH - Acute
### Mycotoxins - Hepatotoxin

**See TOX pg 232; Aflatoxin & Rubratoxin, Toxic metabolites of molds, Grow on feed (grains, corn, cottonseed), Calves > adults cattle > sheep**
- **CS:** Liver failure, Acute liver insufficiency
- **Dx:** Analysis of feeds for mycotoxin conc., Liver biopsy (central lobular fat infiltration & hepatic, necrosis, fibrosis)
- **Tx** not usually successful, Activated charcoal slurry orally & oxytetracycline IM

### Ragwort poisoning, Pyrrolizidine alkaloid toxicity

**See TOX pg 233, P. plants: tansy ragwort & others, alkaloids, cumulative & progressive, chronic disorder; Fibrosis, West USA**
- **CS:** Liver failure, Wt. loss, Hepatoencephalopathy (abnormal behavior, ataxia, wandering), Icterus (uncommon in cattle), Photosensitization
- **Dx:** Difficult w/o hx of eating, Geographic area, Feed analysis, Liver biopsy (central lobular necrosis, centrlobular infiltration & hepatic, necrobiotic foci)
- **Tx:** Euthanasia: if severe fibrosis, Remove plant source, If appetite & little fibrosis treat for liver failure
- **Px:** Poor to grave due to tremendous amount of fibrosis

### Waste oil ingestion (spread to control dust), tetrachlordibenzodioxin

**Tx:** supportive, additionally show acute signs after being exposed fairly recently. Use of intestinal protectants and/or cathartic is indicated

### Telangiectasia (IM 945, Pa 88)

"Sawdust livers", focal degeneration in liver lobular circulation (red-brown foci 1-5 mm in diameter) found at slaughter, Cause unknown, Results in condemnation of 2% of livers of slaughtered cattle

### Cholangitis (Mk 138; IM 948; CT 263; BR-hb 121; BR 324; GI 837; S-O 470)

**Inflammation of bile system; Result of fascioliasis**
- **CS:** anorexia, pain, ruminal stasis, icterus

### Neoplasms of gall bladder (IM 946)

**Rare (most adenomas or adenocarcinomas, 1 case reported of bovine leukosis)**

### Bile stones, Cholelithiasis (Mk 133; IM 947; GI 793; Pa 108)

**Calculi (bile stones) in bile duct, Choledocholithiasis: presence of calculi in bile duct, Cause debatable, Postmortem finding in cattle: Icterus; Decr. milk production, Hypophagia reported before slaughter**
- **Dx:** Findings postmortem

### Hepatic neoplasia (IM 945; GI 835; Pa 105)

<table>
<thead>
<tr>
<th>Rare in cattle</th>
<th>0.01%, Metastasis of lymphosarcoma (2*)</th>
<th>Tx: None</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waste oil ingestion</td>
<td>(spread to control dust), tetrachlordibenzodioxin</td>
<td><strong>Tx:</strong> supportive, additionally show acute signs after being exposed fairly recently. Use of intestinal protectants and/or cathartic is indicated</td>
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<td>(IM 945, Pa 88)</td>
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<tr>
<td><strong>Dx:</strong> Findings postmortem</td>
<td></td>
<td><strong>35</strong></td>
</tr>
</tbody>
</table>
Liver abscesses
Necrobacillosis of liver

**Facts/Cause**
- Beef/Feedlot up to 95% fattened cows
  - Beef > dairy ban. usually associated w/ rumenitis caused by lactic acidosis
  - Condemnation of liver at slaughter
- *Fusobacterium necrophorum* #1 gr. neg. obligate anaerobic, normal flora
- Corynebacterium pyogenes, Strep. spp, Staph. spp, & Bacteroides
- **Causes**
  - Rumenitis (caused by high level carbohydrates [fattening diets] or grain overload or actic acidosis )
  - Ulceration in cran. sac of rumen, popu­lated by F. necrophorum & other bact.
  - Bacterial emboli portal v. to liver
  - Navel infection in young (uncommon)
  - Hardware diz commonly puncture liver to right of reticulum

**Presentation/CS**
- Usually subclinical
  - Still economic loss
  - Weight gain (reduced efficiency of feed utilization)
  - Pain (on moving or pressure over caud. right rib cage)
  - Most regress into a scar
- SEQUELAE to ruptured abscess:
  - Diffuse peritonitis, rupture into abd.
  - CVCT (caud. vena caval thrombosis)
  - Septic or anaphylactic shock
  - Epistaxis & anemia
  - Severe dyspnea

**Diagnosis**
- Hx, CS, Decr. weight gain
- Liver abscesses in 10% of cattle slaughtered in USA
- Not cultured usually
- No liver biopsy bec. of focal lesions
- ± Ultrasound

**Treatment**
- Salvage
- SS Long term antibiotic therapy (oxytetracycline or penicillin)

**Control**
- Reduce the conc. to roughage rat
- Slow transfer from roughage to con
- Multiple feedings, not TID
- Chlortetracycline in diet during fatteni period (70 mg/ head/)

**Liver neoplasia**
BR-hb 120, BR 324
* Rare
Liver flukes, Fascioliasis, Hepatic fascioliasis

- **Fasciola hepatica**
  - Common liver fluke (leaf-shaped)
  - West & Gulf coasts & Rocky Mt. region (endemic)
  - Cattle: subclinical, develop resistance to repeated infec.
  - Sheep: acute cases, no resistance to repeated infec.

- **Fascioloides magna** (giant liver fluke)
  - Cattle encapsulate to stop migration
  - Sheep - not encapsulated, so migrate, can kill lambs
  - Migratory larvae damaging liver
    - Fibrosis/final sclerosis of bile ducts
  - Summer & early fall (liver fluke season)

- **Liver flukes**
  - Chronic - often fatal in sheep, rarely in cattle
  - All seasons
  - Emaciation, Unthrifty, Rough hair coat/Brittle wool
  - Anemia
  - Edema & ascites
  - Milk production
  - Mayhave no CS in cattle
  - Heavy infection in sheep - Fatal

- **Liver fluke CS**
  - 1. Chronic - often fatal in sheep, rarely in cattle
  - 2. Subacute/acute - 1st sheep & often fatal
  - Seasonal
  - Distended, painful abdomen
  - Anemia
  - Sudden death (w/ in 6 wks - acute; 7-10 weeks - subacute) in sheep
  - In conjunction w/ "Black dizz:
    - Mainly sheep (fatal)

- **Liver dizz**
  - Operculated, oval eggs in feces (repeated fecals, ± negative for 16 weeks after infection)
  - ELISA & DOT-ELISA
  - Rapid card test (ELISA) for antibodies in field work
  - Postmortem:
    - Migratory tracts & flukes in bile ducts; immature in parenchyma

- **No pathognomonic CS**

- **Antihelmintics** reduce in host animals
  - Adult & immature: nitroxynil, triclabendazole, diethylcarbamazine, closantel
  - Adults: Clorsulon, Affendazole, rafixzone, netobimin - to eliminate flukes
  - 2nd dose in 2 weeks

Prognosis: Good cattle, Poor sheep

Control
- Reduce snail pop. (drain land, fence, management & molluscsicides)
- Preventive herd health program
  - Tx for flukes
  - Reservoir infect. in horses, deer & rabbits complicate control

Life cycle
- Eggs pass in feces
- Hatch in water
- Infest lymanid snails
- Encyst on vegetation
- Eat by host
- Penetrate intestine to peritoneal cavity, then liver capsule
- Migrate through liver tissue
- Enter bile duct, mature & lay eggs
- Live in bile ducts

**Sheep >> cattle, Fasciola, Snail**
Liver migration/Necrosis
CS: Emaciation, Anemia
Dx: Capped egg
Tx: Anthelmintic

**Infectious necrotic hepatitis, Black dizz**

- Sheep (1-4 yrs-old) & sometimes cattle
- *Clostridium novyi* infection
  - Type B, soil-born & intestines & skin surface
  - Transm: feces from carrier animals
  - Multiples in liver necrosis (migrating liver flukes)
  - Powerful necrotizing toxin
  - Worldwide distribution

- Sudden death usually
  - Sternal recumbency, die w/in a few hrs

- Postmortem: necrotic liver fluke tracts

- **No effective Tx** (ABs in cattle)

Control
- Reduce snails (Lymnaea spp) intermediate host of fluke
- Vaccinate w/ C novyi toxoid more effective than snail removal

**Sheep >> Cattle, Cl. novyi + Liver flukes; Vaccinate**

Bacillary hemoglobinuria - red water disease: See Cardio pg 90, *Cl. hemolyticum* (also called *Cl. novyi* type D), Anaerobic

- IM 846
  - **conditions**: Fluke infection; Hemolyzing exotoxin
  - **CS**: Jaundice & anemia, Port-wine-colored urine
  - **Tx**: IV fluid support, High doses of penicillin, Vaccinate

*Cl. hemolyticum* bacterin • Px: Poor
**Hardware Disease**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
</table>
| Hardware diz, Traumatic reticuloperitonitis, Traumatic reticulitis, Traumatic gastritis | - Mature dairy >> beef  
- Indiscriminate eaters (cows eat wire & nails); FB falls into reticulum  
- Contraction forces FB thru reticular wall - nail, wire  
- Right medial wall of reticulum (most common site of penetration)  
- Commonly into liver  
- Abscesses in right med. wall  
- Rarely into pericardium  
- Pericarditis & pleuritis - through diaphragm  
- Local or diffuse peritonitis  
- Leakage into abd. cavity  
- Fibrous adhesions (m/ disrupt gastric motility) | ACUTE  
- Sudden onset  
- Anorexia  
- Sharp fall in milk production  
- Pain - anxiety expression, careful gait, reluctance to move, shallow fast resp., pulse rate elev.  
- "Grunts" when defecates, urinates or moves  
- Elbows abducted, back arched | CHRONIC  
- Vagal indigestion  
- Fever  
- Shock  
- "Papple bloated"  
- No fecal passage  
- Generalized ileus (no GI movement)  
- CS often abate in couple of ds, Dx then difficult  
- Less severe cases  
- Subtle confusing signs  
- Weight loss, rough hair coat, ± diarrhea | Conservative medical Tx 1st  
- Forestomach magnet  
- ABs IV or IM to control peritonitis - broad spec  
- Nexcels, tetracyclines, Panocillin  
- If Px grave, inform owner before ABs  
- Withdrawal times  
- Supportive care  
- Analgesia (watch for ulcers in abomasum, aspirin cheapest, phenylbutazone, Banamine)  
- Many recover by 3 days; if not - Surgeon |
| Hardware diz, Traumatic reticuloperitonitis, Traumatic reticulitis, Traumatic gastritis | | ACUTE  
- Pinch withers (grunt w/ no movement)  
- "Skooch" test: pressure cn xyphoid - "grunt"  
- Compass to see if magnet present  
- Exploratory lap - most commonly done; lt. flank just behind last rib  
- Standing rads. of cran. ventr. abdomen  
- Foreign body if radiopaque - in or outside reticulum  
- Gas associated w/ an abscess (gram negative organism)  
- Ultrasound - only works w/ abscess adjacent to body wall | Rumenotomy (see box)  
- Remove object; do not break down adhesions (because localizes any peritonitis)  
- Diffuse peritonitis (see box Tx peritonitis) |
| Wire through reticulum, Abscesses, Peritonitis CS: Acute (Pain), Chronic (Vagal indigestion, "Papple") Dx: CS, "Grunts", "Skooch test", Abdominocentesis, Sx Tx: Magnet, ABs, Rumenotomy  
Px: Diffuse - Poor | | CHRONIC reticuloperitonitis  
- Rectal  
- Filling of ventral sac of rumen to right abdominal wall  
- Chronic bloat - serum & rumen electrolytes normal | Rumenotomy (see box)  
- Good w/ Sx  
- Diffuse peritonitis - poor  
- If don't respond, re-evaluate economically |

**DDx for all GI diz bec. of similar signs**
**DDx:**
Pain
- Liver abscesses
- Abomasal ulcers
- Lymphosarcoma
- Laminitis (forelimbs)
- Pyelonephritis
- Rupture of abscesses (liver, rumenal, umbilical, renal, pelvic)
- Uterine rupture/torsion
- Septic abd. Sx
- Ruptured bladder
- Intraperitoneal infections
- Ruptured rectum
- Hernias
- Fat necrosis

Loss of milk abruptly & anorexia, etc.
- Ketosis or indigestion
- Acute systemic mastitis
- Metritis
- Enteritis
- Intussusceptions
- Cecal & abomasal volvulus
- Abomasal displacement

**Respiratory**
- Pneumonia

**Cattle localize peritonitis well**

**Abdominocentesis**
- Negative findings doesn't rule out walled off peritonitis
- Peritoneal fluid normally clots in cattle
  - EDTA tube so doesn't clot (inhibits bact. growth)
  - "Clot" tube for culture
  - Smear if can't do analysis immediately & refrigerate rest (don't freeze)
- Volume: small in normal nonpregnant animal (m/b impossible to collect)
  - Large volume suggests abd. effusion or advanced pregnancy
- Color, norm. straw-colored, odorless, m/b slightly cloudy
- Frank pus, fibrin clumps or turbidity suggests peritonitis
- Ingesta - ruptured bowel or entering bowel w/ needle
- TP (refractometer) - of little benefit bec. of wide range (1-5 g/dl)
- Fibrin- of little benefit bec. of overlap of norm. (100-400 mg/dl) & peritonitis (100-800 mg/dl) levels
  - > 500 mg/dl peritonitis
- WBC count - difficult to interpret (norm. 1-20,000 cells/mm³)
- Peritonitis, PMN > 40% Neutrophilia (Lymphooyte-neutrophil reversal)

**Rumenotomy**
- Incision in left flank, just behind rib (not too close or m/ cause osteomyelitis)
- Feel adhesions in front of reticulum (break down adhesions; they will reform)
- Suture dorsal sac of rumen to skin outside incision, make water tight
  (w/ Connel & Lambert patterns, bites about 45°; outer edge of incision buried & not exposed to contamination from rumen)
- Incise into dorsal sac of rumen
- Pass hand inside along dorsal rumen into reticulum
- Feel every mucosal square for FB (foreign bodies) (if present, immediately remove or will not find it again)
- Palpate for abcess on med. wall (slimy feel)
  - Penetration point (large circular mass [omasum] also to eft of right wall)
  - IV tubing, 16 gauge syringe & stick in, trying to get pus back
  - Draining back into reticulum, but must be sure of good adhesion (walled off peritonitis)
Abomasal Displacement

Abomasal displacement & volvulus (DC 124)

- Common
- Man made diz - metritis, mastitis, incr. conc. diets
- Gas accumulation in abomasum causes displacement to the lt. or rt.
  - Atony of abomasum due to hi VFA (volatile fatty acids) + continued fermentation = gas & distention
  - Abomasum floats up wall on lt. or rt. side (no ligg. holding abomasum down)
- LDA (left displacement) more common
- Adult dairy cows >>>> others
- Early postpartum period commonly

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</tr>
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<tr>
<td>RDA, Rt. displaced abomasum - Abomasal volvulus, RTA, Rt. torsion of abomasum</td>
<td>RDA ≤15% the frequency of LDA</td>
<td>RDA similar to LDA</td>
<td>Auscultation &amp; percussion</td>
<td>RDA or RTA</td>
</tr>
<tr>
<td>Mk 153; C3T 725; C2T 726; IM 870; BM&amp;S 675; BR-hb 110; BR 296; Br 648; DC 129; GI 738; Pa 23; S-J 526; 538; S-N 125; S-O 436, 457 VGS 409</td>
<td>RDA, pathophys., clin. path. &amp; epidemiology same as LDA</td>
<td>“Ain’t doing right” - vague</td>
<td>RDA “Ping” under last 5 ribs in dors. abd. (uniform pitch)</td>
<td>Immediate surgery to correct both RTA &amp; RDA (difficult to DxD RTA &amp; RDA)</td>
</tr>
<tr>
<td></td>
<td>RTA (Right torsion of abomasum)</td>
<td>CS not total obstruction</td>
<td>RTA also into paralumbar fossa &amp; ventral border horizontal line because of fluid in abomasum</td>
<td>Rolling contraindicated (can change RDA into RTA)</td>
</tr>
</tbody>
</table>
| | - Surgical emergency | Moderate to total anorexia | RTA - borborygmi absent | Fluids & electrolytes
| | - Cause uncertain | - Feces (variable) | RTA - Ballottement (succussion) sloshing in abomasum | . IV 20-80 L of 0.9% NaCl w/ 25-100 mEq/L of KCl (careful w/ KCl, not more than 1 mEq/kg/hr - cardiotoxicity) |
| | - Stress, adverse weather | - Frequency of rumenal contractions | Rectal | Broad spectrum ABs |
| | - Hi conc. diet | - Milk (hypogalactia) | | Corticosteroids & NSAIDs for shock |
| | - Concurrent diz | | RTA | Prognosis: |
| | Epidemiology | | | - RTA directly related to time |
| | - Early lactation - greatest risk for RDA, but not for RTA, postpartum | | | - Depends on mucosal integrity |
| | RDA probably leads to abomasal volvulus (RTA) | | | - Higher heart rate, poorer PX |
| | | Sequela | Terminal acidosis (due to perfusion of peripheral tissues) | - Abomasal distension m/ result in vagal indigestion syndrome, then must salvage later |
| | | - Vagal type 2 indigestion | | |
Surgical Emergency - RDA & RTA
CS: RDA -"Ain't doing right" • RTA - More severe
Dx: "Ping" on right, Rectal
Tx: Emerg. Sx, Fluids, ABs, Steroids & NSAIDs

Surgery - Correction of RDA & RTA
(NEVER leave Rt-sided displacement, Sx immediately)
• Right paralumbar approach
• RDA
  - Make sure no volvulus
  - Rt. flank omentopexy, or Right paramedian abomasopexy
• VOLVULUS (RTA)
  - Think twice about laying down (very sick)
  - Untwist, very enlarged, most twisted counterclockwise
  - Alternatively decompress gas w/ needle & untwist
    - Place purse string suture bec. fluid also in abomasum
    - Cut through serosal layer, not mucosa
    - Needle w/ small tubing through mucosa
    - Tighten purse string around tubing (under a lot of pressure)
    - Once decompressed easy to untwist
  - Stabilize w/ omentopexy
  - Must warn owners that cow may go down due to impaction & vagus n. damage

DDx:
• Right-sided "pings"
  - Cecal distention, or volvulus (linear pings below transverse processes to tuber coxae) (p 49)
  - Gas in spiral colon (variable pings, palpate rectally)
  - Pneumoretum following rectal exam (pings like cecal distention)
  - Pneumoperitoneum (heard on both sides)
  - Gas in uterus/physometra (rectal palpation)
  - Abomasal volvulus (most difficult to DDx) (p 40)
• Intestinal obstruction
  - Torsion around root of mesentery (rectal: distended loops) (p 45)
  - Cecal volvulus (p 49)
  - Intestinal obstruction (p 44)
## Abomasal Displacement

### LDA, Left displaced abomasum

- **Condition**
  - Mk 153; C3T 723; C2T 724; IM 868; Br 645; BR-hb 109; Br 292; BM & S 671; DC 124; GI 734; Pa 23; VC/S 406; S-J 523, 529; S-N 119; Plc 67

- **Facts/Cause**
  - More common than RDA
  - Cause uncertain (see box)
  - Stress, adverse weather
  - Hi concentrate diet
  - Concurrent diz
  - Early lactation - greatest risk, postpartum
  - "Swingers", repeatedly displaces & then slips back, empties & lot of diarrhea, not uncommon, so keep checking

- **Presentation/CS**
  - "Ain't doing right" - vague CS, not total obstruction
  - Moderate to total anorexia
  - Feces (variable)
  - Frequency of rumenal contraction
  - Milk (hypogalactia)
  - Don't chew cud (ruminant)
  - Last 1 or 2 left ribs sprung, sunken left paralumbar fossa
  - Retraction of eyeballs
  - Mild pain (treading)
  - Pulse 85-90 beats/min (norm. 60-70)
  - Acetone breath (ketotic)

- **Cause uncertain**
  - Stress, adverse weather
  - Hi conc. diets
    - Sm. size feed particle not mech. stimulating rumination
    - Need large particle roughage
  - Concurrent diz
    - Assoc. w/ endotoxemia or febrile (retained placenta, metritis & severe mastitis), decr. gastric motility
    - Hypocalcemia (milk fever, endotoxemia & sepsis) (decr. motility)
    - Ketonemia (mechanism unclear)

### Facts/Cause
- **Hypocalcemia**
  - Metabolic alkalosis (sequestration of HCl in abomasum)
  - Elev. blood pH & bicarbonate (HCO₃⁻)
  - Blood Cl (hypochloremic)
  - Hypoglycemic w/ ketonuria on farm (transport often changes to hyperglycemia due to stress & cortisol secretion)
  - Dehydration m/ elevate other electrolytes
  - Paradoxical aciduria despite alkalosis (due to hypokalemia & dehydration causing renal retention & hydrogen secretion)

### Prevention
- Slow introduction to concentrated feeds after calving
- Preparum introduction of ensiled & concentrate feeds
- Incr. particle size of forage
- Prevent hypocalcemia
- Prevent inflammatory diz (metritis & mastitis)

### Diagnosis
- Auscultation
  - Gurgling or tinkling in lt. paralumbar fossa (normally scratching sounds)
  - Auscultation & percussion
    - "Ping" over LDA - on line btw. tuber coxae to elbow
    - Palpation of rumen (lt. flank) indistinct bcs. separated from wall
- Rectal exam
  - Rumen displaced medially away from lt. wall
  - M/ feel abomasum betw. lt. wall & rumen
- Aspiration of fluid or gas
  - pH < 4.5 (wide-range pH paper)
  - Odor of abomasal gas (slightly acid or burnt almonds)

### Treatment
- NOT an emergency
- Return abomasum to correct anatomical position
- Fluids & electrolytes: occasionally Tx electrolyte & acid-base abnormalities (usually not required if correct position, normal flow corrects itself)
- Treat concurrent diz

### Prevention
- Slow introduction to concentrated feeds after calving
- Preparum introduction of ensiled & concentrate feeds
- Incr. particle size of forage
- Prevent hypocalcemia
- Prevent inflammatory diz (metritis & mastitis)

### DDx "pings" on left side
- Rumen tympani (assistant blows on stomach tube while "pinging") (p 26)
- Air in uterus/physometra (rectal exam)
- Distended lt. displaced cecum (rectal exam) (p 49)
Repositioning the abomasum

**Nonsurgical**
- Cast cow in right lateral recumbency
- Roll into dorsal recumbency & shake legs back & forth (jiggle gas filled abomasum up to a ventral position)
- Roll cow over to eft lateral recumbency & allows to stand
- Recurrence of LDA in a few days usually (Complication rare (torsion of intest. mass))
- Nonsurgical (outcome usually satisfactory)

1. Blind-stitch abomasopexy
   - Advantage: no celiotomy (opening abdomen), cheap
   - Must have displaced abomasum w/ air & "ping"
   - Cow cast in rt. lat. & then rolled to dorsal recumbency to move abomasum back to ventrum (see nonsurgical above)
   - Use stethoscope to make sure "ping" in correct position, clip area
   - Push special 8 cm needle through body wall & hopefully abomasum, through mucosa, maybe 2 stitches
   - Hope for adhesion
     - Special toggle pin fixation (bar suture) - toggle connected to sutures
     - Complications - abscess, herniation, suturing rumen, pyloric obstruction, death

2. Right flank omentopexy (done standing)
   - Open right flank (be careful of descending duodenum)
   - Bring abomasum under rumen to right side (if trouble, decompress w/ needle & extension tubing)
   - Pull pylorus up to incision to identify (char. appearance)
   - Let pylorus move 4" down, 4" forward of incision
   - Suture omentum into incision w/ peritoneum & transversus muscle

3. Rt. paramedian abomasopexy
   (Most permanent fixation)
   - Dorsal recumbency, no anesthetic used, front & hind legs extended. Clip ventr. abd.
   - Incision hands width behind sternum & hands width to right of midline through rectus abdominis muscle
   - Relocate abomasum & ID greater curvature (greater omentum attached)
   - Locate reticuloabomasal lig. to locate cran. abomasum
   - Suture 6" caudal to ligament, include abomasum in full length of closure w/ peritoneum & deep rectus sheath
     - DO NOT go full thickness, but must include submucosa
     - or it will tear away (pinch between finger & thumb & will feel mucosa slip away)
     - Suture material PDS (absorbable, but lasts some time [Maxon®])
   - Close muscle layer, then superficial (external) rectus sheath, 2-0 Vicryl® wide bites, simple interrupted
   - Close SQ & skin

4. Left flank abomasopexy (done standing)
   - Incision in left flank close to ribs (abomasum must be displaced at time of surgery)
   - ID greater curvature of abomasum (greater omentum attached to it & most dors. part in LDA)
   - Pexy as far forward as possible
     - Suture (6 feet long), 4-5 bites into cran. greater curvature
     - Push needle through ventral abdominal wall from inside
       - 1 hands width from sternum, 1 hands width to right
     - Repeat with other end of suture
   - Assistant takes sutures & ties as you push abomasum into proper position
   - Leave for 3 weeks (good adhesion); cut exposed part of sutures
     - Advantage: stronger hold on abomasum & standing position
     - Disadvantage: hard to get sutures far enough forward to be in correct place
Obstruction of flow through the GI tract

**Causes**
- Congenital malformation (atresia or constriction of a portion)
- Mechanical
  - Intussusception (p 45)
  - Volvulus (p 44)
  - Tumors (p 51)
  - Hernias (p 46)
  - Fat necrosis (p 50)
- Functional obstruction
  - Ileus (p 48)
  - Dilatation

**Facts/Cause**
- Anorexia
- Drop in milk production
- Feces or failure to pass feces
- Abdominal distension (progressive)
- Tympoic resonance in right abdomen
- Colic
- Severe pain m/ cause atony of forestomach
- Mechanical obstruction
  - Circulatory shock & collapse due to dehydration

**Presentation/CS**
- Dehydration
- Pulse rate indicates severity
  - Normal 60-80 beats/min
  - Severe if >100 beats/min
- Electrolyte abnormalities
  - Obstruction: duodenum or pylorus
    - Sequestration of abomasal secretions (HCI)
  - Hypochloremia
  - Hypokalemia
  - Metabolic alkalosis
    - Obstruction of cecum, colon, or rectum
    - Mil dehydration w/o alkalosis
    - Necrosis or rupture
    - Acidosis (due to circulatory collapse from peritonitis & absorption of toxins)
- Shape of abd. from behind
  - Ruminal - lt. dors. distension
  - Fluid distension ("pappel" - 10-4:00 o'clock)
    - of abomasum or rumen
    - Small intestinal distention - pear-shaped, then finally completely round
- Auscultation
  - Look normal sounds
    - Rumenal contractions 21/min
    - Right "pinging" auscultating while percussing
      - Flick hard & listen
        - Heard when gas distended
    - Rectal palpation
      - Feel rumen, degree of distension
      - Cecum (asp. if distended)
      - Abomasum normally too far forward
      - Distended loops of bowel
    - Feces, if not passing, look at what is in rectum
- Stomach tubing
  - Through mouth, using Frick speculum
  - Kingman tube used to get fluid out (1.5" diameter)
- Abdominocentesis
  - Tran puncture or 19 gauge needle
  - Incr. in no. & % of PMNs, cows high of eosinophils (normally w/ in PMNs)
  - TP in normal < 2.5, w/ inflammation
- Rectal exam
  - Scant feces, mucus or blood
  - Gas-filled loops
- Lab:
  - Hypochloremia
  - Metabolic alkalosis
  - Exploratory

**Diagnosis**

**Treatment**
- Treat cause
- "Ping" auscultating while percussing (Flick hard & listen)
  - Hear when gas distended
- Succussion (ballottement) - fist into abdomen & rock it out fast to get fluid shaking, Do both sides
- Rectal palpation
  - Feel rumen, degree of distension
  - Cecum (asp. if distended)
  - Abomasum normally too far forward
  - Distended loops of bowel
- Feces, if not passing, look at what is in rectum
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- Rectal exam
  - Scant feces, mucus or blood
  - Gas-filled loops
- Lab:
  - Hypochloremia
  - Metabolic alkalosis
  - Exploratory

**Long standing obstruction**
- Hypochloremic metabolic alkalosis

**Strangulation**
- Metabolic acidosis

**Volvulus**
- Rare
  - Twisting
  - Long mesentery of spiral colon, dist. jejunum & prox. ileum predisposes to volvulus
  - #1 Segmental volvulus of "flange" (dist. jejunum & prox. ileum)
  - Distention prox. to obstruction, emptying distally
  - Strangulation common in calves & kids
  - Strangulation uncommon in adults bec. of so much fat in mesentery

**Diagnosis**
- Multiple resonant "pings"
  - Rectal exam
    - Scant feces, mucus or blood
    - Gas-filled loops
  - Lab:
    - Hypochloremia
    - Metabolic alkalosis
  - Exploratory

**Treatment**
- Correct acid-base imbalance
- Surgical light flank
- Untwist inside abdomen (if exteriorize hard to replace bec. of distention) if gets tighter, twist other way
- Rarely strangulates so don't need resection

**DOx**
- Intussusception (p 45)
Volvulus around root of mesentery

- Volvulus of large & small intestines around the mesenteric root
- Preruminant neonates most common (any age susceptible)

**DDx:** Grain overload (p 25)

**Purulent neonate**

**CS:** Colic, Abd. enlargement, Shock

**Dx:** Hx, CS, Palpation, Exploratory Sx

**Tx:** Emergency Sx

**Px:** Grave - Good if acute Sx

Intussusception

Mk 161; C3T 733; C2T 734; IM 881; Br 652; GI 746; VC/S I 458; S-J 546

- Telescoping of a piece of bowel into an adjacent segment
- Infrequent cause of obstruction in cattle
- Jejunum of adults
  - Assoc w/ polypos or intraluminal masses
  - Propelled into intussuscipliens
  - Calves associated w/ enteritis
- Pathophysiology
  - Venous return stopped, swells as arterial still pumps
  - Arterial supply then shut off
  - Ischemia & necrosis
  - If rupture, peritonitis

**Obstruction**

- Distends proximally
- Empties distally
- Strangulation - necrosis

Intussusceptum

Obstruction - Distends prox., Empties dist.

**CS:** Colic distention, "Strawberry jam" feces

**Dx:** "Pings" on rt., loops, "Strawberry jam", Alkalosis

**Tx:** Surgical resection

Intussusceptum (orad gut) propelled by peristalsis into intussuscipiens (enveloping portion)

**Intussusception**

Mk 161; C3T 733; C2T 734; IM 881; Br 652; GI 746; VC/S I 458; S-J 546

- History, CS
- Percussion & auscultation
  - Calves - resonant sound, bilat.
  - Adults - tympany on rt. side (ruminen on other side)
- Circulatory shock early (incr. HR & RR 120/min)
- Cold extremities

**Rapid strangulation - clinical course short - Sx quick

**Exploratory laparotomy**

**Lab:**
- Metabolic alkalosis early, then
- Metabolic acidosis (strangulation)

**Obstruction - Distends proximally, Empties distally**

**Obstructive shock**

- Painful colic (violent kicking & vocalization)
- Recumbency & dehydration
- Rapid abdom. enlargement
- Circulatory shock early (incr. HR & RR 120/min)

**Surgical resection** (never reducible)

- Indw on hi in caud. rt. flank
- Fluid & electrolytes

- When stabilized after surgery - oral electrolytes & fluids

**Prognosis:**

- Good if Sx early & peritonitis controlled
- Neutrophilia
- Hyperfibrinogenemia

**Dx:**

- Abomasal ulcers (p 31)
- Neoplasia (p 269)
### Umbilical Hernia

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intestinal incarceration,</td>
<td>• Rare</td>
<td>• Obstructive CS</td>
<td>• CS, History</td>
<td>• Surgical correction</td>
</tr>
<tr>
<td>Internal hernia</td>
<td>• Obstruction due to entrapment of loops</td>
<td>• Colic</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(usually jejunum)</td>
<td>• Depression</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>• Embryonic structures (urachus, omphalomesenteric duct, umbilical vein, [round lig. of liver in falciform lig.])</td>
<td>• Anorexia</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Acquired defects in mesentery</td>
<td>• Absence of feces</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>• Intestinal adhesions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hernia</td>
<td></td>
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<tr>
<td></td>
<td>• Classification of hernia</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>• Location (umbilical, ventral, scrotal, inguinal, diaphragmatic, perineal)</td>
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</tr>
<tr>
<td></td>
<td>• Contents (enterocoele [intest.], omentocele [omentum])</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>• Condition - reducible, irreducible - incarcerated, strangulated</td>
<td></td>
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<tr>
<td></td>
<td>• Small reducible hernias m/ disappear in time</td>
<td></td>
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<tr>
<td></td>
<td>• Incarceration of bowel (m/b obstructed &amp; not strangulating)</td>
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<tr>
<td></td>
<td>• Adhesions between sac &amp; contents</td>
<td></td>
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<tr>
<td></td>
<td>• Strangulation (more serious, compromises blood supply)</td>
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<tr>
<td></td>
<td>• Cause: Inherited, traumatic, incisional</td>
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<tr>
<td></td>
<td>• Inherited: if hernia at birth or develop shortly after</td>
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<tr>
<td></td>
<td>animal should not be bred</td>
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<tr>
<td></td>
<td>• Traumatic or incisional (ventral hernias usually)</td>
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<tr>
<td>• Diaphragmatic hernias</td>
<td>• Congenital</td>
<td></td>
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<td></td>
<td>• Peritoneal/pericardial hernias usually</td>
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<tr>
<td></td>
<td>• Traumatic hernia</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>• Abdominal hernias</td>
<td>• Weakness</td>
<td></td>
<td>• History, CS</td>
<td>• Congenital: no reported successful Tx</td>
</tr>
<tr>
<td></td>
<td>• Resp. distress</td>
<td>• Auscultation: abnormal lung</td>
<td></td>
<td>• Traumatic:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>sounds, muffled heart sounds</td>
<td></td>
<td>- Surgical repair - ventral</td>
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<td></td>
<td></td>
<td>approach, if calf old enough to</td>
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<td></td>
<td></td>
<td>ruminate, empty the rumen via</td>
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<td></td>
<td></td>
<td></td>
<td>rumenotomy 1st, mesh implants</td>
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<td></td>
<td></td>
<td>m/b used for large defects</td>
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</tbody>
</table>

**Parts of external hernia**

1. Hernial sac - inner lining of peritoneum & outer layer of skin & subcutaneous tissue
2. Hernial contents: omentum, intestines or freq. other viscera
3. Hernial ring opening in abd. wall natural or acquired

**Resp. distress**
- Sequela to trauma in late pregnancy
- Usually salvaged because surgery not economical

**Rare**
- CS: Obstructive
- Dx: CS, Hx, Rectal
- Tx: Sx
### Umbilical Hernia

- Common in calves
- 1° DDx for lumps on bellies of calves
  - Can palpate complete ring in linea alba, no thickening, just sac
  - Lined w/peritoneum
- Congenital (at birth)
  - Occasionally umbilical hernias develop after infec. & are not consider inherited
- Abscesses of umbilicus
  - Common cause of hernia

#### Uncomplicated Hernia

- (most common) no adhesions or strangulation
- Reducible through hernial ring
- Incarceration: bowel, pyoic part of abomasum or greater omentum
- Strangulation very rare
- Abscesses m/b present w/ hernia, or just abscess & no hernia
- Urachal abscess
- Umbilical abscess

#### History, CS

- Palpate
- Physical exam
- Needle aspiration

#### Abscess & Hernia

- Open & drain abscess, flush w/ Betadyne®
- Repair hernia later - hernia m/ heal after abscess drained
- Urachal abscess (urachus extend Irom umbilicus to apex of bladder)
  - Must resect urachus & tip of bladder
  - 2 inverting nonperforating layers in apex of bladder (must be water tight)

#### Umbilical Vein Abcess

- Liver abscess
  - More difficult to handle

---

### Inguinal/Scrotal Hernia

- Mature bulls
  - Loop of gut into int. inguinal ring
  - Predisposition: congenital enlargement of int. inguinal ring
  - Almost always left inguinal ring
  - Problems when gut becomes strangulated, if large ring then m/ slide in and out w/o problems for years

#### Strangulation

- Acute abdominal pain
- Tympany
- Abdominal distention
- Fecal output
- Enlargement at neck of scrotum sometimes

#### History, CS

- Rectal palpation of int. inguinal ring
  - Always check in intestinal obstruction

### Prevention

- m/b hereditary, owner can decide to breed or not
Obstruction

<table>
<thead>
<tr>
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</tr>
</thead>
</table>
| Ileus, Pseudo-obstruction  | Adult, lactating dairy cows  
|                            | Adynamic ileus (inhibition of bowel motility) mimics obstruction  
|                            | Cause unknown  
|                            | Often spontaneously resolves                                                | Cow in early lactation (usually)  
|                            | Anorexia (presenting CS)  
|                            | Colic (presenting CS)  
|                            | Rt. abdominal distention  
|                            | No feces                                                                  | Normal temp, HR & RR  
|                            | Amplitude, but normal frequency of rumen motility  
|                            | Auscultation  
|                            | No borborygmi, quiet abd. on right side (± fluid "tinkling" sounds)  
|                            | Auscultation & percussion  
|                            | Areas of high pitched resonance  
|                            | Succussion - "sloshing" sounds  
|                            | Rectal exam  
|                            | Distended loops (spiral colon, cecum or sm. intest)  
|                            | M/b difficult to do rectal because of distention  
|                            | No feces passed, but sticky mucus & feces on examiner's arm  
|                            | Lab - no abnormalities  
|                            | ** Lactating, Mimics obstruction, Cause?  
|                            | CS: Obstructive CS mimic  
|                            | Dx: Quiet abd., Rectal  
|                            | Lab: Normal  
|                            | Tx: Not life threatening, Spontaneous recovery  

DDx:  
- Intussusception (p 46)  
- Intest. obstruction (p 44)  
- Intest. incarceration (p 46)  
- Cecal dilation (p 49)  

Prognosis:  
- Good: spontaneous recovery  
- Sx - many cows pass feces soon  
- Manipulation of gut alone seems to benefit
Cecal dilation & volvulus

**Cecal dilation & volvulus**

**Mk 161; C3T 739; C2T 734; IM 692; BR-hb 114; BR 308; BM&S 679; Br 653; DC 142; GI 743; SJ 547; So 465; Pic 68**

- Associated w/ parturition (postpartum)
- Changes to concentrate diets from roughage
  - Cecal flora metab. CHOs into VFA (volatile fatty acids)
  - VFA reduce motility of cecum + gas = distention
- Distention m/ lead to volvulus
- **Volvulus:** twisting of cecum & proximal loop of ascending colon

**Dilation (not total obstruction)**
- Vague signs, gradual onset
  - Feed intake
  - DMilk production
  - Mild abdominal pain
  - Distended rt. paralumbar fossa
  - Still passes feces

**Volvulus (total obstruction)**
- Abrupt CS
- Right paralumbar distention
- Anorexia
- Agalactia
- Marked abd. pain
- Tachycardia
- Forestomach stasis
- Manure scant or absent

**Dilatation**
- Auscultation - resonance cranial to tuber coxae
- Rectal exam
  - Distended apex in or near pelvic cavity

**VOLVULUS**
- Large area of resonance
- Ballottement - fluid in cecum
- Rectal - exam
  - Distended cecal body (apex cranial)
  - BOTH (more extreme in volvulus)
    - Metabolic alkalosis
    - Hypochloremia
    - Hypokalemia

**Surgery on cecum**
- Incision caud. rt. paralumbar fossa, pull omental "curtain" cranially to see cecum
  - If contracts down & peristalsis when pinched, close abdomen
  - If discolored or remains distended, remove cecum
  - Typhlectomy (see box)

**Typhlectomy (remove cecum)** leave only iliocecocolic junction
  - Double layer closure, inverting (Parker-Kerr)
  - If volvulus involves prox. loop m/ not be able to save ileocecocolic junction
  - Need to anastomose ileum to viable colon
  - Cecal a. in ileocecal ligament on anti-mesenteric side needs to be preserved

**Exploratory celiotomy to Dx**
- Enterolith: massage gently until broken down
  - If firm inject DSS (dioctyl Na sulfo-succinate) into to soften

**Prognosis:**
- Depends on degree of ischemia

**Colonic obstruction**

**C3T 740; DC 145**

- Partial or complete
- **Cause:**
  - Intraluminal obstruction (adult dairy cattle)
  - **Enteroliths** in spiral colon (small diameter)
  - Extraluminal compression
  - Fat necrosis, lymphosarcoma, adhesions from peritonitis

- **Dilation (partial obstruction)**
- **Volvulus (total)**
  - CS: Dil: vague  Volv: abrupt CS
  - **Dx:** Resonance, Rectal, Alkalosis
  - **Tx:** Dil: Medical or Sx  Volv: Sx required

- **Identical to cecal torsion, or cecocolic volvulus**
- **Partial**
  - Gradual & progressive
  - Mild dehydration

- **History, CS**
- Electrolyte & acid-base abnormal in complete, not in partial
- **Tympanic resonance** in right paralumbar fossa

- **Rectal**
  - Scant feces
  - Distended loops of bowel (small & large intestine)

- **Surgical exploration**

**Exploratory celiotomy to Dx**
- **Enterolith:** massage gently until broken down
  - If firm inject DSS (dioctyl Na sulfo-succinate) into to soften
- Incise & remove (usually not necessary)
- Extraluminal compression
  - Sx identification
  - Attempt to free colon
  - If can't be freed: side-to-side colo-colic or ileoileocolic anastomoses
### Obstruction

<table>
<thead>
<tr>
<th>Condition</th>
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</tr>
</thead>
</table>
| **Mesenteric fat necrosis** | - Channel Island dairy breeds (Guernseys, Jerseys)  
- Mature cattle  
- Cause:  
  - Dietary fattening: Long-chained saturated FA form clumps or crystals of FA in cells that resist removal  
  - Clumps or crystals of FA serve as foci for inflammation  
  - Leads to obstruction  
  - Tall fescue (see pg 264)  
- Progression of obstruction: - Weight loss  
- Anorexia  
- Diarrhea  
- Bloody stool  
- Abdominal enlargement  
- Rt. sided "pings"  
- Colic signs (incr. HR, tenesmus, teeth grinding)  
- M/ have no signs & Dx by rectal exam  
- Sequela:  
  - Dystocia (necrotic fat mass in pelvic cavity) | - CS, History  
- Right sided "pings"  
- Lab  
  - † cholesterol  
  - † FFA (free fatty acids)  
- Rectal exam: m/b impossible due to fat constricting pelvic cavity | - None if no obstruction  
- Fungicide isoprothiolane m/b Tx of future  
- Salvage recommended  
- Sx: removal if obstructing intestines | **Fattening diet, FFA, Obstruction**  
**CS: Obstruction**  
**Dx: CS, Hx, Rt. "Pings", Rectal**  
**Tx: None** |  | **Proctitis**  
**C3T 743; C2T 739**  
**  
- Inflammation of rectum  
- Iatrogenic - rectal exam  
- Sadism | - Tenesmus (straining)  
- Sequela:  
  - Peritonitis | - CS  
- Palpation | **Surgical repair**  
Prevention:  
- Rectal palpation: lubrication, xylazine |  | **Rectal tear/stricture**  
**C3T 743; C2T 739; BR-hb 89, 92; BR 230, 238; Br 665; DC 148  
**  
- Rectal constriction  
- Caused by proctitis: Traumatic injury & scarring; Nonexpanding circumferential lesion (lymphosarcoma, peripelvic abscess, fat necrosis)  
- Inherited defect: rectal & vaginal stricture (Jersey cows)  
- Tx: None affective | |  |
**Rectal prolapse**

- Common
- Highest incidence in Herefords

**Prostate of rectum**

- Obvious
- Caused by tenesmus:
  - Diarrhea
  - Frequent coughing
  - Obesity
  - Vaginal prolapse/irritation
  - Coccidiosis
  - Bull calf mounting cows
  - Pyrrealazine alkaloids

**Prevention**

- Castrate bull calves

**Intestinal tumors**

- Very rare in cattle
- Relatively high in sheep in some areas of world

**Intestinal atresia or stenosis**

- Uncommon
- Congenital in calves & lambs
- Stenosis or atresia of GI tract
- Most hereditary (anal & rectal atresia)
  - Atresia ani - usually lethal gene
  - Rectovaginal fistulas, feces out vagina
  - Colonic atresia - palpation of amniotic vesicle at 42 cm
  - Commonly spiral colon doesn't join rest of ascending colon

**Atresia ani**

- No anus - obvious!

**Atresia of GI**

- Digital palpation of rectum
  - Absence of feces, m/b mucus
  - Contrast radiographs (cautiously)

**Surgical repair for salvage, not for breeding**

**Prognosis**

- Poor w/surgery - stasis & peritonitis common
- Death w/o Xs

**Sx of intestinal atresia**

- Rt. flank incision
- Find 2 ends, open proximal & squeeze out meconium
- Side-to-side or end-to-side anastomoses to descending colon (bec. blind end small usually)

Atresia ani - must close any rectovaginal fistulas if surgically correct atresia ani
### Peritonitis

<table>
<thead>
<tr>
<th>Condition</th>
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<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pancreatitis (GI 917)</strong></td>
<td><em>Rare in cattle &amp; seldom manifested clinically unless there is insulin deficiency</em></td>
<td></td>
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</tr>
<tr>
<td><strong>Diabetes mellitus</strong> C1T 917; BR-hb 122; BR 325</td>
<td>• Rare, but reported in cattle • Cause: not acute pancreatitis as in dog; neoplasia, absence of beta cells &amp; chronic pancreatitis, foot &amp; mouth diz • CS: Hyperglycemia, glycosuria, polydipsia, polyuria, weight loss</td>
<td></td>
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<tr>
<td><strong>Pancreolithiasis</strong> C1T 917</td>
<td>• Rare; concretions in pancreatic excretory ducts; usually incidental finding on necropsy (82% of animals over 4 yrs) • CS: rarely associated w/ clinical signs</td>
<td></td>
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</tr>
<tr>
<td><strong>Atrial fibrillation</strong></td>
<td>• See Cardio pg 81; Assoc. w/ gastrointestinal diz 75-95% of time, Common in adult cattle, Not assoc. w/ heart diz • CS: GI DZ, Anorexia, decr. milk prod., Rapid &amp; disorganized heart sound (review S1, S2) described as irregularly regular heart beat • Dx: Dx underlying GI diz, CS, ECG - P waves replaced w/ undulating F waves, Irregular P-R interval, QRS complexes irregularly spaced • Tx: Tx underlying GI diz CS should resolve, If continue after 5 ds: Quinidine + IV fluids, If HR &gt; 120/min -Digoxin then quinidine, but rare • Px: Good if not underlying heart diz or chronic GI diz</td>
<td></td>
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<tr>
<td><strong>Candidiasis</strong> Mk 342; C3T 525; Br 764</td>
<td>• Mucocutaneous diz, Worldwide, yeastslike fungus, Candida albicans, Common inhabitant of oral mucosa &amp; GI • Implicated in bovine oral, GI, &amp; vaginal infections, abortion &amp; mastitis • CS: GI: calves w/ forestomach - Candidiasis - water diarrhea, anorexia &amp; dehydration progressing to prostration &amp; death Resp: Pneumonia, dyspnea, mod. fever • Dx: Scraping or biopsy from mucocutaneous lesions, Ovoid budding yeast cells • Tx: Nystatin ointment or amphotericin B, iodine for oral or cutaneous infec.</td>
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<tr>
<td><strong>Muromycosis</strong> Mk 348</td>
<td>• Fungi of order Mucorales (Mucor, Absidia, Rhizopus, Mortierella, Rhizomucor), inhabitant of soil, manure &amp; rotting vegetation • Often 2° to metabolic disorders or immunosuppression, Granulomatous lesions in several organs: skin, GI, lymph nodes; Placentitis &amp; abortion in Bovid • CS: Nonspecific reflecting organ involved, Pneumonia m/b, Anorexia, pyrexia, persistent diarrhea, Neurological disturbances • Dx: Antemortem Dx uncommon • PM: fungal ID, microscopically, FA, cultures • Tx: No completely satisfactory Tx, Surgical excision of supf. lesions, amphotericin B</td>
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</tbody>
</table>
**Peritonitis**

- **Peritonitis**: inflam. of mesothelia lining the abd. cavity & covering the viscera
- **Common**
  - Local or general
  - Cattle wall off infections better than other species
  - Acute or chronic
  - Hematogenous spread
- **Septic component inflammatory response**
- Stimulates pain receptors
- Fluid into peritoneal space (circ. hypovolemia)

**Causes:**
- #1 hardware diz in cattle
- Abomasal ulcers
- Lymphosarcoma
- Fyaleonephritis
- Rupture of abacuses (liver, ruminal, abomasal, umbilical, renal, pelvic)
- Uterine rupture/torsion
- Septic abd. surgery
- Ruptured bladder
- Intraperitoneal injections
- Ruptured rectum iliartog.
- Hernias
- Fat necrosis
- Acute systemic mastitis
- Metritis
- Enteritis
- Intussusceptions
- Cecal & abomasal volvulus

**Variable:** related to extent of lesion, generalized or local, host response, infecting organism & age of animal
- Ruminination ceases
- Milk production
- Anorexia & depression

**CS - localized peritonitis:**
- Heart rate, temperature
- Abdominal pain, tends to resolve in 24-48 hours
- Kyphosis (arching back, pain)

**CS - generalized**
- Very shocky, septic shock
- HR, RR & temp.
- Mucous membr. injected
- Slowed refill capillary time
- Ileus
- Abdominal pain
- Ascites (pressure put on liver, lymphatics, etc.)

**History & CS**
- "Skooch" test - abd. pain
- Perussion & palpation
- Abdominal laparotomy
- Stasis of GI tract
- Rectal:
  - Adhesions & distended intestines
  - Paracentesis
    - Fluid w/ deg. lt. shift
    - Culture & cytology
  - Alkalosis (Chloride sequestration w/ adynamic ileus)

**DDX:**
- Abdominal pain
  - GI distention (p 25)
  - Urinary tract obstruction (p 96)
  - Reproductive tract pain
  - Pleuritis (p 72)
  - Myositis
  - Multiple limb lameness
- Septic processes
  - Rumenitis (p 24)
  - Toxic enteritis (p 250)
  - Mastitis (p 192)
  - Pneumonia (p 62)

**Prognosis:**
- Localized Hd/dz - fair
- Diffuse - grave

**Control:**
- Prevent causes (Sx aseptic, Limit IP injections, magnet)

**Fluid - place an IV catheter**
- Dehydration in adult bovid - 20-40 L isotonic sol., daily maintenance
  - Monitor hydration w/ serial PCV & TSP
- Alkalosis (most common acid base abn. from Chloride sequestration w/ adynamic ileus)
  - IV saline, 40-100 mEq/L of potassium m/b to correct hypokalemia
- Lactating cows - 500 ml of 23% calcium gluconate to 1st 3 L of saline

**Common, Causes:** Hardware diz, Ulcers, etc.

**CS: Localized (Pain) • Generalized (Septic shock)**

Dx: Hx, CS, "Skooch test", Rectal, Paracentesis, Sx

Tx: Tx cause, Fluids, ABs, Steroids, NSAIDs, TLC
# GI Parasites

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gastrointestinal parasites, Parasitic gastroenteritis</td>
<td>- Ostertagia most pathogenic &amp; control of it controls other GI parasites - Larval stage does much damage - All ages can become infected - Clinical diz mainly in herds less than 18 months old - Mixed infections the rule</td>
<td>- Clinical helminthiasis indicates proportionate subclinical cases - Gastroenteritis - Subclinical - Stunting - Unthriftness</td>
<td>- Presumptive: CS, Hx of grazing &amp; season of year - Mixed infection the rule - Ostertagia especially hard to Dx - Fecal egg counts, neg. counts don't R/O</td>
<td>- Treating Ostertagiasis controls other GI parasites</td>
</tr>
</tbody>
</table>

### Prevention:
- No single program universally effective (different areas & climates)
- Assume every animal infected, esp. at pasture
- Good nutrition
- Pasture management
- Barn management (avoid overcrowding, fecal removal, plenty of bedding, feed off ground, nutrition)
- Anthelmintic Tx (specifics controversial)
  - Strategic strategies - 2-4 Tx/yr
  - Tactical Tx: when periods of abnormally heavy rainfall & mild temperatures or poor nutrition, or when moving from low to high parasite area
  - Ivermectin, albendazole or 2x fenbendazole or fenbentel, oxyclofenbendazole
  - Move to clean pasture that day

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>#1 Ostertagia; Large #s, Susceptible (young)</td>
<td>CS: Gastroenteritis; Subclinical (stunting)</td>
<td>Dx: All infected, Egg count, Culture, Diagnostic deworming • PM</td>
<td>Tx: Tx Ostertagia (anthelmintics)</td>
<td>Prevention: Nutrition, Management, Anthelmintics</td>
</tr>
</tbody>
</table>
Ostertagiasis, Parasitism - diarrhea

- **Ostertagia ostertagi**
  - Medium or brown stomach worm
  - #1 nematode of cattle
  - Most pathogenic & cause of most economic loss
  - Control also controls other nematodes (see box)
  - Life cycle (see box)

- **Type I ostertagiasis** - reaction of larvae in gastric glands
  - Albumin lost into lumen
  - HCI production
  - Alkalinity to abomasum

- **Type II ostertagiasis** - caused by exit of larvae from gastric glands (hypobiosis)
  - Hyperplasia & loss of cell differentiation ("moroccan leather")
  - M/b sloughing of mucosa
  - Young beef & grazing dairy replacement cattle
  - Rarely in older cattle after 1st year on pasture

Type I ostertagiasis
- < 2 yrs old, On pasture
- Anorexia, Poor growth
- Diarrhea
- Death

Type II ostertagiasis (emergence of arrested larvae, hypobiosis)
- 2-4 years (m/b adults)
- Anorexia
- Unthrifty
- Hypoproteinemia
- Submandibular edema
- Diarrhea
- Anemia
- Fever
- ± Death

### Life cycle - Direct
- Ingested 3rd-stage larvae into gastric glands of abomasum
- Complete development in glands 4th stage
  - Can reenter lumen in 18 days
- Hypobiosis: Arrested development, remain in glands for mos. (range 3 weeks - 4 months)
  - Type II ostertagiasis occurs when they emerge months later

### Peak pasture infec./Outbreaks
**In the North:**
- Summer - Type I
- Spring - Type II

**In the South:**
- Fall - Type I
- Spring - Type II

### Deworming program (no single program fits all area & climate conditions, below is a starting point to greatly reduce Ostertagia problem including inhibited larvae)
- **Spring calving**
  - Deworm cows after calving season just before turning out to summer pasture
  - Ivermectin, albendazole or hi-dose fenbendazole
  - Deworm spring calves by midsummer (ideal)
  - Deworm all stock in late fall (at weaning in beef calves)
  - Move to clean pasture that day

- **Fall calving**
  - Deworm cows before overwintering
  - Deworm all stock in spring, before summer pasture
  - Yearling spring calves & fall calves
  - Deworm in late spring
  - Deworm in summer if intensively grazed on summer pasture
  - Beef entering feedlot
  - Deworm
  - All adults
  - Spring & fall minimum

- **Ideal**
  - Ivermectin at 5 wk interval or others at 3 week

### Anthelmintics
- **Adult ostertagia**
  - Give before hypobiosis
  - North - July
  - South - Sept.

- **Hypobiotic larvae** (treatment & prevention of type II)
  - Ivermectin
    - High dose of fenbendazole, albendazole
    - Repeated doses of Ivermectin m/b necessary to kill all
  - Drug withdrawal times

### Prognosis (Px):
- Type I - good
- Type II - damaged mucosa unlikely to recover
  - Profound hypoproteinemia & dehydration has worse Px

---

**Dx:** Hx, CS, Egg count, "Moroccan leather"
**Tx:** Ivermectin

---

**#1 parasite, Controlling Ostertagia controls others**

**Type 1 infec. < 2 yrs**

**Type 2 infec. 2-4 yrs, Hypobiosis ("hibernating")**

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**55**
<table>
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<tr>
<th>GI Parasites</th>
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**Toxocara infection, Ascarid** (Mk 208; BR-hb 473; BR 1239; DC 180; Pa 47; Par 190)
- *Toxocara vitulorum*: Ascarid, stout whitish 1-1/4" long • Transm.: Ingestion of eggs, pass in milk, rumen, small intestine, Red, died aditusia
- CS: diarrhea, reduced wt. gain, anemia & steatorrhea; no CS in older animals
- Dx: Eggs: Thick pitted shell
- Tx: Ostertagia Tx controls, piperazine at 2 wks of age to expel worms before mature

**Oesophagostomum, Nodular worm, Pimply gut** (Mk 208; DC 180; Par 163)
- *Oesophagostomum radiatum*: (nodular worm), 1/2" long & head bent dorsally; Direct life cycle, Loc.: dist sm. intest, ceoeum & colon, M/ encyst in wall in subsequent infections (nODULES)
- CS: Young (anorexia, weight loss, severe constant, dark fecal diarrhea); Older resistant animals (nODULES, decr. motility of intestines, stenosis or intussusception occasionally)
- Dx: NODULES palpated per rectum
- Tx: control Ostertagia

**Chabertia, Largemouth bowel worm** (Mk 208; BR-hb 487; BR 1273; DC 180; Par 162, 288)
- *Chabertia ovina*: 1/2" long & ventrally bent at anterior end • Direct life cycle enter sm. intest. mucosa & then emerge & pass to large colon • CS: Rarely see clinical chabertiasis in cattle, Mucus-coated feces • Tx: control Ostertagia controls

**Trichuris** (Mk 208; BR-hb 487; BR 1237; DC 180; Par 209)
- Common in calves & yearlings, Eggs resistant & persist in environment
- CS: Clinical signs unlikely (dark feces, anemia, anorexia)
- Tx: treatment of Ostertagia controls

**Monezia, Tapeworm** (Mk 208; BR-hb 472; BR 1237; DC 183; Par 132, 138)
- *Monezia expansa, M. benedenti*: Lack rostellum & hooks, segments wider than long, Eggs triangular or rectangular • Life cycle: intermediate host orabid mite, ingestion of mite, Young cattle
- CS: Non-pathogenic in calves, except in young; m/ cause failure to thrive, intestinal stasis has been reported
- Tx: treatment of Ostertagia controls tapeworms

**Nematodirus** (Mk 207; Par 153)
- *Nematodirus helvetianus* most common, 1/2-1" long, Eggs highly resistant, m/ last til next season, Transm.: ingestion of larvae, Loc.: 1st 20" of sm. intestine, Dairy calves after 8 wks old
- CS: Diarrhea & anorexia
- Dx: Eggs: in feces after CS
- Tx: control Ostertagia

**Trichostrongyles** (Mk 209; BR-hb 481; BR 1259; DC 180; Pa 49)
- *Sheep, T. colubriformis, T. vitrinus, T. rugatus*: Direct life cycle, Larvae burrow into crypts of intestine, Villous atrophy - impaired digestion & malabsorption, Protein loss across mucosa
- CS: Anorexia, Persistent diarrhea, Weight loss • Dx: Fecal
- Tx: control Ostertagia

**Haemonchosis, Barber pole worm** (Br-hb 483; BR 1265; Br 247; DC 180; Pa 30; Par 152)
- *Haemonchus placeii* (barber’s pole worm, large stomach worm, wire worm), Large worm - 1" long, Abomasum, Immature cattle (immunity after 3 yrs), Warm weather, Suck blood from abomasum
- CS: Acute - Hemorrhagic anemia, ± Diarrhea, ± Constipation; Chronic - Weakness, lethargy, Weight loss, Submandibular edema (bottle jaw), Anasarca (generalized massive edema)
- Dx: Presumptive, SC, Hx, Fecal egg count, CS often before eggs in feces, not present w/ CS, Direct centrifugate filtration, Fecal smears not recommended • PM: Edema of abomasal mucosa, minute hemorrhages • Tx: Treat Ostertagia, flucicloxic, Move to uninfected pasture

**Cooperia** (Mk 206; BR-hb 481; BR 1259; DC 120)
- *Small intestine, Red, coiled adults - 1/3" long, males have a large bursa, Don’t appear to suck blood
- CS: Heavy infestation - Profuse diarrhea, Anorexia, Emaciation, No anemia
- Dx: Eggs - parallel sides, larval culture for definitive Dx
- Tx: control Ostertagia

**Bunostomum, Hookworm** (Mk 207; C1T 921; Br 247; BR 1257; DC 180; Pa 47)
- *Bunostomum phlebotomum*: 1" long, Hookworm, Warmer climates (tropics or subtropics), Direct life cycle, ingestion or skin penetration, found in small animals; Prepatent period 2 mo, Small numbers (2000) cause severe diz & death
- CS: Larval penetration of legs (uneasiness & stamping), Rapid weight loss, Blood sucking (anemia), Diarrhea & constipation m/ alternate, Edema (Hypoproteinemia), bottle jaw rarely seen as in Haemonchosis • Tx: treating Ostertagia controls

**Strongyloides infection** (Mk 207; DC 180; Par 48): *Strongyloides papillosus*, Only female in parasitic cycle, 1/4" small, prepatent period 10 d, Pass in feces & infect, or become free living adults & cycle to become infective, Young calves, esp. dairy
- CS: Rare (m/v diarrhea, anorexia & wt loss)
- Tx: Tx Ostertagia controls

**Rumen flukes** (BR-hb 471; BR 1236; Br 241)
- *Paraphistomidae*, commonly found in rumen, Conical shape, < 1/2" long (3-11mm)
- No CS of rumen infestation, immature flukes burrow into mucosa of small intestine to get to rumen, m/ cause weakness, anemia & diarrhea
- Tx: carbon tetrachloride effective
### Nasal Cavity

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rhinitis</strong>&lt;br&gt;C2T 654; BR-hb 169; BR 428; Pa 124&lt;br&gt;***&lt;br&gt;CS of other diz&lt;br&gt;Discharge, Sneezing, Dyspnea</td>
<td>• Usually CS of other diz&lt;br&gt;• Inflammation of nose&lt;br&gt;• Can obstruct airway&lt;br&gt;• Airflow</td>
<td>• Discharge - mucoid, serous, mucopurulent, etc.&lt;br&gt;• Sneezing&lt;br&gt;• Stridor, on inspir. &amp;/or expir., hear by standing beside&lt;br&gt;• Congestion of mucus membr. of nose (penlight)&lt;br&gt;• Cyanosis rare in large animals&lt;br&gt;• Dyspnea:&lt;br&gt;• Opened mouth&lt;br&gt;breathing w/ head extended</td>
<td>• Inflam. of nostrils, assoc. w/ other CS&lt;br&gt;• Biopsy - Rhinosporidia Dx (fungal)&lt;br&gt;• Endoscope if far back&lt;br&gt;• Serology for infec.&lt;br&gt;• Nasal obstruction&lt;br&gt;CS more severe than infec.</td>
<td>• Tx 1° cause&lt;br&gt;• IBR (“red nose”) (p 252)&lt;br&gt;• BVD (along with other signs) (p 64)&lt;br&gt;• Bovine Malignant Catarrh (p 10)&lt;br&gt;• Pasteurella hemophilius (p 63), H. somnus - mucopurulent (p 71)&lt;br&gt;• Rhinosporidiosis (p 58)&lt;br&gt;• Allergic rhinitis (p 59)&lt;br&gt;• Foreign bodies (p 59)&lt;br&gt;• Tumor of ethmoids - adenocarcinoma&lt;br&gt;• Hypersensitivity reaction involving lungs</td>
</tr>
<tr>
<td><strong>Mycotic nasal granuloma,</strong>&lt;br&gt;Mycetoma, **&lt;br&gt;Rhinosporidiosis&lt;br&gt;Fungal granuloma&lt;br&gt;Mk 351; IM 620; BR-hb 170; BR 426; Br 763; Pa 125; DC 67&lt;br&gt;Fungus, Allergy&lt;br&gt;CS: Dyspnea, Polyps, Debilitating&lt;br.Tx: Salvage</td>
<td>• Uncommon&lt;br&gt;• Fungus (mold) in Western U.S.&lt;br&gt;• Rhinosporidium spp., Helmithosporium spp., Aspergillus&lt;br&gt;• Spores in nose&lt;br&gt;• Type IV delayed hypersensitivity&lt;br&gt;• No seasonal predilection&lt;br&gt;• Warm, wet climates</td>
<td>• Respiratory noise - stridor&lt;br&gt;• Dyspnea&lt;br&gt;• Creamy to yellow nasal discharge, m/b epistaxis&lt;br&gt;• Polyps (granuloma) ylw, ylw/grn or red, single or multiple, anywhere, urs - or bilateral&lt;br&gt;• Inflammation, ulceration due to irritation&lt;br&gt;• Chronically debilitating, rarely fatal</td>
<td>• Endoscope&lt;br&gt;• Biopsy&lt;br&gt;• Culture&lt;br&gt;• Histopath - eosinophils, sporagia &amp; m/b hyphae&lt;br&gt;• DDx&lt;br&gt;• Atopic rhinitis (p 59)</td>
<td>• Salvage - debilitating&lt;br&gt;• Difficult to treat&lt;br&gt;• Sx - remove polyp&lt;br&gt;• Na Iodide (NaI) (long term)</td>
</tr>
<tr>
<td><strong>Nasal tumor</strong>&lt;br&gt;IM 622&lt;br&gt;***</td>
<td>• Rare, 6-9 yr-olds, unilateral&lt;br&gt;• Ethmoid adenocarcinoma (m/b viral cause)&lt;br&gt;• SCC (squamous cell carcinoma)&lt;br&gt;• Neuroblastoma&lt;br&gt;• Osteoma (sinuses)&lt;br&gt;• Osteosarcoma (sinuses)</td>
<td>• Facial swelling&lt;br&gt;• Nasal discharge&lt;br&gt;• Epistaxis&lt;br&gt;• Dyspnea&lt;br&gt;• M/b invasive, m/b metastatic to lungs &amp; local lymph nodes</td>
<td>• History (Hx), CS, Endoscope&lt;br&gt;• Biopsy&lt;br&gt;• Culture, FA &amp; serology</td>
<td>• Salvage</td>
</tr>
</tbody>
</table>
Allergic rhinitis, Summer snuffles, Atopic rhinitis, 
Nasal Granuloma (pg 58)  
Mk 426; IM 621; BR-hb 170, 625; BR 426, 1622; Pa 126, 129

Granuloma, Allergy  
CS: Pruritus, Polyps  
Tx: Steroids

Epistaxis  
Mk 708; C3T 683; C2T 655; BR-hb 155, 170; BR 427

Nasal foreign bodies (FB)  
IM 621; C2T 655; BR 155; DC 65

Nasal trauma & fx  
IM 621; DC 65
Sinuses - Larynx

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sinusitis, Paranasal sinusitis</td>
<td>- Frontal sinus extends into &quot;horn&quot; (cornual) process &gt; 6 mo</td>
<td>- Dehorning</td>
<td>- Hx of dehorning m/d mos before</td>
<td>- Trephine &amp; flush w/ sterile saline &amp; Abs</td>
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<td></td>
<td>- Opens frontal sinus</td>
<td>- Acute:</td>
<td>- CS, drainage, etc.</td>
<td>- Bone flaps over sinus, replace bone in daisy (cosmetic) or leave open (beef) to drain</td>
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<td>- Drainage from sinus opening</td>
<td>- Trephine (sinus centesis)</td>
<td>- Problem - postorbital diverticulum</td>
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<td></td>
<td></td>
<td>- Crusting at dehoming site, no drainage</td>
<td>- Percuss frontal sinus</td>
<td>- ABs (broad spectrum, parenteral &amp; local)</td>
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<tr>
<td></td>
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<td>- Uni- or bilateral (sinuses separated)</td>
<td>- Chronic - osteolysis or fractures</td>
<td>- Aspirin to decrease inflammation &amp; pain</td>
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<td></td>
<td></td>
<td>- Nasal discharge w/ foul odor</td>
<td>- Soft tissue swelling</td>
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<td></td>
<td></td>
<td>- Neurologic signs, if drainage to brain</td>
<td>- C&amp;S (culture/sensitivity) - trephine hole</td>
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<td></td>
<td></td>
<td>(See strabismus, exophthalmus)</td>
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<td></td>
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<td>- M/ lead to systemic disease</td>
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<tr>
<td>Open frontal sinus</td>
<td>Open frontal sinus</td>
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<tr>
<td>CS: Drainage from opening &amp; nose</td>
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<tr>
<td>Tx: Trephine &amp; Flush, ABs</td>
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<tr>
<td>2 • Infected tooth</td>
<td>- Maxillary tooth involved</td>
<td>- Nasal discharge foul odor</td>
<td>- CS, drainage, etc.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Infected teeth</td>
<td>- Unilateral</td>
<td>- Trephine (sinus centesis)</td>
<td></td>
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<tr>
<td></td>
<td>- Actinomyces bovis</td>
<td></td>
<td>- Percuss maxillary sinus</td>
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<tr>
<td>Laryngeal obstruction</td>
<td></td>
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<tr>
<td>IM 628; C2T 656; BR-hb 173; BR 432</td>
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<tr>
<td></td>
<td>• Laryngeal abscesses</td>
<td>- Trauma = severe resp. signs</td>
<td>- CS - resp. problems</td>
<td></td>
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<tr>
<td></td>
<td>- Actinomyces pyogenes, Calves &amp; sheep</td>
<td>- Inspiratory dyspnea</td>
<td>- Physical exam w/ speculum</td>
<td>• Remove foreign body</td>
</tr>
<tr>
<td></td>
<td>- Areytenoid cartilages</td>
<td>- open mouth breathing, stridor or stertor</td>
<td>- Palpate larynx (very carefully, feel obstruction &amp; swelling)</td>
<td>• ABS (broad spectrum) Naxcel®, Pen, IMSQ</td>
</tr>
<tr>
<td></td>
<td>• Laryngeal papillomatosis</td>
<td>- Paroxysmal breathing (lifting ribs, flanks sink in)</td>
<td>- Endoscope to visualize larynx</td>
<td>• NSAIDs (PBZ, Banamine®, aspirin)</td>
</tr>
<tr>
<td></td>
<td>• Acutely - laryngeal edema</td>
<td>- Salivate excessively</td>
<td></td>
<td>- inflam., pain &amp; swelling</td>
</tr>
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<td></td>
<td>- Flare - smoke, noxious gas inhalation</td>
<td>- Bloat commonly seen (esophageal encroachment)</td>
<td></td>
<td>- long term stricture formation</td>
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<tr>
<td></td>
<td>• Trauma: bailing gun injuries, passing a tube into rumen</td>
<td>- Nasal discharge variable</td>
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<td>• Retropharyngeal lymph nodes swelling, pressing on the larynx</td>
<td>- Difficulty in swallowing</td>
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<td>• Necrobacillosis</td>
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<tr>
<td></td>
<td>• Foreign bodies</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Subepiglottic cyst</td>
<td></td>
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</tr>
<tr>
<td>Rabies!?! CS: Salivation, Dyspnea</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tx: ABs, NSAIDs, Tracheostomy</td>
<td></td>
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</tr>
</tbody>
</table>

RESPIRATORY SYSTEM

Prevention:
- Early (< 6 mo) dehoming w/ dehoming iron
- Cosmetic dehoring using aseptic technique
- Not in fly season or dusty conditions

Prognosis:
- Acute - good
- Chronic - poor/salvage, nonresponsive, even w aggressive therapy or w/ systemic CS of diz
### Calf diphtheria, Laryngeal necrobacillosis, Necrotic laryngitis

- See GI (pg 12)
- *Fusobacterium necrophorum*
  - Necrotizing endotoxin
  - Invades broken skin & laryngeal cartilage
- Necrotic stomatitis
  - Calves <3 months (2 wks - 6 mos)
- Necrotic laryngitis
  - Older calves, 6-18 months
  - Untreated some die 2-7 days from toxemia & upper airway obstruction
- Necrotizing pneumonia

### *Fusobacterium necrophorum*
- CS: Dyspnea, Salivation, Nasal discharge
- Dx: Laryngoscope
- Tx: Isolate, ABs

<table>
<thead>
<tr>
<th>&quot;Honkers&quot;, Tracheal edema</th>
<th>Feedlot cattle</th>
<th>2 forms</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS: Acute - Dyspnea; Chronic - Cough</td>
<td>Acute dyspnea</td>
<td>Chronic cough</td>
</tr>
<tr>
<td>Dx: Auscultate, Endoscope</td>
<td>Endoscopic ultrasound</td>
<td></td>
</tr>
<tr>
<td>Tx: Salvage</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>History, CS, necrotic ulcers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laryngoscope</td>
</tr>
<tr>
<td>Diphtheritic material</td>
</tr>
</tbody>
</table>

### Feeder form

- History, CS, necrotic ulcers
- Nasal discharge, fetid odor
- Older calves, 6-18 months
- Salivation

### Necrotic stomatitis
- Acute (aspiration of infected tissue)
- Death

### Necrotizing pneumonia
- History, CS, necrotic ulcers
- Nasal discharge, fetid odor

### Prognosis:
- Recovering patients tend to relapse so salvage

### Tracheal collapse, stenosis

- Rare: Cause: unknown (blunt trauma, tracheostomies, congenital?)
- Calves - majority thoracic trachea (congenital)
- CS: Dyspnea (exacerbated by excitement), stertorous resp., "honking" cough, fever, cyanosis, ↑ HR & RR, BAR
- Dx: Hx, CS, auscultate trachea, palpate cervical trachea
- DDx: Tracheal FB, Tracheal actinobacillosis, Neoplasms, Bronchopneumonia, Necrotic laryngitis, external compression (abscesses, hematomas, TB)
- Tx: Mild cases - confinement & fattening, Prostheses have been used

### Tracheal foreign body (FB)

<table>
<thead>
<tr>
<th>Rare</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS: chronic cough, inspiratory dyspnea, stridor, extension of head &amp; neck, open-mouth breathing, salivation</td>
</tr>
<tr>
<td>Dx: Auscultation, Endoscope, Rads</td>
</tr>
<tr>
<td>Tx: Remove object (endoscope snare); Tracheostomy</td>
</tr>
</tbody>
</table>

### Laryngeal obstruction

- Tracheostomy \( \rightarrow \) airway obstruction
- NSAIDs, incl. aspirin, Banamine®

### Control

- Clean & disinfect feeding & drinking areas
- Daily PE all calves to find new cases

### Salvage

- No Tx for chronic form
- Acute form
  - Broad spectrum ABs
  - Steroids (Dexamethasone, Prednisolone IV/IM daily)
  - Avoid stress, provide shade

### Prognosis:
- Recovering patients tend to relapse so salvage

---

*Note: The table and diagram provide summaries of various conditions and treatments related to respiratory issues in calves.*
Respiratory Disease

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2) 2° bronchopneumonia 3) Enteric form - diarrhea 4) IPV - Infec. pustular vulvovaginitis 5) Abortion storms ($) (see pro.)</td>
<td>DDx: 1. Laryngitis (p 61) 2. Tracheitis 3. Bovine keratoconjunctivitis (pink eye) (p 178)</td>
<td>Prevention: IBR vaccinate all cattle</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6) Encephalitic - 100% mortality</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>7) Abortion storms 8) Pustular vulvovaginitis</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>9) Encephalitic - 100% mortality</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contagious, Carriers, Stress, 2° bact. CS: Upper respiratory Dx: CS, Hx, Serum neutralization Tx: ABs, Isolation • Pxs: Good</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pneumonia</td>
<td>IM 581; C3T 640; C1T 823; BR-hb 162; BR 410; Br</td>
<td>Mild to rapidly fatal 1. Bilateral nasal discharge 2. Cough 3. Fever - acute 4. Dyspnea 5. Pain indicates pleural involvement</td>
<td>Decide if 1° lung or 2° to systemic diz 1. Upper or lower resp. (auscultation) 2. Empyema (extrapulmonary) or pneumonia (insp. &amp; expir. dyspnea)</td>
<td>Noninfectious (see box) 1. Most infectious (see box) 2. Etiology - Serous then fibrinous exudate - Consolidation - Minirvolve bronchi, bronchioles &amp; pleura - Tissue damage &amp; emphysema - Fibrous organization - Transmission - Bronchogenic (most common) - Apical (cran.) &amp; “middle” lobes most affected - Right &gt; Lt. lung bec. of tracheal bronchus - Hematogenous: Lobular</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Nasal &amp; tracheal swabs (culture) 5. Transtracheal wash (better)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>8. WBCs - bacteria = upper normal w/ lt. athl; Virus - leukopenia</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>9. Radiology in calves</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>10. PM: Consolidation of craniovent: areas</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Most infectious CS: Discharge, Cough, Fever, Dyspnea Dx: 1° or 2°, Upper or lower</td>
<td></td>
<td>11. ABs minimum of 3-4 days 12. Bronchodilators (Isoproterenol, theophylline) 13. Steroids controversial</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cs: Discharge, Cough</td>
<td></td>
<td>Prevention: Vaccines (IBR, BVD, PI 3) 1. Reduce stress</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tx: ABs ≥ 3 wks, Bronchodilators</td>
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</tr>
</tbody>
</table>

Agents/types
- Pasteurella multocida
- Pasteurella hemolytica
- Parainfluenza-3 virus
- Farmer's lung (mold) (p 68)
- Fog fever (pustule) (p 67)
- Haemophilus somnus
- IBR
- BVD
- B. pyogenes
- BRV
- DN-599 virus
- Misc. viruses
**IBR + Pasteurella = Bronchopneumonia (Shipping fever) (See below)**

- 2nd complication of red nose
- Virus destroys mucous membrane of trachea, allowing bacteria to colonize;
- 10% more severe than upper resp. tract infection of IBR

**Bronchopneumonia, Shipping fever, Pasteurellosis, Bovine pneumatic pasteurellosis, Transit Fever, Fibrinous pneumonia**

<table>
<thead>
<tr>
<th>Multifactors</th>
<th>Respiratory problems</th>
<th>History (Hx) (shipping) &amp; CS</th>
<th>Bronchopneumonia</th>
</tr>
</thead>
</table>
| #1 *Pasteurella haemolytica*, P. multocida & other bacteria also possible | **Multifactors**
- Pasteurella normal in upper resp. tract, but not in lung
- CS due to bacterial lesions of lungs
- Virus (IBR, PI-3, BRSV, BVD) or mycoplasma, like stress, increases susceptibility to 2nd bac. | **Respiratory problems**
- 7-21 d after arrival at feedlot
- Found ill, hanging back from feed & water or dead | **Bronchopneumonia**

- Multifactors
  - #1 *Pasteurella haemolytica*, P. multocida & other bacteria also possible
  - Pasteurella normal in upper resp. tract, but not in lung
  - CS due to bacterial lesions of lungs
  + Stress - immunosuppression causes bacteria to proliferate & move to lungs
  + Virus (IBR, PI-3, BRSV, BVD) or mycoplasma, like stress, increases susceptibility to 2nd bac. | **Respiratory problems**
- Found ill, hanging back from feed & water or dead
- Initial wheezes, moist rales & crackles
- Friction sounds
- W/ further consolidation sounds m/ decr. | **History (Hx) (shipping) & CS**
- Abnormal lung sounds
- Expiratory grunt
- Initial wheezes, moist rales & crackles
- Friction sounds
- W/ further consolidation sounds m/ decr.

- Sequela:
  - Survivors m/b chronic poor doers | **Postmortem**
  - Cranioventr. lungs dark red, swollen & hard, often covered w/ fibrin

**DDx:**

- Pleuritis (p 72)
- Pleural effusion, e.g., due to hardware dix (1 animal) (p 38)
- Acute pulmonary emphysema (p 67)
- Fog fever (p 67)
- Pulmonary edema (p 67)
- Laryngitis (p 61)
- Tracheitis
- Lungworms (p 69)

**Stress + Virus + Bact. = Bronchopneumonia, 1-2 wks after shipping**

**CS:** Resp. (fever, dyspnea, cough), Rapidly fatal

**Dx:** Hx, CS, Fibrin

**Tx:** ABs, Isolation  •  **Px:** Good

**Prevention:**

- Precondition 3 weeks before shipping (weaned & conc. diets, castrated, dehorned, resp. vac., Tx parasites)
- Reduce stress (transit time, crowding & mixing, dust, proper ventilation & feed)
- Tx high risk calves w/ Mycotil® or oxytetacyclines IM + oral bolus of sulfamethoxine
- Vaccination

**Prognosis: Good** - 1-10% mortality
### Respiratory Disease

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bovine resp. syncytial virus, BRSV</strong></td>
<td><strong>- Paramyxovirus</strong>&lt;br&gt;- Forms multinucleated cells (syncytiocytic cells)<strong>&lt;br&gt;- Destroys resp. epithelium&lt;br&gt;- 0-20% mortality&lt;br&gt;- Winter/Beef breeds due to husbandry&lt;br&gt;- No maternal ABS&lt;br&gt;- Calves affected more severely</strong>&lt;br&gt;- Two phases: 1st respiratory, 2nd hypersensitivity&lt;br&gt;- Adults serve as reservoir</td>
<td>Two phases&lt;br&gt;- 1st phase&lt;br&gt;- 104-108°F.&lt;br&gt;- Anorexia, depression&lt;br&gt;- Salivation&lt;br&gt;- Nasal discharge&lt;br&gt;- Dyspnea&lt;br&gt;- Remission or progression&lt;br&gt;- 2nd bact. pneumonia common, M/b complicated by mycoplasma</td>
<td><strong>- Difficult, due to other viruses causing similar CS&lt;br&gt;- Development of 2nd phase - severe pneumonia&lt;br&gt;- Cough, easily elicited by tracheal palpation&lt;br&gt;- Difficult to culture in vitro&lt;br&gt;- Postmortem&lt;br&gt;- Intracytoplasmic inclusion bodies&lt;br&gt;- Syncytial cells: multinucleated pneumocytes (coalesce)&lt;br&gt;- Need to differentiate from other viruses because of different Tx</strong></td>
<td><strong>- ABs - preventive (broad spectrum: oxytetracycline, sulfas, Naxcel, etc.)&lt;br&gt;- 2nd phase&lt;br&gt;- Corticosteroids&lt;br&gt;- Dexamethasone, once&lt;br&gt;- Then prednisone&lt;br&gt;- Usu. get dramatic response&lt;br&gt;- Contraindicated in other viral dises&lt;br&gt;- Steroid treatment? Need to know if BSV or some other virus; difficult so treat empirically (from experience)&lt;br&gt;- Banamine® ↓ inflam. response (NSAIDs)&lt;br&gt;- Antihistamines</strong></td>
</tr>
<tr>
<td><strong>Paramyxovirus, Winter/Beef, 2 Phases</strong></td>
<td><strong>CS: 1st phase Resp. , 2nd Hypersensitivity&lt;br&gt;Dx: Hx, CS, Syncytial cells&lt;br.Tx: ABs, Steroids</strong></td>
<td><strong>2nd phase:&lt;br&gt;- Hypersensitivity reaction (m/b)&lt;br&gt;- Severe pneumonia&lt;br&gt;- Dyspnic, lying down&lt;br&gt;- SQ emphysema&lt;br&gt;- Submandibular edema (migrated along mediastinum)&lt;br&gt;- Calves spontaneously cough&lt;br&gt;- Time between 2 phases 1 - 2 wks</strong></td>
<td><strong>- Also part of shipping complex, causing resp. diz &amp; adding to shipping fever&lt;br&gt;- Both upper &amp; lower resp. tract diz (different from PI-3 &amp; IBR)&lt;br&gt;- Predisposing factor for 2nd infac.</strong></td>
<td><strong>- Good 1st phase&lt;br&gt;- Grave 2nd phase</strong></td>
</tr>
<tr>
<td>**BVD/MD Bovine viral diarrhea *****</td>
<td><strong>- See Gen pg 253&lt;br&gt;- Togavirus&lt;br&gt;- Immunosuppressive, may predispose to other dises&lt;br&gt;- Transmission:&lt;br&gt;- Direct &amp; indirect contact&lt;br&gt;- Transplacentally&lt;br&gt;- IP (incubation period) 5-10 days&lt;br&gt;- 1st yearlings up to 2-3 years&lt;br&gt;- M/b part of shipping fever complex</strong></td>
<td><strong>- Classical BVD - Diarrhea (see GI)&lt;br&gt;- Resp. CS w/ intermittent fever&lt;br&gt;- ↑ RR&lt;br&gt;- Recover in 10 d if no 2° bact.&lt;br&gt;- Abortion (&quot;weak calf syndrome&quot;)</strong></td>
<td><strong>- Presumptive - PE &amp; necropsy&lt;br&gt;- Definitive Dx requires 2-3 weeks&lt;br&gt;- Serum neutralization test or viral isolation&lt;br&gt;- Leukopenia&lt;br&gt;- DDx from Rinderpest &amp; FMD&lt;br&gt;- Postmortem:&lt;br&gt;- Degenerative epithelial cells of GI&lt;br&gt;- Erosion from mouth to intestine</strong></td>
<td><strong>- Palliative&lt;br&gt;- Fluids (for dehydration)&lt;br&gt;- Prophylactic ABs (immuno-suppression)&lt;br&gt;- Good husbandry&lt;br&gt;- BVD/MD - cull&lt;br&gt;- Persistently infec. - salvage</strong></td>
</tr>
</tbody>
</table>

### Prognosis:

- **BVD: Guarded to fair**
- **Mucosal diz: Grave - Euthanasia**
<table>
<thead>
<tr>
<th>Other Viruses Isolated in Resp. Diz</th>
<th>Dx of Viral Respiratory Diz</th>
<th>Tx of Viral Respiratory Diz</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Parainfluenza</strong> - 3 virus (PI-3)</td>
<td>• Most mild w/o 2° bacteria</td>
<td>• ABs to prevent 2° bact. infec., be aggressive &amp; continue several days after recovery (Naxol®, oxytetracycline, Tylosin, etc.)</td>
</tr>
<tr>
<td>Malignant catarrhal fever virus: sporadic occurrence</td>
<td>• History, CS, Physical exam</td>
<td>• NSAIDs found to be helpful</td>
</tr>
<tr>
<td>Other herpes viruses: Serologically distinct from IBR, MCF &amp; herpes mambillitis virus, Herpesvirus type 4, Several isolated from cattle w/ respiratory diaz (DN-599, Mavor 33/36, FTC-2); importance poorly defined, not thought to be important enough to warrant vaccine development</td>
<td>• Specific viral Dx difficult w/o lab</td>
<td>• Corticos'roides reported helpful in BRSV infections, Dexamethasone (immunosuppressive) m' cause neaudecency of IBR infec.</td>
</tr>
<tr>
<td>Adenovirus (BAV): Bovine adenovirus, DNA virus; infection often not apparent, assoc. w/ other viruses &amp; bacteria; Assoc. w/ a wide spectrum of diazs (pneumonia, enteritis, pneumoenteritis, conjunctivitis, keratoconjunctivitis, weak calf syndrome &amp; abortion</td>
<td>• Performed in cell cultures</td>
<td>• NO antiviral drugs available in vet med.</td>
</tr>
<tr>
<td>• CS of both upper &amp; lower respiratory tract diaz</td>
<td>- Nasopharyngeal swabs, conjunctival swabs, tracheal lavage fluids, PM tissues</td>
<td>• Supportive care:</td>
</tr>
<tr>
<td>Rhinovirus: RNA virus (picornavirus), infection appears widespread</td>
<td>- Place in virus transport medium &amp; refrigerate (24 hrs) or freeze</td>
<td>- Fluids</td>
</tr>
<tr>
<td>• CS: inapparent to fever, anorexia, depression, RR, lacrimation, conjunctivitis, salivation, coughing &amp; nasal discharge</td>
<td>- Sample in acute phase of diaz &amp; asymptomatic contact animals (m/b incubating)</td>
<td>- Vit. B-complex for anorectic animals</td>
</tr>
<tr>
<td>Reovirus: RNA virus; subclinical infection usually; importance unclear</td>
<td>- BRSV very difficult to isolate</td>
<td>- Selenium or copper supplementation if deficient</td>
</tr>
<tr>
<td>Enterovirus: RNA virus (picornavirus); not considered pathogenic</td>
<td>- Virus identification: neutralization of specific antiserum, fluorescent antibody staining, immunoperoxidase staining, electron microscopy, immunoelectron microscopy</td>
<td>• Tx other concurrent diazs</td>
</tr>
<tr>
<td>Coronavirus: Established cause of diarrhea in young calves, role in respiratory diaz?</td>
<td>- Viral antigen detection: immunofluorescence (rapid) immunoperoxidase</td>
<td>Prevention:</td>
</tr>
<tr>
<td>Calicivirus: Isolated in calves w/ persistent respiratory diaz</td>
<td>- Serum-virus neutralization test, hemagglutination/inhibition test (PI-3), ELISA</td>
<td>• Management important</td>
</tr>
<tr>
<td><strong>Malignant catarrhal fever virus:</strong> sporadic occurrence</td>
<td><strong>Dx of Viral Respiratory Diz</strong></td>
<td><strong>Tx of Viral Respiratory Diz</strong></td>
</tr>
</tbody>
</table>

**Other Viruses Isolated in Resp. Diz** (IM 636; DC 86)

- **Parainfluenza** - 3 virus (PI-3)
  - **Paramyxovirus**
    - All ages affected, 1° weaning calves
    - Predisposes to lower resp. tract diaz.
    - Chipping fever, but in itself a little problem
    - Majority of cattle have antibody levels to PI-3 (ubiquitous)
    - Linked to bovine respiratory diaz (BRD)
  - Can cause diaz alone, but probably 1° infection followed by Pasteurella as a 2° invader

- **Most mild w/o 2° bacteria**
  - Fever, anorexia
  - Serous nasal discharge
  - Lacrimation
  - Coughing
  - CS develop as get to feedlot
  - Predisposes to 2° bact.
  - Pasteurella = pneumonia
  - Incr. severity of CS, Death

- **History, CS, Physical exam**
  - Labs look for virus that has a vaccine
  - CBC & chem. rarely of value
  - Serum immunoglobulins useful for FPT (failure of passive transfer)
  - Virus isolation: time consuming & expensive
  - Performed in cell cultures
  - Nasopharyngeal swabs, conjunctival swabs, tracheal lavage fluids, PM tissues
  - Place in virus transport medium & refrigerate (24 hrs) or freeze
  - Sample in acute phase of diaz & asymptomatic contact animals (m/b incubating)
  - BRSV very difficult to isolate
  - Virus identification: neutralization of specific antiserum, fluorescent antibody staining, immunoperoxidase staining, electron microscopy, immunoelectron microscopy
  - Viral antigen detection: immunofluorescence (rapid) immunoperoxidase
  - Serum-virus neutralization test, hemagglutination/inhibition test (PI-3), ELISA

**Dx of Viral Respiratory Diz**

- **Colostrum**

**Tx of Viral Respiratory Diz**

- **ABs to prevent 2° bact. infec., be aggressive & continue several days after recovery (Naxol®, oxytetracycline, Tylosin, etc.)**
  - **NSAIDs found to be helpful**
  - **Corticos'roides reported helpful in BRSV infections, Dexamethasone (immunosuppressive) m' cause neaudecency of IBR infec.**
  - **NO antiviral drugs available in vet med.**
  - **Supportive care:**
    - Fluids
    - Vit. B-complex for anorectic animals
    - Selenium or copper supplementation if deficient
  - **Tx other concurrent diazs**

**Prevention:**

- **Management important**
- **Vaccinations**
  - Not totally effective for a number of reasons (diverse etiology, few vaccines)
  - Vaccinate IBR, PI-3, BVD
  - BRSV vaccine requires 2 doses
### Respiratory Disease

**Condition**
- Enzootic calf pneumonia, Cuffing pneumonia
- Housed calves; Stress + Virus/Mycoplasma + 2° Bact.

**Facts/Cause**
- Multifactoral
  - Virus (IBR, PI-3, BRSV)
  - Mycoplasma (M. viscosa) or chlamydia
  - 2° Bact. - P. hemolytica, P. multocida or Actinomyces pyogenes
  - Transmission: aerosolization
  - 2-5 mo-olds (waning of maternal antibodies)
  - Depress host defenses + incr. pathogen challenge
  - Housed calves:
    - Crowding, poor ventilation, stress - Intensely managed calves, multiple sources of animals, new pathogens

**Presentation/CS**
- Occurrence & severity vary
  - Initial viral or mycoplasma diz usually mild or subclinical
  - Acute outbreaks - pneumonia
    - Fever 103-107°F
    - Respiratory rate
    - Coughing
    - Weight loss
    - Recovery gradual unless 2° Bact.
    - Toxemic w/ Pasteurella
      - Cold extremities, toxic lines in oral cavity, etc.

**Diagnosis**
- Coughing in housed calves
- Lab detection difficult
  - Viral or mycoplasma
  - Nasopharyngeal swabs - virus isolation & mycoplasma, cultures FA if early
  - Transtracheal wash for bact. cult/sens

**Treatment**
- Eliminate environ. problems
- Treated early
- ABs (transtracheal washes) assume others have similar pathogens
  - Naxcel®, Micocil, oxytetracycline
  - Repeat Tx since relapses are common
- Acute course 10-14 days w/Tx

**Control**
- COLOSTRUM at birth
- Eliminate environmental causes
  - Individual calf hutches placed outside (1st 4-6 wks)
  - Bedded & protected from wind
  - If not space for individual hutches, then certain specifications, temp 55-70°F, humidity 70%, etc.
- Vaccines
  - Isolate incoming calves at least 2 wks
  - Buy calves with adequate colostrum intake

**Prognosis:** Guarded
- Hi morbidity, but w/ therapy, low mortality
- Recover, but some poor doers

**Respiratory System**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
</table>
| Enzootic calf pneumonia, Cuffing pneumonia | Mk 727; IM 646, 325, 632; Br 202; BR nb 407; BR 1051 | • Multifactoral
  - Virus (IBR, PI-3, BRSV)
  - Mycoplasma (M. viscosa) or chlamydia
  - 2° Bact. - P. hemolytica, P. multocida or Actinomyces pyogenes
  - Transmission: aerosolization
  - 2-5 mo-olds (waning of maternal antibodies)
  - Depress host defenses + incr. pathogen challenge
  - Housed calves:
    - Crowding, poor ventilation, stress - Intensely managed calves, multiple sources of animals, new pathogens | • Occurrence & severity vary
  - Initial viral or mycoplasma diz usually mild or subclinical
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    - Fever 103-107°F
    - Respiratory rate
    - Coughing
    - Weight loss
    - Recovery gradual unless 2° Bact.
    - Toxemic w/ Pasteurella
      - Cold extremities, toxic lines in oral cavity, etc. | • Coughing in housed calves
- Lab detection difficult
  - Viral or mycoplasma
  - Nasopharyngeal swabs - virus isolation & mycoplasma, cultures FA if early
- Transtracheal wash for bact. cult/sens | • Eliminate environ. problems
- Treated early
- ABs (transtracheal washes) assume others have similar pathogens
  - Naxcel®, Micocil, oxytetracycline
  - Repeat Tx since relapses are common
- Acute course 10-14 days w/Tx |
| Housed calves; Stress + Virus/Mycoplasma + 2° Bact. | CS: Outbreaks - Pneumonia (Coughing)
Dx: Hx, CS, Lab
Tx: Stop stress, ABs ✶Px: Guarded | | | |
Acute Respiratory Distress Syndrome (ARDS)

- Any resp. condition or sudden onset of dyspnea (usually severe), characterized by: Congestion & edema, Hyaline membranes, Alveolar epith. hyperplasia & Interstitial emphysema
- Examples: Fog fever (ABPE), Moldy sweet potato toxicity & Perilla ketone toxicity, Toxic gases

Atypical interstitial pneumonia, Fog fever
Acute bovine pulmonary edema & emphysema (ABPE), Acute respiratory distress syndrome (ARDS)

- M/b ARDS
  - Moving adults from dry sparse forage to lush green pasture
  - L-tryptophane in lush forages converted by microorganisms into 3-methylindole
    - Pneumotoxic compound (3-methylindole)
    - Damages resp. epithelial cells, resulting in pulmonary edema, alveolar epith. hyperplasia, hyaline membranes = emphysema w/ severe dyspnea
    - Pasture type unimportant, esp. lushness
    - Fall, Western US, moving to lush pastures
    - Morbidity up to 50%
    - Mortality up to 30%
    - Nursing calves & yearlings don't eat enough to gel diz

Adult + Lush pastures (L-tryptophan) = ARDS (lung damage & edema & emphysema)

CS: Acute dyspnea, Death, No coughing
Dx: Hx (Pasture), CS, Hyaline membranes
Tx: None - Don't stress • Px: 30% die

DDx:
- Adult respiratory distress syndrome (ARDS)
- Moldy sweet potato poisoning & perilla mint (pneumotoxins) (ID source) (p 67)
- Parasitic bronchitis (coughing) (p 69)
- Anaphylaxis (only 1 animal affected) (p 251)

DDx:
- Acute respiratory distress syndrome (ARDS)
- Moldy sweet potato poisoning & perilla mint (pneumotoxins) (ID source) (p 67)
- Parasitic bronchitis (coughing) (p 69)
- Anaphylaxis (only 1 animal affected) (p 251)

Prognosis:
- Congested, edema & hyaline membranes
- Histo.: multinucleated giant cells

Prevention:
- Slowly introduce to lush pasture • Gradually decr. hay in feed lot and incr. pasture • Over a period of 10-12 days
- Delay lush pasture until after first frost
- Thoroughly graze lush pasture w/young stock or sheep before older cattle
- Prophylactic - decr. conversion of tryptophane to 3-MI • Monensin for 5-6 ds prior to putting on pasture

“Fog” pastures: British term for lush regrowth after hay cut

Moldy sweet potato toxicity, 4-ipomeanol toxicity & Perilla mint toxicity (See Tox pg 225)

- See PP pg 225 • Both produce ARDS; Sweet potato + fungus = pneumotoxin, Perilla plant (weed in SW) = pneumotoxin
- Damages cells - edema, hemorrhage, cellular necrosis, hyaline membrane formation - 2º emphysema
- CS, same as Fog fever • Dx: exposure to damaged sweet potatoes to DDx from fog fever • Tx: suggested same as fog fever

Toxic gases: See Tox p 210, can cause ARDS, Nitrogen dioxide, Zinc oxide, Chlorine, Manure gas, Smoke inhalation
## RESPIRATORY SYSTEM

### Hypersensitivity Pneumonia

**Facts/Cause**
- Inhaling organic dust
- Moldy hay - spores of *Thermophilic actinomycetes* (Micropolyspora & Thermoactinomyces)
- Wet summers (moldy hay) & cold winters (housed cattle)
  - > 30% moisture content to hay - heats when bailed - thermophilic molds proliferate
- Spores - hypersensitivity - destroys alveoli
  - Confined adult cattle (dairy)

**Presentation/CS**
- Animals in diff. stages
- Acute resp signs:
  - Coughing
  - Dyspnea, tachypnea
  - Dullness, appetite, hypogalactia, moderate transient fever
- Chronic:
  - Insidious onset
  - Fibrosis
  - Weight loss & coughing over several winters
  - CS similar to acute

**Diagnosis**
- History (Hx) & CS
- Auscultation: cranioventr. crackles
- Postmortem:
  - Grossly normal lungs, small gray spots of lymphocytes

**Treatment**
- Remove moldy hay (S)
- Corticosteroids (Dexamethasone IV)

### Moldy Hay - Hypersensitivity - Damages Alveoli

**CS:**
- Acute (Coughing, Dyspnea); Chronic (Wt. loss & Coughing)

**Dx:**
- Hx, CS

**Tx:**
- Remove moldy hay, Corticosteroids
- Px: Good if no fibrosis

### Contagious bovine pleuropneumonia

(Mk 726; IM 651; B-A 672) USA Free since 1892, highly contagious pneumonia generally accompanied by pleurisy
- (Africa, Iberian peninsula, India & China; Mycoplasma mycoides mycoides • Reportable dz

**Facts/Cause**
- Contributes to some outbreaks of enzootic pneumonia in housed calves
- Pneumonia in range calves

**Presentation/CS**
- Fever, depression
- Nasal discharge
- Dry hacking cough
- Dyspnea
- Diarrhea

**Diagnosis**
- Isolation from nasal discharges, trachea
- Inclusion bodies in affected tissue, FA, Complement fixation
- Postmortem: plum-colored lung icties (like enzootic pneumonia)

**Treatment**
- Tetracyclines, large doses (11 mg/kg or more) 3 days

### Pulmonary Listeriosis

(Mk 671) • *Listeria monocytogenes*, Pneumonia resembling atypical pneumonia in feedlots, Stocker & feeder calves, Clinically indistinguishable from other bacterial pneumonias, Also causes encephalitis, abortions, septicemia, conjunctivitis & mastitis • Tx: Oxytetracycline & penicillin at high doses

### Coccidiomycosis

(MK 344) • Dust-born, noncontagious infec.; fungus/Coccidioides immitis, SW USA (arid) • Ruminants m/ have subclinical infection in lungs & lymph nodes of thorax

### Mycoplasma Pneumonia

- In goats, not cattle

### Pneumocystis Carinii Pneumonia

- Also in goats, not cattle

### Pulmonary Adenomatosis, Jaagsiekte, Pulmonary Carcinoma in Sheep

- Not in cattle
Lung worm, Verminous bronchitis, Verminous pneumonia, "Husk"

**Dictyocaulus viviparous**
- Yearling cattle >> adult
- Infected pastures
- Herd problem at pasture
- Late Summer & Fall
- High rainfall or irrigation
- Larvae in alveoli - block small airways

**Coughing** (gradual onset)
- Respiratory rate
- Severity depends on # of larvae
- Can cause death

**Parasitic Pneumonia** (aspiration of eggs & larvae) + tracheitis & bronchitis (adults)
- Consolidation of caud. lung lobe
- Marked coughing
- Dyspnic, off feed, temp. elev., wt. loss
- SQ emphysema due to dyspnea
- May die if untreated
- Self limiting (slow recovery as eliminates adult worms)

**Aspiration pneumonia, Gangrenous/Foreign body/Medication/Lipid Inhalation pneumonia**
- Inhalation of foreign material
- Careless drenching/stomach tube
- Pail-fed calves, pharyngeal paresis, necrobacillary laryngitis, anesthetized animals, parturient paresis, crude oil ingestion

**Sudden death** (if "lots" inhaled)
- Gangrenous bronchopneumonia
  - Depression
  - Dyspnea, Polypnea
  - Coughing
  - Putrid breath

**History (Hx), CS**
- Auscultation: crackles, wheezes, pleural friction rubs
- Postmortem: Consolidation of cranioventral lungs, necrosis

**DDx:**
- Bronchopneumonia (p 63)
- Septicemia (p 258)

**Emergency**
- ABs - long term
- NSAIDs + corticosteroids IV

**Prognosis:** Guarded, but some can be saved

**Dictyocaulus, Summer/Fall**
- Yearling cattle >> adult
- Infected pastures
- Herd problem at pasture
- Late Summer & Fall
- High rainfall or irrigation
- Larvae in alveoli - block small airways

**CS:** Coughing, Self limiting
**Dx:** Baerman sedimentation
**Tx:** Ivermectin

**DDx:**
- Fog fever (less coughing) (p 67)
- Farmer's lung (p 68)
- Bronchopneumonia (p 63)

**Ivermectin** (Broad spec. 3, 8, & 13 weeks after start on pasture)
- Repeat for developing larval stages
- Levamisole in past

**Prognosis w/ Tx:**
- Just cough & dyspnea - Good
- More severe, dyspnic
  - Guarded, some die, some chronically unthrifty

**Direct life cycle**
- Adults lay eggs in trachea & bronchi
- Eggs hatch & larvae are coughed up
- Swallowed & passed in feces
- Larvae re-ingested
- Penetrate intestines
- Move by blood & lymph to caudal lungs, then to alveoli & bronchi
- Larvae in alveoli block small bronchi
- Adults cause inflammation in large airways
- Aspirated eggs & larvae cause consolidation of ventrall part of caudal lobes

**Aspiration pneumonia, Gangrenous/Foreign body/Medication/Lipid Inhalation pneumonia**
- Inhalation of foreign material
- Careless drenching/stomach tube
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**Sudden death** (if "lots" inhaled)
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  - Coughing
  - Putrid breath

**History (Hx), CS**
- Auscultation: crackles, wheezes, pleural friction rubs
- Postmortem: Consolidation of cranioventral lungs, necrosis

**DDx:**
- Bronchopneumonia (p 63)
- Septicemia (p 258)

**Prognosis:** Guarded, but some can be saved
# Tuberculosis

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tuberculosis</strong></td>
<td><strong>Mycobacterium</strong>: acid fast bacilli</td>
<td><strong>Chronic debilitating diz</strong> - Enlarged supf. lymph nodes m/b - Weakness, anorexia - <strong>Dyspnea</strong> - <strong>Chronic wasting &amp; Emaciation</strong> - Low grade fluctuating fever - Intermittent hacking cough</td>
<td><strong>Dx only when advanced</strong></td>
<td><strong>Notify authorities</strong> - Test &amp; Slaughter</td>
</tr>
<tr>
<td></td>
<td><strong>Pathogenesis</strong> - 1° focus in lungs in man &amp; cattle - Drains to adjacent lymph nodes - Seldom heals, progresses slowly or rapidly - Localizes into tubercles (tumorlike granulomatous masses that tend to mineralize) - Transm.: inhalation, ingestion of contaminated feces, milk - M/ spread to udder - Public health</td>
<td><strong>Acute rapid diz occasionally</strong></td>
<td><strong>Tuberculin skin test</strong> - Inject tuberculin intradermally (PPD - purified-protein-derivative) - Inflam. &amp; swelling positive (delayed hypersensitivity reaction) - C-C test (comparative-cervical) M. avium &amp; M. bovis PPD tuberculin injected in separate sites on neck &amp; compared . M. paratuberculosis/ gives false positives</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Main reservoirs</strong>: humans &amp; cattle</td>
<td><strong>Culture organism to confirm 4-8 weeks</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Few infected herds in diverse areas of USA</strong></td>
<td></td>
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</tr>
</tbody>
</table>

## Facts/Cause

- **Mycobacterium**: acid fast bacilli
- **Pathogenesis**
  - 1° focus in lungs in man & cattle
  - Drains to adjacent lymph nodes
  - Seldom heals, progresses slowly or rapidly
  - Localizes into tubercles (tumorlike granulomatous masses that tend to mineralize)
- Transm.: inhalation, ingestion of contaminated feces, milk
- M/ spread to udder - Public health
- **Main reservoirs**: humans & cattle
- **Few infected herds in diverse areas of USA**

## Diagnosis

- **Dx only when advanced**
- **Tuberculin skin test**
  - Inject tuberculin intradermally (PPD - purified-protein-derivative)
  - Inflam. & swelling positive (delayed hypersensitivity reaction)
- **C-C test** (comparative-cervical) M. avium & M. bovis PPD tuberculin injected in separate sites on neck & compared
- M. paratuberculosis/ gives false positives
- Culture organism to confirm 4-8 weeks

## Treatment

- **Notify authorities** - Test & Slaughter

## Prognosis: Grave

## Types of Mycobacterium: can affect other species

- M. tuberculosis: human & nonhuman primates, dogs & parrots
- M. bovis: most warm blooded species, including man
- M. avium: birds, cattle, sheep & other species

## Buss diz, Sporadic bovine encephalomyelitis

- See Neuro pg 151
- Rare, endemic on some farms, Chlamydia (psittacosis), Cattle & buffalo only; Transm. unknown; Vasculitis
- CS: Multisystem diz; Resp: nasal discharge, dyspnea, cough, Grunt - Pleuritis - pain like hardware diz; GI (initial diarrhea); CNS (encephalitis)
- Dx: Elementary bodies in pleural & peritoneal effusions highly suggestive, Culture chlamydia
- Tx: Tetracyclines effective early
Vena caval thrombosis, Metastatic pneumonia, Pulmonary thromboembolism, Embolic pulmonary aneurysm, Lung abscess

- Common > 1% of necropsies (feedlots)
- Multifocal abscessation in lungs
- Thromboembolism
- Septic emboli arise from septic thrombi of caud. vena cava > cran. vena cava
- Cause of septic thrombi
- #1 liver abscesses 2° to rumenitis
- Mastitis, foot rot, jugular phlebitis
- Bact: Fusobacterium necrophorum, Actinomyces pyogenes, staph., strep, E. coli
- Feedlot cattle, most common (assoc. w/ rumenitis), Hi CHO diets - lactic acidosis, bacteria penetrate rumen & pass to liver through portal vein, Abscess, m/ infiltrate caud. vena cava - thrombus
- Traumatic reticuloperitonitis
- < 1 year old
- 100% fatal

Respiratory distress (tachypnea [RR > 30/min], expiratory dyspnea, hyperpnea, coughing, frothy muzzle, SQ emphysema)
- Widespread wheezes
- Epistaxis
- Hemoptysis (spitting blood), melena
- Anemia (hemic murmurs, pale "gums")
- Weight loss
- Thoracic pain
- Nonspecific (fever, depression, anorexia, rumen stasis, scant feces, milk production)
- Acute to chronic
- Chronic sequelae
  - Rt heart failure due to cor pulmonale
  - Jugular pulse
  - Brisket edema
  - Hepatomegaly
  - Ascites
  - Chronic diarrhea

CS: Resp., anemia, wheezing & hemoptysis - pathognomonic
- Lab:
  - Anemia
  - Neutrophilic leukocytosis
  - Hyperglobulinemia (freq.)
  - Liver: bilirubin & liver enzymes
- Rads: density to lungs, small densities
- Postmortem:
  - Abscess in caudal venal cava & adjacent liver, large, uncollapsed lungs, blood clots in airways, abscesses

Tx: Salvage
- Prognosis: 100% fatal
- Prevention: Prevent rumenitis, slow adaptation to hi-energy food, ABs in feed to reduce liver abscesses

Rumenitis - Liver abscess - Caud. venal caval thrombus - Lung emboli

CS: Resp., Anemia, Widespread wheezes, Hemoptysis
Dx: CS pathognomonic, PM
Tx: Salvage • Px: 100% fatal

Haemophilus somnus

- See pg Gen 254; Septicemic diz. frequency in pneumonia, Role in pneumonia not as well defined as CNS role,
- Calves - 4 weeks after entering feedlot
- CS: Resp. diz by itself or w/ CNS (cough, dyspnea, fever, pleuritis); TME: CNS CS; Joint - lameness
- Dx: Calves w/ CNS, resp., & joint disease, Just respiratory signs difficult to Dx
- Tx: IV AIBs (Naxcel®, Micotil®, oxytetracycline)
- Prevention: Bacterin of questionable value, Add aureomycin to feed

DDx before hemoptysis
- Anaphylaxis (p 251)
- Acute resp. distress syndrome (p 67)
- Hypersensitivity pneumonia (p 68)
- Lungworms (p 69)
- Shipping fever (p 63)

Aureomycin

Naxcel

Prevention:
- See pg Gen 254; Septicemic diz. frequency in pneumonia, Role in pneumonia not as well defined as CNS role,
# Pleuritis

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pleuritis w/ pleural effusion</strong></td>
<td>• Acute 1° pleuritis rare in ruminants</td>
<td></td>
<td></td>
<td>Tx animals of economic value</td>
</tr>
<tr>
<td>Mk 707; IM 674, C3T 664; BR-hb 168; BR 422; Br 116; DC 97</td>
<td><strong>2° condition</strong> almost always</td>
<td></td>
<td></td>
<td>• Treat 1° prblm</td>
</tr>
<tr>
<td></td>
<td>• Bronchopneumonia (p 63)</td>
<td></td>
<td></td>
<td>• Cull/salvage</td>
</tr>
<tr>
<td></td>
<td>• Hardware disease (p 38)</td>
<td></td>
<td></td>
<td>1) Drainage of fluid</td>
</tr>
<tr>
<td></td>
<td>• Liver abscesses (p 36)</td>
<td></td>
<td></td>
<td>- Fibrous adhesions develop</td>
</tr>
<tr>
<td></td>
<td>• Trauma (gunshot, broken ribs, perforation)</td>
<td></td>
<td></td>
<td>- Indwelling chest tubes</td>
</tr>
<tr>
<td></td>
<td>• Contagious bovine pleuro-pneumonia (CBPP) (p 68)</td>
<td></td>
<td></td>
<td>2) ABs</td>
</tr>
<tr>
<td></td>
<td>• Systemic conditions</td>
<td></td>
<td></td>
<td>- Empirical before getting cult. &amp; sens. back (many cases broad spectrum ABs - IV, but expensive)</td>
</tr>
<tr>
<td></td>
<td>• Lung abscesses (p 71)</td>
<td></td>
<td></td>
<td>- Mycotil®, Naxcel®, tetracyclines</td>
</tr>
<tr>
<td></td>
<td>• Uropertitoneum (p 96)</td>
<td></td>
<td></td>
<td>- Gram stain</td>
</tr>
<tr>
<td></td>
<td>• Rt. heart failure (p 76)</td>
<td></td>
<td></td>
<td>3) Analgesics, minimize pain (aspirin)</td>
</tr>
<tr>
<td></td>
<td>• Hypoproteinemia (p 302)</td>
<td></td>
<td></td>
<td>4) Supportive therapy - palatable feed, good bedding, easy access to feed and water</td>
</tr>
<tr>
<td></td>
<td>• Ruptured thoracic duct</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>• Hemothorax (p 73)</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>• SBE (sporadic bov. encephalomyelitis)</td>
<td></td>
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<tr>
<td></td>
<td>(p 151)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Lymphosarcoma, uncommon (p 268)</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

## Inflammation & Fluid in Chest, CS, Not Disabling

**CS:** Pain, Dyspnea, Edema

**Dx:** CS, Hx, Auscul., Centesis, US, TTW

**Tx:** Drain, ABs, Analgesics, Support

**Px:** Grave - Poor

## Thoracocentesis - Therapeutic Chest Drainage

- Establish cause & response to Tx
- Assess volume drained for baseline
  - If redrain know if making more fluid
- Correlation between survival & amount of fluid
- Evaluate grossly & record
  - Normal - yellow clear fluid (m' still be abnormal)
  - Yellowish white - infection
  - Cloudy - ↑ in WBCs
  - Odor fetid - anaerobics (gram positive)
- Nonseptic transudate (neoplasia, CHF, hypoproteinemia, uremia)

- Effusion: Acellular & high protein- sporadic bovine encephalomyelitis
- Septic exudates, hi cells & protein (pneumonia, hardware diz, peritonitis, abscesses, penetrating trauma & septicemia)

- Cytologic evaluation
  - Cytology & culture - bact., mycoplasma & chlamydia
  - Cult/sens for therapeutic plan (or transtracheal wash)

- TP (normal < 2 gram/dl)
  - > 2 suggests leakage - damaged capillary or obstruction to drainage or oncotic pressure change

- Cell count < 10,000 /ml normal (no correlation to cell count & survival rate)
**Pulmonary dysmaturity, Neonatal Resp Stress Syndrome, Hyaline membrane diz**

**Results in vicious cycle of hypoxia, pulmonary edema, atelectasis & lung damage w/ production of hyaline membrane**

**CS: Dyspnea, Immaturity**

**Dx: Hx, CS, Auscultation, Rads**

**Tx: Stim. surfactant, ABs, O2, Nursing**

**Failure of passive transfer**

- See Gen pg 246: FPT: Born w/out immunoglobulins; Colostrum, #1 cause of death in 1st wk, Absorption 1st 12-18 hours of life
- CS: Bacteremia, Dyspnea, Diarrhea, Anorexia, Depression, Weakness; Survivors: septic arthritis, meningitis, panophthalmitis
- Dx: Can't be determined by PE • Lab: Zn turbidity field test, Refractometer • Before failure, give colostrum
- Tx: Tx clinical diz, If less than 24 hours, feed colostrum. Over 24 hours - plasma or serum transfusion IV
- Prevention: Feed colostrum automatically w/o test, Make sure suckle in first 6 hours of life, 2 L colostrum in 1st 4 hrs after birth

**Hydrothorax & Hemothorax**

- Accumulation of edematous transudate or whole blood in pleural cavity • Cause: hydrothorax congestive heart failure, B.L.V, ruptured thoracic duct (Chylothorax rare), Hemothorax due to trauma, Hemangiosarcoma; all causing compression atelectasis of ventr. lungs
- CS: Dyspnea, NO fever, no pain or toxemia • Dx: dullness on percussion, absence of breath signs, Thoracocentesis (sterile)
- Tx: Tx primary cause, If severe dyspnea - aspirate fluid (reaccumulates quickly), Fluid replacement in hemorrhage

**Pneumothorax**

- Uncommon in cattle • Associated w/ pleural effusion
- Causes: - Thoracocentesis - small • Trauma: flail chest • Ruptured lung
- Bovid - complete mediastinum • 1 side only

- ± Dyspnea • Abnormal respiratory effort • SQ edema

- Seeing open chest • Auscultation - absence of lung sounds dorsally
- Abnormal respiratory effort & SQ edema

- Uncommon, Complete mediastinum

**CS: SQ edema**

**Emergency**

- Initiate before CS if suspect
- Stimulate surfactant formation • Glucocorticoids or ACTH
- Thyroxine (T4) IM BID or TRH
- Prolactin, pilocarpine

- Aminophylline: bronchodilation & stimulate surfactant (IV TID)

- Isoxaprine, lessen hypertension & bronchospasm, stimulates surfactant
- Diuretics controversial

- ABs for 2° septicemia
- Oxygen therapy
- Supportive nursing care • Whole milk by nasogastric tube, stim oral cavity w/ negative pressure
- Thyroxine (T4) 1M BID or TRH

- Prevention: Premature parturition anticipated: give TRH, ACTH or steroids to dam

**Prognosis: Guarded**
## Anaphylaxis

<table>
<thead>
<tr>
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<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anaphylaxis</td>
<td>Anaphylactic reactions - Type 1 immediate hypersensitivity</td>
<td>Acute, transient, w/in 20 min of injection</td>
<td>History (Injection), CS</td>
<td>Emergency: life threatening</td>
</tr>
<tr>
<td></td>
<td>- Alters vascular permeability &amp; smooth muscle contractions</td>
<td>Anxiety, distress</td>
<td>Crackles on auscultation</td>
<td>- Epinephrine IV, 1:10,000, 5 ml slowly</td>
</tr>
<tr>
<td></td>
<td>- Causes:</td>
<td>Tachycardia</td>
<td>Radiology for pulmonary edema</td>
<td>- Repeat at 15 min intervals if necessary</td>
</tr>
<tr>
<td></td>
<td>- Biological product injection</td>
<td>Dyspnea, open mouth breathing, abducted elbows, flaring of nostrils, stertor</td>
<td>Postmortem (PM):</td>
<td>- Steroids (Methylprednisolone Na succinate or Dexamethasone)</td>
</tr>
<tr>
<td></td>
<td>#1</td>
<td>Shivering</td>
<td>- Vascular engorgement</td>
<td>- IV fluids</td>
</tr>
<tr>
<td></td>
<td>- Repeated blood transfusions - same donor</td>
<td>± Brad, cough, nasal froth</td>
<td>Pulmonary edema</td>
<td>- ± Tracheostomy</td>
</tr>
<tr>
<td></td>
<td>- Repeated vaccines (Bruella abortus)</td>
<td>Piloerection, urticaria, angioedema</td>
<td>- Emphysema</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Repeated penicillin injections</td>
<td>Nystagmus, cyanosis</td>
<td>- Laminitis</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Hypodermic spp. larvae killed SQ</td>
<td>Recumbency, convulsion &amp; death</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Target organ: lungs in cow</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lung tumors</td>
<td>Uncommon in large animals, (pulmonary alveolar carcinomas, papillary adenomas, adenocarcinomas, metastatic tumors [lymphosarcoma])</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Most incidental finding at slaughter</td>
<td></td>
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</tr>
</tbody>
</table>

Contagious bovine pleuropneumonia: eradicated in USA in 1892, Mycoplasma

Chronic interstitial pneumonia

| IM 663, DC 103, Br 673 |

- Fibrosing alveolitis (FA) diffuse inflammation beyond terminal bronchiol • CS: BAR, weight loss, coughing, tachypnea, dyspnea; terminal cor pulmonale & heart failure; may represent chronic farmer's lung • Tx: none; lesions are irreversible
- Bronchiolitis obliterans: chronic respiratory condition of yearlings or yearlings young adults • CS: deep, infrequent cough, tachypnea, hyperpnea, exaggerated respiratory effort, no fever; lung don't collapse at necropsy

Hydrogen sulfide (H₂S)

- See Tox pg 210; “Rotten egg”, Manure pits, PH
- CS: Pulmonary edema, dyspnea, Asphyxia, CNS
- Remove animals & humans before agitating manure pit; Ventilate

Smog (Sulfur oxides)

- See Tox pg 212; air pollution, urban areas
- CS: Eye irritation & salivation, Emphysema, Respiratory distress
- Dx: History, CS
- Tx: None specific Tx

Smoke Inhalants

- See Tox pg 212; Barn fires: Smoke toxicity, CO toxicity (carbon monoxide poisoning)
- CS: Oral burns, Conjunctivitis, Laryngospasms, Cough, Strider, Tachypnea
- Dx: History (fire), CS
- Tx: Patent airway, O2 therapy, IV fluids, ABs, Bronchodilators

"Silo gas", NO₂

- See Tox pg 211; Heavier than air, nitric acid
- Lung damage
- Salivation, dyspnea, cough, fever, SQ emphysema, pneumonia
- Dx: History, CS, Postmortem
- Tx: O₂, Sedation, Diuretic, ABs for 2nd infection
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## Congestive heart failure, CHF

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<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
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<tr>
<td>Rt. sided CHF, fluid backs out to the periphery (caud. &amp; cran, vena cava)</td>
<td>• Edema: brisket, submandibular, limbs • Jugular pulsation, jugular distension (pulse should only go 1/3rd of the way up the neck) • Ascites (abd. fluid) • Splitting of 2nd heart sound, pulmonic &amp; aortic valves not closing synchronously due to dilation of rt. ventricle</td>
<td>Cs, Grunt test (press up on ventrum) • Auscultation (Pleural effusion) • Muffled heart sounds • Pericardial friction rubs • &quot;Washing machine murmur&quot; gas &amp; fluid splashing sounds • Pericardiocelesis (lt. 5thICS at costochondral junction) • Fluid is odiferous • Protein &amp; WBCs • Record volume drained off</td>
<td>• Cull/slaughter - Tx unrewarding</td>
<td>$ If pregnant, or embryo transfer, 48 hrs to induce calving or to supervolunteer • Pericardial drainage to incr. myocardial action • No furosemide • Broad spectrum ABs (antibiotics) • IV fluids, based on lab abnormalities</td>
</tr>
</tbody>
</table>

## Lt. sided CHF: fluid backs up into lungs

- Poor peripheral perfusions
- Pulmonary edema w/ crackles on auscultation
- Respiratory dyspnea
  - Prominent S3 (third heart sound)
  - Tachycardia
  - Pleural effusions

## Fluid Backup:
- Right side - into body
- Left side - into lungs

### Traumatic reticulopericarditis

"Hardware diz"

<table>
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<tr>
<td>Uncommon - cattle, rare - sm. rumin.</td>
<td>• Indiscriminate eaters • FB (foreign bodies - wire, nail) through reticular wall &amp; diaphragm into pericardial sac • Fluid into sac (pericardial) • Pleuritis • Heart failure due to compression, sudden death due to acute hemorrhage or dysrhythmia</td>
<td>Fever, HR, RR • Pain, abducted elbows • Respiratory grunt • Constriction of Rt. side • Jugular pulse • Extended jugular veins • Ascites, submandibular edema • Dehydration • Toxemic, arrhythmias, off feed • GI stasis • Milk prod. • CHF (congestive heart failure)</td>
<td>CS</td>
<td>Cull/slaughter - Tx unrewarding</td>
</tr>
</tbody>
</table>

### "Wire" → Compression = Heart failure

**CS: Jugular pulse, Pain, Dehydration**

**Dx: Grunt test, "Washing machine" murmur**

**Tx: Send to slaughter**

### Other causes of CHF

- Pleuritis w/ pleural effusion (has distinctive signs)
- Hematogenous spread (rare)

### DDx:

- Rt. heart failure
- Bacterial endocarditis (p 81)
- Rt. AV insufficiency
- Cardiomyopathies (p 77)
- Pericarditis (p 76)
- Lt. heart failure
- Pleuritis or pleural effusions (p 72)
- Pulmonic valve stenosis
- Cardiac neoplasm (p 79)

### Often see bilateral heart failure in cattle & horses
Cardiomyopathy, Dilatative cardiomyopathy
IM 527; C3T 352; BM&S 751; Br-hb 632; BR 1633; Br 145; DC 42; GI 790; Pic 85

***

- Dilatative - only significant cardiomyopathy in large animals
- Causes:
  - Vit. E/Se deficiency
  - Ingestion of Lasalocid, Gossypol, Cassia occidentalis, Phalaris spp., monensin
  - Copper deficiency
  - Excessive molybdenum/sulfates (2° Cu defc)
  - Lympho- or fibrosarcoma
  - Abomasal displacement assoc. w/ cardiomyopathy

- Cardiac failure
  - Peripheral edema (rt.)
  - Jugular venous pulse or distention (rt.)
  - Resp. distress (lt. heart)
  - Tachypnea
  - Dyspnea (pleural effusion)
  - Bloody froth in nostrils
  - Nonspecific signs
  - Diarrhea, Anorexia, Syncope
  - Exercise intolerance
  - Milk production

- Sudden death

- CS
  - Auscultation abnormal
  - Tachycardia
  - Gallop rhythm
  - Muffled heart sounds
  - Cardiac dysrhythmia, murmurs 2° to dilatation

- Postmortem (PM):
  - Grossly enlarged heart
  - Heart failure signs
  - Gen. edema
  - Congestion of liver, lungs & spleen
  - Pleural effusion

- Prevention: see postmortem (PM)

- Grossly enlarged heart
- Heart failure signs
- Gen. edema
- Congestion of liver, lungs & spleen
- Pleural effusion

- DDx:
  - Seafood
  - M/toxins: myodegen.

- ADULT:
  - Bacterial endocarditis (p 81)
  - Thoracic abscesses (p 71)
  - Cardiac neoplasia (p 79)
  - Pericarditis (p 76)
  - Pleuritis (p 72)
  - Diaphragmatic hernia (p 460)

- Haemophilus somnus (See Gen pg 254)
  - Calves, Feedlot, Septicemic diz: TME.
  - Lungs, Joint, Repro & Heart abscesses, Infertility, Conjunctivitis,
  - CS: CNS, Resp, Joint, Myocardial abscesses, Fever & Resp. distress & depression from left heart failure, or Found dead

- Myocarditis
  - Uncommon
  - Inflammation of myocardial wall
  - Bacteria (Staph., Strep., Clostridium, Mycobacterium)
  - Virus (foot & mouth disease)
  - Parasite (toxoplasmosis, sarcocysts, cysticercosis)
  - Thromboembolic diz (rare in cattle)
  - 2° - bacteremia, septicaemia, pericarditis, endocarditis

- Variable or unobserved
  - 1° diz may mask vague heart signs (e.g., mastitis)
  - Tachycardia
  - Febirile
  - CHF (peripheral edema)
  - Sudden death
  - M/lead to idopathic dilatated cardiomyopathy

- Rarely diagnosed: mild, vague signs of heart involvement
  - 1° cause masks heart signs
  - Postmortem:
    - M/toxins: no gross lesions

- Treat 1° agent
  - Control complications: CHF,
  - Shock, Dysrhythmias

- Prognosis:
  - Good, if no CHF
  - Guarded to poor with CHF

- Prevention
  - Vaccination
  - Parasite control

- Salvage
  - Digoxin (inotropic agent)
  - Diuretics (Furosemide)
  - Reat
  - Removal of pleural or abd. fluid

- Prognosis (Pc): Poor

- Prevention: see agents on following page

- Congenital cardiomyopathy:
  - Polled Hereford - Curly hair coat - Rare

-reetings from
- Lg. Animals = Dilatative
- CS: Cardiac failure
- Dx: Auscultation, PM
- Tx: salvage • Px: Poor

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  - Uncommon
  - Inflammation of myocardial wall
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  - Guarded to poor with CHF

- Prevention
  - Vaccination
  - Parasite control
**Myocardial Diz**

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<tr>
<td>Vit. E - Selenium Deficiency, White muscle diz, Enzootic muscular dystrophy, Nutritional myopathy of lambs &amp; calves</td>
<td>- Mechanism not understood&lt;br&gt;- Selenium (Se) or Vit. E defc (antioxidants, protect from free radicals)&lt;br&gt;- PUFA (polyunsaturated fatty acids) in diet (produce free radicals) - lead to Vit. E deficiency&lt;br&gt;- Calves 2 wks to 6 mos - Most rapidly growing&lt;br&gt;- Congenital - death 2-3 ds old&lt;br&gt;- Delayed type (2 wk- 6 mo)&lt;br&gt;- Cardiac &amp; skeletal muscle&lt;br&gt;- Degeneration of myocardium - To necrosis&lt;br&gt;- US &amp; Canada Se defc soils</td>
<td>- Sudden death, handling/exercise brings on signs or death&lt;br&gt;- Dyspnea, due to myocardial diz., pleural, pericardial &amp; peritoneal effusions &amp; pulmonary edema&lt;br&gt;- Weakness&lt;br&gt;- Recumbent&lt;br&gt;- Stiffness in gait&lt;br&gt;- BAR (bright, alert, responsive)</td>
<td>- CS, History (Hx)&lt;br&gt;- Vit. E, Se not supplemented&lt;br&gt;- Postmortem&lt;br&gt;- Pale muscles, linear pale areas in skeletal mm., symmetrical&lt;br&gt;- Myocardium, subendocardial plaques, Lt. ventricle in calves, both ventricles in lambs&lt;br&gt;- Lab: Elev CPK in 1000s IU/L</td>
<td>- Vit. E/Se to asymptomatic&lt;br&gt;- Vit E/Se to affected, every 2 wk., not to exceed 4 doses&lt;br&gt;- Selenium toxicity - follow manufacturer's suggestion</td>
</tr>
</tbody>
</table>

**Myodegeneration**, 1-2 yrs - 6 mos old<br>CS: Sudden death, Dyspnea, Weak, BAR<br>Dx: Defc diet • PM: Pale muscles, Elev CPK<br>Tx: Vit E/Se • Px: Cardiac - Grave, Muscle - Better<br>Prevention: Supplement in defc areas

DDx<br>- Sudden death<br>  - Enterotoxemia, pneumonia, toxemia<br>- Cardiotoxic plants (p 78)<br>  - Lasalocid, gossypol, *Cassia occidentalis*, *Phalaris* spp<br>- Stiffness in gait, BAR<br>  - Spinal cord compression, cerebellar diz, meningitis, polyarthritis, neurotoxins (OPs), tetanus, trauma, Clostridial myositis

**Monensin/ Lasalocid toxicity**<br>**•**

- See Tox pg 203; Feed additive: Coccidostat (AB), Improves feed efficiency, Feed mixing errors, Cattle << horses<br>- CS: Dilatated cardiomyopathies (peripheral edema, jugular pulse, dyspnea, sudden death)<br>- DDx: Se/Vit E defc, Gossypol toxicity, Any diz causing hemoglobinuria<br>- Dx: Hx, CS, Lab: Hemoglobinuria<br>- Tx: Remove from source • Px: Poor • Prevention: Clean silo, Monensin will settle from bag to bag

**Gossypol, Cottonseed toxicity**<br>**•**

- See Tox pg 227; Cottonseed - cheap feed, contains gossypol (cardiotoxic); calves on starter rations of cottonseed meals<br>- CS: Calves - Sudden death, Dyspnea, Depression, Anorexia, Hemoglobinuria; Adults - Repro: Sterility in bulls, ↓ conception rate in cows<br>- DDx: Monensin, Lasalocid, Vit E/Se defc, Cassia poisoning •<br>- Dx: Hx, CS, Feed & tissue analysis<br>- Tx: No response to any treatment • Px: Poor, survivors m/b chronic poor doers • Control: Do not feed calves < 4 mos cottonseed meal

Some myopathies respond only to Se or Vit E, some to both
**Congenital heart defects**

- **Ventricular Septal Defects (VSD)**
  - Holosystolic murmur, blood from left to right; murmur in area of AV valves. More blood in rt. ventricle so more through pulmonary trunk, resulting in a relative stenosis & systolic stenotic murmur.
- **PDA (patent ductus arteriosus):** continuous "machinery murmur" (left 3-4th ICS, shoulder level)
- **Tetralogy of Fallot** (overrides aorta, ventricular septal defect, pulmonary stenosis & hypertrophy of rt. ventricle); loud holosystolic murmur w/ palpable thrill (left 4-6th ICS)
- **Atrial septal defects (ASD):** most commonly patent foramen ovale, common in calves, usu. asymptomatic because different pressures in atria cause functional closure even though it's not an anatomical closure
- **Ventricular hypoplasia**: m/b present w/ other defects & usually assoc. w/ early death
- **Persistent rt. aortic arch:** forms a ring around the esophagus with the pulmonary trunk, ligamentum arteriosum & base of heart; Sequela: megaesophagus
- **Ectopic cordis cervicalis:** relatively common in cattle, heart usually in neck region, some in pectoral region or abdomen; assoc. w/ other defects; Px: Poor for productive life, but m/ live up to 1 yr
- **Eisenmenger's complex:** VSD, overriding aorta, dilated pulmonary trunk; gallop rhythm

**Lymphosarcoma cardiomyopathy, Enzootic lymphosarcoma**

- **See Gen, pg 269**
- **Myocardial damage (rt. atrium)** also uterus, lymph nodes & abomasum
- **BLV** (bovine leukemia virus)
- **Adult cattle**
- **AV valves, then whole heart**
- **Rt. AV (tricuspid) insufficiency**

**BLV - Virus, Right atrium**

- **CS:** Cardiomyopathy, Edema, Jugular pulse
- **Dx:** Difficult
- **Tx:** None; Cull all BLV +
- **Px:** Grave

**DDx:**
- **Reticulopericarditis** (p 76)
- **Bact. endocarditis** (p 81)
- **Cu deficiency** (p 89)

**Dx difficult**

- **Ultrasound**
- **Lymphosarcoma elsewhere**
- **Cardiac arrhythmias**
- **Leukemia in only 1/3rd of clinical cases**
- **Biopsy/necropsy definitive Dx**
- **BLV titers not diagnostic, indicate exposure**
- **Negative titer rules out**

**Prognosis (Px):** Grave

**No treatment**

**Eradication of BLV infection is feasible**

**Cardiac tumors**

- Rare in large animals, 1st or 2nd to tumors of lungs, pleura, lymph nodes or diaphragm, BLV - lymphosarcoma, thymic lymphosarcoma; No Tx, test for BLV positive animals; death expected in 6 months
Heart Condition
High mountain disease, Brisket edema, High altitude diz, Pulmonary hypertensive heart disease

Facts/Cause
- Chronic hypoxia of high altitude
  - Pulmonary vasoconstriction & hypertension
  - Right ventricle overworked, chronic pressure overload
  - Enlarged heart, either hypertrophy or dilatation
- Leads to CHF (congestive heart failure)
- Stress initiates (cold weather)
- Moved > 6000 feet
- Genetic disposition, inline assoc. (mother to daughter), variable from animal to animal
- Locoweed (Oxytropis & Astragalus spp) ingestion worsens diz

Presentation/CS
- Slow onset
- Stress precipitates CS
- 1st depressed & isolated
- Right CHF
  - Edema: brisket, submandibular, ventr. abdomen & less commonly limbs
  - Ascites
  - Jugular pulse
  - Diarrhea
  - Dyspnea
  - Cyanotic m/b
  - Refractory to move, progressive diz
  - Exertion - collapse & death

Diagnosis
- History (Hx), CS
- Auscultation
  - HR, gallop rhythm
  - Splitting of 2nd heart sound
  - Rt. AV murmur (2nd dillation)
- Postmortem:
  - Nutmeg liver (congestion)
  - Myocardial damage

Treatment
- Reversible if caught early & moved to low altitude
- ABs - 2° pneumonia
- $ Congestive heart failure, Digoxin, Diuretics
- O2 therapy - not done

Prognosis (Px):
- Good, mortality < 2%
- Poor once signs of heart failure

Prevention:
- Outbreed, don't breed those that have had diz
- Move to low altitude

Control:
- Keep at low altitudes

CARDIOVASCULAR SYSTEM

Presentation/CS
- Slow onset
- Stress precipitates CS
- 1st depressed & isolated
- Right CHF
  - Edema: brisket, submandibular, ventr. abdomen & less commonly limbs
  - Ascites
  - Jugular pulse
  - Diarrhea
  - Dyspnea
  - Cyanotic m/b
  - Refractory to move, progressive diz
  - Exertion - collapse & death

Cor pulmonale:
- Pulmonary hypertension leading to right heart hypertrophy, dilatation &/or failure

DDx:
- 1° Pulmonary diz
- Parasitic bronchitis (p 69)
- Bacterial endocarditis (p 81)
- Tricuspid insufficiency
- Cardiomyopathy (p 77)
- Lymphosarcoma (p 79)
- Traumatic pericarditis (p 76)
- Pulmonary stenosis
- Chronic pneumonia (p 62)
- 1° myocardial lesions
- Pleuritis (p 72)
- Left heart failure (p 76)

Vascular diz, Aneurysms

Aneurysms
Thrombosis
Embolism

- Aneurysm: vascular dilation (weakening of medial coat of the vessel), pseudaneurysm (weakening of all coats), uncommon
- Thrombosis: clot formation in vessel that obstructs flow; #1 Cause: Catheterization, Trauma, venous stasis • Tx: Remove catheter & rest vessel, DMSO
- Thrombophlebitis: inflam. of vein assoc. w/ a thrombus
- Embolism: foreign material carried in bloodstream, Freq. arise from thrombus
  - Caudal vena caval thrombosis (CVCT) & embolic pneumonia: #1 cause of bilat. epistaxis w/ hemoptysis
- Arteriosclerosis: thickening of arterial wall • Cause: excessive Vit D3 from ingestion of cardiogenic plants (Solanum, Cestrum, Trisetum)
Bacterial endocarditis

Vegetative endocarditis, Endocardial Disease

**Corynebacterium pyogenes**, Strep., Erysipelothrix, Actinomyces, E. coli.
- Subclinical bacteremia
- Septic thrombus - 2nd to pyemia, masitis or urisalitis
- Iatrogenic jugular sticks

Vegetation on valves, layers of fibrin, blood cells, bacteria & necrotic tissue, most commonly affect endocardium of valves
- Determine if during systole (AV valves) or diastole (semitransvalves)

- Weight loss, hypophagia
- Milk production
- CHF signs
- Edema, ascites, milk vein distention
- Systolic jugular pulse
- Intermittent fever
- 2nd organ systems
- Pyelonephritis
- Pneumonia (adventitial sounds, bronchial tones)

History, CS
- Systolic murmur - Rt. AV
- Ultrasound
- Positive blood culture
- Lab:
  - Leukocytosis
  - Positive blood culture
- Postmortem:
  - Vegetation on valves

DDx:
- Endocarditis of other causes
- Degeneration of valves
- Viral
- Inflammation
- Trauma
- Rupture of rt. chordae tendinae
- Brisket edema (p 80)
- Cardiomyopathies (p 77)

Salvage
- $ Expensive pregnant cows
- AB (antibiotic) empirical* (penicillin)
- Long term treatment: mos. ($) - Fibrous tissue of vegetation m/ protect bacteria from Abs
- Chronic poor doers
- Drug residue in body & milk

Prognosis:
- Grave
  * Empirical: from your vast experience

Vegetation on valves, stops the valves from completely closing, blood backs up through the valves - murmur of insufficiency (leaky). Cattle: right AV valve most common, blood backs into rt. atrium; Other species: aortic or Lt. AV (bicuspid) valve

**Septic thrombus, Iatrogenic**
- CS: CHF - Edema, Jugular pulse
- Dx: CS, Murmur, US, Culture, Vegetation
- Tx: Salvage • Px: Grave

**Atrial fibrillation**

**Mk 45, C3T 689; IM 541; BM&S 759; BR 128; BR 347; DC 47**

**Assoc. w/ Gl diz 75 - 95% of the time**
- Also foot rot & pneumonia
- Usually no underlying heart diz (if underlying heart diz - Px worse)
- Atrialcardial diz
- Autonomic imbalance
- Rapid, uncoordinated atrial contractions, resulting in insufficient filling of ventricles

**GI diz**
- Anorexia
- Milk production

**Underlying GI diz**
- Auscultation:
  - Rapid & disorganized heart sounds

- ECG:
  - F (fibrillation) waves replace P waves
  - Irregular P-R interval
  - QRS irregularly spaced

- Underlying electrolyte abnormalities
  - Metabolic acidosis, hypochloremic, etc.

Quinidine sulfate IV (not oral, diluted in saline or LR) until conversion
- IV fluids in other jugular vein simultaneously
- Side effects during administration
- Diarrhea & depression, continue treatment
- Monitored with ECG while admin.
- If do not convert, grave Px

**Prognosis:**
- Good if not underlying heart diz or chronic GI diz
- Grave if no conversion

**Quinidine**

* Empirical: from your vast experience
### Anemia

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anemia</td>
<td><em>O2-carrying capacity of blood</em></td>
<td>CS due to inadequate O2 to body tissue</td>
<td><em>History</em></td>
<td>Treat underlying cause</td>
</tr>
<tr>
<td></td>
<td><em>Pathophysiology of causes</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Blood loss</td>
<td></td>
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<td></td>
<td>2. Hemolysis (incr. RBC destruction)</td>
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<td></td>
<td>3. Inadequate erythrocyte production (bone marrow)</td>
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<tr>
<td></td>
<td>Types</td>
<td></td>
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<tr>
<td></td>
<td><em>Regenerative anemias</em></td>
<td>Blood loss or hemolysis - bone marrow responds by incr. erythropoiesis</td>
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</tr>
<tr>
<td></td>
<td><em>Nonregenerative</em></td>
<td>inadequate RBC prod., bone marrow problem</td>
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</tr>
</tbody>
</table>

### Facts/Cause

- **Regenerative anemias**
  - Blood loss or hemolysis - bone marrow responds by incr. erythropoiesis
- **Nonregenerative** - inadequate RBC prod., bone marrow problem

### Presentation/CS

- CS due to inadequate O2 to body tissue
- **Types**
  - Regenerative anemias
  - Blood loss or hemolysis - bone marrow responds by incr. erythropoiesis
  - Nonregenerative - inadequate RBC prod., bone marrow problem

### Diagnosis

- **History** (Hx): diet & access to pasture
  - Other herd members affected or systemically ill
  - Immune status & exposure
- **PE (physical exam):**
  - Color of mucous membr. (icterus is rare in cattle, except in assoc. w/ hemolysis)
  - Fever: m/b sign of hemolysis or systemic diz
  - Hemoglobinuria caused by most hemolytic anemias, except anaplasmosis
  - Onion breath
- **CBC:**
  - PCV reduced < 24%
  - Regenerative signs: blood loss or hemolysis w/ normal bone marrow
    - Basophilic stippling, anisocytosis, polychromasia, Howell-Jolly bodies, nucleated RBCs
  - Nonregenerative signs: abnormal bone marrow, acute blood loss or acute hemolysis < 4 days
- Hemoglobinuria assoc w/ pink plasma + occult blood w/o urinary sedimentary abnormalities
- Myoglobinuria (myopathy) assoc w/ clear plasma + RBCs

### Treatment

- Treat underlying cause

### Plasma protein changes:

- Hypoproteinemia + anemia => blood loss
- Hyperproteinemia, hyperglobulinemia &/or hyperfibrinogen = chronic inflam. diz

### Urine analysis (dipstick) for occult blood:

- If positive do sedimentation exam to rule out hematuria
  - Hemoglobin assoc w/ pink plasma + occult blood w/o urinary sedimentary abnormalities
  - Myoglobinuria (myopathy) assoc w/ clear plasma + RBCs

### Occult blood in feces:

- Melena: GI blood loss (gastric ulcers)
- Bone marrow analysis: necessary if no peripheral signs of regeneration
**DDx - Anemia**  (IM 477; C3T 695, 696) • See DDx pg 300

**REGENERATIVE ANEMIA**
- Blood loss
  - Trauma/Sx
  - Parasites (p 55)
  - Intestinal (p 55)
  - External - ticks & lice (p 180)
- Abomasal ulcers (p 31)
- DIC (p 85)
- Moldy sweet clover toxicity (p 229)
- Severe pyelonephritis
- Pulmonary abscess
- Hematuria
- Vascular neoplasia

**Hemolysis**
- **Intravascular**
  - Bacteria
    - Leptospirosis
    - *Clostridium hemolyticum*
    - *Clostridium perfringens* type A
  - Babesiosis (RBC parasite)
  - Bacillary hemoglobinuria (p 90)
- Chronic copper toxicosis (p 88)
- Onion toxicity (p 89)
- **Extravascular**
  - Anaplasmosis (p 92)
  - Immune-mediated
  - Drug-induced
  - Autoimmune hemolytic anemia (p 92)
- Plants can cause intra- & extravascular hemolysis
- Intrinsic RBC defects

**NONREGENERATIVE ANEMIA**  (Inadequate RBC production)
- Nuclear maturation arrests
- Vit B12 defc/Cobalt defc/Folic acid defc
- Hemoglobin synthesis disorders
- Iron defc
- Copper defc (p 89)
- Molybdenum toxicity (p 88)
- Lead toxicity (p 202)
- Pyridoxine defc
- RBC hypoplasia/aplasia
- Anemia of chronic diz
  - Liver abscess (p 36)
  - Johne’s diz (p 23)
  - Chronic pneumonia (p 62)
  - Chronic BVD (p 253)
  - Chronic abscess
- Lymphosarcoma
- Bone marrow damage
  - Bracken fern toxicity (p 228)
  - Radiation toxicosis
  - Inadequate erythropoietin
  - Chronic renal failure (p 100)
## Blood Loss Anemia

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hemorrhage</td>
<td>- Trauma: Laceration, Splenic vessel rupture, Abdominal vessel rupture, Pericarditic</td>
<td>- Sudden death, External hemorrhage, Occult w/ internal bleeding, Acute massive loss = hypovolemic shock</td>
<td>- CS of hemorrhage, Anemia &amp; hypoproteinemia, Abdominal &amp; thoracic taps (for internal bleeding), Bone marrow responds in 5 days</td>
<td>- Stop hemorrhage: Ext.: suture or pressure bandages, Internal: m/ not attempt if poor surgical risk (cause often not found)</td>
</tr>
<tr>
<td></td>
<td>- Surgery: Castration, Dehorning</td>
<td>- HR &amp; RR, Cold extremities, Muscle weakness, Cardiovascular collapse, No icterus</td>
<td>- Acutely PCV &amp; TP normal, Regenerative anemia (polychromasia, basophilic stippling, Howell-Jolly bodies)</td>
<td>- Tx hypovolemic shock ($)</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>- Fluids IV 40-80 ml/kg Na containing, Cold extremities (declines in 24 hr due to mobilization of extracellular fluid to maintain volume)</td>
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<td></td>
<td>- Give more than blood loss because distal butes</td>
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<td></td>
<td></td>
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<td></td>
<td>- Muscle weakness, Renal anemia</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- Die from blood loss 1-2 wks, Intermittent hematuria</td>
</tr>
<tr>
<td>Trauma or Surgery</td>
<td></td>
<td></td>
<td></td>
<td>- Salvage early</td>
</tr>
<tr>
<td>CS: Hypovolemic shock</td>
<td>Dx: Anemia/No icterus</td>
<td>Tx: Fluids</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Enzootic hematuria, Bracken fern poisoning

- Mk1641; IM 969; BR-hb 596; BR 1561; Br 620, 127, C3T 350; BM6; 639; DC 55, 363
- Cause: unknown, Bracken fern areas, > 4 yrs of age, Hemangiomatous tumors in the bladder wall (cauliflower-like)
- Blood clots in urine, Hemorrhagic anemia, weak, pale muscles, Die from blood loss 1-2 wks
- Anemia late in diz (bone marrow), Bladder tumors (wartlike), 3-2 cystitis
- History (Hx) (Bracken fern area); CS
- Rectal, Bladder thickening
- Intermittent hematuria
- Hemoglobinuria
- Postmortem
- Acute: Hemorrhagic bladder mucosa, Chronic: Tumors pedunculated into lumen, Bladder wall fibrotic & thickened
- Cystitis (p 95), Pyelonephritis (p 98), Urolithiasis (p 96)
- Clear bracken fern ($), diz disappears

### Prognosis: Poor - Salvage

### Prevention:

<table>
<thead>
<tr>
<th>Disorder</th>
<th>Acquired: hepatic failure, rodenticides (dicoumerol), moldy sweet clover poisoning, DIC</th>
<th>Dx: PTT &amp; PT times</th>
<th>Congenital: hereditary defc - coagulation factor VIII (Hereford cattle), factor XI (Holstein cattle)</th>
<th>Dx: PTT time</th>
</tr>
</thead>
</table>

## CARDIOVASCULAR SYSTEM

### Presentation/CS

- Sudden death, External hemorrhage, Occult w/ internal bleeding, Acute massive loss = hypovolemic shock
- HR & RR, Cold extremities, Muscle weakness, Cardiovascular collapse, No icterus
- CS of hemorrhage, Anemia & hypoproteinemia, Abdominal & thoracic taps (for internal bleeding), Bone marrow responds in 5 days
- Acutely PCV & TP normal, Regenerative anemia (polychromasia, basophilic stippling, Howell-Jolly bodies)
- Fluids IV 40-80 ml/kg Na containing, Cold extremities (declines in 24 hr due to mobilization of extracellular fluid to maintain volume)
- Give more than blood loss because distal butes
- Muscle weakness, Renal anemia
- Die from blood loss 1-2 wks, Intermittent hematuria
- Salvage early

### Diagnosis

- Stop hemorrhage: Ext.: suture or pressure bandages, Internal: m/ not attempt if poor surgical risk (cause often not found)
- Tx hypovolemic shock ($) - Fluids IV 40-80 ml/kg Na containing, Cold extremities (declines in 24 hr due to mobilization of extracellular fluid to maintain volume)
- Give more than blood loss because distal butes
- Muscle weakness, Renal anemia
- Die from blood loss 1-2 wks, Intermittent hematuria
- Salvage early

### Prevention:

- Clear bracken fern ($), diz disappears

## Bleeding disorder of Simmental cattle

Rare; Prolonged episodes of bleeding, Spontaneous epistaxis, Superficial hematomas
DIC, Disseminated intravascular coagulation, Consumptive coagulopathy, Intravascular coagulation fibrinolysis

- Never a 1° disease entity
  - Dizs causing vasculitis activate platelets & clotting mechanism
  - Septic processes (salmonellosis, mtritis)
  - Neoplasia
  - Acute Gl disorders (strangulation, acute aneritis, protein losing enteropathy, emboli)
  - Hemolytic uremic syndrome
  - Hemolytic anemia
- Spectrum from diffuse thrombosis to ischemic organ failure
  - RBCs are damaged passing through damaged arteries & removed by endocytic system
  - Peracute diz in Gr. Britain: Pasteurella multocida, CS: Septicemia & high mortality
  - USA probably free

**2° Entity; Activated platelets & Clotting**

<table>
<thead>
<tr>
<th>CS: Thrombosis/Organ failure - CNS</th>
<th>Dx: Difficult, Platelets &lt; 100,000</th>
<th>Tx: Tx 1° cause, Supportive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Platelet count &lt; 100,000</td>
<td>Premature cell destruction or</td>
<td>Impaired production</td>
</tr>
<tr>
<td>Causes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Sepsis due to DIC</td>
<td>- Immune-mediated drug reaction</td>
<td></td>
</tr>
<tr>
<td>- Neoplasia</td>
<td>- Isoimmunization of newborn calves</td>
<td></td>
</tr>
<tr>
<td>- Bracken fern poisoning</td>
<td>- Blood transfusion</td>
<td></td>
</tr>
</tbody>
</table>

| Variable - dep. on 1° diz         | Rarely overt hemorrhage           | Hemorrhagic diathesis       |
| - Thrombosis & ischemic organ failure | CNS - microvascular thrombosis | - Petechial or ecchymotic hemorrhages (depletion of clotting factors) |
| - Delirium, convulsions, coma      | - Life threatening hemorrhage very rare |
| - Depression & ileus              | - Thrombocytopenia (< 100,000 platelets) |
|                                   | - Mild to moderate prolongation of PT &/ or APTT time |
|                                   | - Occult blood in feces           |

**Systemic CS**

- No test for definitive Dx, Findings often NOT helpful
- Strongly suggestive
- Thrombocytopenia
- Petechial or ecchymotic hemorrhages: (depletion of clotting factors)
- Life threatening hemorrhage very rare

**Sequelaes:**

- Renal failure - common
- Oliguria, azotemia (excess urea or other nitrogenous bodies in blood, BUN)
- Depression & ileus

**DDx:**

- Septicemia
- Warfarin toxicosis (pg 214)
- Moldy sweet clover toxicosis (pg 229)
- Inherited coagulation abnormalities

**Prognosis**

- Poor if doesn't coagulate
- Depends on underlying diz

**Treat 1° disorder**

- Supportive Tx to combat shock & maintain tissue perfusion
- IV fluids
- ABs for septic conditions
- Banamine® (flunixin meglumine) (IV, q4h) for endotoxins
- Corticosteroids not indicated, m² worsen
- Heparin - highly controversial

**Thrombocytopenia**

| Mk 56, 428; C3T 698; IM 1204; BR-hb 150; BR 372 |

<table>
<thead>
<tr>
<th>Causes</th>
<th>Vary w/ underlying diz process</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Sepsis due to DIC</td>
<td>- Hemorrhagic diathesis</td>
</tr>
<tr>
<td>- Immune-mediated drug reaction</td>
<td>- Petechial hemorrhages</td>
</tr>
<tr>
<td>- Neoplasia</td>
<td>- Oral, ocular, nasal mucosa</td>
</tr>
<tr>
<td>- Isoimmunization of newborn calves</td>
<td>- Epistaxis</td>
</tr>
<tr>
<td>- Bracken fern poisoning</td>
<td>- Prolonged bleeding from wounds or injection sites</td>
</tr>
<tr>
<td></td>
<td>- Hematoma formation w/ trauma (&lt; 40,000 µl)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>History, CS - Rule out DIC</th>
<th>Tx</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lab</td>
<td>- Thrombocytopenia (&lt; 100,000 platelets)</td>
</tr>
<tr>
<td>- Prolonged bleeding time &amp; abnormal clot retraction</td>
<td>- Blood transfusion</td>
</tr>
<tr>
<td>- No effect on clotting time or plasma fibrinogen</td>
<td>- Response to Tx supports Dx</td>
</tr>
</tbody>
</table>

**Unexplained case**

- Stop all drugs, if Rx necessary replace w/ most dissimilar Rx
- Steroids: Dexamethasone, Prednisolone

| ABs | Banamine |

| Prognosis | 85 | < 100,000 platelets |
|--------------------------|------------------------|
| Poor if doesn't coagulate | Depends on underlying diz |
### Cardiovacular System

**Hemorrhage**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment - Prognosis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Moldy sweet clover &amp; Anticoagulants</strong> (Warfarin, coumarins)</td>
<td>- See Tox pg 229, 214</td>
<td>- CS: Hemorrhagic diathesis</td>
<td>- Lab: Platelet &lt; 40,000/ml (200,000 norm.)</td>
<td>- Usually too late&lt;br&gt;- Batyl alcohol as a bone marrow stimulant, but rarely works</td>
</tr>
<tr>
<td></td>
<td>- CS: Hemorrhagic diathesis</td>
<td></td>
<td>- Profound leukopenia (neutropenia)</td>
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</tr>
<tr>
<td></td>
<td>- Dx: Hx (exposure), Hemorrhages, Prolonged PT, Anemia, Hypoproteinemia</td>
<td>- Nonregenerative anemia less severe than thrombocytopenia due to longer half life of RBC</td>
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<tr>
<td></td>
<td>- Tx: Remove source, Remove plants, Vit. K1, Fresh plasma, Whole blood transfusion</td>
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<tr>
<td><strong>Abdominal ulcers</strong></td>
<td>- See GI pg 31; Stress, Feed, Lymphosarcoma</td>
<td>- Dx: Fecal occult blood, Anemia, Exploratory</td>
<td>- History (bracken fern area), CS</td>
<td></td>
</tr>
<tr>
<td>***</td>
<td>- CS: Variable (Abdominal pain, Melena, Peritonitis)</td>
<td></td>
<td>- Lab:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Tx: Salvage, Tx ulcers (Fluids, ABs, Antacids, Sx)</td>
<td></td>
<td>- Platelet &lt; 40,000/ml (200,000 norm.)</td>
<td></td>
</tr>
</tbody>
</table>

**Nonregenerative Anemias**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment - Prognosis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bracken Fern toxicosis</strong></td>
<td>- See Tox, pg 228&lt;br&gt;- Pteridium&lt;br&gt;- Not very common&lt;br&gt;- Western USA</td>
<td>- Hemorrhagic syndrome due to platelet loss&lt;br&gt;- Bleeding from body orifices &amp; into body cavities&lt;br&gt;- Melena (lost of blood in feces)&lt;br&gt;- Epistaxis&lt;br&gt;- Mucosal petechiation&lt;br&gt;- Hematuria&lt;br&gt;- Hyphema (blood in anterior eye)&lt;br&gt;- Blood from med. canthus&lt;br&gt;- Temperature elevation&lt;br&gt;- Chronic infec. of multiple systems due to no WBCs&lt;br&gt;- Bacteremia&lt;br&gt;- Death 1-3 days after CS</td>
<td>- History (bracken fern area), CS&lt;br&gt;- Lab: Platelet &lt; 40,000/ml (200,000 norm.)&lt;br&gt;- Profound leukopenia (neutropenia)&lt;br&gt;- Nonregenerative anemia less severe than thrombocytopenia due to longer half life of RBC</td>
<td>- Usually too late&lt;br&gt;- Batyl alcohol as a bone marrow stimulant, but rarely works</td>
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<td></td>
<td>- Chronic ingestion of plant (must ingest large amounts for 2-3 weeks or longer, cumulative)</td>
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<td></td>
<td>- Bone marrow aplasia&lt;br&gt;- Pancytopenia (complete bone marrow depression, all precursors destroyed)</td>
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<tr>
<td></td>
<td>- Clotting abnormality</td>
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<td></td>
</tr>
<tr>
<td><strong>Bone marrow damage, Pancytopenia</strong></td>
<td></td>
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</tr>
<tr>
<td>CS: Bleeding</td>
<td></td>
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<tr>
<td>Dx: &quot;No platelets&quot; &lt; 40,000</td>
<td></td>
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</tr>
<tr>
<td>Tx: None, Batyl alcohol • Px: Grave - Die</td>
<td></td>
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</tr>
</tbody>
</table>

**DDx:**

- Leptospirosis (p 257)  
- Anaplasmosis (p 92)  
- Bacillary hemoglobinuria (p 90)  
- Crotalaria spp  
- Sweet clover (p 229)  
- Warfarin poisoning (p 214)
| Iron defc anemia | • Commonly assoc w/ chronic blood loss: parasitism, bleeding ulcers, GI lesions or hemostatic defects, modest anemia in veal calves raised on milk diets, otherwise dietary defc seldom causes, even in neonates  
• CS: often asymptomatic because adapt to slowly progressing anemia, cows m/ stand & graze w/ hematocrit of 5%  
• Dx: PCV < 24%, microcytic, hypochromic anemia  
• Tx: correct chronic blood losc; iron oral supplementation or feed additives |
| Chronic inflam. diz | • Cause: chronic internal or cutan. infec., immune-mediated processes resulting in chronic inflam., active malignant neoplasia, traumatic injuries or fractures  
• Pathogenesis: sequestration of iron in liver & bone  
• CS & Dx: CS of 1° diz, Mild to moderate nonregenerative anemia  
• Tx: Tx primary disease process |
| Internal parasites (IM 1234) • Trichostrongylus, due to bone marrow suppression |
| Leptospirosis (DC 55) • See Gen pg 257 |
| Lymphosarcoma | • See Gen pg 269: Anemia m/b present w/ GI hemorrhage (microcytic, hypochromic), nonregenerative anemia |
| 2° to Organ dysfunction | • Nonregenerative anemia (mild to moderate); chronic endocrine, hepatic, renal or GI diz |
| Cobalt/Vit B12 defc (Folic acid) | • Cobalt needed for Vit B12, Ruminants meet Vit B12 needs if sufficient Co; Deficiency = inefficient metabolism of propionate  
• CS: Nonspecific: Decr growth, Weight loss, Unthriftiness, Pale mucous membranes, Diarrhea, Lacrimation, Anorexia  
• Dx: Hx, CS, Anemia (normocytic normochromic), FIGLU (formiminoglutamic acid) level in urine (0.08-0.2 μmol/ml) metabolite  
• Tx: Vit B12 injection (2-3000 μg weekly)  
• Prevention: Salt mineral mixes, top dressing of pasture, rumen pellets |
| Lead toxicity | • See NS pg 152, Cattle indiscriminate eaters (crankase oil), Interferes w/ heme synthesis (-SH enzymes) shortened RBC lifespan, cerebellar edema  
• CS: CNS (bellowing, blind, maniacal, convulsions, ataxia), GI  
• Dx: > 0.3 ppm in blood, nonregenerative anemia  
• Tx: EDTA, Thiamine, Supportive, Rumenotomy |
## Hemolytic Anemia

### Condition
- **Postparturient hemoglobinuria**
  - *"Red water diz"
  - Mk 455, C3T 323; IM 1229; BR-hb 148, 524, 542; BR 1362, 1428; DC 55

### Facts/Cause
- Uncommon, 1-2 cows in a herd, minor economic losses
- High producing dairy cattle
- <6 wks after calving
- Cause unknown, predisposing factors:
  - #1 Hypophosphatemia
    - Low intake in low phosphate soils after a drought - lush pastures, housed cows in summer on pasture or winter for pasture cows
    - Phosphorus drainage into milk at early lactation
  - Eating hemolytic agents - turnips & beet pulp or cruciferous plants (rape & kale), m/not
  - Copper defc from molybdenum fertilizer (New Zealand)
  - Intravascular hemolysis, low P
    - Depressed glycolysis & ATP + incr. fragility to RBCs (spherical - rupture)
- **Intravascular hemolysis, low P**
- Eating hemolytic agents - turnips & beet pulp or cruciferous plants (rape & kale), m/not relate to parturition (see below)
- Copper defc from molybdenum fertilizer (New Zealand) (see below)

### Presentation/CS
- Acute 3-5 ds - death
- Weakness & staggering
- Milk production
- Red-brown to black urine
- Inappetant m/b
- Dehydrated
- Pale mucous membranes, anemia
- HR/RR, afebrile usually
- Photosensitization, gangrene, sloughing of teats, tail, digits, diarrhea occasionally
- Pica, osteomalacia, lameness, predisposition to botulism, GI obstruction m/b
- Icterus if lives long enough
- Survivors - slow recovery 3-8 wks

### Diagnosis
- History, CS - hemolysis
- Lab:
  - Regenerative anemia (if survives)
    - Basophilic stippling, Heinz bodies, Nucleated RBCs, anisocytosis & polychromasia
  - Hemoglobinuria (<8 g/dl)
  - Hemoglobinuria (differentiate from myoglobinuria) (Labstix®), absence of RBCs in urine confirms
  - Low blood P (hypophosphatemia) (<1 mg/dl, norm. 4-7)
  - Nonfatal cases - ketosis
  - Postmortem:
    - Icteric carcass
    - Pale, swollen liver, centrilobular necrosis
  - Hemoglobinuric nephrosis
  - Discolored urine in bladder

### Treatment
- Supportive, cause unknown
- IV fluids (add glucose)
- Blood transfusions
- Remove predisposing factors
- Phosphorus IV & SQ 60 g Na acid phosphate in 300 ml of sterile saline, also drench w/30 g Na phosphate or 150 g of bone meal or feed 100 g/d of dicalcium phosphate (DCP)
- Bone meal in feed
  - Methylene blue IV (antioxidant)
  - Steroids (20 mg Dexamethasone IM)
  - Oral ketosis Tx
  - Copper glycinate SO (copper defc areas)
  - Remove cruciform plants, feed quality hay
  - Severely affected don't respond
  - Marginally affected & eating - bonemeal over long period of time

### Prevention
- Nutrient analysis of feedstuff (P, Cu, Se)
- P supplementation in defc. areas
  - Bone meal or Na acid phosphate or DCP or bone meal licks
  - Copper glycinate SO mo before parturition or 20 g oxidized wire needles in copper defc areas
  - Limit cruciferous plants <1.5 kg/d & restrict turnip & beet pulp in 1st 2 months of lactation

### Copper toxicity
- See Tox pg 203; Rare in cattle; 1° of sheep; Chronic copper over time, massive amounts of copper from liver (stress?) = Severe Intravascular hemolysis
- CS: Acute intravascular hemolysis - Icterus, Dark urine, Excessive thirst, Weak, Incr. HR, RR, Painful back (nephrosis)
- Dx: PM gunmetal kidneys, Hx, CS, Red plasma, Hb/-hemoglobinuria, Heinz bodies in RBCs, Blood & kidney levels of Cu.
- Tx: Most die if CS, Tx intensive, Best Tx is prevention (correct Mo/Cu ratio in diet)
- Px: Grave, despite therapy. Usually not treated
Copper defc, Molybdenum toxicity ***

Hypocuprosis, SMCO poisoning
Mk 1197; C38, 397, 304; IM 901, 1232; BR-hb 148, 528, 566; BR 1433, 1379; Br 263.

1° Cu defc, 2° Molybdenum/Sulfate excess
CS: Poor growth, Anemia, Loss of hair color
Tx: Copper injection

Heinz body hemolytic anemia,
Toxigenic hemolytic anemia,
Kale, Beet pulp, Rye grass, Onion toxicity
C3T 382, 390; IM 1227, 1888; Br 613; P 278; Br-hb 148; BR 1536; DC 55; Tox 397

Copper - Important for Hb (hemoglobin) & osteoblasts
1° Deficiency - low dietary
2° Assoc w/ excess molybdenum, Zn, Iron or Sulfate
S methyl-L-cystein sulfoxide
Calves > adult; Cattle > sheep

Poor weight gain
Pale mucous membranes
Bone fragility (spontaneous fx)
Wetery diarrhea
Myocardial fibrosis
Physitis enlarged ends to leg bones
Loss of hair color (cattle)
Congenital rickets
Swayback or enzootic ataxia (lambs)
CNS - demyelination - incoordination, blindness & death

Heinz bodv
Oxidizing agents
- Plants:
  Wild or domestic onions
  Brassica family/cruciferous plants (turnips, rape, kale)
  Rye grass (Secale cereale)
  Selenium defc pastures in Florida
  Copper defc (see above) N. Zealand
  Phytohaemagglutinin (dewormer rarely used), methylene blue
  Hypophosphatemia (see above)

Heinz bodies formed by oxidative denaturating of hemoglobin in RBC (prot. clumps in RBCs)
- Spleen removes RBCs (reticuloendothelial system) - RBCs w/ Heinz bodies less deformable, oxidized & broken down (extravasc.
  hemolysis)
  Also change toxicity - intravascular hemolysis

Oxidative denaturing of Hb, Plants
CS: Pale, No fever, Weakness
Dx: Anemia, Heinz bodies, Hemoglobinemia
Tx: Remove plant, Support
Px: Good if mild, Poor if renal damage

Copper (injectable or dietary)
- 1 injection for 1° defc
- Repeat inject. 2° defc every 4-6 wks

Copper toxicity
- Sheep more susceptible

Prevention
- Cu supplementation

Prognosis
- Guarded to good

CS, History
DDx:
- Poor wt. gain - Parasitism (p 54)
- Trace mineral defc (Se, Cobalt)
- Nutritional (p 78)
- Johne's disease (p 23)
- Anemia
  - Vit E/Se deficiency (p 78)
  - Ingestion (Lasalocid, gossypol, Cassia occidentalis, Phalaris spp.)
  - Lympho- or fibrosarcoma (p 268)

Remove source of toxicity
- Supportive:
  - Blood transfusion if PCV < 10-12%
  - IV fluid if evidence of renal damage
  - Laxative (mineral oil) to empty GI of toxins

Prognosis
- Good if modest anemia
- Poor if renal damage (but can be saved)

Ddx: See Ddx for postparturient hemoglobinuria above

Rye Grass
### Hemolytic Anemia

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sporadic Bacillary hemoglobinuria</td>
<td>&quot;Red water diz&quot;</td>
<td>Found dead</td>
<td>Port wine-colored urine, foams on agitation</td>
<td>Emergency: very, very early</td>
</tr>
<tr>
<td>&quot;Red water diz&quot;</td>
<td></td>
<td>Anemia, severe</td>
<td>Lab:</td>
<td>ABs - penicillin or broad spectrum</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&quot;Port wine&quot; urine</td>
<td>- Anemia, PCV &lt; 24%, Low # RBCs &amp; Hgb, Discolored plasma</td>
<td>IV fluids</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Icterus</td>
<td>- Culture Cl. hemolyticum</td>
<td>Blood transfusions, well warranted($)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Acutely toxemic</td>
<td>- Hemoglobinuria w/ no RBCs</td>
<td>Part of herd not showing CS respond to Tx</td>
</tr>
<tr>
<td></td>
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<td>Spore in anaerobiosis of liver to vegetative form &amp; release</td>
<td>Postmortem</td>
<td>Antitoxins, hyperimmune serum</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Brisket edema</td>
<td>- &quot;Anemic&quot; liver infarcts</td>
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<td></td>
<td></td>
<td>Hi temp., then subnormal temp.</td>
<td>pathognomonic (pale elevations surrounded by reddish zone of congestion)</td>
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<td></td>
<td></td>
<td>Acute anoxia</td>
<td>- Rapid rigor mortis</td>
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<td></td>
<td></td>
<td>Tachycardia &amp; tachypnea</td>
<td>- Blood in cavities (thorax &amp; abd)</td>
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<td></td>
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<td>Course rapid, 1/2 - 4 days</td>
<td>- SQ hemorrhages</td>
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<td></td>
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<td>Die due to hypoxia &amp; toxemia</td>
<td>- Blood thin &amp; clots slowly (no clotting factors - not DIC)</td>
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<td></td>
<td></td>
<td></td>
<td>- Kidneys dark &amp; friable w/ hemorrhage</td>
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<td></td>
<td></td>
<td>- Spleen normal size</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>- Grossly adult liver flukes in bile ducts</td>
<td></td>
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<tr>
<td>Liver necrosis (flukes) + Clostridium</td>
<td>= Diz</td>
<td></td>
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<tr>
<td>CS: Dead, Anemia, &quot;Port wine&quot; urine</td>
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<td></td>
</tr>
<tr>
<td>Dx: Hx, CS, &quot;Anemic&quot; liver infarcts</td>
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<tr>
<td>Tx: Emerg. antitoxin, ABs, Fluids • Px: 95% die</td>
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<tr>
<td>Prevention: Vaccine, Flukacides, Fencing</td>
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</tbody>
</table>

### Control:
- Fence off highly irrigated, poorly drained pastures
- Anthelmintics (flukes) - Clorsolo® & Alendazole®
- Bury or burn carcass to eliminate conc. of Cl. hemolyticum
- Vaccination - inactivated bacterin (immunity for 6 months)
- Geopraphic - administer 4-6 wks prior to liver fluke season
- If fluke present longer, vaccinate every 6 months
- Goal to decr. number of organisms, can’t eliminate

### Prognosis
- Grave > 95% die w/o Tx

### DDx:
- Acute leptospirosis - 1° in calves (p 257)
- Toxicities (chronic Cu toxicity: sheep, goats & calves)
- Bracken fern toxicosis (p 228)
- Rape & kale intoxication (p 231)
- Post parturient hemoglobinuria (p 88)
- Anaplasmosis (spleen enlarged) (p 91) & Babesiosis (p 92)
- Anthrax (spleen enlarged) (p 247)
Hemolytic diz of newborn calves, Neonatal isoeathyrogeny

Blood derived vaccines for

- Rare
- Isoimmune hemolytic anemia
- Blood derived vaccines for anaplasmosis may contain RBC antigens given to dam, antibodies made
- Bull w/ same antigen m/ pace to calf
- Antibodies in colostrum destroy calf's RBCs
- Owners often revaccinate dam if see red urine from calves, exacerbating problem
- Calves normal at birth
- CS 24-36 hours after suckle (colostrum)
- Variable - mild to peracute
- Depressed, weakness
- Pale mucous membranes
- Icterus mild to mod. 1-2 days
- ↓ HR, RR due to anemia
- Red urine
- Dyspnea (hypoxia)
- Pernicous - die in 24 hours
- Mild - nonfatal anemia
- History: dam vaccinated & anemic calf
- Anemia
- PCV 7% peracute, 18% in mild cases
- Coombs' test
- Lytic &/or agglutination tests
- Dam's milk agglutinates calf's RBCs & causes hemolysis if complement added
- Postmortem
- Pale &/or icteric, splenomegaly
- Pulmonary edema
- Minimize stress
- Confinement (♂ exercise)
- Transfusions if severe anemia (PCV < 15%) not usually done
- Corticosteroids
- Abx m/ help

Prevention
- Check vaccinated dam's titer against bull's RBCs
- Use colostrum from another cow w/ out a titer for 24-48 hrs

Trypanosomiasis ★

- Flagellated protozoan causing serious diz throughout world, T. thelari (americanum) only one in N. America & chiefly of academic interest, m/b seen in blood smear (Usually not pathogenic, rarely fever, depression & ♀ milk production)

Pink tooth, Erythropoietic porphyria ★

- Rare congenital disorder of hemoglobin production (1st in Holstein cattle), lack enzymes resulting in pigments that deposit in teeth & bone, Hemolysis
- CS: Slow growth rates, photosensitization, exfoliation of nonpigmented skin, reddish-brown teeth, modest anemia
- Dx: Pink fluorescence under UV light, brownish-red urine
- Tx: None, house indoors, out of sunlight, genetic counselling

Babesiosis, Pyroplasmosis, Tick Fever, Texas Fever, Red Water

- No new cases in USA since tick eradication program
- Protozoa: Babesia bigemina & B. bovis
- Tick, Boophilus spp.
- M/ also carry Anaplasmosis marginale
- Combination of babesia or anaplasmosis can cause tick fever (tristaze)
- Chronic carriers
- Calves - natural immunity, can become asymptomatic carriers
- Bos indicus, more resistant
- Fever 104-107°F, malaise & anorexia
- Hemolytic anemia, rapid
- "Red water" (hemoglobinuria)
- Hypoxia, ↓ HR & RR, pale muc. membr.
- Loud tachycardia
- Icterus, less common than in anaplasmosis
- CNS m/ cerebral babesiosis, hyperexcitability, convulse, opisthotonous, coma & death
- Abortion & death
- CS, in tick areas
- Geimsa stained org. in RBCs of thin blood smear (m/n find)
- Anemia, PCV sharp drop to < 10%
- Complement fixation (doesn't pick up carriers)
- Direct immunofluorescence
- Postmortem
- Icterus
- Enlarged spleen
- Tx: depends on PCV
- Whole blood transfusions, indicated w/ signs of anoxia, limit amount, usually 4 L fluids
- Imidocarb (protozoicide) - protects new animal up to 2 mos & premunition immunity

Prognosis
- PCV > 15% Good w/ early Tx of whole blood transfusions
- PCV < 12% Guarded

Control:
- Successful eradication of tick in USA

Tick life cycle - 3 weeks
- Female ingests parasites in a blood meal, passed transovarially to larval progeny
-Tick drops off the animal & lays eggs
- Eggs to larvse which attach to a new host
-Parasites in tick saliva enter bloodstream to RBCs, merozoites break out of RBC to infect others

DDx (Same as anaplasmosis):
- Leptospirosis (p 257)
- Babesia bigemina (p 90)
- RBC parasites - anaplasmosis (p 92)
- Postparturient hemoglobinuria (p 88)
- Trypanosomiasis (p 261)
- Theileriosis

CNS signs:
- Rabies (p144)
- Encephalitis (p 154)
Anaplasmosis

**Gall sickness**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Peracute to chronic</em></td>
<td><em>Rickettsial organism</em></td>
<td><em>Calves usually asymptomatic, lethargy &amp; anorexia may be mild &amp; last 1-2 ds</em></td>
<td><em>History (endemic area), CS</em></td>
<td><em>Oxytetracycline</em> (long acting) in acute phases for 3-5 ds</td>
</tr>
<tr>
<td><em>Anaplasma marginale</em> in USA</td>
<td><em>A. ovis in other countries</em></td>
<td><em>Acute - adults</em></td>
<td><em>Anemia - extra-vascular hemolysis</em></td>
<td><em>Wait 1 wk, then repeat for 4 ds</em></td>
</tr>
<tr>
<td><em>Intra-RBC bodies</em> (marginal)</td>
<td><em>Boophilus &amp; Dermacentor</em> (ticks)</td>
<td><em>Temp. 104-106°F, w/in 24 hrs., return to normal or subnormal before death</em></td>
<td><em>NO hemoglobinuria</em></td>
<td><em>Eliminates carriers</em></td>
</tr>
<tr>
<td><em>latrogenic-bleeding, vaccination</em></td>
<td><em>Carriers</em></td>
<td><em>Dehydrated, muzzle dry</em></td>
<td><em>PCV &lt; 30% at 1st, in 24 hr, 6-10%</em></td>
<td><em>Blood transfusions</em></td>
</tr>
<tr>
<td><em>Severity related to age</em></td>
<td><em>Calves - mild, no death</em></td>
<td><em>Feces dark brown, mucous covered</em></td>
<td><em>Death</em></td>
<td><em>Water by stomach tube</em></td>
</tr>
<tr>
<td><em>Yearlings - severe, but recovery</em></td>
<td><em>Adults die</em> - w/ 20-50% mortality</td>
<td><em>Urinate frequently (conc. dark yellow)</em></td>
<td><em>Abortion, late gestation</em></td>
<td><em>Careful handling so don't get hypoxic &amp; die</em></td>
</tr>
<tr>
<td><em>Parasitized RBCs eliminated by spleen so no hemoglobinuria</em></td>
<td><em>Chronic survivors of hemolytic crisis</em></td>
<td><em>Eosynphils, appearance of reticulocytes</em></td>
<td><em>Serologically Dx: card agglutination, complement fixation, IFT, DNA probe well for asymptomatic carriers, not for early dz detection</em></td>
<td><em>Prognosis</em></td>
</tr>
<tr>
<td><em>Late spring to early fall (anytime if latrogenic)</em></td>
<td><em>Weight loss, Icterus</em></td>
<td><em>Regenerative anemia w/ polycytosis, basophilic stippling, reticulocytosis, anisocytosis</em></td>
<td></td>
<td><em>Vector control (difficult)</em></td>
</tr>
<tr>
<td><em>Endemic in some areas, w/ chronic carriers, SE &amp; SW United States</em></td>
<td><em>Stress - die from hypoxia</em></td>
<td><em>Serologically Dx: card agglutination, complement fixation, IFT, DNA probe well for asymptomatic carriers, not for early dz detection</em></td>
<td></td>
<td><em>perioc spraying, ear tags, dust bags, etc., during vector season</em></td>
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<td></td>
<td><em>Older animals, stagger, weak, wander off</em></td>
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<td></td>
<td><em>Iatrogenic control (needles, dehorning)</em></td>
</tr>
</tbody>
</table>

**Autoimmune hemolytic anemia, AIHA**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>IM 1225; BR-hb 148; DC 56</td>
<td><em>2° process to: Anaplasmosis (above), Babesiosis (pg 91), Anti-RBC antibodies against own RBCs, Antibodies complex w/ antigens on RBCs causing destruction &amp; removal; Young</em></td>
<td><em>HR &amp; RR, Fever</em></td>
<td></td>
<td><em>Oxytetacycline in feed</em></td>
</tr>
<tr>
<td></td>
<td><em>CS: Variable, Depression, Pale mucous membranes, Variable icterus, HR &amp; RR, Fever</em></td>
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</tbody>
</table>

**Anaplasma marginale (Rickettsia), Ticks, latrogenic**

**CS:** Adults - Anemia, Icterus & Fever

**Dx:** Low PCV, No hemoglobinuria, Giesma stain

**Tx:** Oxytetracycline, ANAPLaz (vac)

**Px:** PCV > 12% Good, < 8% Grave
<table>
<thead>
<tr>
<th>Condition</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acorn/Oak bud poisoning</td>
<td>101</td>
</tr>
<tr>
<td>Acute renal failure</td>
<td>100</td>
</tr>
<tr>
<td>Amaranthus poisoning</td>
<td>101</td>
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<tr>
<td>Aminoglycosides</td>
<td>101</td>
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<tr>
<td>Amyloidosis</td>
<td>94</td>
</tr>
<tr>
<td>Antifreeze</td>
<td>101</td>
</tr>
<tr>
<td>ARF (acute renal failure)</td>
<td>100</td>
</tr>
<tr>
<td>Arsenic</td>
<td>101</td>
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<tr>
<td>Bladder paralysis</td>
<td>95</td>
</tr>
<tr>
<td>Cadmium</td>
<td>101</td>
</tr>
<tr>
<td>Calculi</td>
<td>96</td>
</tr>
<tr>
<td>Contagious pyelonephritis</td>
<td>98</td>
</tr>
<tr>
<td><em>Corynebacterium renale</em></td>
<td>95, 98</td>
</tr>
<tr>
<td>Cystitis</td>
<td>95</td>
</tr>
<tr>
<td>Embolic nephritis</td>
<td>98</td>
</tr>
<tr>
<td>Enzootic hematuria</td>
<td>99</td>
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<tr>
<td>Ethylene glycol toxicity</td>
<td>101</td>
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<tr>
<td>Glomerulonephritis</td>
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<tr>
<td>Greasewood</td>
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<td>Halogeton</td>
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<td>Heavy metals</td>
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<tr>
<td>Hydronephrosis</td>
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<tr>
<td>Interstitial nephritis</td>
<td>99</td>
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<tr>
<td>Kidney failure</td>
<td>100</td>
</tr>
<tr>
<td>Lead</td>
<td>101</td>
</tr>
<tr>
<td>Leptospirosis</td>
<td>257</td>
</tr>
<tr>
<td>Mercury</td>
<td>101</td>
</tr>
<tr>
<td>Mycotoxins</td>
<td>101</td>
</tr>
<tr>
<td>Navel ill</td>
<td>102</td>
</tr>
<tr>
<td>Nephritis</td>
<td>98</td>
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<tr>
<td>Nephrotoxins</td>
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<tr>
<td>NSAIDs</td>
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<tr>
<td>Oak poisoning</td>
<td>101, 234</td>
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<tr>
<td>Oliguric</td>
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<tr>
<td>Omphalitis</td>
<td>102</td>
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<tr>
<td>Omphalophlebitis</td>
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<tr>
<td>Oxalate</td>
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<tr>
<td>Patent urachus</td>
<td>102</td>
</tr>
<tr>
<td>Pyelonephritis</td>
<td>98</td>
</tr>
<tr>
<td>Perirenal edema</td>
<td>101</td>
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<tr>
<td>Pigweed</td>
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<td>Quercus poisoning</td>
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<tr>
<td>Renal failure</td>
<td>100</td>
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<tr>
<td>Ruptured bladder</td>
<td>96</td>
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<tr>
<td>Sorghum cystitis/ataxia</td>
<td>95</td>
</tr>
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<td>Sudan/Johnson grass</td>
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<td>Sulfonamide toxicity</td>
<td>101</td>
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<tr>
<td>Surgery:</td>
<td></td>
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<tr>
<td>Calciuli removal</td>
<td>97</td>
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<tr>
<td>Ischial urethrotomy</td>
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<td>Penile amputation</td>
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<tr>
<td>Tetracycline</td>
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<tr>
<td>Urachus, patent</td>
<td>102</td>
</tr>
<tr>
<td>Uremia</td>
<td>99</td>
</tr>
<tr>
<td>Urethral rupture</td>
<td>96</td>
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<tr>
<td>Urethral obstruction</td>
<td>96</td>
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<tr>
<td>Urinary calculi</td>
<td>96</td>
</tr>
<tr>
<td>Urolithiasis</td>
<td>96</td>
</tr>
<tr>
<td>Waterbelly</td>
<td>96</td>
</tr>
</tbody>
</table>
### Amyloidosis - Cystitis

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amyloidosis</td>
<td>- Uncommon&lt;br&gt;- Amyloid - twisted sheets of proteins&lt;br&gt;- &gt; 4 yrs-old&lt;br&gt;- Accumulation assoc. w/ chronic inflammation (chronic mastitis, chronic peritonitis, etc.)&lt;br&gt;- Multisystems - Amyloid deposited in glomeruli - Impaired permeability - Excessive protein loss into urine&lt;br&gt;** Edema&lt;br&gt;** Uremia (oral lesions)&lt;br&gt;- GI deposits&lt;br&gt;- Malabsorption &amp; diarrhea</td>
<td>- Intractable diarrhea&lt;br&gt;- Weight loss&lt;br&gt;- Ventral edema of brisket, submandibular region (proportional to hypoproteinemia)&lt;br&gt;- Oral lesions (due to uremia)&lt;br&gt;- Profuse watery diarrhea</td>
<td>- Usually easy&lt;br&gt;- Nephrotic syndrome&lt;br&gt;- Edema&lt;br&gt;- Diarrhea&lt;br&gt;- Lab:&lt;br&gt;** Massive hypoproteinemia, hyperproteinuria ** (think amyloidosis) (+4 on dipstick)&lt;br&gt;- BUN &amp; creatinine&lt;br&gt;- Congo red stained amyloid protein in urine sediment&lt;br&gt;- Postmortem:&lt;br&gt;** Waxy, large kidneys, yellow-tan w/ wide cortex <strong>&lt;br&gt;- Histo: amyloid in glomeruli&lt;br&gt;- Rectal exam:&lt;br&gt;</strong> Kidney grossly enlarged, painless, w/ norm. lobation &amp; consistency **&lt;br&gt;- Ultrasound - large kidney, not specific for this disease&lt;br&gt;- Renal biopsy</td>
<td>- Salvage as early as possible (before weight loss)</td>
</tr>
</tbody>
</table>

** Uncommon, Adults, Amyloid protein, Assoc w/ Chronic inflam.**

CS: Nephrotic syndrome: Edema & Diarrhea; Weight loss
Dx: Hx, CS, Hypoproteinemia & Hyperproteinuria
Tx: Salvage before wt. loss • Px: grave

---

**Glomerulonephritis**

| IM 994; BM&S 830; DC 359 | Rare, Immunological disorder (antigen-antibody complexes in glomerular basement membrane), impairment of filtration, Bovine glomerulus morphologically different from other species & m/ be less susceptible to this diz | CS: Weight loss, chronic diarrhea, generalized edema | Dx: CS, Hx, Proteinuria, hypoalbuminemia, anemia, elev. serum creatinine & BUN, Renal biopsy | DDx: Amyloidosis

Tx: Not described, probably not indicated because advanced stage at Dx
CYSTITIS

- Sporadic inflammatory disease
- Cattle >> sheep
- Cystitis, ureteritis
- #1 Corynebacterium renale
- Subacute pyelonephritis
- E. coli, chronic urinary infec.
- C. pilosum, C. cystis
- 2° Ascending problems
  - Urinary calculi
  - Sets up inflam. of bladder wall
  - Difficult parturition, w/ trauma to urethra; metritis; conformational deformity
  - Handling (catheterization, etc., iatrogenic)
  - Venereal transfer
  - Urine splashing

Types
- Chronic
  - Weight loss
  - Milk production
- Cystitis in males - check for uroliths (stones)

DDx:
- #1 - Urolithiasis (crystalluria)(p 96)
- Enlarged kidneys (no pyuria or bacteruria)
  - Hydronephrosis
  - Congenital cystic kidneys
  - Neoplasia
  - Amyloidosis (p 94)
- Hematuria
  - Enzootic hematuria (no pyuria or bacteruria)(p 228)
  - Leptospirosis (p 257)
  - Bacillary or postparturient hemoglobinuria (p 88, 90)

TX: Antibiotics, Water & Salt
  - Px: Good

Sorghum cystitis/ataxia, Sudan/Johnson grass; Bladder paralysis, Lathyism

- See Tox pg 242; Ataxia & cystitis in horses, cattle & sheep. Usually valuable forage, Sorghum spp., Johnson & Sudan grasses; Mechanism unknown, cyanide? Myelomalacia of lumbar, sacral & caudal spinal cord, Poisonous plants
- CS: CNS: posterior incoordination; "Dribbling"; Cystitis 2°, Scalding of skin & dermatitis, Pyelonephritis sequela, Paresis of tail m/b
- Dx: Hx, CS, No specific tests, Urinalysis for cystitis; PM - Wallerian degeneration & swelling of axons
- Tx: Withdraw Sorghum, improve over wk-mo (m/mot be complete), No specific Tx, ABs for urinary tract infec.
- Px: Recovery rare, Control: Diversify diet (Sorghum not a complete diet)

Treat early
- ABs based on urinalysis, culture & sen.
  - C. renale - intensive penicillin
  - E. coli - resistant - $ - ampicillin
- Naxcel, $ Ampicillin (broad spec) if culture not possible or E. coli
- Reassess by culture & bacterial count
  - 1 week post Tx
- Water & salt - flushing effect

Prognosis:
- Cystitis - good, if Tx early

Prevention & control
- Isolate (infectious)
- Hygiene - when handling urogenital tract
- Assoc w/ bulls, switch to artifi. insem. (AI)
- Difficult to remove from herd once established

Female > males - short wide urethra, infection easily ascends

2° ascending problem

CS: Frequent, Bloody, Painful urination w/ Blood clots

Dx: Hx, CS, US, UA (hematuria, bacteruria)

Tx: Antibiotics, Water & Salt

Px: Good
### Urolithiasis

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urolithiasis</td>
<td>• Urinary calculi - big problem</td>
<td>1. Urethral obstruction</td>
<td>• History</td>
<td>• Unblock - due to urethral diverticulum, can't catheterize so no retrograde flushing</td>
</tr>
<tr>
<td></td>
<td>- Feeder steers &amp; range cattle</td>
<td>• Early blockage</td>
<td>- CS - dry preputial hairs, straining, colic</td>
<td>- Aminophylline (antispasmodic)</td>
</tr>
<tr>
<td></td>
<td>- Calculi form in bladder, nidus (deposited cells &amp; necrotic tissue), solutes pcpt out around nidus, mucoprotein solidifies around pcpt</td>
<td>• Urethral pain, straining &amp; twitching of tail</td>
<td>- Rectal exam:</td>
<td>- early m/ relax enough to pass (causes slight straightening of sigmoid flexure)</td>
</tr>
<tr>
<td></td>
<td>- Obstruction, when passes into urethra</td>
<td>• Complete blockage</td>
<td>- Enlarged bladder</td>
<td>- Surgery to remove</td>
</tr>
<tr>
<td></td>
<td>- Irregularly-shaped are trapped</td>
<td>- Dry preputial hair (calculus on hairs)</td>
<td>- M/ have enlarged ureter</td>
<td>- Perineal urethrostomy</td>
</tr>
<tr>
<td></td>
<td>- Smooth stones pass</td>
<td>- Tenesmus (straining)</td>
<td></td>
<td>- Fluid TX, but m/ rupture bladder (diuresis)</td>
</tr>
<tr>
<td></td>
<td>- Predisposing factors</td>
<td>- Off feed, depressed, ↑ HR &amp; RR</td>
<td></td>
<td>- ABs (sulfas, tetracyclines - long acting &amp; concentrate in urine) 2° infect</td>
</tr>
<tr>
<td></td>
<td>- Incr. in high concentrate diets (pelleted rations, etc.)</td>
<td>- Colic</td>
<td></td>
<td>- Cull early if not easily unblocked, if not early then meat takes on uremic smell (condemned)</td>
</tr>
<tr>
<td></td>
<td>- Plants high in oxalates</td>
<td>- &quot;Tail pumping&quot; when trying to urinate</td>
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<tr>
<td></td>
<td>- Low intake of water</td>
<td>- Pulsation of urethra below anus</td>
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<tr>
<td></td>
<td>- Castration (smaller urethra)</td>
<td>- Untreated, isolate themselves, refuse to eat or drink, become uremic &amp; die</td>
<td></td>
<td>- To late to salvage because of uremic smell</td>
</tr>
<tr>
<td></td>
<td>- Feedlot steers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Infection &amp; inflammation</td>
<td>2. Urethra rupture: if blockage not relieved</td>
<td></td>
<td>• Urethrostomy</td>
</tr>
<tr>
<td></td>
<td>- Vit A deficiency</td>
<td>• &quot;Waterbelly&quot; - urine into subQ, swelling ventral abdomen, initially soft, easily indented; then cellulitis, hot &amp; painful</td>
<td></td>
<td>- Allow animal to reach slaught weight</td>
</tr>
<tr>
<td></td>
<td>- High estrogen diet</td>
<td>• Straining &amp; colic relieved, appetite norm. &amp; defecation normal</td>
<td></td>
<td>- Drain SQ urine by ventral lacations</td>
</tr>
<tr>
<td></td>
<td>- High urinary pH (alkaline) incr. w/ high conc. diet, intermittent feeding, urinary stasis</td>
<td>• Skin sloughing (due to urine scalding)</td>
<td></td>
<td>• Cover w/ ABs &amp; fluids</td>
</tr>
<tr>
<td></td>
<td>• Three syndromes</td>
<td>• Untreated, death in 10%</td>
<td></td>
<td>Prognosis:</td>
</tr>
<tr>
<td>1. Urethral obstruction</td>
<td></td>
<td></td>
<td></td>
<td>• Poor for return to breeding (adhesion)</td>
</tr>
<tr>
<td>- Distal bend of sigmoid flexure</td>
<td></td>
<td></td>
<td></td>
<td>• Urletrostomy</td>
</tr>
<tr>
<td>- Nekrosis &amp; penetration</td>
<td></td>
<td></td>
<td></td>
<td>- Trocar abdomen, drain slowly</td>
</tr>
<tr>
<td>2. Urethral rupture</td>
<td></td>
<td></td>
<td></td>
<td>- Urethrostomy</td>
</tr>
<tr>
<td>w/ in 48 hrs</td>
<td></td>
<td></td>
<td></td>
<td>- so urinate w/in 48 hrs, don't fix bladder, hope it heals spontaneously</td>
</tr>
<tr>
<td>- Temporary relief of CS, for a few days</td>
<td></td>
<td></td>
<td></td>
<td>- Fluids &amp; ABs</td>
</tr>
<tr>
<td>- Then uremia, depression, anorexia</td>
<td></td>
<td></td>
<td></td>
<td>- Salvage animal in a few mo to avoid further complications</td>
</tr>
<tr>
<td>- Dehydration (urine pulls fluid into abdomen)</td>
<td></td>
<td></td>
<td></td>
<td>Px: Poor to good, depending on the duration of rupture &amp; intensive care postop</td>
</tr>
<tr>
<td>- Dry preputial hairs</td>
<td></td>
<td></td>
<td></td>
<td>- Only 50% recover after surgery</td>
</tr>
<tr>
<td>- Pear-shaped abdomen</td>
<td></td>
<td></td>
<td></td>
<td>- Uremic - poor</td>
</tr>
<tr>
<td>- Off feed, depressed</td>
<td></td>
<td></td>
<td></td>
<td>- Hi serum K - grave (&gt; 9 mg/dl)</td>
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<tr>
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<tr>
<td>3. Ruptured bladder</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>- Fluid across abdomen</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Peritonitis (urine)</td>
<td></td>
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</tbody>
</table>

### URINARY SYSTEM

<table>
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<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1. Urethral obstruction</td>
<td>• History</td>
<td>• Unblock - due to urethral diverticulum, can't catheterize so no retrograde flushing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Early blockage</td>
<td>- CS - dry preputial hairs, straining, colic</td>
<td>- Aminophylline (antispasmodic)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Urethral pain, straining &amp; twitching of tail</td>
<td>- Rectal exam:</td>
<td>- early m/ relax enough to pass (causes slight straightening of sigmoid flexure)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Complete blockage</td>
<td>- Enlarged bladder</td>
<td>- Surgery to remove</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Dry preputial hair (calculus on hairs)</td>
<td>- M/ have enlarged ureter</td>
<td>- Perineal urethrostomy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Tenesmus (straining)</td>
<td></td>
<td>- Fluid TX, but m/ rupture bladder (diuresis)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Off feed, depressed, ↑ HR &amp; RR</td>
<td></td>
<td>- ABs (sulfas, tetracyclines - long acting &amp; concentrate in urine) 2° infect</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Colic</td>
<td></td>
<td>- Cull early if not easily unblocked, if not early then meat takes on uremic smell (condemned)</td>
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<td></td>
<td></td>
<td>- &quot;Tail pumping&quot; when trying to urinate</td>
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<tr>
<td></td>
<td></td>
<td>- Pulsation of urethra below anus</td>
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<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Untreated, isolate themselves, refuse to eat or drink, become uremic &amp; die</td>
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</tbody>
</table>

### History

<table>
<thead>
<tr>
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<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2. Urethra rupture: if blockage not relieved</td>
<td>• History</td>
<td>• Unblock - due to urethral diverticulum, can't catheterize so no retrograde flushing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• &quot;Waterbelly&quot; - urine into subQ, swelling ventral abdomen, initially soft, easily indented; then cellulitis, hot &amp; painful</td>
<td>- CS - &quot;waterbelly&quot;</td>
<td>- Aminophylline (antispasmodic)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Straining &amp; colic relieved, appetite norm. &amp; defecation normal</td>
<td>- No lab work - ($)</td>
<td>- early m/ relax enough to pass (causes slight straightening of sigmoid flexure)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Skin sloughing (due to urine scalding)</td>
<td>- Ultrasound - echogenic calculus (urethra)</td>
<td>- Fluid TX, but m/ rupture bladder (diuresis)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Untreated, death in 10%</td>
<td>- Aspirate &quot;water belly&quot; m/not smell unless heated</td>
<td>- ABs (sulfas, tetracyclines - long acting &amp; concentrate in urine) 2° infect</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- Cull early if not easily unblocked, if not early then meat takes on uremic smell (condemned)</td>
</tr>
</tbody>
</table>

### 3. Ruptured bladder

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>3. Ruptured bladder w/ in 48 hrs</td>
<td>• History of relieved colic</td>
<td>- Trocar abdomen, drain slowly</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Temporary relief of CS, for a few days</td>
<td>- Dry preputial hair + crystals</td>
<td>- Urethrostomy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Then uremia, depression, anorexia</td>
<td>- Lab: Azotemia</td>
<td>- so urinate w/in 48 hrs, don't fix bladder, hope it heals spontaneously</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Dehydration (urine pulls fluid into abdomen)</td>
<td>- ↑ creatinine but &lt; peritoneal fluid</td>
<td>- Fluids &amp; ABs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Dry preputial hairs</td>
<td>- ↑ putasiurn, decr. Na &amp; Cl</td>
<td>- Salvage animal in a few mo to avoid further complications</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Pear-shaped abdomen</td>
<td>- Metabolic alkalosis</td>
<td>Px: Poor to good, depending on the duration of rupture &amp; intensive care postop</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Off feed, depressed</td>
<td>- Rectal - sm. bladder in fluid</td>
<td>- Only 50% recover after surgery</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Fluid wave across abdomen</td>
<td>- Peritoneal tap:</td>
<td>- Uremic - poor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Peritonitis (urine)</td>
<td>- Fluid - urine smell &amp; red</td>
<td>- Hi serum K - grave (&gt; 9 mg/dl)</td>
</tr>
</tbody>
</table>
High risk animals
- Castrated males >>> females
  (feeder steers castrated early = small urethra)

Blockage sites (males)
- Cattle - sigmoid flexure, ishial arch, urethral orifice - usually single

Prevention of all syndromes
- Water available - heated in cold weather
- Early detection
- Acidify urine; good for phosphate calculi, not silicates
  - Ammonium chloride or ammonium sulfate
- NaCl to diet (2-4%) to inor. water consumption
- Ratio of 2 to 1 Calcium to Phosphate
- Vit A supplement to diet
- Delay castration - not at 3 months
- Oxytetracyclines or sulfas to decrease UT infection

Surgeries:

Stone removal (for unruptured cases)
- Cast in dorsal recumbency
- Local infiltration of anesthetic, 4" area cranial to scrotum
- Grasp penis through skin
- 3" skin incision cranial to scrotum
- Exteriorize penis by deeper incision through SQ
  - ID retractor penis mm. joining penis just dist. to sigmoid flexure (usual location of calculi)
  - Urethra runs on outside of curve (ventr.)
- Feel stones (calculi)
  - If possible, move stone to healthy tissue
- Attempt to crush stone (drive points of towel forceps into stone & massage pieces out, phosphate stones usually too soft to crush)
- Incise into urethra over calculi (if unable to crush)
- Tease stone out of small opening
- Flush out
- Determine state of urethra
  - 1" closure if healthy & not traumatized
  - Leave open if bruised, heals by second intention
- Do not close skin

Penile amputation (ruptured urethra)
- Couple of incisions on ventral abdomen to drain SQ urine
- Standing bull - epidural anesthesia
- Surgically prep perineal area to scrotum
- 6" skin incise to base of scrotum on midline
- Bluntly dissect down to penis
- Grasp penis & pull penis out incision
- Tie vessels off, or dissect between penis & vessels, leaving vessels in place
  - Due to retraction w/ healing (scalding of urine if too short)
- Cut penis, corpus cavernosum on top of corpus spongiosum
- Tie suture to skin
- Pass suture through body of penis just dorsal to urethra
- Pass suture dorsally around penis & back through penile body
  (acts as tourniquet to help slow bleeding of corpus cavernosum)
- Tie suture to skin
- Close skin incision, putting no pressure on urethra

Ischial urethrotomy for ruptured bladder
- Drain abdominal cavity by paracentesis
  - Unnecessary to suture bladder, just keep it empty to heal
  - Insert an abd. drain paramedian betw. umbilicus & pubis for 48 hrs
- Standing, under epidural anesthesia
- Prep perineum
- 5" incision on midline starting 2" below anus
- Incise down to retractor penis & deeper to bulbospongiosus m.
- Find tunica albuginea at dist. end of bulbospongious m.
- Palpate urethra
- Incise tunica albuginea into corpus spongiosum
- 1" incision into urethra
- Remove stones by pushing up to urethrostomy incision w/ catheter
  (extend penis, by straightening out sigmoid flexure)
- Pass a Foley catheter w/ a stilette up urethra & into urinary bladder
  (inflate cuff), pushing catheter against cran. wall of urethra while passing urethral diverticulum (located caudally)
- Close tunica albuginea, SQ fascia & finally skin around catheter
- Put 1-way valve on end of catheter to stop negative pressure of abd. pulling air into bladder
- Remove catheter in 5 days
- Let heal by 2nd intention
- ABs for 3 days

Feeder steers, 5-10 mos-old, Winter, High concentrate feed
## Nephritis

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<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
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<tr>
<td>Nephritis</td>
<td>Br-hb 190; BR 445; DC 355; BM&amp;S 634</td>
<td>• Not an important clinical entity, except for pyelonephritis or embolic nephritis</td>
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<td></td>
<td>- Glomerulonephritis only noticed at necropsy w/ no manifestation of diz</td>
<td>- Interstitial nephritis accompanies leptospirosis, but CS more closely related to leptospirosis</td>
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</tbody>
</table>

### Contagious pyelonephritis

- **Corynebacterium renale** considered specific agent, gram positive, short thick rods
- Obligate parasite of cattle
- Strep, staph., Actinomyces (Corynebacterium) pyogenes, E. coli also implicated
- **Ascending infection**
  - Females > males
  - > 3 yr-olds
  - Carrier animals
  - Dairy herds, winter
  - Obstruction (calculi) = stasis, important factor

- **Variable**: initially m/b intermittent hematuria in healthy appearing cattle or colic
- **Usually insidious onset**
  - Gradual loss of condition
  - Milk production
  - Fluctuating appetite
  - Intermittent fever
  - Bloody urine & debris
  - PU painful, small amounts of urine
  - Death due to kidney failure & blood loss

- **History** (Hx), CS (clinical signs)
- **Rectal palpation**:
  - Enlarged kidneys, ureters
  - Painful kidneys
- **Urinalysis**:
  - Hematuria
  - Pyuria, bacteruria
  - RBCs, WBCs, epithelial tissue debris
- **Gram stain C. renale**, FA
  - Usually no azotemia unless bilateral, or terminal stages
- **Postmortem**:
  - Kidney: enlarged, loss of lobulation
  - Mottled, greyish-white, necrotic areas
  - Abscesses & necrotic streaks in parenchyma
  - Ureters dilated & filled w/ pus
  - Bladder wall & urethra thickened, edematous, hemorrhagic & necrotic

### Diagnosis

- **Dx**: Rectal, Pyuria, Culture - PM
- **Tx**: Procaine penicillin G (DOC), large doses sid 10 days
- **Px**: Guarded

### Prognosis

- **Guarded**: relapses common, clearing infection difficult
- If tissue damage only temporary recovery, but m/ allow fattening before slaughter

---

**Corynebacterium renale, Ascending**

**CS**: Insidious - Renal CS (Hematuria, Dysuria)

**Dx**: Rectal, Pyuria, Culture - PM

**Tx**: Penicillin (DOC) • Px: Guarded
**Embolic nephritis**

*** DC 354

- Follows purulent infection elsewhere in body or sepsis.
- Cause: *Corynebacterium pyogenes? E. coli*
- 1° infec - Navel ill, Mastitis, Pneumonia, Hepatitis, Peritonitis

2° to purulent infec.
CS: Insidious
Tx: Long term ABs

**Uremia**

BR 439; Sx-G 632; BM&S 629

- Clinical signs (CS), not diz
- Due to an inability to produce & eliminate a normal amount of urine
- Cause:
  - Circulatory defc.
  - Extensive kidney lesions (hydronephrosis, pyelonephritis)
  - Obstruction of urinary tract
  - Rupture of bladder or ureter
  - Poisonous plants
  - Heavy metals

**Hydronephrosis**

BR-hb 181; BR 447; BM&S 838; Sx-G 634

- Distention of kidney w/ urine
- Ureteral obstruction (rarely urethral)
- Unilateral usually

**Enzootic hematuria**

** DC 363

- See pg 84, 228; Cause unknown, bracken fern (worldwide), > 4 yr of age, cauliflower-like bladder wall
- CS: Acute (blood clots in urine, anemia, die in 1-2 weeks), Chronic (anemia, bladder tumors, 2° cystitis)
- Dx: Hx (Bracken fern), CS, Rectal (bladder thickening); PM: Chronic - Pedunculated mass from bladder wall
- DDx: Cystitis (pyuria & bacteruria), Pyelonephritis
- Tx: Salvage early
- Prevention: Clear Bracken fern ($)
**Renal Failure**

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<tr>
<td>Acute renal failure, ARF</td>
<td>• Not a primary condition in cattle&lt;br&gt;• 2° condition</td>
<td>• CS fairly nonspecific&lt;br&gt;• CS of 1° diz m/mask&lt;br&gt;• Polyuria&lt;br&gt;  - Oliguric (diminished urine; anuria very uncommon in large animals)&lt;br&gt;• Depression &amp; anorexia&lt;br&gt;  - Bleeding diathesis&lt;br&gt;  - Recumbency&lt;br&gt;  - Dehydration&lt;br&gt;  - Uremia, muscular weakness, labored breathing, reduced urine output (none in obstruction), loss of condition, scleral congestion, ammonium (urine) odor to breath&lt;br&gt;  - Chronic uremia (ulcerations of oral tissue, † HR, muscular tremors, coma followed by death)&lt;br&gt;• M/b abdominal pain, mild colic</td>
<td>• History (exposure), Clinical signs&lt;br&gt;• Dx: difficult due to vague clinical signs&lt;br&gt;• Lab:&lt;br&gt;  - † Creatinine &amp; BUN&lt;br&gt;  - † Cl, potassium (K), Ca, Na&lt;br&gt;  - † P, Mg&lt;br&gt;  - Peracute nephrosis&lt;br&gt;  - Metabolic acidosis &amp; hyperkalemia (K)&lt;br&gt;• Urinalysis:&lt;br&gt;  - Proteinuria in cattle pathologic (normal = 0.3 g/l)&lt;br&gt;  - Low sp. gravity (&lt; 1.020) (isosthenuria)&lt;br&gt;  - Urinary casts, granular or leukocytic&lt;br&gt;• Ultrasound: enlarged or abnormally-shaped kidneys, w/ abn. consistency to parenchyma&lt;br&gt;• Postmortem: m/b normal on gross exam, heavy, cut surface bulges&lt;br&gt;  - Perirenal edema&lt;br&gt;  - Histopathology&lt;br&gt;  - Tubular necrosis&lt;br&gt;  - casts in tubules&lt;br&gt;• Renal biopsy (generally not done due to risk of hemorrhage)</td>
<td>• Treat predisposing cause&lt;br&gt;• Remove causative agent&lt;br&gt;• Fluids: restore blood volume&lt;br&gt;  - % dehydration x body weight over 4-6 hrs&lt;br&gt;• If oliguric after volume &amp; electrolyte correction&lt;br&gt;  - Lasix® (furosemide) 1 mg/kg IV w/ fluids, repes every hour until urine flow&lt;br&gt;  - Mannitol 0.25 g/kg or&lt;br&gt;  - Dopamine 3-5 µg/kg/min IV&lt;br&gt;• Normal urine flow, more likely than oliguria&lt;br&gt;  - Fluids 40-80 ml/kg/day until marked decrease in serum creatinine</td>
</tr>
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**Causes:**
- • 2° to acute infection/septicemia<br>  - Septic metritis (pg 111)<br>  - Septic mastitis (pg 192)<br>  - Anthrax, Blackleg (pg 196), Malignant edema (pg 196), Shipping fever (pg 63), Endotoxemia, Abomasal torsion, Salmonellosis, Pregnancy toxemia<br>• 2° Nephrotoxins<br>  - Poisonous plants (Oaks, Amaranthus, Isotropis, Rumex spp, Oxalates, dogbane, micotoxins)<br>  - Heavy metals mercury, arsenic, cadmium, lead<br>  - Drugs (aminoglycosides, Tetracyclines, sulfonamides, monensin)<br>  - Endogenous (tissue, hemoglobin, myoglobin)<br>  - Miscellaneous: chlorinated hydrocarbons, ethylene glycol, Phenol & coal tar, phosphorus, blister beetle<br>  - Anthelmintics (carbon tetrachloride, phenothiazine)<br>• 2° to hypoxia due to reduced blood flow

**Complications**
- • Diarrhea<br>• Hemolysis (may also be result of renal failure)

**2° to Septic diz, Nephrotoxins, Ischemia**
- CS: Vague/Masked by 1° diz - Polyuria, Dehydration, Depression
- Dx: Hx, CS, † BUN, Proteinuria, SG < 1.020, Casts, Ultrasound
- Tx: Tx 1°, Remove cause, Fluids, Check urine output

**Prognosis:**
- • Good in early Dx & Tx of poisonous plants
- • Poor if due to septic processes
- • Renal failure > 1 d or perirenal edema or kidney enlargement, Px goes down
- • Px monitored daily by checking creatinine
Oak poisoning, Quercus poisoning, Oak bud or acorn poisoning

- See Tox pg 234; Oak, *Quercus* spp., SW USA (buds in spring), Midwest & NE (acorns in fall); #1 Cattle; Oak tannin
- CS: Gradual onset; Peracute (edema, anuria, m/b found dead); Subacute (diarrhea); Advanced stages (large volumes of dilute urine, dehydration, icterus, hematuria, ammonium breath, oral lesions, occasional abortions)
- Dx: Hx, CS, ↑SGOT, SGPT, BUN & creatinine, dehydration, Low specific gravity, granular casts & hematuria; PM: edema, perirenal edema, renal lesions
- DDX: Pigweed poisoning (similar lesions); Aminoglycosides poisoning, Clostridial diz, Viral diz (oral lesions)
- Tx: Remove from oaks, Stimulate rumen (oils), Fluids (dehydration & acidosis), Supplemental feed
- Px: Grave - rarely recover once renal dysfunction
- Prevention: 10-15% calcium hydroxide in grain ration to protect m/b, if exposure can't be prevented

Amaranthus, pigweed: See Tox pg 234: similar to oak, Acute tubular necrosis & perirenal edema in cattle & pigs, Toxic element not identified

Mycotoxins

- See Tox pg 256; Aspergillus & Penicillium spp., Nephrotoxic

Oxalate

- See Tox pg 224; Halogeton, Greasewood, 1° cattle, West, Insoluble pcpt w/ Ca, Vascular necrosis & renal tubular blockage
- CS: Colic, Weakness, Frequent urination, Crystals in urine
- Tx: Hopeless once CS; Fluids, Ca gluconate

Aminoglycosides

- See Tox 217; One of most common causes of tubular nephrosis
- Neomycin most nephrotoxic > gentamycin > kanamycin > amikacin > streptomycin (least)
- Accumulate in tubular epithelial cells, disrupt metabolism & die

Sulfonamide & tetracycline ABs (C3T 816): Sulfonamides cause crystalluria, mainly of older sulfas (sulfathiazole), Tetracycline problem w/ high dose NSAIDs (C3T 818): Not a potent nephrotoxin, m/b if given w/ aminoglycosides or if hypotension or dehydration; causes papillary necrosis & interstitial nephrosis

Amphotericin B ★

- Antifungal drug, nephrotoxic even at therapeutic doses, too expensive to use in cattle

Ethylene Glycol, Antifreeze ★

- See Tox pg 209; 1° dogs & cats, 1° lg. animal is ruminants, Sweet tasting alcohol, forms insoluble Ca oxalate in renal tubules
- CS: Hind limb ataxia, Salivation, Depressed sensorium, Nystagmus, Tonic clonic seizures, Status epilepticus, Acidosis, Dehydration
- Dx: Azotemia, ↑serum creatinine, Oxalate crystals in kidney, microscope using polarized light
- Tx: Early w/in 12 hr of exposure, 20% ethanol (50 ml/hr), Activated charcoal, NaHCO3 IV, Replace fluids

Heavy metals (C3T 823) ★

- See Tox: Rare, Hg (mercury), Arsenic, Cadmium, Lead
- CS: GI signs (+ salivation, oral erosions, colic, hemorrhagic diarrhea); CS of uremia (depression, seizures, oliguria)
- Dx: Tubular necrosis, azotemia, isosthenuria, enzyuria, & electrolyte imbalances
- Tx: Dimercaprol, 1 lb of activated charcoal orally, ARF (acute renal failure) Tx
**Neonate**

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</table>
| Patent urachus     | • Urachus connects bladder w/ allantoic sac during gestation                | • Moist hair around navel               | • Moist dribbling umbilicus                                                                       | • Conservative<br> - Chemical cauterization: Tincture of iodine on cotton swab & swirl around inside urachus, must not be infected. Most respond<br>• Surgery: remove urachus, taking off tip of bladder, remove umbilical v. & aa. as well |**
|                    | • Should close at birth when umbilical cord is severed                      | • Dribbling of urine from umbilicus      | • Lab: Serum IgG, CBC, urinalysis for systemic infec.                                              |**
|                    | • Early severance or ligation of umbilical cord, inflammation, infection & excessive handling of neonate implicated |                                          | • Ultrasound                                                                                        |**
|                    | • Abscesses of any of above structures                                       | • Check for FPT (failure of passive transfer) |**
| From navel to bladder |                                                                              |                                          |**
| CS: Dribbling from "navel", Moist hair |                                                                              |                                          |**
| Dx: Hx, CS, Ultrasound |                                                                              |                                          |**
| Tx: Chem. cauterization or Sx removal |                                                                              |                                          |**

**Navel ill**

Omphalitis/Umbilical infec.

IM 987, 422; C3T 101; 221; BR-hb 48; BR 140; Br 213; S-J 1110; DC 365

**

- See Musculoskeletal pg 172
- Inflam. of umbilical structures
  - Umbilical arteries connects internal iliac aa. to placenta (pass on either side of urinary bladder (become round lig. of bladder)
  - Umbilical vein (single) connects placenta to liver (becomes round lig. of bladder in free edge of faliform lamnent)
  - Urachus: connects the apex of urinary bladder to the allantoic cavity
  - Abscesses of any of above structures
    - Local infection, or
    - Source of septicemia
  - Cause: external envir. infec. (Corynebacterium pyogenes, E. coli, Proteus, Enterococcus spp.)
  - FPT (failure of passive transfer) potentiates

- Hot enlarged navel (m/ look normal)
- Purulent drainage
- Severely ill (sepsis) m/b
  - Fever
  - Joint infection
  - Pneumonia
  - Diarrhea
  - Meningitis
  - Uveitis

- CS - purulent navel
- Palpation to see depth of infec.
- Ultrasound - visualize size of structures (persistent dilation)
- Check for FPT (failure of passive transfer)

**Prevention:**

- Minimum handling of neonate
- Allow umbilical cord to rupture w/o ligation suggested
- Early ABs & supportive care
- Surgery: remove structures involved

**Prognosis**

Better if adequate colostrum

Inflam. Umbilical arteries, vein or urachus

CS: Hot, draining navel, Septicemia • Dx: Hx, CS, US

Tx: ABs, Sx - Removal

**URINARY SYSTEM**

Abscesses

- From navel to bladder

ABs
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<td>113</td>
</tr>
</tbody>
</table>
Anestrus

Anestrus
IM 247, 1373; Mk 1127; BR 456; R-M 247

- Anestrus: lack of estrus
- Pregnancy #1 cause of anestrus - rule it out 1st. Seasonal anestrus in horses, not in cattle, which are not considered to be seasonal breeders
- Causes: pregnancy, mummified fetus, pyometra
- Dx:
  - Reproductive & general history (Hx)
  - Thorough breeding soundness exam (BSE)
  - Evaluate estrus detection program
  - Rule out (R/O) pregnancy 1st
  - Animal side milk or serum progesterone test kits

Repeat breeders
IM 249; C3T 101, 821; BR 140; Br 449

- Bred during 3 or more successive periods w/o becoming pregnant
- Management goal: < 10-15% repeat breeding in herd
- Pathogenesis
  - FF (failure of fertilization)
  - EED (early embryonic death)
- DDx FF from EED
  - Interestrus interval
  - FF not affected
  - EED prolongs interval (intermediate length to multiples of normal cycle lengths)...
  - After maternal recognition of preg. at 15-17 d
  - FF &/or EED
  - Heat stress incr. EED & by affecting spermatogenesis, also incr. FF

Diagnosis:
- Evaluate heat detection
  - Milk progesterone level to see if cow is in heat
- Evaluate breeding technique
- Herd problem (multiple cows)
  - Bull or AI evaluation
  - Physical condition, Semen quality, libido & ability to mount
  - Trichomoniasis & campylobacteriosis
  - AI (artificial insemination) technique
  - Genetic (sperm quality): evaluate thawing, transportation, timing & deposition techniques
- Individual problems - Cow
  - Body condition - poor nutrition
  - Reproductive exam
    - Urine pooling - FF (spermicidal)
    - Cervical canal occlusion - FF
    - Postpartum metritis - pus & debris - FF
    - Endometritis & little pus - EED, not FF
- Uterine culture
- Cytological smear
- Endometrial biopsy
  - Embryo flushing to DDx FF from EED
  - Collecting unfertilized egg - FF
  - Collecting degenerating embryo - EED
  - Failure to collect either indicates oviduct blockage
- Ultrasound detection of pregnancy
  - Loss of embryo after detection w/ ultrasound confirms EED

Causes (IM 244, 1367)
- Pregnancy (p 106)
- Poor heat detection (p 105)
- Luteal cysts (p 108)
- Nursing beef cow
- Nutritional infertility/Weight loss (p 266)
- Heat stress
- Freemartinism (p 107)
- EED (early embryonic death)
- Pyometra (p 113)
- Less common causes:
  - Macerated or mummified fetus (p 107)
  - Hydrometra or mucometra
- Uncommon causes:
  - Ovarian tumor
  - Segmental aplasia (p 113)

Common causes:
- Poor heat detection (p 105)
- Poor AI timing/technique
- Malnutrition (p 266)
- Follicular cysts (p 108)
- Endometritis (p 111)
- Campylobacteriosis (p 119)
- Leptospirosis (p 121)
- Trichomoniasis (p 120)
- Inadequate involution of uterus
- EED (early embryo death) (p 104)

See DDx chapter for less common & uncommon causes
<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>AI/Breeding Unobserved estrus, Silent estrus</td>
<td><strong>False Hx of anestrus</strong> (failure to cycle) - 90% cycle normally - Only 10% truly anestrus - Only 60% detected on 2/d checks</td>
<td><strong>CS of estrus</strong> - #1 &quot;Standing heat&quot; (willingness to stand while being mounted) - Riding other cows, more common at night than day (betw. 5 PM - 6 AM &gt; 6 AM) - 6 PM decr. in hot or cold weather &amp; during milking &amp; feeding, Number of mounts/hr 2-8 - Homosexual behavior - Restlessness, belowing - Reduced milk production - Relaxation &amp; congestion of vulva - Clear, stringy mucous from vulva - Rilling of tail head, hair loss from being ridden</td>
<td><strong>Eliminate other causes of anestrus</strong> (pregnancy, pyometra, mummification)</td>
<td><strong>Twice daily observation by experienced person still best</strong> - Teaser bull (pg 107)</td>
</tr>
<tr>
<td>Mk 1129; BM&amp;S 848; IM 1527; C2T 781; C3T 776; Br 442; DC 343; R-M 153; S-UG 4; T 158</td>
<td><strong>Reasonable excuses for missing estrus</strong> - Silent estrus - Short duration of estrus in middle of night - Extreme environmental heat (don't show estrus)</td>
<td><strong>Establish if cycling or pregnant</strong> - Progesterone in milk indicates cycling or pregnant. Hi progesterone in luteal phase, suspect bad detection of estrus - Rectal - CL ≥ 1&quot; (2 cm) indicates pregnant or cycling</td>
<td><strong>Heat detectors</strong> - still require observation - Glued to tail head, change color when crushed when mounted</td>
<td><strong>Accurate records</strong></td>
</tr>
<tr>
<td><strong>Estrous cycle</strong> 21 days (18-24 days) - Estrus, receptivity of 18 hours - Ovulation 10-14 hours after estrus - 24-48 hours post estrus endometrial hemorrhage (90% of heifers &amp; 50% of cows, no relationship to conception) - Diestrus 15 days (6-25 days) - Lifespan of sperm 24 hours - Lifespan of ova 6 hours</td>
<td><strong>CS of poor heat detection</strong> - Prolonged intervals from calving to 1st breeding &gt; 70-80 days - Prolonged interval betw. services - Insenmination intervals of &lt; 18 or &gt; 25 days - Record of progressive ovarian changes, but no record of observed estrus - &gt; 15% cows open at pregnancy check - Anestrus after service (m/ not be pregnant)</td>
<td><strong>Palpated CL</strong> - <strong>Lutease® (PGF2α)</strong> brings into heat by lutealizing CL 1 shot: Estrus in 3 day (2-5 d) after injection - CL must be &gt; 7 d old - No effect on fertility + observation in 2-5 d for standing heat - Or insemination at 80 hrs (if no standing heat by then) will get 80% 2 shots 11-12 days apart, better than 1 because will bring all into heat - Insenimate cattle 80 hrs after last injection or if standing heat - Can be used to synchronize large number of animals at same time</td>
<td><strong>Palpated CL</strong> - Watch for estrus over next 2 wks or</td>
<td><strong>Palpated CL</strong></td>
</tr>
<tr>
<td>Management - Miss estrus, 12-16 hr estrus CS: Long calving intervals, &gt; 15% Open, Cycling Dx: Hx, CS, Exam, Records Tx: 2/d observation, Palpate ovaries, Heat detectors</td>
<td><strong>Rectal palpation</strong> - Locate cervix, hook dors. intercornual lig. &amp; flip tract into pelvic cavity - Palpation of ovaries &amp; uterus Day 1: F (1'), CL absent or small, UT pits on pressure Day 2: ovulation depression Day 3: nothing, UT m/b endometrial bleeding Day 4 &amp; 5: CH soft 0.5-1&quot;; UR Day 6-17: CL 1&quot;; F 1&quot;; UR Day 18-21: CL small; F; UT F = Follicle CL = Corpus luteum CH = Corpus hemorrhagicum UT = Uterine tone UR = Relaxed uterus</td>
<td><strong>Insenmination</strong> betw. middle of estrus to 6 hours after estrus - If observed in estrus in morning - inseminate in afternoon of same day - If observed in afternoon, inseminate following morning</td>
<td><strong>Lutease</strong></td>
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<tr>
<td><strong>Rectal palpation</strong></td>
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</tbody>
</table>

**Condition**

- False Hx of anestrus (failure to cycle)
- 90% cycle normally
- Only 10% truly anestrus
- Only 60% detected on 2/d checks
- Reasonable excuses for missing estrus
- Silent estrus
- Short duration of estrus in middle of night
- Extreme environmental heat (don’t show estrus)

**Presentation/CS**

- #1 "Standing heat" (willingness to stand while being mounted)
- Riding other cows, more common at night than day (between 5 PM - 6 AM > 6 AM)
- 6 PM decrease in hot or cold weather & during milking & feeding, Number of mounts/hr 2-8
- Homosexual behavior
- Restlessness, belowing
- Reduced milk production
- Relaxation & congestion of vulva
- Clear, stringy mucous from vulva
- Rilling of tail head, hair loss from being ridden

**Diagnosis**

- Eliminate other causes of anestrus (pregnancy, pyometra, mummification)
- Establish if cycling or pregnant
  - Progesterone in milk indicates cycling or pregnant. High progesterone in luteal phase, suspect bad detection of estrus
  - Rectal - CL ≥ 1" (2 cm) indicates pregnant or cycling

**Treatment**

- Twice daily observation by experienced person still best
- Teaser bull (pg 107)
- Heat detectors - still require observation
  - Glued to tail head, change color when crushed when mounted
- Accurate records

**Palpated CL**

- Watch for estrus over next 2 wks or
- Lutease® (PGF2α) brings into heat by lutealizing CL
  1 shot: Estrus in 3 days (2-5 d) after injection
  - CL must be > 7 d old
  - No effect on fertility
  + observation in 2-5 d for standing heat
  - Or insemination at 80 hrs (if no standing heat by then) will get 80%
  2 shots 11-12 days apart, better than 1 because will bring all into heat
  - Insenimate cattle 80 hrs after last injection or if standing heat
  - Can be used to synchronize large number of animals at same time

**Insenmination** betw. middle of estrus to 6 hours after estrus
- If observed in estrus in morning - inseminate in afternoon of same day
- If observed in afternoon, inseminate following morning
Pregnancy Diagnosis

**Reproduction**

**Natural breeding & AI**

**AI (Artificial insemination)**

**Cow categories**

- **Pregnant cows**
- **Postpartum anestrus cows** (calved within 45 days, time for involution & return to estrus)
- "Open" cows to be rebred
- **35-50 d** to be rebred for a 12 mo calving interval
- **285 days gestation**
- **45 d postpartum period** (before back in estrus)
- Excessive "days open" - 90% due to failure of heat detection
- **Timing of AI**
  - **AM-PM rule**: insemination between middle of estrus to 6 hrs after estrus
  - If observed estrus in morning - inseminate in afternoon of same day
- **Factors affecting AI fertilization rates**
  - Maintain semen at -130°C or lower at all times (prevents recrystallization)
  - Inseninator expertise: place semen in uterus (junction of cervix & uterine body) quickly w/ minimal trauma to cervix & endometrium
  - AI fertilization rates of 90-100%, similar to natural breeding possible w/ proper technique
  - Average 60-90 day nonreturn rates - 70%

**Pregnancy diagnosis**

- Early & accurate Dx important economically
  - 25% that are bred & don't return to estrus are not pregnant
  - Predict parturition date
  - Separate pregnant from nonpregnant
  - Beef herd Dx & cull nonpregnant before winter feeding period
- Presentation:
  - Enlarged abdomen
  - Udder enlargement about 4th month of pregnancy
  - SQ edema of udder, teat & abd. wall in last 1-3 wks of gestation
  - Mucous from vulva last 2 months of pregnancy

**Dairy cows (AI)**

- Rectal palpation at least 35 days after AI
  - CL always present in pregnancy (also in mid estrous cycle) on side of gravid horn
  - in size of horn, accumulation of fetal fluid - 28 days
  - 4 positive signs of pregnancy
    1. "Membrane slip", choioallantoic membrane - 30-35 days
    2. Amnionic vesicle - 30-35 to 70 days; 3. Placentomes 65-70 days
    4. Fetus 65-70 days (not felt at 35 days)
- Milk progesterone assay - Collect 21-24 ds after breeding
  - Low level indicates nonpregnant (95% accurate)
  - Hi level possible pregnancy (75% accurate); inaccuracies usually due to EED or cystic ovaries
  - More useful in determining nonpregnancy than pregnancy

**Beef cattle** are palpated later; those not pregnant are culled

- CL always present in pregnancy
- Placentomes: 65-70 days
- Fetus 65-70 days earliest, but maybe out of reach
- Uterine artery to gravid horn enlargement - 90 days (fremitus/pulsation)

- Calving interval economic goal
  - Beef cows: 12 month calving interval
    - Beef cow must calf every 12 mo in a defined calving season or are culled
  - Dairy cattle: 12-13 month calving interval
    - Managed to maintain high level of milk production
    - Cows that don't conceive or conceive too late are culled

- **Natural breeding**
  - Most beef cattle are bred naturally (95%)

- **AI (Artificial Insemination)**
  - **Dairy cows** - most are bred by AI (75%)
  - **Some purebred beef Al'd once & then put out w/ a "clean up" bull (to get those not pregnant)

**Presentation**

- **Early & accurate Dx important economically**
  - 25% that are bred & don't return to estrus are not pregnant
  - Predict parturition date
  - Separate pregnant from nonpregnant
  - Beef herd Dx & cull nonpregnant before winter feeding period

- **Natural breeding & AI**

- **AI (Artificial insemination)**

- **Cow categories**

- **Factors affecting AI fertilization rates**

- **Timing of AI**

- **Postpartum anestrus cows** (calved w/in last 45 ds, time for involution & return to estrus)
  - "Open" cows to be rebred
  - **35-50 d** to be rebred for a 12 mo calving interval
  - **285 days gestation**
  - **45 d postpartum period** (before back in estrus)
  - Excessive "days open" - 90% due to failure of heat detection

- **Calving interval economic goal**

- **Natural breeding**

- **AI (Artificial Insemination)**

- **Cow categories**
### Anestrus, Prolonged Luteal Function

- **Presentation:** anestrus
- **Persistent elev. progesterone:** > 1 ng/ml in all
- **Causes:** pregnancy, mummified fetus, pyometra, luteal cyst

#### Pregnancy
- **Dx:** Fetal membrane slip, Amniotic vesicle, Placentomes, Palpable fetus
- **Tx:** Let calf, seldom unwanted pregnancy
  - Unwanted pregnancy: PGF$_{2a}$ betw. 7-150 ds, PGF$_{2a}$ + dexamethasone (20 mg) beyond 150 ds

#### Fetal mummification/maceration
- **Dx:** Palpation of dried, leather-like fetus, No fetal membrane slip, No placentomes, Full term & no abdominal swelling
- **Tx:** PGF$_{2a}$ injection, fetus usually expelled in 3 days; Manual removal if not expelled in 4 days

#### Pyometra
- **Dx:** No positive signs of pregnancy, Uterine enlargement, Vaginal discharge m/b

### Freemartinism, Twinning

- **Female born co-twin to a male, causing it to have a defective genital tract**
  - Anastamoses of pacental circulation to the twin fetuses
  - Male differentiates 1st & transfers X-Y antigens which inhibits development of ovaries
  - 80% of female twins are freemartins
  - Single freemartin if male lost after 30 days of gestation

- **Rectal** (breeding age animals)
  - Hypoplasia of tubular genital organs
  - Hypoplastic ovaries

- **Small animals** (rare)
  - Small glass speculum
  - Sh o, rt vagina (extends past urethral opening)

- **Karyotype** suspect female - male cells found

### Teaser Bulls

- **Used to identify cows in estrus, esp. w/ AI program in beef cattle**
- **Prevent ejaculation** (Vasectomy, Epididymotomy, Urethotomy)
  - Both vasectomy & epididymotomy allow intromission & possible spread of diz
  - Check sperm content before utilizing

- **Prevent insertion** (Suture penis to abd. muscles, Penile deviation)
  - Prevents spread of venereal diz

- **Problem:** bulls lose interest & need to be replaced in time

### Vasectomy
- **Remove 1" of vas deferens**
  - Ejaculate at least 3 times before using as teaser (examine for sperm)

### Epididymotomy
- **Quick**
  - Stab tail of epididymis & w/ pressure prolapse tail
  - Cut off tail w/ scissors
  - Check semen in 3 months to see if reunion has occurred

### Penile deviation
- **Want a bull that has bred cows, usually older, success rate better**
- **Circular incision (3" diameter) around preputial orifice**
  - Circular skin incision (3") in flank region (just caud. & lat. to prepuce)
  - Make SQ tunnel from flank to base of scrotum
  - Drag prepuce through tunnel
  - Suture prepuce to surrounding circular incision edges
  - 6 weeks of rest afterwards
  - Can combine w/ removal of tail of epididymis or vasectomy

### Treatment

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freemartinism, Twinning</td>
<td>Female born co-twin to a male, causing it to have a defective genital tract</td>
<td>Anestrus female</td>
<td>Hypoplasia of tubular genital organs</td>
<td>No Tx</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>Hypoplastic ovaries</td>
<td>Cull</td>
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<td>Small animals (rare)</td>
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<td></td>
<td>- Small glass speculum</td>
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<td>- Short vagina (rarely extends past urethral</td>
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<td></td>
<td>opening)</td>
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<td>Karyotype suspect female - male cells found</td>
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</tbody>
</table>
### Ovary

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
<th>DDx</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ovarian hypoplasia</td>
<td>Autosomal recessive trait</td>
<td>Anestrus</td>
<td>Rectal palpation</td>
<td>None</td>
<td>Nonfunctional ovaries &amp; anestrus from</td>
</tr>
<tr>
<td></td>
<td>Partial or complete; unilateral or bilateral</td>
<td>Sterile</td>
<td>- Ovaries: cord-like thickening to bean-sized</td>
<td>Cull</td>
<td>- Malnutrition</td>
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<td></td>
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<td>Subfertile</td>
<td>- Uterus: cord-like to near normal size</td>
<td></td>
<td>- &quot;Debilitating diz&quot;</td>
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<tr>
<td>Oophoritis</td>
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<td></td>
<td>Inflammation of ovary</td>
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<tr>
<td></td>
<td>Cause: Traumatic manipulation, enucleation of corpora lutea, attempts to drain ovarian cysts &amp; ascending infection from uterus; Ovarian abscess (colic)</td>
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</tr>
<tr>
<td>Cystic ovarian diz, COD, Nymphomania, Buller cow</td>
<td>Due to failure of ovulation</td>
<td>Anestrus (70-80%)</td>
<td>History, CS</td>
<td></td>
<td>Induce luteinization of cyst &amp; establish normal estrus</td>
</tr>
<tr>
<td></td>
<td>&gt; 2.5 cm (&gt; 1&quot;) structure on ovary</td>
<td>Nymphomania (intense estrus) 20-30%</td>
<td>- Rectal</td>
<td></td>
<td>- hCG (human chorionic gonadotropin hormone)</td>
</tr>
<tr>
<td></td>
<td>Persist ≥ 10 days in absence of CL</td>
<td></td>
<td>- Cyst-like structure (blister)</td>
<td></td>
<td>- Normal cycle in 3-4 weeks</td>
</tr>
<tr>
<td></td>
<td>Follicular cysts - thin walls, simple, multiple or multilocular on one or both ovaries</td>
<td></td>
<td>- Flaccid uterus</td>
<td></td>
<td>- GnRH (gonadotropin-releasing hormone) estrus in 18-23 days</td>
</tr>
<tr>
<td></td>
<td>Luteal cysts - single unilat. structure w/ thick walls</td>
<td></td>
<td>- Lab</td>
<td></td>
<td>- PgF2a + GnRH</td>
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<tr>
<td></td>
<td>More common in high producers</td>
<td></td>
<td>- Low plasma progesterone conc.</td>
<td></td>
<td>- Reduce time of next estrus from 18-23 ds to 12</td>
</tr>
<tr>
<td></td>
<td>Jerseys &amp; Guernseys predisposition</td>
<td></td>
<td>- Milk progesterone high = luteal cyst</td>
<td></td>
<td>- Give PgF 9 days after GnRH</td>
</tr>
<tr>
<td></td>
<td>Rare in beef cattle</td>
<td></td>
<td></td>
<td></td>
<td>- Manual rupture is archaic Tx (hemorrhage &amp; adhesions sequela)</td>
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<td>Cause: unknown</td>
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<td>Low gonadotropin or ovarian dysfunction</td>
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<td></td>
<td>Retained placenta</td>
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<tr>
<td></td>
<td>Metritis &amp; hypocalcemia assoc.</td>
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<tr>
<td></td>
<td>Inherited</td>
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<tr>
<td>Follicular or Luteal cysts</td>
<td>CS: Anestrus or Nymphomania, &quot;Buller&quot; cows</td>
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<td>Dx: Hx, CS, Rectal cysts</td>
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<td>Tx: Luteinize (hCG, GnRh, PgF2a)</td>
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</tbody>
</table>

**Follicular or Luteal cysts**

**CS:** Anestrus or Nymphomania, "Buller" cows

**Dx:** Hx, CS, Rectal cysts

**Tx:** Luteinize (hCG, GnRh, PgF2a)

### Prevention:

- GnRH 12-14 days after calving reduces prevalence of COD
- Breed to daughters of low COD cows
- Cull daughters of hi COD cows
**Ovariectomy, "Spaying"**
Mk 674; S-UG 99; VC/T 385

- Indicated
  - Pathological ovaries
  - Beef up young
  - Prolonged, uninterrupted milk production (if done at height of cow's milk production [6-8 weeks postpartum])
  - Stop fertilization (don't have to worry about dystocia, etc.)

**Feedlot mass "spaying"** (can do many in a short time)
- Done in chute
- Lt. flank, knife to cut through skin & ext. abd. oblique muscle
- Twist hand through int. abd. oblique & peritoneum
- Grab both ovaries & snip off w/ scissors
- Ligation of ovarian stumps unnecessary
- Close abdomen w/ several interrupted "through & through" sutures

**Midline in tiny calves**
- Similar to cat
- Bringing ovaries to incision site (just cranial to udder)

**Older cows w/ larger vagina**
- Epidural anesthesia
- Incision through vagina & peritoneum dors. to cervix
- Incision dilated w/ fingers until hand in abd.
- Pull ovary into vagina
- Remove w/ ecraseur
- Careful not to involve small intestines
- Vaginal incision is not sutured

**Ovarobursal diz, Ovarian hemorrhage**
C3T 782; IM 1532

- Adhesions between ovary & fimbriae (mild to severe), uncommon in heifers, but w/ age, hemorrhage of ovulation. Acquired infection (mycoplasma) or trauma (manual enucleation of corpora lutea [archaic practice assoc. w/ Tx of anestrus or pyometra; prostaglandin Tx has replaced this practice])
- CS: Infertility - prevent entrance of ova into uterine tube, Rt > Lt ovary
- Dx: Difficult: rectal m/ find some; US, Exploratory in valuable cows
- Tx: If unilat. palpate & breed when ovulation on unaff acted side; Surgical removal of unilat. affected ovary

**Salpingitis**
C3T 782 C2T 789; IM 1532;
BR 908; Br 453, DC 340;
VC/T 319; Pic 166

- Uterine tube inflammation
  - Enlargement of uterine tubes
  - Bilateral or unilaterial
- Causes:
  - Following uterine infections
    - Necrotizing & granulomatous salpingitis
    - Actinomycosis (Corynebacterium) pyogenes,
      Mycobacterium tuberculosis, Brucella abortus
    - Mild infection, Campylobacter fetus sp venearealis, Trichomonas foetus
- Sequelae to ovarian manipulation
- Sequelae to aggressive irrigation of uterus
- Inappropriate estrogen hormones

**Infertility**
- History (Hx), Clinical signs
  - Rectal
    - Mild, m/b missed
    - Insert fingers into ovarian bursa & roll tube betw. fingers & thumb
  - Exploratory laparotomy, or peritoneoscopy
  - Embryo recovery indicates 1 or both tubes patent

**DDx:**
- Ovarian neoplasia
- Parovarian cysts
- Cystic ovary (p 108)

**Pyosalpinx:** segmental accumulation of pus in uterine tubes
- Usually unsuccessful
- Sexual rest in valuable animals
- Uterine lavage (like when harvesting embryo) m/b therapeutic

**Prevention:**
- Prevent ovarian trauma (rupture of cysts or corpora lutea)
- Avoid excessive irrigation of uterus by infusion (100 ml in heifers or 150 ml in cows are excessive volumes)
- Avoid estrogen administration
- Prevent uterine infections

**Hydrosalpinx:** accumulation of serous to mucoid fluid in uterine tube; sequela to chronic salpingitis

**Uterine tube inflammation**
CS: Infertility • Dx: Rectal
Tx: Unsuccessful • Px: Poor

**CS: Infertility - preve成 entrance of ova into uterine tube , Rt> It ovary**

**Dx: Difficult: rectal m/ find some; US, Exploratory in valuable cows**

**Tx: If unilat. palpate & breed when ovulation on unaffected side; Surgical removal of unilat. affected ovary**

**History (Hx), Clinical signs**
- Rectal
  - Mild, m/b missed
  - Insert fingers into ovarian bursa & roll tube betw. fingers & thumb
- Exploratory laparotomy, or peritoneoscopy
- Embryo recovery indicates 1 or both tubes patent

**DDx:**
- Ovarian neoplasia
- Parovarian cysts
- Cystic ovary (p 108)

**Pyosalpinx:** segmental accumulation of pus in uterine tubes

**Hydrosalpinx:** accumulation of serous to mucoid fluid in uterine tube; sequela to chronic salpingitis
**Retained placenta (RP), Retained fetal membranes**

- Cotyledonary placenta
- Retained fetal membranes
  - Normally expelled in 3-8 hrs
  - Retained if >12 hrs
- Dairy >> beef
- 10% retained placenta expected

**Predisposing factors**
- Male calves (larger)
- Twins
- Dystocia
- Short or long gestations
- Uterine torsion
- Dexamethasone induction of labor
- Cause:
  - Fatal cotyledons fail to separate from maternal caruncles
  - Early calving (short gestation retards separation)

**Minimum effect on fertility**
- (in absence of 2° repro. abnormalities)
- Less of an emergency than in mare

**Presentation/CS**
- RP usually obvious
- Majority: no serious CS
  - Transient ↓ in appetite & milk production
  - Malodorous discharge & unsightly tissue hanging out
  - 4-10 days usually dispelled (w/ caruncle necrosis)

**Diagnosis**
- RP hanging out vulva (partial retention m/ occur w/o anything hanging out)

**Treatment**
- Spontaneous in 4-10 days
- No Tx is best Tx
- Control intrauterine bacteria
  - Manual removal, only if gentle traction w/ rotation works
  - Contraindicated if CS of septicemia (sequela: septic metritis & peritonitis)
  - Many owners insist on removal
- IV calcium solution - if 2° to hypocalcemia
- Intrauterine oxytetracycline m/ reduce metritis, but pyometra m/ occur anyway, m/ reduce fertility
  - Doesn't expel placenta (necrosis does that)
- Intrauterine ABs if septic metritis
- Oxytocin of questionable value (doesn't reduce RP in normal calving or dystocia)
- Prostaglandins of little value

**Prognosis**
- RP > 12 hrs more likely to develop metritis
- RP w/o metritis - minimal effect on fertility

**Prevention**
- Difficult (sporadic & uncertain of cause)
  - Vaccine against infec. causes abortion (associated w/ RP)
  - Adequate dry period 6-8 weeks
  - Balanced ration (Ca+, K+, Vit. A & E & Se)
  - Injection of Selenium & Vit. E one month prior to calving in selenium defc areas
Uterine infection
Endometritis, Metritis, Pyometra

- **Endometritis** (endometrial inflam.)
- **Metritis** (inflam. of ALL layers of uterus)
- **Pyometra** (accumulation of pus in uterus)

**Causes:**
- Abnormal parturition
- Gross contamination

**Organism:**
- *Actinomyces pyogenes*
  - Gram neg. anaerobic bacteria
- Coliforms, *P. aeruginosa*, hemolytic Strep., gram pos. & gram neg. anaerobic bact.
- Synergism btw. A. pyogenes, Fusobacterium necrophorum & Bacteroides spp to incr. severity
- Clostridium occasionally - severe gangrenous metritis
- Penicillinase bact. have little effect on fertility, but stop effectiveness of pen. when treating other bacteria

**Predisposing factors:**
- **Retained membranes**
  - Abortion, concurrent systemic diz, malnutrition, fat cow syndrome (over fed during dry period), imbalance of Ca & P in feed, contaminated envir. during calving, dystocia & manipulation
- **Beef < dairy** bec. cal in uncontaminated pasture
- **Involution of uterus:**
  - Normally occurs by 10-15 days (before that can't be safely retracted)
  - Fluid abnorm. after 14-18 days
  - Involution & repair by 40-50 days

**Repeat breeder**
- Endometritis normal
  - 2-4 weeks after calving
  - Slight opacity to estrual mucosa
  - Slightly enlarged uterus
  - Abnormal if feild or cow develops other CS

**Metritis**
- Discharge from genital tract
  - Septic metritis
  - Fever, depression
  - Anorexia
  - Laminitis
  - Decr. milk yield
  - Unwilling or unable to rise

**Pyometra**
- Few clinical signs, not ill
  - Anestrus main complaint (persistent CL)
  - M/b vaginal discharge

**Complication of metritis**
- Peritonitis (perimetritis)
- Laminitis

**History, CS** (clinical signs)
- Vaginal speculum

**Rectal palpation**
- Palpate fluid (lochia or pus in uterus)
- Fluid abnormal in uterus after 14-18 days
- Friable & swollen uterus (be careful)
- CL if pyometra

**Microbiology**
- Bacterial cultures - don't support or deny Dx of endometritis (contamination problem)
- Used for sensitivity & tentative Dx

**Lab**
- Severe degen. It. shift, toxic immu-ture WBCs & marked incr. PMNs
  - Associated w/ toxemia & sepsis

**Systemic prostaglandins** shorten estrous cycle, no milk withdrawal time

**Systemic ABs** minimum of 3 days
- Trimethoprim-sulfadinoxine, tetracyclines, ampicillin (esp. if concurrent urinary tract infec.) & penicillin

**Oxytacin** (evacuate uterus before local infusion) usually effective w/in 48 hours of parturition, if not, sphon

**Uterine infusion** (large volumes [200-500 ml] before involution)
- Oxytetracycline in povidone
- Every 2nd day + penicillin systemically if fever
- Observe withdrawal times in dairy cows
- 1st pathog. A. pyogenes & gram neg. anaerobes

**If not systemically ill, spontaneous recovery common**

**Chronic**
- Antibiotic infusion
- Disinfectants (Lugol's sol) cause necrosis of endometrium & regeneration m/ improve potential

**Pyometra - destroy CL**
- PgF2a (TOC) (3-9 days evacuation of uterus in most cows)
- Sexually rest 30 days (allows endometrium to heal)

**Prognosis:**
- Endometritis - Good if doesn't progress
- Pyometra - Good, esp. if Dx & Tx early

**Prevention:**
- Good nutrition
- Sanitation at calving & early postpartum period

---

RP, Metritis worse than endometritis

**CS:** Metritis: Genital discharge, Sepsis • Pyo.: Anestrus

**Dx:** Hx, CS, Rectal

**Tx:** Metritis: ABs, Infusion, Oxytocin • Pyo: PgF & Rest

---

**Lochia** (normal vaginal discharge during 1st or 2nd wk postpartum) m/ look bad, but normal unless has a foul odor.
R. Youngquist knows some funny words!

**Cause:**
- Barriers to infection of endometrial cavity (uterus)
  - Vulva, vestibular sphincter & cervix
  - Parturition breaches all borders, also service & AI, exam, or defer in a barrier
  - Bacteria that enter usually transient & eliminated during puerperium (period of confinement after labor)

**Prognosis:**
- Endometritis - Good if doesn't progress
- Pyometra - Good, esp. if Dx & Tx early

**Prevention:**
- Good nutrition
- Sanitation at calving & early postpartum period
**Uterus**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Uterine prolapse</strong></td>
<td>• Most common in dairy cow &amp; sow</td>
</tr>
<tr>
<td>Mk 710; VC/T 317; IM 14; BR 334; DC 324; S-O 884; S-UG 90; S-T 285</td>
<td>• Invagination of uterus &amp; protrusion from the vulva</td>
</tr>
<tr>
<td></td>
<td>• Uterus eversion: invagination of uterus horn, not protruding from vulva</td>
</tr>
<tr>
<td></td>
<td>• Just after calving usu. w/in a few hrs</td>
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<tr>
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<td>• M/b up to 5 ds after calving</td>
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<tr>
<td></td>
<td>• Associated w/ hypocalcemia (results in lack of uterine tone &amp; delayed involution)</td>
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<tr>
<td></td>
<td>• Dystocia</td>
</tr>
<tr>
<td></td>
<td>• Vaginal prolapse before calving</td>
</tr>
<tr>
<td></td>
<td>• Inversion of uterine horn, not seen from outside</td>
</tr>
</tbody>
</table>

**Presentation/CS**

- Protrusion of uterus from vulva
  - Fresh initially
  - In few hrs tissue edematous & enlarged
  - Contaminated tissue (m/b lacerated & traumatized)
- Straining, abd. pain, restlessness
- Anorexia, pulse & RR
- Parturient paresis common in dairy
- CS transient usually
- Sequelae
- Shock
- Hemorrhage (wt. pulls uterus away from blood supply)
- Thromboembolism

**Diagnosis**

- CS obvious
- Hypocalcemia
- PCV

**Prognosis:**

- Favorable - generally if no serious damage
- No tendency to recur at subsequent parturitions

**Prevention & control**

- Balanced ration (hypocalcemia)

**Treatment**

- Tell owner to protect uterus until you reach farm
- Restrain animal (prevent trauma or escape)
- Clean & protect uterus
- Tx hypocalcemia before replacing
- Epidural anesthesia m/b
- Replace uterus, mild pre-surgical scrub of uterus.
  - Remove placent if easy, if not leave, standing or on sternum w/legs pulled out behind to tilt pelvis
  - Easy if fresh, alternately massage dorsal & ventr. aspect to move cervical end in, then invert prolapsed horns
  - If enlarged & edematous, vigorously & carefully massage emollient ointments (or sugar) into edematous tissue
  - Crenubertos (reported to relax uterus)
  - Check for complete inversion: insert hand or wine bottle to tip of horns or fill w/ water then siphon off

- Oxytocin (stim. contraction) after uterus replaced
- Antibiotics
- Caslick's (temporary closure of vulva w/ heavy sutures m/ or m/not be necessary to keep uterus in)
- Amputation if severely traumatized or if impossible to replace, 1st check that bladder or sm. intestine not inside

**Uterine torsion**

- Unrecognized & untreated commonly
- Torsion of gravid uterus can result in death

C3T 735; DC 322

**Unrecognized & Untreated**

- CS: Straining at parturition, Sudden death
- Dx: Hx, CS, Rectal palpation
- Tx: Try to untwist: "plank & roll", C-section

**Unproductive straining at parturition**

- Cow calving that never gets into 2nd stage labor
- Sudden death
- Sequelae

**Unrecognized**

- Rectal palpation
- Broad ligament crisscrossing abdomen (Dx)
- Counterclockwise Usually (viewed from behind)
  - Usually 360°, Cervix included
- Speculum, cranial part of vagina goes into twist

**C-section**

- Placing in paralumbar fossa, someone stands on plank for weight
- Ropes on legs, roll cow over
- Hope baby moves around uterus
- Try to correct torsion prior to C-section
  - If can't, do C-section when torsed
  - Incision through broad lig. being very careful to keep hold of uterus
  - Then untwist uterus when calf is out

**Thromboembolism**

- Open side uterus torsed toward
- Once in abdomen
- Try to correct torsion prior to C-section
  - If can't, do C-section when torsed
  - Incision through broad lig. being very careful to keep hold of uterus
  - Then untwist uterus when calf is out
**Uterine tears** • If occur during parturition, need to be sutured, usually abdominal so must do abd. approach to repair tear

"Windsucker", Pneumovagina
IM 1548; S-O 559

- Occasional cause of infertility in cows (#1 cause of infertility in mares), Aspiration of air & contamination into vagina. Trauma to vestibule or vagina
- CS: Infertility
- Tx: Caslick's surgery + sexual rest, partially sew vulva closed

"Urine pooling" Urovagina
IM 1548; R-M 345; VC/T 311

- Urine accumulating in vagina
- Cause:
  - Obstetric trauma that alters configuration (cranial vagina falls below pelvic floor)
  - Delayed uterine involution
- Toxic to sperm
- Continuous or only occurring during estrus
- Cervicitis
- Endometritis
- FF (failure of fertilization)
- History (FF), CS
- Palpation/visualization
- Some spontaneously correct during involution
- Surgical correction

OB trauma, Urine toxic to sperm
CS: Infertility (FF)
Tx: Time or Sx

Tumors of uterus, cervix, vagina (IM 1544; DC 321, 339) • Rare; Uterine, cervical or vaginal tumors; Leiomyomas (benign), Lymphosarcoma m/ affect uterus (Px: Poor)

- Large tumors must be differentiated from normal fetus, placentomes & abscesses

Segmental aplasia, White heifer diz
IM 1544; R-M 1921, 476

- Sporadic occurrence in all breeds of cattle, failure of part of genital tract to develop; cranial parts usually develop (ovaries, uterine tubes & uterine horns), m/ only be imperforate hymen (endometrial secretions can't escape)
- CS: Anestrus (fluid accumulation interferes w/ PGF release & luteolysis of CL)
- Dx: Rectal palpation
- Tx: Slaughter; Tx only for imperforate hymen (Sx incision releases fluid accumulation)

Hermaphrodite (BR 1653; BR-hb 632; Br 152)

- Both true & pseudohermaphroditism
- Tx: None, sterile, salvage

Hydrops amnii & hydrops allantois, Fetal dropsy
BR 306; Br 475; DC 323; R-M 207; S-J 1113

- Edema of chorioallantois, extreme accum. of fluid; Cause unknown, ankylosis of calves
- CS: Enormous abd. last trimester (both flanks & ventrum), dyspnea, death • Sequela: rupture prepubic tendon
- Tx: Prostaglandin F2a (TOC) to induce parturition, Corticosteroids & oxytocin to hasten uterine contraction after parturition
- Px: Extremely guarded, recurrence uncommon, no prevention

Rupture of prepubic tendon, Prepubic desmorhesis (DC 326; Plc 45, 167)

- Cause hydrops allantois, excessive weight on abdomen

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C-Section in the Cow

### Procedure for all approaches
- Surgical prep., restraint, anesthesia
- Open through either flank or ventral abdomen
- Explore abdomen & judge condition of uterus
- Grasp limb & pull tip of uterine horn out of incision
- Cut over greater curvature (avoid cutting cotyledons)
- Deliver fetus using sterile OB chains (in hospital use overhead hoist)
  - OB chains on legs if cranial presentation
  - Pull head out if posterior presentation before OB chains on limb
- Enlarge incision if danger of tearing uterus
  - Remove live calf slowly as in normal birth, do not tear umbilicus until breathing, stable & pulsation of umbilical artery subsides
  - Break umbilicus a distance away from body so can mummify & protect from infection
- Avoid spilling contaminated fluids (normal fluids are OK)
- Assess placenta - if loose remove, if not, leave in
- Insert uterine medication
  - Connell or Cushing suture (inverting) closure of uterus (bury knots)
    - Start from prox. side bec. involuting uterus m/ pull quickly back into abd.; 2nd row m/ be required or contraindicated (inf.)
- Replace uterus in normal position
- Close abdomen
- Oxytocin for involution & milk let down
- Antibiotics if worried about contamination
- Treat calf’s navel w/ iodine

### Approaches

1. **Standing C-section**
   - Limited to easily restrained cows that can stand throughout procedure
   - Contraindicated for emphysematous fetuses (peritoneal contamination)
   - Advantage of C-section: Possibility of live fetus, easier on small heifer

2. **Dorsal Recumbency**
   - Right or left paramedian (disadvantage SQ abdenal veins) or Midline
     - Advantages - Ease of exteriorizing uterus, Better drainage of fetal fluids (important if emphysematous fetus), Fetotomy easy to perform, easier to suture uterine tears, easier to sell since incision not as visible
     - Disadvantages - Dehiscence of ventral incision more likely, Not as easy as left standing, rumen tympany & breathing compromised, requires more assistance, usually takes longer

3. **Lateral recumbency**
   - Oblique incision best, Incise just inside fold of flank
     - Advantage - Directly over uterus, Done in lateral recumbency, has all of other dorsal recumbency advantages

### Considered in dystocia:
- Non-relaxed cervix (despite massage), uterine laceration, torsion (nonresponsive to repositioning) or rupture, oversized fetus (small heifer, large fetus), dead fetus (fetotomy 1st choice), monster fetus (fetotomy 1st choice), Hydrops allantoi, irreducible malpresentations, severe placental hemorrhage near term, severely prolapsed vagina
- Contraindicated as not economical - mummified fetus

### Cesarean section or fetotomy is a judgement call
- Advantage of C-section: Possibility of live fetus, easier on small heifer
- Fetotomy requires experienced surgeon

### Sequelae of C-section
- Risk of contamination & peritonitis
  - Normal uterine fluid - no harm
  - Dead (emphysematous fetus) causes problems
- Adhesions principle determinant of success rate (breeding after C-section)
  - To prevent need atraumatic Sx, lavage & bury knots
Dystocia

**Difficult delivery**
- When either of 1st or 2nd stages of parturition are prolonged or not progressive
- Major cause of calf losses (34-50%)
  - Highest in heifers calving for 1st time
- #1 fetus too big for maternal pelvis
  - Inversely proportional to replacement heifers age & size

**Three Stages of Parturition**
- Stage 1: characterized by restlessness & occas. colic signs
  - Ends when cervix dilates & ‘eal parts enter birth canal
- Stage 2: Delivery of calf
  - Passage of unbroken amnionic sac through vulva
  - Abdominal press stimulated by fetus in birth canal
  - Survival of 8 hours after start of stage 2 is possible
- Stage 3: expulsion of fetal membranes

**Normal presentations**
- Cranial: both forefeet into canal w/ nose atop forelimbs
- Caudal presentation can be delivered w/o assistance, but likelihood of stillbirth increases
- All others considered abnormal

**Sequelaes:**
- Retained placenta: not passed w/in 8-12 hours of delivery
- Uterine rupture

**Abnormal postures/positions**
- Cranial presentation
  - Dorso-llial, dorso-pubic
  - Retained forelimb
  - Elbow lock
  - Foot-nape
  - Dog sitting
  - Head deviation
  - Poll in pelvis
- Caudal presentations
  - Hock or hip flexion
  - Transverse presentation
  - Back - pelvis
  - Feet - pelvis

**Dystocia/indications for intervention**
- 1st stage longer than 6 hrs
- Stage 2 for 2 hours & progress is slow or absent
- Amnionic sac hanging out of vulva for 2 hrs

**Diagnosis**
- **Hx, CS**
- **Examine birth canal**
  - Clean & disinfect perineum
  - Copious lubrication
  - Evaluate dilation of cervix & size of pelvis if feet not out of vulva (uncommon)
- **Fetus alive?**: withdrawal when nose, mouth or interdigital space pinched; blink when eyes touch, contracts anus when finger inserted, pulse in umbilicus or heart beat
- **Position**: dorso-sacral
- **Presentation**
  - Manipulate dist. limbs to differentiate cranial & caudal presentation
  - Both fetlock & carpus flex same way → forelimbs
  - Fetlock & tarsus flex opposite → hindlimbs
  - Finding head or tail also clues!
- **Posture**: how limbs & head are arranged

**Treatment**
- **Lubrication!**
  - Dilating birth canal m/b necessary, lubricate, insert & interlock hands, stretch canal
- **Mutation** (manually correct presentations, positions & postures)
  - Repulsion & reposition to cran. or caudal. presentation
- **Forced extraction** (standing or right lateral recumbency)
  - Cranial presentation
    - Loop of chain above fetlocks & half hitch below fetlocks, pull
    - “Walk” shoulders by alternate traction on limbs (no: C-section)
    - Stimulate breathing when head & forelimbs out (clean & tinkle nose w/ straw)
    - Rotate 45-90° when head & forelimbs out to prevent hip lock
    - If hip lock, stop, allow calf to breath...
    - Repel & re-rotate, pull calf towards dam’s side
    - Once hook locked, calf slides out
  - Caudal presentation (more complications)
    - Rotate 45-90° to pass hips, pull dorsally
    - Once hips pass, re-rotate & calf usually slides out...
    - Extract as quickly as possible to prevent asphyxiation
    - Fetal extractors: if maximum of 3 traction assistants not available.. Do not use a jeep or "come along" to a tree!
  - If can't mutate enough for traction
    - C-section - deliver live baby
    - Fetotomy - cut in pieces & deliver pieces, requires expertise...Better than C-section if dead, emphysematous & the dam toxic

**Difficult delivery, 3 stages, Cran./caud. presentation**
**CS**: 6 hrs - 1st stage, 2 hrs - 2nd stage
**Dx**: Alive? Presentation
**Tx**: Mutation, Extraction, Fetotomy, X-section

DDx: See page 291
### Vagina - Vulva

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
</table>
| Vaginal prolapse| • Most common in cow & ewe  
• Late pregnancy, before calving  
• Older COWS (usually multiparous) 5-10 yr  
• Hereford & Ayrshire predisposed  
• Hereditary  
• Caused by straining  
• Predisposing factors  
  - Relaxation of pelvic canal near parturition  
  - Incr. abd. pressure  
  - Intra-abd. fat  
  - Rumen distension  
  - Constipation  
  - Prolapse itself, causing more straining | • Prolapse of vagina  
• Continued straining  
• Sequelae:  
  - Occlusion of urethra - bladder rupture  
  - Uterine prolapse after parturition | • Prolapse of vagina | • Replace:  
  - Epidural  
  - Wash w/ soap, water & rinse  
  - Apply gentle pressure to reduce edema  
  • Topical antibiotics  
  • Retain vagina in position  
  - Suture vulva (small opening so can still urinate) or  
  - Anchor vagina in pelvic canal (see box)  
  • Remove retaining devices during stage 1 of parturition  
  • Once calved, replace retaining device until next breeding  

### Stabilize vagina

**Anchor vagina through sacropelvic ligament**

- Stay sutures, Johnson button, or plastic disc on tube w/ trocar  
- Take device into vagina  
- Locate point above palpable internal iliac artery  
- Push device through vaginal wall, sacrotuberous lig. & skin  
- Not likely to be far enough to get ischiatic nerve  
- When trocar tents skin, inject bleb of local anesthetic & nick  
- Tie sutures or connect outer button w/ pin  
- Cow can calf through this  
- After parturition, remove  
- Sometimes cows really strain & rip device out  

**Cervicopexy - cadillac method**

- 2 lateral branches of prepubic tendon to bumps on pelvis (ileopubic eminence)  
- Catheterize prior  
- Take bite of ventral os of cervix & through side of prepubic tendon done blindly, watch out for vessels!  
- Braunamid® suture, long length  
- M/b done postpartum on cows you want to keep  

**Straining before calving**

CS & Dx: Prolapsed vagina  
Tx: Clean & Replace, Anchor vagina
**Vulvitis & Vaginitis**

- **Trauma**
  - Breeding
  - Parturition
  - Exam
  - Relief of dystocia
- **Pneumovagina**
- **Bacteria nonspecific** (A. pyogenes, E. coli, Staph. & Strep.)
- **Fertility usually not compromised**

**Granular vulvitis**

- **Irritants or antigens** - nonspecific hyperplastic lymphatic response
  - Similar hyperplasia of lymphatic follicles of bull’s penis
- **Young animals** - antigens
- **Cause:**
  - IPV
  - Most unknown - idiopathic
  - Ureaplasma diversum

**Infectious pustular vulvo-vaginitis (IPV) IBR**

- **Herpesvirus I** (IBR - infectious bovine rhinotracheitis)
- Resp. & genital forms of diz
  - Rarely occur together
  - Abortion rarely follows genital form
- Transm. by coitus & mechanical
- Spreads rapidly through herd
- Genital carriers

**Mucopurulent discharge**

- **Pustules to ulcers** (3 mm) vulva & penile mucosa
- Infertility due to reluctance to breed
- Fetid, watery, reddish discharge
- CS subside in 10-30 days (transient immunity)

**Granules or papules of vulvar mucosa**

- **Mucopurulent discharge**
  - Retained placenta (p 110)
  - Rabies (p 144)

**Granules & papules**

- **Vaginal discharge**
- **DDx:**
  - IPV (Infectious pustular vulvo-vaginitis) (p 117)

**DDx:**

- Vaginal discharge
- Retained placenta (p 110)
- Rabies (p 144)

**Hx, CS, PE**

- Prognosis:
  - Good - mild
  - Necrotic - m/b fatal

**Subside spontaneous** (10-14 ds)

- Sexual rest - 2 weeks
- Al

**Spontaneous recovery** (Tx not required)

- Sexual rest 3-4 weeks
- Oily AB ointment (2° bact)

**Prevention:**

- IBR vaccine before outbreak (not effective in face of outbreak)
- Al, need to be free of virus

**Prognosis:**

- Excellent

**Prevention:**

- IBR vaccine before outbreak (not effective in face of outbreak)
- Al, need to be free of virus
<table>
<thead>
<tr>
<th>Abortion</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Abortions</strong></td>
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<tr>
<td><strong>Abortion</strong></td>
<td>• Expulsion of dead or nonviable fetus</td>
<td>• Infertility</td>
<td>• Does not depend on cause</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Most undiagnosed, 25% diagnosed by labs from submitted fetuses</td>
<td>• Abortion</td>
<td></td>
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<tr>
<td></td>
<td>• Causes same, no matter location, but % of each varies</td>
<td>Causes of abortion (See pg 291)</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>• Called infertility when unnoticed abortion (EED)</td>
<td>• IBR (p 118)</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>• If fetus retained - autolyses (opaque cornea, soft mushy organs, gelatinous bloodtinged SQ &amp; placenta)</td>
<td>• A. pyogenes (p 119)</td>
<td></td>
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<tr>
<td></td>
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<td>• Misc. bacteria (p 119)</td>
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<td>• Campylobacter (p 119)</td>
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<td>• Salmonella (p 259)</td>
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<td></td>
<td>• Mycoplasma</td>
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<td></td>
<td></td>
<td>• Anomalies/genetic</td>
<td></td>
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<td></td>
<td></td>
<td>• BVD (p 121)</td>
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<tr>
<td></td>
<td></td>
<td>• Brucella (p 122)</td>
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<td></td>
<td>• Listeria (p 122)</td>
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<td>• Leptospira (p 121)</td>
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<tr>
<td><strong>Infectious bovine rhinotracheitis</strong></td>
<td>• Common cause of abortions</td>
<td>1) Upper resp. tract, calf &gt;6 mo. “Red nose”</td>
<td>• Hx (previous infec. of dam)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Bovine herpesvirus 1 ( BHV 1)</td>
<td>2) 2nd bronchopneumonia (Pasteurella)</td>
<td>• Autolysis of fetus obscures gross lesions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Multiple system diz</td>
<td>3) Enteric form (calves) - Intractable diarrhea</td>
<td>• Histopath: focal necrotizing lesions of tissue</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• No effect on future breedings</td>
<td>4) IPV - Infec. pustular vulvovaginitis</td>
<td>• Viral isolation: from placenta or fetal lung (pos. in 1/3 cases)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Older carriers - 1st reservoir for younger animals (latent infection in neural tissue)</td>
<td>• Abortions not a sequela</td>
<td>• Viral antigen in fetal tissue</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Contagious - aerosolization of viral particles</td>
<td>• No permanent infertility</td>
<td></td>
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<td></td>
<td>• Found in semen, nasal secretion, resp. sec.</td>
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<td></td>
<td>• Recovery = long term immunity</td>
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<tr>
<td></td>
<td>• IPV virus different from abortion virus</td>
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<tr>
<td><strong>Feedlot/Resp. form; Breeders/Abortion, Carriers</strong></td>
<td>CS: Abortion storms - Weeks after Dam infec.</td>
<td>5) Abortion</td>
<td></td>
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<tr>
<td></td>
<td>Dx: Hx, CS, Histopath, Viral isolation or Antigens</td>
<td>• Infertility if early infec. causing EED (early embryonic death)</td>
<td>• IPV - Stop breeding until CS gone</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tx: No effect on fertility • Vaccinate</td>
<td>• Abortion storms ($) 25-60% of herd</td>
<td>• Abortion - No lasting effect on fertility</td>
<td></td>
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<td>• Initial infec. to dam 20-50 ds earlier</td>
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<td>• Seldom CS in dam</td>
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<td>• Rarely fetus to term, but stillborn or die in 1st wk of life</td>
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<td>• No effect on future breedings</td>
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<td>6) Encephalitic - calves</td>
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</tbody>
</table>

**Vaccines:**
- MLV - IM feedlot cattle
  - Can cause abortions
  - Ok for young & open females
- MLV - IN (intranasal) - breeders
  - Will NOT cause abortions
  - Faster immunity?
  - Will not interfere w/ passive immunity
| **Actinomyces pyogenes** | \*Common cause of abortions  
\*Maternal bacteremia presumed cause  
\*Abortion at any stage of gestation  
\*Most in late gestation  
\*\pm Retained placenta  
\*Isolate in nearly pure culture from abomasal contents of fetus  
\*R/O other causes  
\*Placentitis & bronchopneumonia most common lesions  
\*Control measures impractical because of sporadic nature of abortions |
|---|---|
\*CS, Dx & control similar to A. pyogenes |
| **Bovine Campylobacteriosis, Vibriosis** | \*Campylobacter fetus, sp. venerealis  
\*Obligate parasite of bovine genital tract, doesn't affect other species  
\*Gr. neg. curved or spiral rod, motile (polar flagellum)  
\*Infertility (EED - early embryonic death)  
\*Sporadic abortions at 5-6 mo  
\*Transm. - coitus  
\*Subclinical carrier bulls (crypts of prepuce)  
\*Pregnant carriers  
\*Pathophysiology  
\*Vaginal infec. (mucopurulent endometritis), also cervix, uterus & uterine tube  
\*Persists for 2-3 mo  
\*Prevents conception or EED (early embryonic death), resorption  
\*Irregular estrus cycles  
\*Hi % returning to estrus  
\*Prolonged interresus periods  
\*Calving late (bec. repeat breeders)  
\*Thin, overworked bull  
\*Unobserved herd: 1st clue different stages of pregnancy  
\*2° abortion, low incidence (< 5% of herd) anytime (between 4-6 months)  
\*1° temporary infertility (esp. replacement heifers) due to EED  
\*Repeat breeders  
\*Curved rod w/ darting corkscrew motility  
\*Culture from placenta or fetal abomasal content  
\*Inoculate Clark's media (immediately)  
\*72 hr for results  
\*Mucus agglutination test  
\*Survey herd for infection  
\*Swab & culture penis & preputial mucosa  
\*Difficult bec. org. slow growing & often overwhelmed by saprophytes  
\*Trichomoniasis (p 220)  
\*Darkfield microscope  
\*Intrauterine infusion hastens recovery  |
| **Herd infertility (EED), Carrier bulls** | CS: Repeat breeders, Low % abortion  
Dx: Isolate  
Tx: Recover in 5 mos. • AI, Vaccinate  

**Prevention**  
• Vaccination  
  - Heifer - killed bacteria 1 month before breeding, booster 2 weeks later (IM) ≥ 4 wk (Mk)  
  - Bull vaccinate w/ 2.5 X cow dose repeatedly to prevent carrier state  
  - Need 6 neglular cultures to be considered free  
  - Revaccinate bulls & cows annually  
  - AI from noninfected bulls or treat semen w/ streptomycin  
  - AI (artificial insemination) exclusively controls diz by preventing transm.  

**History, CS**  
• Demonstrate or isolate org.  
  - Darkfield microscope  
  - Curved rod w/ darting corkscrew motility  
  - Culture from placenta or fetal abomasal content  
  - Inoculate Clark's media (immediately)  
  - 72 hr for results  
  - No contamination or overwhelmed  
  - Mucus agglutination test  
  - Survey herd for infection  
  - Swab & culture penis & preputial mucosa  
  - Difficult bec. org. slow growing & often overwhelmed by saprophytes  

**Prognosis: Good**  
- Spontaneous recovery & resist reinfection  
- Severe endometritis or salpingitis infertility m/b permanent  

**DDX (impossible w/o lab):**  
• Trichomoniasis (p 220)
### Abortion

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
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<tbody>
<tr>
<td><strong>Trichomoniasis</strong>&lt;br&gt;Mk 662; C3T 608; 785; C2T 790; IM 1566; BR 796; Br 472; DC 338; R-M 275, 296; VCT 358</td>
<td>• <em>Trichomonas foetus</em> (protozoan)&lt;br&gt;• Transmissions venereal - Colonizes vagina, cervix, uterus &amp; oviduct - Bulls are mechanical carriers&lt;br&gt;• Pathophysiology - Doesn’t interfere w/ conception - EED (early embryonic death) freq. w/in 1st 2 months of infection - 2-6 mos period of immunity to re-infection - Clearance in 3 mo., rarely past 6 months - Resistance not permanent, 1-1.5 yrs susceptible again - Infections in bulls over 4 year-old permanent - Young bull resistant to infec.</td>
<td>• Infertility (EED)&lt;br&gt;- Hi nonpregnancy rate - ↑ calving interval to 100 days&lt;br&gt;• Occasional pyometra (uncommon sequela to early embryonic death)&lt;br&gt;• Early occasional abortion (3-4 months gestation) between 5-30% - Placenta retained or expelled - Infection after 4 months of gestation usually deliver live calf</td>
<td>• Hx (bull breed cows)&lt;br&gt;• Clinical signs&lt;br&gt;• ID &amp; culture trichomonads - Preputial smegma cultured from fornx of prepuce - bulls - Cervicovaginal mucus, uterine exudate, placental fluids or fetal abomasal contents - Diamond’s media - Transport at ambient temp., out of sunlight, not refrigerated &amp; promptly to lab - Microscope (size 10 X 15 μm) - 3 anterior flagella &amp; undulating membrane - Jerky, rolling motion</td>
<td>• Cull infected cows or give 3 months sexual rest&lt;br&gt;• Bull - Imidazole (ipronidazole), Dimetridazole, Metronidazole (Flagyl®), not officially approved&lt;br&gt;Prevention: • AI reduces, but doesn’t eliminate chance of infection • Young bulls in natural breeding helps reduce incidence - Divide herd into groups old &amp; new, different bull for each - Test old bulls repeatedly • Quit breeding for 3 months</td>
</tr>
</tbody>
</table>

"VD", Bulls/Permanent infection<br>CS: Infertility (100 d calving interval)<br>Dx: ID (Diamond’s media)<br.Tx: Cull or Rest • Prevention: Al

| Mycotic abortions<br>VCT 361; C3T 525; IM 1563; BR 1180; Br 472, 764; R-M 298 | • *Aspergillus fumigatus* - #1 fungal abortion in mare & cow (Mucor, Allescheria, Coccidioides, Histoplasma, Candida, Cryptococcus)<br>• Sporadic - Winter more common - 1-10% of abortions - regional<br>• Predisposing factors - Stable confinement - Fungal contaminated feed - Steroid or AB feeds - Ingestion or inhalation - Granulomas in lungs or stomach - Hematogenous spread to placenta | • Abortion 3rd trimester (often near term) - 1 or 2 animals in herd<br>• Dam no clinical signs<br>• Sequela: - Retained placenta | • History, CS + fungus (from specific lesions)<br>• Postmortem - Thick, leathery placenta (placentitis), esp. chorioallantois (maternal side)<br>• Fetal bronchopneumonia - Ringworm-like lesions (2-25%)<br>• Fungal culture of placenta, abomasal fluid or lungs<br>• Histopath., KOH wet mount from skin scrapings | • Fertility not affected<br>Control: • Reduce exposure to fungus |

**DDx:**
- Campylobacter (p 119)
- No pyometra, ID organism
Bovine viral diarrhea abortion
Mk 166, C3T 432; IM 1552; Br 492; R-M 254, 298

**Multisystem viral diz, GI, Resp., Abortion, Mucosal disease**

- Togavirus
  - Cytopathic & noncytopathic biotypes
  - Immunosuppressive m/. predispose to other diseases
- Transmission:
  - Direct contact w/ sick or carriers
  - Indirect from contaminated material
- Transplacentally

1. Majority - usually unobserved systemic infect.
2. Classical BVD - Gastroenteritis
   - Diarrhea, oral erosions, recover in 10 ds
3. Respiratory signs w/ fever, recovery in 10 ds
4. Transplacental infection
   - Abortion - any stage (1-4 months)
   - "Weak calf" syndrome
   - Dysplastic lesions
     - Teratogenic effects (cerebellar hypoplasia, ocular defects)
     - Persistently infected & develop mucosal diz later if infection w/ cytopathic BVD virus
   - Mucosal disease (chronic BVD)
     - 100% fatality, Oral erosions, lameness
   - Cerebellar hypoplasia (see pg 124)

**Difficult to Dx**

- Mummified or
- Dysplastic lesions (cerebellar hypoplasia or dysplasia, hydrocephalus, microencephaly, retinal dysplasia, spinal dysmyelogenesis, brachygnathia, alopecia, bronchial dysplasia, arthrogryposis, cataracts, optic neuritis)
- Mild nonsuppurative placentitis (histo)
- Viral isolation from fetal tissue seldom successful

**Leptospiral abortion**

- Leptospira harjo #1 (L. pomona, L. canicola, L. icterohemorrhagiae, etc.)
- Abortion weeks-mos after infection
- Abortion < 10%
- Ubiquitous, persistent infections
- Shed in urine & pass through abraded skin
- Public health - infective to man, caution

**Infertility, Abortion outbreaks**

- Calves - fever, anorexia & dyspnea
- Older cattle
  - Drop in milk production for 10 ds
  - Infertility
  - Abortion (4 mos to term, esp 3rd trimester)
- Birth of weak or dead calf
  - Icterus, hemoglobinuria, agalactia, fever
- Frequent abort w/o CS

**Diagnosis (Dx):**

- Mummy, Dysplastic
- Screening & Eliminate
- Px: Fertility OK

**Screening to eliminate persistent infections & clean up a herd**

- Vac. all over 6 mo twice (Kv)
- Serum neutralization titters on all 1 wk after 2nd vaccine
- Seronegative or low titer cattle (naive or persistent shedders) - virus isolation
- If virus present, but no antibodies, they are persistent shedders - cul
- Repeat in calves less than 6 mos when they reach 6 mos old
- Test calves born 7-10-8 mos after abortion
- Remove aborted fetuses

**Prevention & Control**

- Vaccination - good for dairy herds & beef cow/calf operations, questionable for feedlots
- Screening & elimination of persistent infected cattle (see box)

**Prognosis:** Breeding back: good to excellent

**MLV vaccine (MLV):**

- Not in pregnant cows - fetopathic
- Killed vaccine (KV): Most recommend killed vaccine at 6 mos
- Only use killed in pregnant
- Vaccination schedule:
  - 1st immunization 2 wks - booster; Annual revaccination
- Breeding farm
  - Vaccinate all breeding-age cattle
  - Vaccinate nulliparous heifers between 6 - 14 mos twice (KV)
- Goal is to reduce losses, not eliminate infec. agent

**Abortion outbreak**

- Vac. herd w/ killed bacterin
- Oxytetracycline (m/b limited to sick cows in dairy herd)
- Isolate aborting cows & Tx w/streptomycin if not destined for slaughter
- Remove aborted fetuses & placentas from premises

**Vaccine:**

- 6-12 month intervals or more frequent in bad areas
### Abortion

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
</table>
| *Brucella abortus*, gram negative coccobacilli | - Contagious diz (spreads rapidly in unvaccinated herd w/ many abortions)  
- Cows only abort once  
- Cattle -> sheep, goats, pig & dogs  
- Incidence in USA 0.2% in 1989; 2/3rds of USA Brucella free | Abortion (after 5th months)  
- Stillborn calves  
- Reduced milk yield  
- Healthy cow  
- Bulls: seminal vesicles, ampullae & epididymides & testes  
- Sequelae  
- Retained placenta  
- Mastitis  
- Lameness | Culture of *B. abortus* from fetal lung, abdominum, or placenta, uterine or mammary secretions  
- Standard plate or tube serum agglutination test - 1:100 agglutination - unvac.  
- 1:200 for vaccinated animals | Report to State & Feds  
- Quarantine & slaughter all reactors in herd diagnosed positive to brucellosis |

#### Brucellosis, Bang's disease, Contagious abortion, *Brucella abortus*

- **Mk 667; C3T 551; C2T 791; IM 1555; BR 787; Br 471, 476; DC 482; L 117; R-M 271, 296**

- **Public health - undulant fever**

- **Contagious abortions, ingestion - Reportable**

- **Dx: Culture, Agglutination test**

- **Tx: Screening, Quarantine & Slaughter**

- **Prevention:** B free, Strain 19 vac., Rt ear tag

#### Listeriosis abortion

- *Listeria monocytogenes*  
- Gram pos. pleomorphic coccobacilli  
- Placentitis & septicemia kill fetus  
- Often retained several ds before expulsion  
- Sporadic < 15%  
- Winter  
- Spoiled silage (elev. pH enhances growth of org.)  
- Public health - aborted tissues infect people (handle w/ care)

- **Hx (history), CS**

- **Culture readily from aborted fetus (serovars 1 & 4b)**

- **Impaction smears** (Gram pos. pleomorphic coccobacilli)

- **Postmortem:**  
  - Autolyzed fetus  
  - Gray-white hepatic foci (0.5-1 mm)  
  - Placentitis & endometritis (histo.)

- **Transient, tends to resist reinfecction**

- **Tetracyclines** (m/b in rest of pregnant animals in herd)

- **Segregate aborting animals**

- **Remove fetuses & placentas from premises**

- **Prevention:**  
  - Avoid spoiled silage feeding

#### Diagnosis

- **Screening tests:**
  - *BRT* (Brucella milk ring test) every 3-4 mo to ID infec. dairy herds  
  - Pool milk of herd & test  
  - Positive herds: individual blood tested on all  
  - Reactors - slaughtered  
  - *MCT* (market cattle testing): for nondairy herds  
  - Collect sera from cattle for slaughter at markets  
  - Reactors are traced to herd of origin & all animal tested  
  - Reactors slaughtered  
  - *Brucella free herds* maintained by BRT (dairy) & *MCT* (nondairy) & slaughter  
  - 2-3 successive neg. tests given at regular intervals

#### Treatment

- **Protect herd:**
  - Replacement - vaccinated calves or nonpregnant heifers  
  - If must, have pregnant & fresh cows from brucellosis-free areas (seronegative)

- **Isolate replacement for ≥ 30 d & retest before adding to herd**

- **Vaccination:**
  - *B. abortus* Strain 19 to calves 4-12 mos old  
  - Herd, resistance to infec. (not complete)
  - Small % develop antibodies thal m/ persist for yrs. (confuses Dx tests)
  - USDA tattoo in rt. ear of vaccinated animals

- **Avoid spoiled silage feeding**

#### Facts/Cause

- *Brucella abortus*, gram negative coccobacilli

- Contagious diz (spreads rapidly in unvaccinated herd w/ many abortions)

- Cows only abort once

- Cattle -> sheep, goats, pig & dogs

- Incidence in USA 0.2% in 1989; 2/3rds of USA Brucella free

- Transmission
  - 1st Ingestion
  - Organism shed in milk & uterine discharges
  - Venereal transm. rare
  - Brucella m/ enter body through mucous membranes, conjunctiva, wounds or even intact skin
  - Mechanical vectors (including man)

- Public health - undulant fever

#### Prevention

- Avoid spoiled silage feeding

#### Transmission

- Ingestion

- Organism shed in milk & uterine discharges

- Venereal transm. rare

- Brucella m/ enter body through mucous membranes, conjunctiva, wounds or even intact skin

- Mechanical vectors (including man)
### Epizootic bovine abortion (EBA), Foothill abortion

- **Late abortn. in foothills of Calif.**
- **Cause:**? Not *Chlamydia psittaci*
  - **Tick** (*Ornithodoros coriaceus*) vector
  - Calif, Nevada, Oregon, N. Mex.
- **Pathophysiologyn**
  - Transformation & proliferation of fetal lymphocytes & macrophages
  - IgG & IgM elevated
  - **90 days for fetal lesions** (so no abortion if infection after 6 months)

**Cause? Tick vector**

**CS:** Late abortions, Weak calves, Cows OK

**Tx:** Chlortetracycline reduces abortion

#### Ureaplasma

- **IM 1562; BR 908; R-M 282, 298; VC/T 357; T 282**
- Infection common, abortion - rare: Small bacterium w/o cell walls, ability to hydrolyze urea differentiates it from mycoplasma. Assoc w/ granular vulvitis & abortion in cattle
- **CS:** Reddish nodules in vulvar mucosa, mucopurulent discharge, not systemically ill, abortions
- **Tx:** Tetracycline infusions of uterus

#### Sarcocystis

- **IM 1563; BR 1191; VC/T 361**
- See Gen 251; Sarcocystis cruzi (protozoan); carnivore - cattle life cycle, ingestion of carnivore feces, protozoa usually encysts in muscle w/ no CS
- **CS:** Most cattle influc. w/ sarcocystis, but show no CS of infection; depression, anorexia, wt. loss, lameness, hair loss, death; abortions in late gestation
- **Tx:** FA of protozoa in cotyledon or caruncle
- **Tx:** none developed
  - **Control:** keep canine or feline feces away from cows, & don't let carnivores eat placenta, aborted feces or ruminant carcasses

#### Toxoplasmosis

- **IM 1568; BR-hb 461, BR 1201; Br 246**
- Toxoplasma gondii (protozoan) Abortion not well documented in cattle, not important cause, but a rule out

#### Mycoplasma

- **IM 1560; DC 336; R-M 288; T 288**
- **Mycoplasma bovis,** Mycoplasma bovigenitalium common in genital tract. Transmission m/b venereal
- **CS:** Infertility more common than abortion, Abortion, Granular vulvovaginitis, endometritis
- **Tx:** Placentitis & fetal pneumonia, Isolate Mycoplasma from genital tract, milk, placenta or fetus (not diagnostic), Eliminate other causes
- **Tx:** Tetracycline or Tylosin

#### Chlamydial (VC/T 364; R-M 279)

- Experimental abortion, not sure if natural

#### Bluetongue

- **IM 1552; R-M 258, 298; VC/T 351**
- Infection common, but fetal infection rare, if fetus infection - CNS teratogenic (hydroencephaly), fetal death, mummification or abortion

#### Bovine protozoal (Neospora) abortion

- **IM 1585; DC 336; VC/T 359**
- Newly recognized, *Neospora* (protozoa similar to *T. gondii*), Major problem in California, 4-6 mo (3-9) of gestation, Transmission unknown
- **CS:** Sporadic, multiple or storms of abortions, Only clinical sign, Year round abortions, Occasional live calves w/ protozoal encephalomyelitis, CNS: dysfunction, limb paresis, unable to stand, BAR, m/ live several wks w/ supportive Tx
- **Tx:** Hx, CS, FM: Fetuses - autolyzed, Histopath of fetal brain
- **Tx:** No effective Tx
- **Control:** Difficult bec. life cycle & mode of transmission unknown

**Chlortetracycline reduces rate of abortion**

**Chlortetracycline Prevention & control:**

- Seldom abort in subsequent pregnancies
- No vaccine
- Expose heifers to tick before breeding
- Change from spring to fall calving (reduces exposure to tick only during last trimester)
Pregnancy Related Conditions

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>BVD - Cerebellar hypoplasia</td>
<td>- See Gen pg 253</td>
<td>- At birth - &quot;Weak calf&quot; syndrome</td>
<td>- Hx, CS</td>
<td>- None</td>
</tr>
<tr>
<td></td>
<td>- BVD infec. of pregnant cows - 100-170 days - congenital cerebellar hypoplasia</td>
<td>- Truncal ataxia</td>
<td>- BVD antibodies in precolostral blood</td>
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<td>- 90-100 ds - abortion or stillbirth</td>
<td>- Opisthotonus</td>
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<td>- Base-wide stance</td>
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<td>- Intentional head tremors</td>
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<td>- Hypermetria, hyperreflexia</td>
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<td>- Nystagmus or strabismess</td>
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<td>- Deficient menace response (not blind unless ocular malformation)</td>
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<td>- Other signs - corneal opacity, thymic atrophy, microphthalmia, retinal degeneration</td>
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<tr>
<td>BVD - Pregnant cow</td>
<td>CS: At birth - Ataxia, Wide-based, Tremors</td>
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<tr>
<td>Tx: None</td>
<td>Px: Grave</td>
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<tr>
<td>Bluetongue</td>
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<tr>
<td>Miscellaneous CNS genetic conditions</td>
<td>- See Neuro pg 135, Cerebellar abiotrophy, Hydrocephalus, Inherited congenital myoclonus, Occibito-atlantal malformation, Dodder calves, Progressive ataxia, Spinal bifida, Cerebellar malformations, Arnold-Chiari Syndrome, Weaver Syndrome, Bovine familial convulsions &amp; ataxia, Maple syrup diz, Inherited congenital myoclonus</td>
<td>- Disorders of hemostasis (pg 84); Pink tooth (pg 91); Heart defects (pg 79); Skin dizz (pg 191); Hermaphrodite (pg 113); Segmental hypoplasia of repro. tract (pg 113) Elso heel (pg 137); Freemartin (pg 107), Ovarian hypoplasia (pg 108)</td>
<td>- Prognosis:</td>
<td>- Prevention: BVD vac. (p 252)</td>
</tr>
<tr>
<td>Other genetic defects</td>
<td>- See pg 88; High producing dairy cattle 2-4 wks after calving; Cause: unknown, Hypophosphatemia</td>
<td>- CS: Intravascular hemolysis =&gt; hemoglobinuria &amp; anemia; icterus</td>
<td>- Grave - rarely improves</td>
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<tr>
<td></td>
<td>- Dx: Hx, CS, Red urine, Regenerative anemia, Low phosphorus levels in blood</td>
<td>- Tx: IV fluids, Phosphorus supplementation</td>
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<td>- Px: Severely affected don't respond</td>
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<tr>
<td>Poisonous plants</td>
<td>- See Tox pg 241: Abortions: Locoweed, Wild tobaccos, Nitrate/nitrite poisoning, Pyrrolizidine alkaloids, Broomsnakeweed, Oak poisoning, Ponderosa pine</td>
<td>- Teratogenic plants: Lupine &amp; Poison hemlock (p 241) &quot;Crooked calf diz&quot; as in lupine toxicosis</td>
<td>- CS: Reduced conception rate</td>
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</tr>
<tr>
<td></td>
<td>- Zearalenone: Rare; Estrogenic chem. (mold), Natural contamination of ear corn stored in cribs, Cattle more resistant than swine</td>
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**Bluetongue** can also cause cerebellar hypoplasia
<table>
<thead>
<tr>
<th>Condition</th>
<th>Clinical Signs</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fat cow syndrome</td>
<td>Diz of fat dairy cows that have just calved (1-3 ds)</td>
<td>CS: Anorexic, Severe ketonuria, Recumbency, CNS, Terminal tachycardia &amp; coma</td>
<td>Tx: IV glucose, Oral propylene glycol, Results are poor</td>
</tr>
<tr>
<td>Ketosis, Acetonemia, Ketonemia</td>
<td>Diz of dairy cows at peak lactation (3 ds post calving, hi energy demand - low energy)</td>
<td>CS: Wasting &amp; CNS</td>
<td>Tx: Glucose + steroids + propylene glycol + feed</td>
</tr>
<tr>
<td>Pregnancy toxemia</td>
<td>Rare diz of fat pregnant beef cows - no feed last 2 mo, twins (more common in sheep)</td>
<td>CS: Recumbent &amp; die before calving</td>
<td>Tx: Rarely die</td>
</tr>
<tr>
<td>Postparturient paresis, Milk fever</td>
<td>Adult high prod. dairy cows (Jerseys), 0-72 hr after birth, Drain of Ca to milk, Hypocalcemia (release of ACh at NMJ)</td>
<td>CS: Early - Wobblily standing, bellowing, Downer cow (head turned to flank); Lat. recumbency as approaches coma</td>
<td>Tx: Watch postpartum for 72 hrs, Early IV Ca gluconate (SQ or IP) Repeat in 8-12 hrs, IV phosphorus</td>
</tr>
<tr>
<td>Calving paralysis</td>
<td>Obturator &amp; sciatic nerves, Dystocia (calf damaging obturator &amp; ischiatic nerves on way through canal)</td>
<td>CS: Splay leggedness, “Splits”, Recumbency w/ hind legs to each side</td>
<td>Tx: Keep on firm ground, no slippery surfaces, Tie hocks together just prox. to calcaneus, Hope function returns</td>
</tr>
<tr>
<td>Downer cow</td>
<td>Most common sequel to recumbency of parturient paresis, other causes: bone, muscle or nerve damage, Systemic illnesses, Trauma &amp; lymphosarcoma, metabolic disorders 2° to milk fever</td>
<td>CS: Unable to rise 24 hrs, “Creeping” or “crawling”; Nonalert downer cows</td>
<td>Tx: Good footing, Retreat milk fever, Phosphorus, Stimulate to rise, If all fails - supportive care</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
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</table>
| Penile hematoma, "Broken penis" | • Most common injury in Bull  
                              • Tearing of tunica albuginea into corpus cavernosum  
                              - Transverse tear  
                              - Dorsum of penis at distal flexure  
                              - Peak thrust of coitus, corpus cavernosus pressure is 100X arterial pressure  
                              • Explosion of blood into surrounding tissue, damaging elastic tissue around penis  
                              • Disease of inexperienced, over exuberant male, catches penis, bending it | • Pain & stiffness  
                              • Swelling just cranial to scrotum  
                              • Dark purple prepuce  
                              • Sequelae:  
                              - Prolapse of prepuce  
                              - Abscess if infected  
                              - Damage to sensory n. on dors. aspect, numb end of penis  
                              - Adhesions, restriction  
                              - Acquired vascular shunts between corpus cavernosum & dors. veins, erection impossible | • Hx, CS: Swelling  
                              • Paracentesis w/ large needle into clot gives biopsy | 1• Conservative Tx:  
                              - Systemic antibiotics  
                              - Ice, hosing w/ water  
                              - Massage moving skin back & forth  
                              - #1 sexual rest - 3 months  
                              2• Sx: 1-2 days after injury  
                              - Remove hematoma digitally  
                              - Suture tear  
                              - 2 months sexual rest  
                              - NSAIDs  
                              - Antibiotics |
| Torn tunica albuginea            | CS: Swelling cran. to scrotum  
                              Dx: Needle biopsy  
                              Tx: Sexual rest, ABs, Ice; Sx | DDx:  
                              • Laceration of prepuce | | |
| Phimosis                         | • Inability to protrude the penis, Causes: sequel to injury & scarring (cicatrix formation), contusions, lacerations, abrasions, frostbite  
                              • CS & Dx: Inability to protrude penis  
                              • Tx: Minor injuries m/ resolve spontaneously; Hygiene: clean preputial cavity daily & infuse w/ hydrogen peroxide, Infuse oily antibiotics; Broad spec. ABs systemically; If prepuce prolapsed, protect w/ bandages & hold in place w/ purse string suture, Sx removal of scar tissue m/b necessary after healing complete  
                              • Px: depends on severity of injury | | |
| Paraphimosis, Penile prolapse    | • Inability to withdraw penis into prepuce; Causes: trauma, tumor, denervation, rabies  
                              • CS & Dx: Protruded traumatized penis, edema, swelling & balanoposthitis, Surface of penis dry, thickened & inelastic  
                              • Tx: Prompt Tx to reduce swelling & edema & return to prepuce, Freq. cleaning & oily AB soaked bandages, Support penis next to body, Return to prepuce as soon as possible, pack sheath w/ petroleum jelly to prevent adhesions  
                              • Px: Poor if can't retract penis in a few days | | |
| Priapism                         | • Persistent erection w/o sexual arousal | | | |
Preputial prolapse
Mk 672; C3 T797; IM 240, 1760; T 141; RM & S 1187; RM 363; S-UG 36; S-O 531, 529; Pic 158

- Pendulous prepuce
  - Bos indicus, Zebu, Brahmas, Santa Gertrudis (common problem)
- Trauma (contusion &/or laceration)
- Edema causes preputial prolapse
- If attempt coitus, splitting on ventrum of prepuce

• Collar of pink mucosa hanging out
• Trauma exacerbates problem
• Trouble urinating if swollen

• Pink mucosa out prepuce
• Clean & evaluate for viability

Circumcision - if traumatized & not viable
- permanent cure
- Done similar to rectal prolapse Sx
- Use squeeze chute
- Use ring block around prepuce
- Overlapping mattress sutures hold 2 layers together
- Cut off excess
- 2 mucosal edges apposed & sutured
- Place tubing around penis & bandage
- Leave bandage 10-14 days
- Sexual rest for 30 days

Balano-posthitis
C3 T797; IM 1568; Br 486, 502

- Inflammation of glans penis (balanitis) & prepuce (posthitis); Causes: Trauma, Hair ring (smegma matted) around preputial orifice or penis, Herpes virus 1, IBR, IVP
- CS & Dx: Stenosis of preputial orifice, adhesions betw. penis & prepuce, Pain, Copulation avoided
- Tx: Spontaneous usually; Symptomatic, Sexual rest, Sx removal of hair rings

Penile deviation
Mk 672; C3 T797; IM 240; T 141; RM & S 1181; RM 359; S-UG 20; Pic 157

- Dorsal apical ligament
  - Fans out over dorsum of penis
  - Just dorsal to tunica albuginea
  - Normally causes ventr. bend & counter-clockwise spiral
- Deviation: if dors. lig. slips off it & causes corkscrew appearance of penis during erection
- 3-4 year-old, highly fit bulls

- Deviation of penis (ventral or spiral)
- Can't breed

• Hx, CS
• Observe bull trying to breed unsuccessfully

- Stabilize by suturing down dors. lig.
  - Usually not enough alone due to excessive force
- Shortening dorsal ligament
- Homologous graft of fascia lata betw. tunica albuginea & ligament

Dox:
- Persistent frenulum

Dors. apical lig., Adult bulls
CS: Spiral or ventr. deviation
Tx: Sx shorten lig. or Fascia lata graft

Warts, viral papillomas (C3 T796): See Skin pg 190; Freq. on penis, but not on prepuce • Tx: Surgical removal preferred over thermocautery (deep necrosis)
### Male

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<tr>
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<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
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<tbody>
<tr>
<td>Persistent frenulum **</td>
<td>• Congenital fibrous band from tip of penis to prepuce</td>
<td>• Ventral deviation of penis</td>
<td>• Hx (young)</td>
<td>• Surgically cut band</td>
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<tr>
<td></td>
<td>• Highly hereditary</td>
<td>- Noticed when coitus attempted</td>
<td>• Ventral deviation during</td>
<td>• Cull in purebred herds</td>
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<tr>
<td></td>
<td>• Few blood vessels in band</td>
<td>- Rarely is entrance accomplished</td>
<td>attempted coitus</td>
<td></td>
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<tr>
<td></td>
<td>• Inherited - recessive?</td>
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<tr>
<td>Congenital, Hereditary</td>
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<tr>
<td>CS/Dx: Ventr. deviation of penis</td>
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<tr>
<td>Tx: Cut; Cull in purebred herds</td>
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**Dorsal laceration of penis (V/C/T 796):** m/ interrupt sensory nerve supply essential for intromission & ejaculation • Dx: Attempt to mate, scars • Tx: none

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<tr>
<td>Tumors of penis &amp; prepuce ***</td>
<td>• Fibropapilloma most common, single or multiple, usually young bulls; Cause: papilloma viruses through epithelial damage</td>
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<td>• CS: small - none; Large: m/ prevent withdrawal of penis into prepuce, hemorrhage (friable)</td>
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<td>• Tx: Many spontaneously regress in a few months (most likely in bulls approaching 2 yr-old), Vaccines, Sx removal (recurrence common); Sx amputation</td>
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<td>• Control: Vaccinate</td>
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**Testicular hypoplasia ** IM 1571, 1759; Br-hb 631; Br 1627, Br 152, 504, 491; C3T 798

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<tr>
<th>Facts/Cause</th>
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<th>Treatment</th>
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<tbody>
<tr>
<td>• Aplasia - rare (complete absence of 1 or both testes)</td>
<td>• CS &amp; Dx: Small testicle; scrotal circumference normally at least 32 cm at 12 months old, ejaculates m/b azospermia or low # of sperm w/ numerous morphologic defects</td>
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<tr>
<td>• Hypoplasia unilat. or bilateral, both scrotal or abdominal testicles; Cause: transplacental infec. or intoxication, hormonal insufficiency, Zinc defc, impaired testicular descent, vascular disturbances, abnormal karyotype</td>
<td>• No successful Treatment</td>
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**Testicular degeneration, Heat injury IM 1571; C3T 795; Br 491, 504 ***

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<th>Diagnosis</th>
<th>Treatment</th>
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<tbody>
<tr>
<td>• Temperature (cryptorchid, ectopic testes, inguinal hernias), Systemic diz temporary infertility due to hi temp., Prolonged high environmental temp. + high humidity; Torsion of spermatic cord, scrotal edema, obstruction of epididymis, steroids</td>
<td>• CS: Small testicles</td>
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<tr>
<td>• DDx: Testicular hypoplasia (hard to DDx)</td>
<td>• Dx: PE &amp; semen exam; US, testicular biopsy last resortbec. of hemorrhage &amp; pressure necrosis</td>
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<tr>
<td>• Tx: Remove cause, Sexual rest • Px: If temporary, improved semen in 4-5 months</td>
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</table>
Castration, Orchiectomy
R-M 373; S-UG 52; S-J 1062; S-T 289
- Common procedure in feedlot animals
- Animal standing in chute & tailed up for restraint
  - Skin incision
    - Small calves: remove bottom third of scrotum w/ a scalpel
    - Larger cattle: scalpel or Newburry knife incise from above testicle to distal scrotum
  - Pull out testicle surrounded by vaginal tunics (closed castration)
  - Emasculator high on spermatic cord
    - "Nut to nut" of emasulators, make sure cutting edge is distal to crushing
  - Maintain crush for 1-2 minutes
  - Leave wound to granulate in
  - Emasculotome can also be used, it doesn't leave a wound

Cryptorchidism
IM 1571, 1759; Br-hb 632; BR 1553; Br 152; S-J 1065
- Most are located in SQ tissue near inguinal ring, occasionally testicle lies transversely in scrotum rather than in normal vertical position, true abdominal cryptorchidism is rare
- Tx: Abdominal cryptorchid: any laparotomy incision, locate testicle between inguinal ring & kidney

Testicular neoplasia
IM 1572
- 1° rare, Interstitial cell (Leydig cell) tumors (don't produce hormones usu.), seminomas
- CS: Enlarged testicle, ↓ sperm count m/b, fertility m/ not be affected
- Tx: Unilat. surgical removal (wait until end of breeding season if semen quality OK)
  - Bilateral: wait until semen quality falls to negate use in breeding, then remove

Acute orchitis
IM 1572; C 3795
- Inflammation of testicles
  - Small % of males
  - Unilateral
  - Cause: trauma or infec. (Brucella abortus, Mycobacterium tuberculosis, Actinomyces pyogenes, Nocardia farcinica, bovine herpesvirus III (IBR/IPV)
- Hot, swollen, painful testicle
  - Refuse to mate
  - Chronic: testicular atrophy, fibrosis & sterility
- Palpation of testicle
  - US (ultrasound)
  - Ejaculate (WBCs, decr. motility & incr. morphological abnormalities)
  - Sexual rest
  - ABs IV (C&S - culture & sensitivity)
  - NSAIDs
  - Cold hydrotherapy (30 min BID) reduces inflammation

Bull Infertility:
See pg 289

Infec. or Trauma - IBR
CS: Hot, painful testes
Tx: Cold Tx, Rest, ABs

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<th>Treatment</th>
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<tbody>
<tr>
<td>Varicocele</td>
<td>• Abnormally distended &amp; tortuous veins of pampiniform plexus, Backflow &amp; stasis in veins, infertility causes disturbances in thermoregulatory mechanism (counter current heat exchange between hot artery &amp; cool veins, keeping testicle temp. down)</td>
<td>• CS &amp; Dx: Nonpainful &quot;bag of worms&quot; w/in spermatic cord</td>
<td>• Palpate epididymis, especially tail, (induration, spermatic granulomas, abscesses &amp; enlargement)</td>
<td>• Spontaneous recovery in unilateral (valuable bull)</td>
</tr>
<tr>
<td></td>
<td>• CS &amp; Dx: Nonpainful &quot;bag of worms&quot; w/in spermatic cord</td>
<td>• Infertility (due to obstruction)</td>
<td>• Rectal palpation</td>
<td>• No cure if obstructive</td>
</tr>
<tr>
<td></td>
<td>• If thrombosis: unilateral castration (transect spermatic cord prox. to thrombus)</td>
<td>• Pain</td>
<td>• Broad spectrum ABs (culture in vitro sensitivity 2-4 weeks)</td>
<td>• Remove testicle &amp; epididymis if unilateral</td>
</tr>
<tr>
<td></td>
<td>• Infertility (due to obstruction)</td>
<td>• Enlargement of tail of epididymis</td>
<td>• Narrow spectrum ABs (culture &amp; sensitivity)</td>
<td>• Spontaneous recovery in many</td>
</tr>
<tr>
<td></td>
<td>• Adhesions to vaginal tunics</td>
<td>• Chronic abscesses, periortchitis &amp; fibrosis</td>
<td>• Concurrent infections:</td>
<td>• Broad spectrum ABs (culture in vitro sensitivity 2-4 weeks)</td>
</tr>
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<td></td>
<td>• Chronic abscesses, periortchitis &amp; fibrosis</td>
<td>• Granulomas if sperm escape accessory sex glands</td>
<td>• Epididymitis, orchitis</td>
<td>• Tx failures OCCUR (Erythromycin, trimethoprim (both hi pKa &amp; fat soluble), not aminoglycosides (low pKa &amp; not fat soluble))</td>
</tr>
<tr>
<td></td>
<td>• Granulomas if sperm escape accessory sex glands</td>
<td>• Culture, ejaculate - abnormal sperm</td>
<td>• Semen m/ contain PMNs &amp; RBCs</td>
<td>• Cull</td>
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<tr>
<td></td>
<td>• Obstruction often develops</td>
<td>• Bilateral obstruction: azoosperminia</td>
<td>• Culture vesicular secretions (sterile catheter up urethra (12&quot;), massage accessory sex glands)</td>
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<tr>
<td>Epididymitis</td>
<td>• Inflam. of epididymis, esp. tail</td>
<td>• Infertility (due to obstruction)</td>
<td>• Rectal palpation</td>
<td></td>
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<tr>
<td></td>
<td>• Cause: Infection or trauma, - 1° or 2° to orchitis or infec. of accessory sex glands; Brucella abortus, Actinobacillus seminis, Actinomyces pyogenes</td>
<td>• Pain</td>
<td>• Broad spectrum ABs (culture in vitro sensitivity 2-4 weeks)</td>
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<tr>
<td></td>
<td>• Obstruction often develops</td>
<td>• Enlargement of tail of epididymis</td>
<td>• Concurrent infections:</td>
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<tr>
<td>Tail of epididymis, Obstruction</td>
<td>• Infertility (due to obstruction)</td>
<td>• Chronic abscesses, periortchitis &amp; fibrosis</td>
<td>• Epididymitis, orchitis</td>
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<tr>
<td>CS: Infertility, Pain, Swelling</td>
<td>• Infertility (due to obstruction)</td>
<td>• Granulomas if sperm escape accessory sex glands</td>
<td>• Semen m/ contain PMNs &amp; RBCs</td>
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<tr>
<td>Dx: Palpation, Culture</td>
<td>• Infertility (due to obstruction)</td>
<td>• Culture, ejaculate - abnormal sperm</td>
<td>• Culture vesicular secretions (sterile catheter up urethra (12&quot;), massage accessory sex glands)</td>
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<tr>
<td>Tx: Spontaneous, Culture</td>
<td>• Infertility (due to obstruction)</td>
<td>• Bilateral obstruction: azoosperminia</td>
<td>• Semen m/ contain PMNs &amp; RBCs</td>
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</tr>
<tr>
<td>Seminal vesiculitis</td>
<td>• Few signs</td>
<td>• No cure if obstructive</td>
<td>• Culture vesicular secretions (sterile catheter up urethra (12&quot;), massage accessory sex glands)</td>
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</tr>
<tr>
<td>C3T 793; IM 1574; Br 493; DC 341</td>
<td>• ± Deterioration of semen quality</td>
<td>• Prognosis: Poor - obstruction usually occurs, preventing sperm from leaving</td>
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<td></td>
<td>• Severe cases:</td>
<td>• Spontaneous recovery in many</td>
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<td></td>
<td>- Pain (reluctance to move, stiff gait, tense abdomen)</td>
<td>• Broad spectrum ABs (culture in vitro sensitivity 2-4 weeks)</td>
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<td></td>
<td>- Refuse to mate</td>
<td>• Concurrent infections:</td>
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<tr>
<td></td>
<td>- Infertility</td>
<td>• Epididymitis, orchitis</td>
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<td>• Concurrent infections:</td>
<td>• Semen m/ contain PMNs &amp; RBCs</td>
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<td></td>
<td>- Epididymitis, orchitis</td>
<td>• Culture vesicular secretions (sterile catheter up urethra (12&quot;), massage accessory sex glands)</td>
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<tr>
<td>Common, Homosexuality</td>
<td>• Few signs</td>
<td>• Rectal palpation</td>
<td>• Broad spectrum ABs (culture in vitro sensitivity 2-4 weeks)</td>
<td></td>
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<tr>
<td>CS: Few • Homosexuality</td>
<td>• ± Deterioration of semen quality</td>
<td>• Acute - normal to enlarged seminal vesicles, painful</td>
<td>• Concurrent infections:</td>
<td></td>
</tr>
<tr>
<td>Dx: Rectal, Culture, Semen</td>
<td>• Severe cases:</td>
<td>• Chronic: enlarged, lose lobularity &amp; fibrotic</td>
<td>• Epididymitis, orchitis</td>
<td></td>
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<tr>
<td>Tx: Broad spec. ABs</td>
<td>• Pain (reluctance to move, stiff gait, tense abdomen)</td>
<td>• Semen m/ contain PMNs &amp; RBCs</td>
<td>• Epididymitis, orchitis</td>
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<td></td>
<td>- Refuse to mate</td>
<td>• Culture vesicular secretions (sterile catheter up urethra (12&quot;), massage accessory sex glands)</td>
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<tr>
<td></td>
<td>- Infertility</td>
<td>• Rectal palpation</td>
<td>• Broad spectrum ABs (culture in vitro sensitivity 2-4 weeks)</td>
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<td>• Concurrent infections:</td>
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<td></td>
<td>- Epididymitis, orchitis</td>
<td>• Chronic: enlarged, lose lobularity &amp; fibrotic</td>
<td>• Epididymitis, orchitis</td>
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<tr>
<td></td>
<td>• Concurrent infections:</td>
<td>• Semen m/ contain PMNs &amp; RBCs</td>
<td>• Epididymitis, orchitis</td>
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<td></td>
<td>- Epididymitis, orchitis</td>
<td>• Culture vesicular secretions (sterile catheter up urethra (12&quot;), massage accessory sex glands)</td>
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<td>Condition</td>
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<td>Aujesky's diz</td>
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<td>Arnold-Chiari syndrome</td>
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<tr>
<td>Ataxia</td>
<td>139</td>
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<tr>
<td>Babesiosis</td>
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Spinal Cord

UMN & LMN CS: helps differentiate peripheral from central lesions; & if central, helps localize level of the lesion
• LMN CS to area innervated by damaged spinal cord segment (not UMN CS bec. UMN requires intact LMNs)
• UMN CS caud. to damage spinal cord segment

Degree of signs depends on amount of damage to spinal cord (white &/or gray matter)

LOWER MOTOR NEURON (LMN): motor part of reflex arc to muscles or glands (peripheral nerves). Spontaneously active w/out input of UMN

LMN damage: (periphery or cell body in CNS) (thumbs down)
• Flaccid paresis or paralysis ("limp as a dish rag")
• Tone - ↓ to none (hypotonia - atonia)
• Reflexes - ↓ to absent (hyporeflexia - areflexia)
• Fast atrophy (neurogenic atrophy) w/in 1 wk

UPPER MOTOR NEURON (UMN): CNS neuron affecting LMN (peripheral or cran. nerves). Initiates & maintains conscious movements & provides tone to extensor muscles (posture). Excitatory UMN (inactive until needed) & inhibitory UMN (constantly keep LMN under control)

UMN damage: (thumbs up) loss of ability to initiate voluntary motor activity & possibly uncontrolled hyperactivity of LMNs due to decr. inhibition
• Tone - normal to ↑
• Reflexes - normal or ↑ (normoreflexia or hyperreflexia)
• Spastic paresis or paralysis
• Slow disuse atrophy
• Extensors facilitated (extended limb)

Lesion localization - NS (From Dr. Charles Hutchison's lectures; BR 459)

SHIFF-SHERRINGTON SYNDROME: hyperextension of the forelimbs w/ lesions to thoracic spinal cord, removal of ascending inhibition (bad prognostic sign, serious spinal cord lesion)

Proprioception loss: usually 1st CS in spinal cord compression
For localization, interpreted the same as LMN/UMN
• Ataxia
• Postural deficits (wide base stance, knuckle over)
• Delayed initiation of movement

Superficial pain loss: lost at same time as motor function is lost. If superficial pain perceived, will also have deep pain. (A withdrawal reflex DOES NOT require perception of pain.)

Deep pain: 1st to show & last to disappear ("first to show, last to go"). Loss of deep pain a bad prognostic sign. Evaluated only when superficial pain is absent.

Cutaneous trunci reflex or panniculus reflex: a normal twitching of cutan. trunci m. to stimul. Sensory fibers from lat. wall dermatomes pass craniodorsally to thoracolumbar spinal cord segments (1 or 2 vertebrae cranially). Ascending sensory tracts extend up the spinal cord to lat. thoracic n. (C8) which innervates cutan. trunci muscle.

• Panniculus absent localizes to 1 - 2 vertebrae caud. to spinal cord lesion

Hyperesthesia: abnormal increased sensitivity. Spinal cord segment lesions cause a focal hyperesthesia to the dermatome supplied.

Diffuse or multifocal pain: often due to inflammation.

Focal pain: often due to compression of spinal cord or nerve root.

CS & spinal cord region damaged
C1-5: Cervical region
• No LMN to all limbs
• UMN, proprio. & pain defc - all limbs

C6-T2: Cervicothoracic region
• LMN - thoracic limb
• UMN, propriocep. & pain defc - hindlimbs

T3-L3: Thoracic & thoracolumbar region
• Normal thoracic limb (+/- Shiff-Sherrington)
• UMN, proprio. & pain defc - pelvic limbs
• Cutan. trunci absent 1-2 vertebrae caud.

L4-S2: Lumbosacral region
• Normal thoracic limbs
• LMN - pelvic limbs

S3-C5: Sacral region (cauda equina)
• UMN - to bladder, anus & urethra (flaccid paralysis of anus, no defecation)
• Loss of sensation to tail, penis, vulva & perineum
• Distended flaccid bladder, incontinence

Lesions betw. C1-S2
• UMN - pelvic region
  - Anal & tail tone normal
  - Bladder m/b distended, urethralis m. normal
### Spinal dysfunction

**IM 1004; C3T 653; VC/N 184; BR-hb 210; BR 498; L 351; DC 426; N-L 244, 1266

**Condition**
- Focal: extramedullary compression (more common)
  - Common sites: C2-C4, T10-T13, L3-L5
  - Calves 3-6 mo due to softening of bones from nutrit. osteodystrophies
  - Vit. D, Calcium/Copper defc.
  - Adult - slipping, fx of lumbosacral spine
- Diffuse/multifocal (less common)

**Causes:**
- Abnormal bone mineralization
- Spinal abscesses
- Trauma - fx
- Lymphosarcoma
- Spondylosis
- Congenital vertebral malformation

**LMN - "thumb down" (flaccid)**
**UMN - "thumb up" (spastic)**
**CS:**
- C2-4: 4 spastic limbs
- C5-T2: Flaccid FL*, Spastic HL*
- T3-L3: Norm. FL, Spastic HL
- L4-Cd5: Norm. FL, Flaccid HL
- S3-Cd5: Norm. FL & HL

**Dx:** Hx, CS, PE, Rectal
**Tx:** Euthanasia or wait & see

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<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment - Prognosis</th>
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<td>C2-4: Cervical region</td>
<td>Noncompressive - stiff neck</td>
<td>History, CS</td>
<td>Evaluate suffering (manage or salvage from evaluation)</td>
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<td>Mild compression - ataxia (proprioception - &quot;first to go&quot;)</td>
<td>Physical exam</td>
<td>Manage pain (if severe, Banamine®; PBZ)</td>
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<td>Severe</td>
<td>Tail/anal tone</td>
<td>Evaluate repeatedly over 1st hours for prognosis</td>
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<td>Recumbent</td>
<td>Rectal palpation</td>
<td>Salvage - if unable to rise after several days or if suffering</td>
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<td>BAR to depressed</td>
<td>Anal tone</td>
<td>- If bladder problem</td>
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<td>M/b phrenic n., paralysis of diaphragm - death</td>
<td>Bladder tone</td>
<td>- If paralyzed rectum</td>
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<td>UMN all 4 limbs (spastic)</td>
<td>Rads</td>
<td>Most recoveries spontaneous, not influenced by drugs, some still give: dexamethasone if acute</td>
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<td>C5-T2: Cervicothoracic region</td>
<td>LMN thoracic limb (flaccid)</td>
<td>Tetanus</td>
<td>Slings: If fx stable &amp; animal stands w/ assistance</td>
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<td>UMN pelvic limb (spastic)</td>
<td>Botulism</td>
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<td>T3-L3: Thoracic &amp; thoracolumbar</td>
<td>Norm. thoracic limb (± Shiff-Sherrington)</td>
<td>Hypocalcemia</td>
<td>Good: If clinical signs in 48 hrs</td>
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<td>UMN CS, proprio. &amp; pain defc. - pelvic limbs</td>
<td>Hypoderma</td>
<td>- Repeated neurological exam (1st several hrs) - not from radiographs, b/c pieces likely to be in different position than at injury</td>
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<td>Cutan. trunkl absent 1-2 vertebrae caud.</td>
<td>Rabies</td>
<td>Ascending bact. myelitis</td>
<td>Longer recumbent &amp; neurologically impaired, poorer prognosis</td>
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<td>- Dog sitting posture</td>
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<td>Lymphosarcoma, Spinal abscess, Fxs - poor</td>
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<td>- When in sternal recumbency - pelvic limbs extended, not tucked up</td>
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<td>L4-S2: Lumbosacral region</td>
<td>Normal thoracic limbs</td>
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<td></td>
<td>LMN signs pelvic limbs</td>
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<td>S3-Cd5: Sacral region (cauda equina)</td>
<td>Norm. limbs</td>
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<td></td>
<td>UMN signs to bladder, anus &amp; urethra</td>
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<td></td>
<td>(flaccid paralysis of anus, no defecation)</td>
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<td></td>
<td>Loss of sensation to tail, penis, vulva &amp; perineum</td>
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<td></td>
<td>Distended, flaccid bladder, incontinence</td>
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**Lesions betw. C1-S2**
- UMN - pelvic region
  - Anal & tail tone normal
  - Bladder m/b distended, urethralis m. normal

**DDx:**
- Neurological (Central/Peripheral)
  - Neuritis (p 136)
  - Obturator nerve paralysis (p 137)
- Musculoskeletal
  - Myositis
  - Fxs
- Metabolic
  - Milk fever (p 148)
### NERVOUS SYSTEM

#### Neurologic Diseases

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
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<tr>
<td><strong>Vertebral body abscesses, Osteomyelitis</strong>&lt;br&gt;Mk 591; C3T 877; IM 1134; VCN 187; BR 521; DC 422; N-L 277&lt;br&gt;***</td>
<td>• Hematogenous infection&lt;br&gt;• Young cattle 1 mo - 2 yrs - Neonates - septicaemia (lack of passive transfer or omphalitis)&lt;br&gt;• Actinomyces pyogenes&lt;br&gt;• Adult w/bacteremia&lt;br&gt;• Fusobacterium necrophorum&lt;br&gt;• Compresses spinal cord</td>
<td>• Mimic spinal trauma - focal signs depend on which vertebra, see preceding pg for localization&lt;br&gt;• Acute neurological signs (m/b chronic)&lt;br&gt;• ↑Temp. (helpful in Dx)&lt;br&gt;• Sick, bacteremia, septicaemia&lt;br&gt;• CS of other systems involved&lt;br&gt;• Pain, heat, swelling over site usually&lt;br&gt;• Standing or recumbent&lt;br&gt;• If standing often reluctant to move due to pain&lt;br&gt;• Sequeleae - Meningitis, if erodes&lt;br&gt;• Pathological fxs</td>
<td>• History, CS, PE&lt;br&gt;• Lab:&lt;br&gt;  - Epidural abscess, CSF normal&lt;br&gt;  - Inside: CSF &gt; 100 PMNs/dl, protein &gt; 200 mg/dl&lt;br&gt;  - CBC other d/z (mnr. fibrinogen, ammrea w/ chronic infection)&lt;br&gt;• Rads - osteomyelitis (random hypolucency &amp; sclerosis)&lt;br&gt;• Definitive Dx&lt;br&gt;• Myelogram (site of compression)</td>
<td>• Euthanasia (too young for slaughter usually)&lt;br&gt;• $ Long term ABs (antibiotics)&lt;br&gt;  - Generally effective if early (Cut/Sensitivity)&lt;br&gt;  - Broad spec. ABs if culture inconclusive&lt;br&gt;  - Procaine pen G for 2-3 months&lt;br&gt;</td>
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<td><strong>Young cattle, Hematogenous</strong>&lt;br&gt;CS: Mimic focal spinal cord trauma&lt;br&gt;Dx: Hx, CS, PE, Lab, Rads&lt;br&gt;Tx: Euthanasia, Long term ABs&lt;br&gt;Px: Poor to Grave</td>
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<td><strong>Verminous myelitis/</strong>&lt;br&gt;myeloencephalitis, Cerebrospinal nematodiases, Cattle grubs&lt;br&gt;**</td>
<td>• See pg 182, Systemic organophosphate grub treatment when parasites are in CNS, Larvae of Hypoderma bovis (heel fly); More common economic problem is damage to hides due to “warbles” &amp; wt. loss due to “gadding about” (running from heel flies)&lt;br&gt;• CS: Diffuse spinal cord CNS signs 2 ds after organophosphate deworming - stiffness of rear limbs, ataxia, paraparesis &amp; paraplegia&lt;br&gt;• Dx: Hx of grub Tx 2 ds previously &amp; CNS signs&lt;br&gt;• Tx: None&lt;br&gt;• Prevention: Don’t Tx grubs in summer (July to Oct.), Tx in fall</td>
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<td><strong>Vertebral spondylitis</strong>&lt;br&gt;Mk 529; C3T 877; BR-hb 676; ER 1716; Br 390; IM 1134, 1298; VCN 187; DC 400&lt;br&gt;***</td>
<td>• Aged bulls&lt;br&gt;• High Ca diet&lt;br&gt;• Bony proliferation along vertebral bodies &amp; facies &amp; ankylosis of adjacent vertebrae&lt;br&gt;• Fxs during Al semen collection</td>
<td>• Slowly progressive, stiff hind-limb gait, weakness&lt;br&gt;• Recumbency (assoc. w/ vertebral body fracture)&lt;br&gt;• Difficulty mounting (bulls)&lt;br&gt;• Pain - lumbar vertebrae</td>
<td>• History, CS&lt;br&gt;• $ Rads</td>
<td>• No specific Tx&lt;br&gt;• Analgesics to prolong use of bull&lt;br&gt;</td>
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Lymphosarcoma
of Spinal Cord
Mk 592, IM 1136; C3T 917; VC/N 186; DC 424

- See Gen, pg 268
- > 5 yrs-old, Adult
- Cauda equina & lumbar segments of spinal cord
- Pathophysiology
  - Extravascular
  - Compressive, usually involves white matter, unless severe
  - Indistinguishable from spinal fx
- Variable (degree of compression)
- Progressive onset
- Cauda equina (common site)
  - Flaccid tail & anus
  - Dysuria, urine scalding
  - Distended bladder
  - Perineal analgesia
  - +/- ataxia, paraparesis
  - (if far enough cranial, dog-sit)
- BAR (bright, alert, responsive)
- Other systems involved
- Cranial nerves normal, unless involvement of the eye
- Dx difficult unless other systems involved
- History, CS
- CSF tap: m/ biopsy tumor
- BAR points toward this dz
- If BLV positive, m/ support Dx
- Rads usually not helpful
- Postmortem: Definitive diagnoses
- Rare, Devon calves
- Developmental defect
- Spinal cord compression
- Lesion to UMN & conscious proprioceptive pathways
- M/b palate malformation axis
- Rads - definitive Dx
- M/b palpate malformation axis
- No therapy
- Prognosis:
  - Grave, euthanasia
- Control
  - Control vectors (blood transmission)
  - Eliminate lymphosarcoma from herd by testing & culling positive animals; possible, but costly
- DDx:
  - Abscesses around spinal cord
  - Downer cow syndrome (p 267)
  - Obturator n. damage (p 137)
  - Trauma of spinal cord (p 133)
  - Metabolic defc (hypocalcemia)
  - Cervical spinal cord lesions
  - Spinal fracture (p 133)
  - Cattle grubs (p 182, 134)
- Miscellaneous genetic conditions
  - (BR-hb 213, 630; BR 503; C3T 92)
  - Dodder calves (IM 1148; BR-hb 643; BR 1647; Br 698) • Rare, congenital, lethal in Jerseys; down w/intermittent spasms, nystagmus
  - Progressive ataxia of Charolais calves (Mk 592; IM 1145;VC/N 188) • Rare, inherited?
  - Spinal bifida (Mk 586; IM 1148) • Rare; paraparesis & para- or tetraplegia
  - Cerebellar malformations (IM 1105) • Reported in 2 Ayrshire calves & in Jersey calves
  - Arnold-Chiari Syndrome (Mk 578; Br 699) • Cerebellum through foramen magnum
  - Weaver Syndrome (Mk 581, 592; BR-hb 639; BR 1640; IM 1144; VC/N 189; C3T 92; DC 428; N-L 262)
    - Brown Swiss calves, rare, genetic, progressive degenerative myeloencephalopathy, begins at 6 mos.; Course: 12-18 mos. • Tx: Euthanasia
  - Bovine familial convulsions & ataxia (IM 1105; BR-hb 641; BR 1644; N-L 234)
    - Angus cattle, multiple tetanic clonic convulsions & a spastic ataxia that persists for several mos, gradually recover by 2 yrs old; fatten & slaughter, don’t breed (possibly genetic)
  - Neuraxial edema: Maple syrup diz (BR-hb 639; BR 1641; Br 149; 695; IM 1111; N-L 200)
    - Rare, polled Hereford calves, amino acid metabolism problems
    - CS: Dullness, opisthotonus, recumbency, poor response to touch or auditory stimulus
    - Dx: Elevated ketones in urine & burnt sugar smell to urine, vacuoles in neuraxis, esp. white matter
  - Inherited congenital myoclonus (BR-hb 642; BR 1645; Br 149; IM 1112; N-L 200)
    - Rare; Hereford & polled Hereford-cross calves; short gestation, hip joint lesions
    - CS: BAR (bright & alert), but recumbent, some unable to move heads, Extension & crossing of hind limbs, hypersensitivity to sound & touch, Myoclonic spasms & body rigidity on stimulation
    - Tx: none; Euthanasia
  - Inherited congenital myoclonus (BR-hb 642; BR 1645; Br 149; IM 1112; N-L 200)
    - Rare; Hereford & polled Hereford-cross calves; short gestation, hip joint lesions
    - CS: BAR (bright & alert), but recumbent, some unable to move heads, Extension & crossing of hind limbs, hypersensitivity to sound & touch, Myoclonic spasms & body rigidity on stimulation
    - Tx: none; Euthanasia
### Peripheral Nerves

<table>
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<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
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<tbody>
<tr>
<td>Peripheral nerve</td>
<td>• Low incidence • Problems localized to only 1 limb (monoparesis) by LMN signs • Problems in specific nerve roots, nerve or group of nerves or muscles they innervate • Cause: usually trauma</td>
<td>• Gait &amp; posture abnormalities • Loss of cutaneous sensation</td>
<td>CS, Hx</td>
<td>• Reduction of inflammation - Dexamethasone (0.5 mg/kg) daily 3-5 ds - Phenytoin IV 1st 24 hr - Cold packs 1st 24 hr</td>
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<td>damage</td>
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<td>• Relief of pain - NSAIDs: Banamine®, Phenytoin (PBZ)</td>
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<td>• Stall Rest w/ good footing/bedding</td>
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<td>• Recumbent animals turned 6-8 times/d</td>
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<td>• Calcium gluconate to downer cows</td>
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<td>Radial n.</td>
<td>• Radial nerve: dives into triceps brachii m. • Passes in brachial groove to emerge on lat. side of limb under the dist. border of lateral head of triceps • Innervates all extensor mm. of limb</td>
<td>• &quot;High radial nerve paralysis&quot; injury above entrance into the triceps m. • &quot;Dropped elbow&quot; • Unable to bear weight on limb • Neurogenic atrophy of extensor mm. of limb • + CS of lower radial nerve injury • &quot;Lower radial n. paralysis&quot; (injury near lat. elbow) • Knuckling over (fetlock joint)</td>
<td>History, CS</td>
<td>• Tx: (see above) Time &amp; TLC to see if function returns • Animal can learn to &quot;flip&quot; dist. limb so foot lands correctly (&quot;lower radial n. paralysis&quot;)</td>
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<td>Prognosis: Poor if dysfunction &gt; 2 wks</td>
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<td>Sciatic n. paralysis</td>
<td>• Most commonly in postpartum cows, part of &quot;obturator n. paralysis&quot; syndrome; Injection in gluteal mm. in neonates, pelvic fps, tumors, abscesses • CS: Limb hangs at rest, dropped stifle, knuckling, but can bear wt. (femoral n. intact) • Tx: see above</td>
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<td>Femoral n. paralysis</td>
<td>• Overstretching (struggling downer cow, calf during dystocia) • CS: Can't bear wt. (extensors of stifle) • Tx: see above</td>
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**"Sweeney", Suprascapular paralysis** *(IM 1169; Br 364; VCN 193; L 338; DC 428; N-L 337)*

** • Trauma to suprascapular n. where it crosses cran. border of scapula • CS: Acute - lat. slipping of shoulder; Chronic - atrophy, "Sweeney" (prominent scapular spine) • Tx: Rest • Prognosis: Not severely incapacitated

**Brachial plexus evulsion** *(IM 1169; Br 365; VCN 194; L 341; DC 430; N-L 341):* • Excessive traction during calving • CS: variable on nerves involved • Tx: NSAIDs & support • Px: depends on severity

**Radial n.** *(IM 1169; VCN 196; C3T 68; BR 1320; Br 365; L 338; S-U 68; N-L 339; DC 429)**

**Extensor mm "Dropped elbow" Knuckling over**
**Peroneal n. paralysis**

Mk 500; IM 1170; VC/N 208; C3T 322; Br 367; L 347; DC 433, N-L 344

- Peroneal n.: supf. as crosses lat. surface of gastrocnemius m.
- Recumbent postpartum dairy cows w/ hypocalcemia or other causes (lying on nerve)

***Obturator n.***

- Obturator nerve: passes down shaft of ilium (pelvic inlet) through obturator foramen
- Supplies adductors of hindlimb

**Spastic syndrome, Elso Heel**

Mk 592, 502; C3T 92; VC/N 168; BR 463, 1644; Br 149, 367, 685, 700; DC 389; N-L 516

- Adult > 3 yr, Holsteins & Guernseys
- Genetic in nature
- Beef rarely affected

**Spastic paresis, Calving paralysis**

Mk 495; IM 1172; C3T 322; Br 366; VC/N 202; L 344; DC 433, N-L 311, 342, 345

- Adult as crosses lat. surface of gastrocnemius m.
- Recumbent postpartum dairy cows w/ hypocalcemia or other causes (lying on nerve)

**Spastic syndrome, Elso Heel**

- Calves 3 wks - 12 mos
- More common than stretching
- M/h hereditary, ("Elso" a bull w/ lots of affected offspring)
- Holsteins & Angus (all breeds affected)

**Myotonia**: sustained contraction of muscles w/ stimulation

**DDx**: Tetanus (recumbency) (p 145)

- Spastic paresis (calves)
- Laminitis
- Colic
- Peritonitis

**Spastic paresis, Calving paralysis**

- Nonslip surfaces - minimum deficit
- "Splits" to sides on slippery surfaces (can't adduct limbs)
- Hopping gait
- Recumbency w/ hind legs to each side
- No cutaneous sensation loss

- Hindlimb lameness w/ fetlock flexed

**Just calved**

- Keep on firm ground, no slippery surfaces
- Hobbles around on dist. metatarsus

**Provide ample exercise, relieves spasms**

- No cure, just manage

**Prognosis**: Good if adequate exercise

**Salvage**

- Salvage procedure to gain weight, not for breeding (hereditary)
- Sx - cut branches of tibial n. to gastro: Sx - tenotomy of gastro. & partial tenotomy of SDF

**Prognosis**: Cut tibial n. - 54% success

**Tenotomy - 40%**
### Brain

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<th>Condition/Facts</th>
<th>Presentation/CS</th>
<th>Causes</th>
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| **Brain stem lesions** (IM 159; VC/N 182; BR-hb 204; BR 461)  
Brain stem: midbrain, pons & medulla  
- RAS (reticular activating system): concerned w/ conscious level  
- Proprioceptive fibers pass through  
- Cranial nerves assoc. w/ brainstem  
- UMN, sensory & proprioceptive fibers pass through  
- Walking motion reflexes  
  - Generated in centers caud. to the midbrain  
  - Initiated rostral to midbrain (higher centers)  
  - Descending motor tracts from higher centers cross over in the midbrain |  
- ↓ Consciousness (depression, stupor, coma)  
  - Profound depression (RAS)  
  - Deficits in CN III - XII  
  - Vestibular system CS (see below)  
  - Proprioceptive (Propcpt) deficit & gait  
    - Proprcpt. defc. w/ norm. gait - midbrain or rostral  
    - Proprcpt defc. w/ abnorm. gait - caud. to midbrain  
  - UMN & proprioceptive deficits all limbs |  
- Listeriosis (pg 143)  
- Thromboembolic meningoencephalitis (TEME) (pg 141)  
- Otitis interna/vestibular diz (pg 142)  
- Brain abscess or tumor  
- Horner's syndrome (can be due to oculomotor n. damage)  
- Hypovitaminosis A (pg 142) |

#### Lesion - Vestibular System
- Control posture in relationship to gravity; & eye movements in relationship to head movements  
- Peripheral vestibular centers: inner ear (labyrinth, receptors, & vestibular n., not proprioceptive fibers)  
- Central vestibular (vestibular nuclei in brain stem & centers in cerebellum) motor, sensory & proprioceptive centers (brain stem) located in area  
- Head tilt  
- Nystagmus  
- Ataxia  
- Possibly circling & falling towards lesion  
- Strabismus  
- Central vestibular diz (brain stem) also shows:  
  - Nystagmus in any direction  
  - Postural deficits (proprioception) & paresis (UMN)  
  - Depression (RAS in area of vestibular nuclei)  
  - Recumbency, lesion side down  
  - Lean against wall  
  - Loss of perception of sensation  
- Peripheral vestibular diz also show:  
  - Nystagmus - horizontal only  
  - No UMN signs (paresis)  
  - Ataxia bec. of loss of balance, not due to proprioception  
  - No decr. sensorium or depression |  
- Listeriosis (pg 143)  
- TEME (Haemophilus somnus)  
- Peripheral vestibular diz  
- Brain abscess or brain tumor  
- Otitis media/interna (pg 142)
Cerebellar lesions

- Coordinates movements, but does not initiate them
- Vestibular system connections to help coordinate balance & posture
- Proprioceptive fibers don’t pass through cerebellum
- Menace response, somehow cerebellum plays a role

- Incoordination (ataxia) (excessive range, rate & force of movement)
- Wide-based stance from balance deficits, not proprioception
- Tremors
- Abnormal movements of the head
- Vestibular diz signs, including:
  - Head tilt
  - Nystagmus
- Loss of menace response, but not blind
- BAR, because RAS not affected
- No proprioceptive deficits

Cerebral lesions

- Mild to marked depression (less than brain stem lesion)
- Alterations in behavior (agression, rage, hypersexuality)
- Seizures
- Propulsive circling (wide)
- Head pressing, continual chewing (odontoprisis)
- Normal gait in straight line w/ abnorm. postural reactions (proprioception loss, stumbling, knuckling over fetlock)
- Blindness (occipital lobe) w/ normal pupillary responses

- Cerebellar hypoplasia
- BVD, Blue tongue, Akabane, Border diz
- Cerebellar abiotrophy (pg 143)
- Bovine familial convulsions & ataxia (pg 135)
- Grass staggers (Bermuda, Dallis, Ryegrass. Kikuyu, Canary)
- Hypomagnesemia (pg 146)
- Locoism (pg 147)

Hypothalamus

- Controls the autonomic nervous system (ANS) & the endocrine system
- Pituitary abscess (IM 1035)
- Sporadic ataxia, Death

Autonomic & endocrine abnormalities

- Polyuria/Polydipsia (PU/PD)
- Altered sleep patterns
- Rage to affectionate behavior
- Abnormal appetite

Pseudorabies (pg 141)
- Malignant catarrhal fever
- Urea poisoning (pg 153)
- IBR (pg 154)
- Insecticide poisoning
- Dehorning/sinusitis

BVD - Cerebellar hypoplasia

- See Repro. pg 124; Infection of pregnant cows at 100-170 days: congenital cerebellar hypoplasia; infection at 90-100 days: abortion or stillbirth
- CS: At birth - truncal ataxia, opisthotonus, wide-base stance, intentional head tremors, hypermetria, hyperreflexia, nystagmus or strabismus
- Dx: Hx, CS, BVD antibodies in precolostral blood
- Tx: None • Px: Grave - rarely improves

Bluetongue can also cause cerebellar hypoplasia
**Brain**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polioencephalomalacia, PEM, Thiamine defc, Cerebrocortical necrosis, Cerebral edema,</td>
<td>Thiamine (Vit B1) defc</td>
<td>Sporadic w/ occas. outbreaks</td>
<td>History, CS: &quot;Star gazing&quot;</td>
<td>Emergency (brain cells dying by millions)</td>
</tr>
<tr>
<td></td>
<td>Calves &amp; lambs (fast growing)</td>
<td>&quot;Star gazing&quot; (dorsomed. strabismus)</td>
<td>Response to thiamine Tx</td>
<td>Thiamine whether Dx or not</td>
</tr>
<tr>
<td></td>
<td>Causes; not clear</td>
<td>Isolation &amp; anorexia</td>
<td>RBC transketolase, focal or ruminal thiaminase assays</td>
<td>- If respond then Dx (signif. changes in demeanor, 3 wk convalescence)</td>
</tr>
<tr>
<td></td>
<td>- 2° to grain overload</td>
<td>Depression</td>
<td>- IV Thiamine hydrochloride (10-20 mg/kg). Repeated 4 x/d, then 2 x/d</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Hi CHO, low roughage diet</td>
<td>Rumen activity</td>
<td>- If no response, check DDx</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Sudden diet changes (to conc. &amp; corn silage)</td>
<td>Centrally blind (no menace response, but intact pupillary response)</td>
<td>- ↓ CHO (to rest of herd)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Hi sulfate levels</td>
<td>Head pressing</td>
<td>High quality roughage 5 days prior to return to concentrates</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Kochia (poisonous plant)</td>
<td>Opisthotonus</td>
<td>Transfaunate rumen</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pathophysiology</td>
<td>Ataxic (while still standing)</td>
<td>Anticonvulsants</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Thiamine normally produced by rumenal flora</td>
<td>Comatose, convulse &amp; death</td>
<td>Dexamethasone to decr. inflammation &amp; stabilize membranes</td>
<td></td>
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<tr>
<td></td>
<td>- CHO - change flora to thiaminase producers</td>
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<tr>
<td></td>
<td>- Thiamine necessary for CHO metab. to glucose</td>
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<tr>
<td></td>
<td>Thiamine defc ... Glucose to brain</td>
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<tr>
<td>Cerebral edema</td>
<td>↓ Glucose to brain</td>
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<tr>
<td></td>
<td>Cerebral edema &amp; necrosis</td>
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</tbody>
</table>

**Hi CHO = Thiamine defc - ↓ Glucose to brain**

**CS: CNS - Star gazing, Centrally blind**

**Dx: Response to thiamine Tx**

**Tx: Emergency - Thiamine**

**Brain abscesses**

<table>
<thead>
<tr>
<th>IM 1036; BR 489; BR-hb 205; Pic 143; DC 409; N-L 90</th>
<th>Actinomyces pyogenes</th>
<th>Slower onset &amp; more asymmetrical than meningitis</th>
<th>Presumptive Dx on abscesses in other parts of body or chronic infection</th>
<th>Penicillin DOC</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Actinomyces pyogenes</td>
<td>• Hematogenously spread from other organ systems via bacteria emboli</td>
<td>• CNS CS vary, dep. on location</td>
<td>• Presumptive Dx on abscesses in other parts of body or chronic infection</td>
<td><strong>DDx:</strong> Meningitis</td>
</tr>
<tr>
<td>• Dehorning due to ascending infect from sinuses</td>
<td>• Dehorning due to ascending infect from sinuses</td>
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<tr>
<td>• Affinity for the pituitary gland &amp; hypothalamus</td>
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</tbody>
</table>

**Actinomyces pyogenes**

**DDx:**

- Lead poisoning (p 152)
- Nitrofurantoin toxicity
- Urea toxicity (p 153)
- Salbutamol intoxication (p 153)
- Hypomagnesemia (p 146)
- Hepatoencephalopathy (p 154)
- Meningitis or encephalitis (p 151)
- TME (p 141)
- Brain abscess (p 140)
- Type D Clostridia enterotoxemia
- VIT A defc (p 148)
- Chlorinated hydrocarbon (p 207)

**Control**

- Thiamine supplementation
- Gradual change to concentrates
- Check sulfate levels & Kochia plant

**Actinomyces pyogenes**

**DDx:** Meningitis
Haemophilus septicemia, TEME, ITEME
Thromboembolic meningoencephalitis, Mk 602, C3T 546; IM 1092; C3T 662; BR 486; BR 811; VCN 61; Pic 144; N-L 87

- Haemophilus somnus, Gram neg. pleomorphic rod or coccobacillus
- Calves, Feedlot, 4-12 mos - 4 wks after entering feedlot
- Septicemic diz
  - Tropism for brain (cerebellum & brain stem)
  - Lungs (pneumonia more common)
- Joint infections
  - Infertility, metritis, vulvitis, orchitis, conjunctivitis, otitis, mastitis
- Morbidity low 2-10%

***

Calves, 4 wks after entering feedlot
CS: Resp + CNS + Joint
Dx: Calf (Resp + CNS + Joint); CSF
Tx: Hi ABs + Thiamine

Pseudorabies, Aujesky's diz, Mad Itch, Infec. Bulbar Paralysis
Mk 602, IM 1017; VCN 49; C3T 422; BR-hb 419; BR 1094; BR 705; DC 415; N-L 86, 361; Pic 147

- Herpes virus
- 1° seen in swine (swine resistant to clinical diz, lately infec. on recovery - Spreads to ruminants)
- Fatal diz in cattle - CNS
- Hx: contact w/ swine
- IP: 90 to 156 hrs (short)

Pigs - Herpes virus
CS: Mad itch, Salivation
Dx: Swine contact + CS • DDx: Rabies
Tx: Fatal

- Initial excitement phase (m/b aggressive, agitated)
- Mad itch, acute pruritus, self mutilation
- Salivation
- Abnormal behavior (depression or aggression)
- Weakness & ataxia, paralysis
- Convulsions & death 24-48 hrs after initial CS
- Found dead (short IP)

DDx:
- Polioencephalomalacia (p 140)
- Hypovitaminosis A (p 142)
- Listeriosis (p 143)
- Malignant catarrhal fever
- Lead poisoning (p 152)

Calves w/ CNS, resp., & joint disease
Lab
- CSF analysis
  - Neutrophilia (elev. PMNs)
  - t protein
  - Xanthochromia
  - H. somnus org. hard to culture
- Postmortem
  - Vasculitis to septic infarcts & abscesses

DDx:
- Polioencephalomalacia (PEM) cannot be distinguished clinically from TEME so give thiamine along w/ ABs
- CS + Exposure to swine
- Brain submitted for rabies

- Effective if early (check other feedlot cattle every 2 hrs)
- IV ABs at hi levels (double dosages)
  - Micotil®
  - Oxytetracycline
  - Penicillin/streptomycin
- Also thiamine - in case m/b PEM, if cow has headache give thiamine
- Chlorotetracycline in feed for 10 ds (for herd Tz)
- Course of disease 2-3 wks

Prognosis:
- Good if early
- Mortality 90% if not Treated early,
- Once recumbent - grave

Bacterin - available, but only 80% seroconvert
- Given at time of weaning, prior to shipping to feedlot (should be preconditioned to go to feedlot, but not cost effective. At most castrations & weaning on farms, then rest [vac., etc.] at feedlot)

- None, once contacted virus
- No vaccine

Prognosis:
- Fatal, occasional spontaneous recovery

Control:
- Prevent contact w/ swine
- Disinfect area (quaternary ammonium)

Rabies (p 144)
PEM (p 140)
Salt poisoning (p 153)
Meningitis (p 151)
Lead poisoning (p 152)
Hypomagnesemia (p 146)
Enterotoxemia (p 149)
### Otis media & otitis interna

**Condition:** MK 312; IM 1094; CST 854; 142; VC/N 183; BR-hb 207; BR 493; Br 216; DC 435; N-L 186

- **Facts/Cause:** Common diz in cattle & sheep
- **Cause:** Usu. sequela to resp. infec. (Pasteurella pneumonia, c. pseudotuberculosis, H. somnus)
- **Presentation:** BAR
- **Diagnosis:** CS of vestibular diz
- **Treatment:** Long term ABs, several wks.

#### Sequela to resp. infection

- **CS:** Vestibular & Facial n., BAR
- **Dx:** CS + Norm. proprioception
- **Tx:** Long term ABs

### Hypovitaminosis A

**Condition:** MK 1199; IM 1064; CST 911; BR-hb 548; Br 1449; Br 220; DC 464; VC/N 119; N-L 131

- **Facts/Cause:** Vit. A maintains integrity of epithelial tissue
- **Diet:** Rare now due to better nutrition
- **History:** Vit. A levels in blood
- **DDx:** Central vestibular diz

#### Rare - Better nutrition now

### Tick paralysis

**Condition:** MK 624; BR-hb 620; BR 1610; VC/N 103; N-L 315

- **Facts/Cause:** Rare, Dogs most commonly, but can cause losses in calves
- **Dx:** Lead poisoning (p 152)
- **Control:** Vit. A supplement

#### CS: Paralysis

- **Dx:** CS + Norm. proprioception
- **Tx:** Remove tick - Recover rapidly

### NERVOUS SYSTEM
Listeriosis, Circling Diz, Listeriosis,

- **Listeria monocytogenes**
  - Gram positive rod
  - Present in soil, silage & feces
  - Assoc. w/ silage feeding (therefore in winter or spring, prior to new pasture growth)
- **Brain stem meningoencephalitis** (most common in ruminants)
  - Gram positive rod
  - Present in soil, silage & feces
  - Assoc. w/ silage feeding (therefore in winter or spring, prior to new pasture growth)
- **Microabscesses** in brain
  - #1 Bact. infec. of CNS in adults
  - Herd outbreaks
- **Brain stem & cran. nerve “lateralizing” diz - adults**
  - Ascending infec. cran. nerves
  - #1 Bact. infec. of CNS in adults
  - Herd outbreaks

- **Septicemia** - neonates & steers
  - More common in monogastric animals, seen in lambs & calves before rumen is functional
  - < 3 wk of age
- **Abortions** (late gestation)

- **Depressed** (RAS)
  - Fever, anorexia
  - Unilateral limb signs
  - - Knuckle over
  - - Weakness to paralysis
- **Unilat. cranial nerve CS** (see box)
  - Lip droops, inability to blink
  - Head tilt, Nystagmus
  - Cirlcing, Ataxia
  - Facial sensation
  - Dysphagia (difficult swallowing, m/b only sign (paralysis of facial & throat muscles)
  - Stertorous breathing
  - Paralysis of tongue ipsilateral

- **ABORTIONS** (late gestation)
  - Encephalitic form & abortions usually don't occur simultaneously
  - **SEPTICEMIA**
  - Dysentery
  - Focal hepatic necrosis

- **Isolation & ID org.** (difficult, brain, fetal tissue)
- **Herd outbreak of brain stem diz w/ unilat. signs of circling**
- **Unilat. involvement of multiple cran. nn.** highly suggestive
  - CSF fluid - i # of mono-cytes (thus name)
  - Postmortem:
    - Microabscesses in brain

**Cranial Nerves:**
- **Facial n.** paralysis
  - Lip droop, inability to blink
  - 2nd keratoconjunctivitis
- **Vestibulocochlear n.** (CN 8)
  - Head tilt
  - Nystagmus
  - Cirlcing
  - Ataxia
  - **Trigeminal** (CN 5)
    - Decr. facial sensation
    - Poor jaw tone
  - **Cranial nerves 9 & 10**
    - Dysphagia (trouble swallowing)
    - Stertorous breathing
  - **Hypoglossal** (CN XII)
    - Paralysis of tongue, ipsilateral

**Brain tumors**
- Cause compression of brain stem; Cran. Nerves V, VII & VIII & cerebellum
- Tumors: medulloblastoma, ependymoblastoma, neurofibrosarcoma, meningioma, meningeal hemangioma, angioblastoma, neurofibroma
- **CS & Dx:** Hypermetric gait, ataxia, Depression, Facial paresis/paralysis, Facial anesthesia/analgesia, Head tilt, strabismus & nystagmus
- **Tx:** None

**Cerebellar abiotrophy**
- Degeneration of formed cerebellar tissue due to premature aging, 3-9 mo-old Holstein heifers (NE U)
  - Can; also in Heref., Ayrshire & Jerseys; Hereditary (recessive gene)
  - CS: Normal at birth, Cerebellar CS at 3-9 mo, progresses rapidly for several days then stabilizes, m/ remain static or slowly progress to recumbency
  - **DDx:** Cerebellar hypoplasia (present at birth)
  - **Tx:** Euthanasia

**Hydrocephalus**
- Dome-shaped cranium, Neurologic deficits

**Public Health**
- Humans/listeriosis from milk or secretions
- CS: septicemia, meningitis & abortions

**Brain stem**
- **Tetracyclines** (high doses, but m/v followed by fatal relapse, therapeutic levels in brain difficult)
- Penicillin - high dose
- Isolate (long time, 1 mo)
- Take off silage on trial basis
- IV fluids, TLC
- NO vaccine in USA

**Prognosis:**
- **Early Tx - Good**
- Recumbent, coma - Grave

**Contro:**
- **No spoiled silage**

**DDx**
- Brain stem abscesses (p 140)
- Inner ear infections (p 142)
- Rabies (p 144)
- Bacterial meningitis (p 151)
- TEME (p 141)
- Polioencephalomalacia (p 140)
- Lead poisoning (p 152)

**PH**
- Brain stem abscesses (p 140)
- Inner ear infections (p 142)
- Rabies (p 144)
- Bacterial meningitis (p 151)
- TEME (p 141)
- Polioencephalomalacia (p 140)
- Lead poisoning (p 152)
### Botulism & Rabies

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
</table>
| Rabies    | **Rhabdovirus** (Lyssavirus)  
- Worldwide, except some free islands (Eng.)  
- Fatal neurological diz of warm blooded animals  
- Reservoirs (bats, dogs, foxes, skunks & raccoons)  
- **Pathophysiology**  
  - Transt: bites (virus in saliva)  
  - Reaches CNS over peripheral nn.  
  - Fom CNS to salivary glands over nerves  
  - IP 3 wks - 3 mo (different length nerves)  
  - **Progressive & rapidly fatal diz** | **Behavioral changes (1st)**  
- Tenesmus (constant sign)  
- M/ or m/n "salivate"  
- Progressive lameness, ataxia & posterior paresis  
  **Furious form ("mad dog" form)**  
- Alert, not normal placid expression  
- Muscle tremors  
- Bloat  
- Tenesmus  
- Aggression, bellowing, belligerent, attack & pursue (as diz progresses, less belligerent)  
- Run frantically through fences, etc.  
- Hypersexuality, mounting objects, paraphimosis  
- Tactile/auditory stim. behavioral changes  
- Pruritic  
  - Proropioceptive deficits  
  - Recumbent, convulse, Die w/in 2-4 ds  
  **Dumb form**  
- Severely depressed  
- Profuse salivation, dysphagia (inability to swallow due to pharyngeal paralysis)  
- Anorexia, temp > 103° F, drooped head  
- Flaccid paralysis, wide base stance, difficulty rising  
- Die - laryngeal paralysis  
  **Paralytic form** (common in cattle)  
- Flaccid tetraparesis or paraparesis  
- Forms can overlap | **Notify authorities**  
- PM done by state officials  
- **FA staining tech. (Ag/Ab) (fast)**  
- Intracerebral inoculation - mice, examine brain in 5 ds  
- Negri bodies - microscopic brain sections (hippocampus) (historic method) | **Isolate/Euthanize & notify authorities**  
- Valuable animal isolate for at least 6 mo |

**DDx for all abnormal behavior**  
Furious, Dumb & Paralytic forms - All fatal  
CS: Behavior changes, Tenesmus  
Dx: Notify authorities - they post  
Tx: Euthanize - 6 mo isolation  

**Control:**  
- Mass vaccination of dogs & cats  
- Approved vaccines for cattle  
  - Recommend annual vaccinations in endemic areas  

**Public Health**  
Human immunization strongly recommended for veterinarians
Botulism, Forage poisoning
Mk 328, IM 1159; C3T 568; BR-hb 284; BR 880; Br 554; DC 436; L 120; N-L 302; VCN 89; Pic 206

**

- Rare
- Lethal food poisoning of man & animal
- Clostridium botulinum (type B, C & D)
  - Toxin: Blocks Acetylcholine at NMJ (neuromuscular junction), motor peripheral nn. affected, not sensory or CNS
  - Gram pos., anaerobic, spore forming
  - Ubiquitous in soil
- Assoc. w/ silage feeding
  - Wound contamination, Carcasses m/ harbor
  - Poultry litter
- Individ. sporadic cases > herd outbreaks

ACh at NMJ - Silage - Individual
CS: Rapidly fatal motor paralysis (mimics Rabies)
Dx: Difficult, Mice inoculation
Tx: Supportive if alive • Px: Grave

Tetanus, Lockjaw
Mk 330; IM 1159; C3T 567; BR-hb 284; BR 677; Br 567; DC 436; L 120; N-L 302; VCN 89; Pic 206

**

- Clostridium tetani
  - Toxin producing, Spore in soil/feces
  - World wide distribution
  - All species susceptible (1 horse & man)
  - Gen. individ. cattle, not herd outbreak
  - IP 10-14 d (wk - wks)
- Transm.: Contamination of uterus (dairy), tail docking, castrations, dehoming, bull rings, infec. umbilical stalks, deep puncture wounds
- Toxin ascends nerves to spinal cord, causing ascending paralysis, if excess toxin in blood to brain, descending tetanus, toxins: tetanospsammin, tetanolysin & nonspasmogenic
- Reduce inhibition to motor nerves, causing hypertonia & spasms

Toxin - Decr. inhib. on motor nerves
CS: Muscular rigidity => "Sawhorse"
Tx: Penicillin, Muscle relaxants, Quiet
Px: Good if standing; Long recovery

Progressive muscular paralysis
- Mimics rabies
- Muscle weakness & ataxia
  (hindlimbs t'then cranially) m/ persist for wks if nonfatal
- Disturbed vision
- Salivation & dysphagia (paralysis of tongue)
- Droopy expression, protruded tongue, ptosis (ANS)
- GI: rumen atony, bloat, constipation & mucus-covered faces
- Urinary: distended atomic bladder
- Death - 24 hrs or persists for wks

Dx: Rabies (p 144)
- 2nd-stage milk fever (responds to Ca Tx) (p 148)
- Listeriosis (p 143)
- Bovine spongiform encephalopathy (no paralysis)(p 154)

Usu. presumptive Dx: History & CS
- No reliable clinical test for Dx (CSF tap, culturing not too helpful)

Tx: Supportive if alive · Px: Grave

Symptomatic
- Fluid, nutrition, nursing
- Controversy over value of purgatives
- Antitoxin of little value even in early stages

Prognosis: • Grave: Acute & peracuate will die

Control:
- Proper disposal of carcasses
- No decaying grass or spoiled silage in diet
- Vaccine (toxoid) only in enzootic areas

1. Remove source
2. High levels of penicillin (lavage uterus w/ penicillin). Give systemically, plus debride & inject wound site
3. Antitoxin if early (prevents toxin binding to nerves, once bound, can't unbind)
4. Muscle relaxation
- Acepromazine + 5% penoborbital (cheap), or Diazepam ($)
5. Support
- Quiet, dark stall, pack ears w/ cotton
- Good footing, deep bedding, m/b sling
- Good nutrition, rumenotomy

Px: Good, if can make stand, better than horses; If survive 7 d's - fair to good; Long recovery, 3-4 wks

Prevention: No immunity on recovery
- Generally don't vaccinate (because more resistant than horses & small ruminants)
## Poisonous Plants

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypomagnesemia</td>
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</tr>
<tr>
<td>Grass tetany, Milk tetany</td>
<td>Wheat pasture, CReated wheat-grass poisoning, Winter tetany, Transport tetany</td>
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<tr>
<td>Green oat poisoning, Barley poisoning, Grass Staggers</td>
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<tr>
<td>Adult tetany</td>
<td>Acute or gradual (dep. on diet)</td>
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<tr>
<td>Anorexia, Isolation, Alert</td>
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<tr>
<td>Hypermexitable (twitching erect ears)</td>
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<tr>
<td>Tetanic muscle spasms: fasciculations, head &amp; neck tremors, high stepping forelimb gait</td>
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<tr>
<td>Bellrowing &amp; frenzy if severe</td>
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<tr>
<td>Staggering ataxia, recumbency</td>
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<tr>
<td>Violent clonic convulsions &amp; opisthotonus (precipitated by stimuli &amp; alternates w/ tetanic spasms)</td>
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<tr>
<td>Salivation &amp; frothing at mouth</td>
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<tr>
<td>Snapping eyelids</td>
<td></td>
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<tr>
<td>Nystagmus &amp; involuntary eye movements</td>
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<tr>
<td>Inor. HR, loud heart sounds (m/b audible from a distance)</td>
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<tr>
<td>Rapid, forceful respirations</td>
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<tr>
<td>Death - resp. failure during a seizure (often w/in hours of start of seizures)</td>
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<tr>
<td>Found dead w/ evidence of convulsions</td>
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<tr>
<td>Mild or chronic lactation tetany</td>
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<tr>
<td>Milk tetany</td>
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<tr>
<td>Anorexia, decr. milk</td>
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<tr>
<td>Odd facial expressions or behavior</td>
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<tr>
<td>Low Mg, Stim. NMJ - Adult &amp; Calf forms</td>
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<tr>
<td>CS: Tetanic spasms, Violent convulsions, Death</td>
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<tr>
<td>Dx: CS, Hx, Tx response</td>
<td></td>
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<tr>
<td>Tx: Emergency - Ca/Mg combo IV</td>
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</table>

### NERVOUS SYSTEM

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypomagnesemia</td>
<td></td>
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</tr>
<tr>
<td>Grass tetany, Milk tetany</td>
<td>Wheat pasture, CReated wheat-grass poisoning, Winter tetany, Transport tetany</td>
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</tr>
<tr>
<td>Green oat poisoning, Barley poisoning, Grass Staggers</td>
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<tr>
<td>Adult tetany</td>
<td>Acute or gradual (dep. on diet)</td>
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<tr>
<td>Anorexia, Isolation, Alert</td>
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<tr>
<td>Hypermexitable (twitching erect ears)</td>
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<tr>
<td>Tetanic muscle spasms: fasciculations, head &amp; neck tremors, high stepping forelimb gait</td>
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<tr>
<td>Bellrowing &amp; frenzy if severe</td>
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</tbody>
</table>

### Mg+ (Magnesium)

**DDx:**
- Adults
  - Rabies (p. 144)
  - Other viral encephalitides
  - Hypocalcemia (p. 148)
  - Nervous ketosis (p. 149)
  - Nervous coccidiosis (p. 150)
  - Claviceps parasitica
  - Tetanus (p. 145)
  - Rye grass staggers (p. 146)
  - Chem. intoxicants (strychnine) (p. 152)
  - Heavy metals (lead, arsenic) (p. 152)
- Calves
  - Polioencephalomalacia (p. 140)
  - Enterotoxemia (p. 149)
  - Tetanus (p. 145)
  - Lead toxicity (p. 152)
  - Salt poisoning (p. 153)
  - Bacr. & viral encephalitis (p. 151)

**Postpartum paresis** (dullness & weakness)

**Prognosis:**
- Good if treated early
- Guarded if convulsions & tetany

**Prevention:**
- Mineral blocks & salt licks
- Mg fertilization on pasture
- Most efficacious way

**Tx:**
- Calves
  - IV commercial preparation 6% Mg borogluconate (125 ml)

**Tx response:**
- Improvement in 3-5 hrs (do not disturb, tranquilize if convulsions)
- Relapses common in 3-6 hrs (SQ 50% Mg, sloughing)
- 20% of treated die during a convulsion (bec. Mg crosses blood-brain barrier slowly)
### Other Poisonous Plants Affecting the Nervous System (VC/N 156)

<table>
<thead>
<tr>
<th>Poisonous Plant</th>
<th>Clinical Signs</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sorghum (lathyrism) (pg 242)</td>
<td>Ataxia, &quot;Dribbling&quot;, Cystitis</td>
<td>Withdraw, ABs (cystitis), Recovery rare</td>
</tr>
<tr>
<td>Dallis grass (Paspalum spp)</td>
<td>Staggers, tremors, &quot;Goose stepping&quot;</td>
<td>Weak calves, Abortions</td>
</tr>
<tr>
<td>Locoweed (Astragalus, Oxytropis spp) (pg 236)</td>
<td>Blind staggerers, vision, circling, convulsions</td>
<td>Rapid, Hepatic diz</td>
</tr>
<tr>
<td>Algae poisoning (pg 237)</td>
<td>Acute death, excitement, seizures, prostration</td>
<td>Fungal parasite of grasses</td>
</tr>
<tr>
<td>Ergot (Claviceps spp) (pg 237)</td>
<td>Ataxia, aggressiveness, collapse, convulsions, opisthotonus</td>
<td>Growing wild (WW II hemp plants)</td>
</tr>
<tr>
<td>Marijuana (Canabis)</td>
<td>Drowsiness, depression, ataxia</td>
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<tr>
<td>Selenium toxicity (pg 226)</td>
<td>Chronic &quot;blind stagger&quot; weakness, dyspnea, blindness</td>
<td></td>
</tr>
<tr>
<td>Jimsonweed (Datura spp) (pg 239)</td>
<td>Trembling, aggressive mania, convulsions, death</td>
<td>P- CN - Dry mouth, Mydriasis, Incr. HR</td>
</tr>
<tr>
<td>Water hemlock (Cicuta spp) (pg 238)</td>
<td>Sudden death, trembling, twitching, mania, violent convulsions</td>
<td>Aquatic</td>
</tr>
<tr>
<td>Poison hemlock (Conium spp) (pg 238)</td>
<td>Trembling, mania, coma, death</td>
<td>Semi-aquatic</td>
</tr>
<tr>
<td>Tobacco (Nicotine spp) (pg 239)</td>
<td>Trembling, mania, convulsion, coma, death</td>
<td>Tranquilize</td>
</tr>
<tr>
<td>Milkweeds (Asplepias spp) (pg 230)</td>
<td>Tremors, ataxia, hyperpnea, tachycardia, collapse, death</td>
<td>Unpalatable</td>
</tr>
<tr>
<td>Death camas (Zygadenus spp) (pg 239)</td>
<td>Trembling, ataxia, collapse, resp. paralysis, death</td>
<td>Toxin decr. after flowering</td>
</tr>
<tr>
<td>Larkspur (Delphinium spp) (pg 235)</td>
<td>Trembling, ataxia, collapse, resp. paralysis, death</td>
<td>Less common than diphtheria</td>
</tr>
<tr>
<td>Monkshood (Anconitum spp)</td>
<td>Twitching, abnormal gait</td>
<td>Toxic to bees</td>
</tr>
<tr>
<td>Buckeye (Aesculus spp)</td>
<td></td>
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<tr>
<td>Nightshade (Solanaum spp) (pg 239)</td>
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</tbody>
</table>

**IBR**

**Encephalitic diz,**

- "Rednose"
  - Mk 730; C3T 417; 837; IM 1009, 639; BR-hb 409; BR 1061; Br 266; DC 80; 197; GI 777; RM 250; Derm 106; NL 361

**See Gen 252**

- **Acute fatal encephalitic form**
  - Calves < 6 months old
  - Occasionally infected
  - Adults: common upper respiratory tract/trichophagoneumonia diz, also enteric form, IBR, & abortion storms

**Herpesvirus 1 (BHV 1)**

**CNS signs - 100% mortality**

- Incoordination (proprioception)
- Alternating excitement, depression
- Blindness
- Head pressing, aimless circling, head tilt, nystagmus
- Salivation
- Bellowing
- Convulsions, coma, death
- Mild nasal & ocular discharge

**History, CS**

- Antibody titers only good indication of exposure
- Serum Neutralization Test - TOC
- Necropsy
  - Lesion in cerebral cortex, internal capsule
  - Immunoperoxidase test (monoclonal antibodies)
  - Virus isolation

**No adequate treatment**

- Keep warm
- If convulsions: diazepam or phe-nobarbital

**Prevention:**

- Vaccination just before weaning may prevent all clinical forms of IBR

**Prognosis:**

- **Grave** near 100% die in 5 days (occasional recovery)
Nervous System

**Postparturient paresis, Milk fever, Parturient paresis, Hypocalcemia**

- 5-9 yr-old high prod. dairy cows (Jerseys)
- 3-6 lactation, not 1st calf heifers
- Assoc. w/ endotoxemia
- 0-72 hr after birth (m/b before, during, or mos after)
- Drain of Ca to milk
- Hypocalcemia: decr. ionized Ca (3-7 mg/dl, normal 10)

**Facts/Cause**

- Serum Mg: Decreased -> tetany
- Elevated -> flaccid paralysis
- Decr. feed intake at parturition due to other illness (e.g., metritis)
- Incidence in herd 8%-75%

**Calcium required for:**
- Release of ACh at NMJ
- Stasis of gut (smooth muscle)
- Decr. cardiac output
- Skeletal muscle weakness
- Decr. peripheral perfusion, hypothermia & depression

**DDx:**
- Mastitis, esp. coiform (p 192)
- Metritis (p 111)
- Grass tetany (p 146)
- Acute indigestion (p 28)
- Traumatic gastritis
- Coxofemoral luxation (BAR) (p 166)
- Obturator paralysis (BAR) (p 137)
- Spinal compression (BAR) (p 133)
- Pelvic fractures (BAR) (p 133)
- Hypomagnesium - prolonged excitability, strong peripheral pulses & not at parturition (p 146)

**Presentation/CS**

1. Early (stage I, 6.5 mg/dl)
   - Wobbly standing, bellowing (excitement, treading or restless, trembling over body, hypersensitive & teeth grinding)

2. Downer cow - (stage II, sternal recumbency, 5.5 mg/dl)
   - Head turned to flank
   - Drowsy or sleepy
   - Dull eyes, dilated pupils w/ poor pupillary light response
   - Pulse weak, rapid (facial a.)
   - Extremities cool (check ears)
   - Dilated flaccid anus
   - No rumenal contractions

3. Lat. recumbency as approaches coma
   - Position predisposes to bloat, regurgitation, aspiration pneumonia
   - Flaccid paralysis, worsening circulatory signs m/b no peripheral pulse
   - HR > 100 bpm
   - Untreated - coma, death (due to cardiovascular compromise)
   - Down > 48 hrs - myositis, m/ never be able to stand

**Diagnosis**

- Hx (old dairy cow - calving)
- CS (Downer cow)
- Hypocalcemia
- Hypophosphatemia

**Treatment**

- Watch postpartum for 72 hrs
- Early IV Ca gluconate (to avoid muscular or nervous damage) (250-500 mL, 25% sol)
  - Given over 10-20 min.
  - Auscultate heart & peripheral pulses (facial a.) for change in HR or cardiac arrhythmias leading to cardiac arrest
  - SQ or IP (less cardiac failure) (asepsis & 50 ml per site so no local reactions)
  - Retreat in 8-12 hrs (those that lapse or fail to get up)
  - Ketosis (250-500 ml of 50% dextrose IV)
  - IV phosphorus in field if doesn't respond to Ca Tx & no blood analysis
  - Commercial preparations containing Ca, Mg & K can be tried

**Prevention:** Appropriate feeding during dry period, ability to mobilize Ca in response to PTH & incr. absorption of Ca from G, requiring PTH & Vit D

- Lower Ca intake during dry period (i.e., 80-100 mg Ca/d, 2-3x this in lactating)
  - Excessive amounts of Ca during dry period causes a decr. in synthesis of PTH, which takes time to change

- Feed just hay during dry period (want Ca/P ratio of 2.3 to 1, but better to check amount of Ca. Some alfalfa 2% Ca. Need 0.4% Ca for dry cows)

- Massive doses of Vit D (20-30 million units daily) in feed 5-7 d before parturition will reduce incidence (incr. Ca from GI tract), but if parturition more than 4 ds later, cow more susceptible (toxicity also a concern)

- Single IV injection of crystalline Vit D 8 ds before calving effective, if doesn't calf give another injection

- High doses of Ca 1 d before, at, & 1 d after calving

- High Cl & Sulf diets, ammonium chloride & ammonium sulfate in basal diet, working w/ nutritionists
High prod. dairy, After birth, ↓ Ca
CS: Wobbly - Downer - Lat. recumbency
Dx: Hx, CS
Tx: IV Ca gluconate, Retreat in 8-12 hrs
Prevention: Lower Ca during dry period

Characteristic responses to Ca therapy:
• Tremors over flank, then spread to entire body
• Improved cardiac function, stronger heart sounds, pulse rate decr.
• Eruption & defecation, muzzle starts to sweat
• Animal rises gen. win an hour, then urinates. 60% usually stand 1-2 hrs into therapy
• If not within 8-12 hrs, must re-eval.; may need P or Mg or more Ca, or may have toxemia

Down long time & little response or relapse
• Maintain in sternal recumbency - allows eructation
• Water & electrolytes
• Roll from side to side if doesn’t immediately rise, or sling if available. Get off heavy muscles
• Check udder for mastitis either prior to parturition or due to recumbency

Enterotoxemia
***
• See Gen pg 250; Clostridium perfringens types B&C, Well fed calves up to 1 mo
• CS: Acute diarrhea, Dysentery, Abd. pain, Convulsions, Opisthotonus, Death m/b in few hrs, Recovery over couple of ds possible
• Dx: PM - Hemorrhagic enteritis & ulcerations of mucosa, Gram stain for gram +, rod-shaped bact., Toxin detection of filtrates
• Tx: Usually ineffective, Hyperimmune serum, Antibiotics PO, Outbreak in newborns: antiserum immediately after birth
• Prevention: Vaccination of pregnant dam in last 3 rd of pregnancy, initially 2 doses 1 mo apart then annually

Fatty liver/Pregnancy toxemia
***
• See Gl pg 32; Sporadic diz in fat, pregnant cows, Fat (dairy), Pregnancy toxemia (beef)
• CS: Fat pregnant cows, anorectic, restlessness & incoordination, sternal recumbency, rapid resp. & grunting, 7-10 ds comatose & death
• Dx: Ketonemia, ketonuria, hypoglycemia & proteinuria, Elev. liver enzymes, PM: Enlarged, fatty liver
• Tx: Generally ineffective, esp. if recumbent, steroids, glucose, fluids, propylene glycol, induce parturition, supplement herd
• Px: Grave

Nervous ketosis
DC 419
***
• See Gl pg 32; Metabolic diz of lactating cows, days to few wks postcalving, reduced CHO's - metabolizes fat = ketoses
• CS: Weight loss, circling, staggering, head pressing, blind, acetone breath, self limiting; subclinical: no CS
• Dx: Hypoglycemia, ketonemia & ketonuria (Ketostix®), Response to Tx
• Tx: Glucose IV, Glucocorticoids IV, Propylene glycol PO
• Px: Rarely die, return to milk production important
• Prevention: Hi plane of nutrition before calving, incr. after parturition

Babesiosis, Tick fever
*  
• See Cardio. pg 9*; Tick borne erythocytic diz, tick eradicated in USA - protozoan, Babesia (many types), B. bigemina & B. bovis
• CS: Fever, Hemolytic anemia, “Red water”, icterus, cerebral hypoxia: hyperexitable & convulse, opisthotonus, coma & die, Abortion and death
• Successful eradication of tick in USA

Rumen alkalosis: Soy bean or high protein engorgement, Fermentation reduced & saliva continues • CS: Muscle tremors, Convulsions, Slow, shallow breathing, then dyspnea • Tx: Ringer's

Enterotoxemia
***
• See Gen pg 250; Clostridium perfringens types B&C, Well fed calves up to 1 mo
• CS: Acute diarrhea, Dysentery, Abd. pain, Convulsions, Opisthotonus, Death m/b in few hrs, Recovery over couple of ds possible
• Dx: PM - Hemorrhagic enteritis & ulcerations of mucosa, Gram stain for gram +, rod-shaped bact., Toxin detection of filtrates
• Tx: Usually ineffective, Hyperimmune serum, Antibiotics PO, Outbreak in newborns: antiserum immediately after birth
• Prevention: Vaccination of pregnant dam in last 3 rd of pregnancy, initially 2 doses 1 mo apart then annually

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• Dx: Ketonemia, ketonuria, hypoglycemia & proteinuria, Elev. liver enzymes, PM: Enlarged, fatty liver
• Tx: Generally ineffective, esp. if recumbent, steroids, glucose, fluids, propylene glycol, induce parturition, supplement herd
• Px: Grave
### Horner's Syndrome

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Clinical Signs</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
</table>
| Horner's syndrome | - A syndrome, not a disease  
- Disruption of sympathetic pathways to head (see box)  
- Causes:  
  - Compression of gray matter of T1-3 spinal cord segments  
  - Injection in neck (vagosympathetic trunk)  
  - Mediastinal/thoracic abscesses  
  - Cervical abscesses or tumors  
  - Space occupying lesions of cran. thorax  
  - Escaphageal rupture  
  - Otitis media or interna  
  - Retrobulbar abscesses or tumors  
  - Brainstem (mesencephalon) lesions at level of rostral colliculus, m/ cause miosis  
  - Polioencephalomalacia  
  - Lead poisoning  
  - Horse >> cattle | - Ipsilateral (same side) CS  
- Miosis (small pupil, same side, due to loss of sympathetic innervation)  
- Enophthalmos (sinking of eyeball, paralysis of periorbital smooth muscle)  
- Ptosis (drooping of upper eyelid, paralysis of smooth muscle)  
- Regional warmth (hyperthermia)  
- Loss of sweating on ipsilateral side of planum nasale | - Find location of damage  
- Physical exam  
- Palpate jugular groove for swelling  
- Rads of cervical vertebrae  
- Check chest (auscultation, rads)  
- Gait & proprioceptive responses | - Depends on cause  
- Injection damage: quickly infiltrate (inject) saline (perivascular) to dilute out & NSAIDs  
- Prognosis:  
  - Neurological signs often irreversible |

#### Sympathetic pathway
- Descend from brainstem down neck to synapse in T1-T3 segments of spinal cord  
- Preganglionic fibers pass over T1-T3 spinal nerves to sympathetic trunk in dors. thorax  
- Pass through stellate (cervicothoracic) & middle cervical ganglia to pass up neck in vagosympathetic trunk to synapse in the cranial cervical ganglion  
- Postganglionic fibers pass to sweat glands of head, dilator muscles of the iris, periorbital smooth muscles & periarteriorial musculature

---

### Malignant catarrhal fever

- See GI pg. 10; "Sheep assoc" viral dz of GI & resp. systems. CNS CS occasionally from disseminated necrotizing vasculitis of CNS  
- *Tx: Unsuccessful  
  - Px: > 95% die in 2-18 ds

### Nervous coccidiosis

- See Gen pg. 260  
- Coccdial protozoan  
- Eimeria bovis, E. zuernii  
- Mechanism unclear  
- 2 yr, winter  
- Depression, somnolence  
- Blindness  
- Ataxia/conscious proprioceptive deficits  
- Odontoprisis (teeth grinding)  
- Hyperexcitability  
- Propulsive walking  
- Head pressing  
- Intermittent seizures, progressing  
- History, CS, Postmortem  
- Therapeutic Tx ineffective  
- Try 1 treatment of Sulfadiazine, amprolium, thiamine, ABs, fluids & leave calf alone

#### Prognosis: Grave  
- Control  
- Monensin (100 mg/kg 30 d) prophylactic feeding

---

#### Eimeria

- CS: CNS - Blindness, Ataxia, Seizures  
- Tx: None effective
Meningitis

**Neonate**
- Sequela of sepsisemia (E. coli or Strept.)
- Failure of passive transfer (FPT) predisposes to navel ill & enteritis
- Hematogenous spread to CNS

**Adult**
- TEME (H. somnus) (see pg 141)
- Pasteurella haemolyticum & P. multocida, Pseudomonas aeruginosa (septic mastitis)
- Embolic showers (endocarditis)

**Sporadic bovine encephalomyelitis, Buss diz, Transmissible serositis, Meningoencephalitis**

**Rare, Chlamydia**
- CS: Resp, GI, CNS
- Dx: Elementary bodies, Culture
- Tx: Tetracyclines

**History, CS**
- CSF tap & culture
- Postmortem
- Swollen meninges
- Cloudy CSF

**Radiology**
- Metabolic encephalopathies
- Hypoglycemia
- Hypomagnesemia (p 146)
- Septicemia
- Neonatal maladjustment syndrome
- Seizure syndrome (p 295)
- Hepatocencephalopathy (p 154)
- Trauma (p 133)

**Emergency: Early recognition & Tx**
- Large dose - Broad spec. ABs 10-14 ds, Culture & sensitivity
- Naxel®, Penicillin, 3rd gen Cephalosporins, Trimethoprim-sulfonamide (TMS) combo
- NOT chloramphenicol or tetracyclines
- Plasma/blood transfusion (IgG)
- Supportive therapy
  - Fluids
  - Sedation (Valium®, 0.01-0.4 mg/kg IV; phenobarbital, 20 mg/kg IV)
  - Long term control of convulsions
  - Valium®, phenobarbital
  - Analgesics (Banamine® & PBZ)

**Prognosis: Guarded**
- Tetracyclines effective early
- Tetracyclines

**Prognosis: Death rate 31%**

**Sporadic bovine encephalomyelitis, Buss diz, Transmissible serositis, Meningoencephalitis**

**Rare, endemic on some farms**
- Chlamydia (psittacosis); also a form caused by a paramyxovirus
- Cattle & buffalo only
- Transmission: unknown
- Pathophysiology
  - Vasculitis

**Rare, Chlamydia**
- CS: Resp, GI, CNS
- Dx: Elementary bodies, Culture
- Tx: Tetracyclines
Miscellaneous

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
</table>
| **Lead toxicity**  | • Cattle >> horses  
• #1 inorganic poisonings  
• Cattle indiscriminate eaters, more likely to lick or chew lead objects & drink used motor oil  
• Ingestion >>> through skin  
• Old batteries #1  
• Vegetation & soil contaminated from fallout from smelters & mining  
• Leaded gases, Crankcase oil  
• Painted fences  
• Cumulative over time  
• Pathophysiology  
  - Pb deposited in bone, "sink organ"  
  - Interferes w/-SH enzymes (sulfhydryl) involved in heme synthesis  
  - Shorts RBCs life & basophilic stippling  
  - Rapidly enters brain = Acute cerebellar hemorrhage & edema (capillary dysfunction) | • Encephalopathy - GI  
  - Acute  
  - Bellow  
  - Stagger (propriocceptive)  
  - Blind, head pressing  
  - Maniacal excitement (crash into objects)  
  - Death w/in 2 hrs or Convulsions (intermittent)  
  - Depression, ataxia, circling & grinding teeth  
  - "Snapping of eyelids"  
  - GI  
  - Constipation  
  - Colic  
  - Diarrhea older cattle  
  - Bloat (crankcase oil)  
  * "Lead line" on teeth rarely seen | • CS  
• Conc. whole blood (>0.3 ppm) diagnostic  
• Admin. CaNa2 EDTA & measure rise in Pb in plasma (solubilizes bone stores)  
• Measure lead in environment  
• Postmortem: - Edema & congestion of cerebral cortex (occipital lobes)  
| Depends on degree of CNS damage  
• CaNa2 EDTA IV or SQ (chelating agent, solubilizes from tissue, incr. urinary excretion)  
• Thiamine therapy for cattle (m/l make Pb-thiamine complexes that are excreted)  
| Mg sulfate  
- D-penicillamine (oral chelating agent) given to dogs, not to horses or ruminants  
| Good nursing  
| Supportive care - water  
| Rumenotomy & laxative in rumen to remove lead from GI |

**#1 inorg. poison, Old batteries**

CS: CNS & GI - Maniacal  
Dx: > 0.3 ppm in blood  
Tx: EDTA, Thiamine

**Strychnine**

• See Tox pg 208; To kill burrowing rodents & Coyotes, No rationale for its use! Stimulates CNS, Interferes w/ inhibitory neurons of spinal cord  
• CS: Uncontrolled reflex activity - extensor rigidity, "Saw horse" stance, Tonic seizures, Death due to exhaustion or hypoxia  
• Dx: CS, Check for strychnine: stomach contents, liver, kidney  
• Tx: Control seizures (diazepam), Muscular relaxation (GGE), Robaxin®, Maintain oxygenation, Quiet, darkened environment, Activated charcoal orally, Diuresis, Laxative

**OPs, Organophosphates & Carbamate**

• See Tox pg 206; Major cause of poisonings now, Pesticides & anthelmintics, inhib. of AChE, Overstim. of p-ANS, skeletal mm. & CNS  
• CS: Acute, Colic, Diarrhea, "Slobbering", Dyspnea, CNS CS: Tetany, Hyperexcitability or depression, Usually no convulsive seizure  
• Dx: Hx w/in 48 hrs + parasympathetic signs tentative Dx of OPs or carbamate poisoning, Response to atropine therapy  
• Tx: Emergency: Atropine, ASAP: 2 PAM, Activated charcoal & osmotic laxatives  
  Contraindicated: morphine, succinylcholine & phenothiazine tranquillizers

DDx:  
• Inorganic arsenic  
• Nervous acetonemia  
• Polioencephalomalacia (p 140)  
• Moldy feeds  
• Vitamin A deficiency (p 142)

**Thalamine**

**EDTA**

**Mg**

**Strychnine**

**OPs, Organophosphates & Carbamate**

**Atropine**
<p>| Chlorinated hydrocarbons (HCH) | ** | See Tox pg 207; Use curtailed bec. of persistence in environment (DDT [prototype]), Lindane approved for use around livestock, Sources: contaminated feed or water, Recommended levels no problem, Diffuse stimulant of CNS Death during severe seizure, Fever, Dehydration, anorexia Dx: Hx, CS, Lab (levels in blood, serum or urine), PM (Absence of lesions, ppm of CHC in liver &amp; brain tissue) Tx: No antidote, Symptomatic: Dermal - wash; Oral: oil, activated charcoal, CNS: Barbiturate, Valium® IV fluids or gastric tube |
| Water deprivation, Salt poisoning, Sodium toxicity | ** | See Tox pg 205: Water deprivation/ &quot;Salt poisoning&quot;, Swine &amp; poultry, Occasionally in ruminants (if low water consumption Gl tract (vomiting, diarrhea, abd. pain, anorexia, mucous in feces); CNS (blindness, seizures, partial paralysis, knuckling) Die w/in 24 hrs of CS Dx: CS, Hx of limited water intake, Na conc. in plasma &amp; CSF &gt;160 mEq/L, Necropsy Tx: IV fluids, induce diuresis &amp; correct gradually, too fast = cerebellar edema, Lasix® Px: Grave - most die |
| Urea toxicity NPN, *** | Urea not poisonous Ammonium (NH₃) is toxic Sources: NPN feed additive Need to adapt over days to weeks Mechanism: Inhibits TCA cycle: incr. in lactate (acidosis) Rapidly progressive 20-60 min Muscle tremors initially &quot;Bovine bonkers&quot; Rumen atony =&gt; bloat Terminal convulsions to death CS, History, dietary exposure Smell ammonia m/b Often impossible - speed of CS Fluid therapy, Relieve bloat Ruminal infusion (vinegar), l. water (40 L) Rumenotomy add hay slurry Prevention: NPN &lt; 1/3 of total nitrogen in ration Slowly adapt to NPN feed Prognosis: highly fatal |
| Excess NPN converted to ammonium CS: Acute, &quot;Bonkers&quot;, Convulsions, Death Dx: Hx, CS, Ammonia smell, Lab, PM Tx: Difficult (rapid), Relieve bloat, Fluids |
| Narcolepsy/ cataplexy | IM 1086; BR-hb 194; N-L 136 Rare, reported in a Brahman bull; sleep episodes at inappropriate times, Stimulation (restraint, feeding, change in environment) causes animal to fall down &amp; appear comatose; animal appears normal between episodes Tx: Imipramine (0.5 mg/kg) a tricyclic antidepressant or amphetamine sulfate m/ prevent narcoleptic attacks |
| Epilepsy IM 1084; BR-hb 209, BR 497; N-L 95 Extremely rare, described in Herefords &amp; Brown Swiss Cause: genetic? So rare no specific Tx regime Tx not indicated: incurable |</p>
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<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
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<tr>
<td>Hepatic encephalopathy, Walking diz</td>
<td>Severe hepatic insufficiency due to liver diz or portosystemic shunts</td>
<td>Diffuse cerebral impairment&lt;br&gt;- Behavioral changes (docile to aggressive or vice versa)&lt;br&gt;- Mania, Excessive vocalization&lt;br&gt;- Depression &amp; anorexia&lt;br&gt;- Stand w/ head hanging, jerking it up occasionally&lt;br&gt;- Grimacing, twitching of muzzle &amp; lips&lt;br&gt;- Head pressing&lt;br&gt;- Compulsive, oblivious walking&lt;br&gt;- Aggressive or manicalex&lt;br&gt;- Blindness w/ time&lt;br&gt;- Seizures &amp; coma terminally (w/in hours or months, depending on cause)</td>
<td>History, CS&lt;br&gt;- Lab: liver failure&lt;br&gt;- Ammonium&lt;br&gt;- Liver enzymes: GGT, SDH, LDH&lt;br&gt;- Excretion test: bilirubin elevated</td>
<td>• Empirical &amp; supportive&lt;br&gt;- IV glucose (correct hypoglycemia)&lt;br&gt;- Nutrition - low protein, high CHO diet (grass hay/citrus or beet pulp)&lt;br&gt;- Mineral oil (slow absorption of toxic products)</td>
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<td>Liver failure</td>
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<td>Cerebral - Compulsive walking</td>
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<td>Bovine spongiform encephalopathy, BSE, Mad cow diz, Crazy cow diz</td>
<td>Not reported in USA&lt;br&gt;Found in Britain in 1985&lt;br&gt;- Holstein-Friesian - 4-5 years old average&lt;br&gt;Incubation period 1-2 years&lt;br&gt;Huge scare in 1995, human deaths reported, banning of British beef, crisis&lt;br&gt;Implicated in human diz (Creutzfeldt-Jakob diz &amp; kuru)&lt;br&gt;Concern over threat of introduction into USA&lt;br&gt;- USA halted importation from England&lt;br&gt;- Eliminated sheep byproducts in cattle feed&lt;br&gt;Cause:&lt;br&gt;- Scrapie-like prion or slow virus (may be same organism that causes scrapie in sheep)&lt;br&gt;Current theory: sheep by-products in meat &amp; bone meal in cattle feed caused diz</td>
<td>Hyperexcitability&lt;br&gt;- Anxious/apprehensive: won't pass through gates&lt;br&gt;- Hypersensitivity to sound &amp; touch&lt;br&gt;- Progressive belligerence/agression (kicking)&lt;br&gt;- Progressive, hypermetabolic ataxia&lt;br&gt;- Frenzy &amp; falling down&lt;br&gt;- Facial &amp; ear twitching&lt;br&gt;- Excessive grooming&lt;br&gt;- Short course 6 months</td>
<td>History (England), CS&lt;br&gt;- Histopathology of brain&lt;br&gt;- Bilateral, symmetric degenerative changes w/ vacuolation of neurons &amp; gray matter&lt;br&gt;- Scrapie-associated fibrils (EM)&lt;br&gt;CSF normal</td>
<td>• Fatal&lt;br&gt;• Euthanasia - recumbency&lt;br&gt;- Surveillance for introduction into USA&lt;br&gt;- Reportable</td>
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<td>Britain - PH? Crisis - 1995</td>
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</table>

**Prognosis:**

- Poor to hopeless, but occasional recoveries recorded

**DDx:**

- Rabies (p 144)<br>- Hypomagnesemia (p 146)<br>- Nervous acetonemia<br>- Lead poisoning (p 152)<br>- Polioencephalomalacia (p 140)<br>- Brain abscess (p 140)<br>- Spinal abscess (p 134)<br>- Hepatoencephalopathy (p 154)<br>- Tremogenic toxins

**Prognosis:**

- Fatal in 6 months - 100%
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<td>White muscle diz</td>
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## Foot Disease

### Diagnosis

- **History CS**: Lameness, Basewide rear limbs stance, Hoof testers, Check both legs (clean body)
- **Presentation CS**: Lame, Bruise, Gangrene, Wooden block, -1 inch
- **Diagnosis**: Bruised sole, -Lat. hind claw most commonly 
- **Treatment**: Rest, Confinement, Leave on pasture

### Prevention

- Keep on pasture
- **History CS**: Lameness, Loses, irregular ground
- **Presentation CS**: Hoof testers, Pare out sole

### Treatment

- **History CS**: Lameness, Basewide rear limbs stance, Hoof testers, Check both legs (clean body)
- **Treatment**: Debride granulation tissue, Wooden block by elevating it
- **Prognosis**: 3-6 wks to heal

### Presentation

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- **Prognosis**: 3-6 wks to heal
**Subsolar abscess, Puncture of sole**

**Pododermatitis traumatica**

| IM 1317; C37 864; BR 868; VCL 35; S-O 196; Pic 90; DC 370; L 182 |

- **#1 lameness of cattle (90%)**
- **Causes:** damage to sole
  - FB (foreign body) penetration
    - M not be infected if it doesn't reach corium
    - Abscess forms in sensitive corium if infected
  - Laminitis
  - White line separation
  - Cracks
  - #1 Lat. claw (hind foot), med. claw (front foot)
- **3 legged lameness**
  - Reluctance to bear wt on toe
    - Base-wide or base-narrow stance
  - Drainage above coronary band in time
  - Sequelae
    - Osteomyelitis of coffin joint
    - Tenosynovitis
- **Hoof testers (repeat 3-4 times)**
- **Pare out sole**
  - Follow black lines or visualized punctures
  - Rads - not indicated & often unrewarding in cattle, in horses used to see if joint or bone involvement & taken prior to FB removal
  - Hoof testers (repeat 3-4 times)
- **Remove foreign body**
  - M cure lameness if it hasn't penetrated the corium
- **#1 Adequate drainage**
  - Pare out dark tract, remove all undermined sole
    - Leave any new sole deep to abscess
  - Release pus & possible gas
  - Don't block drainage hole
  - Trim wall to 1/3" (1 cm) below reforming sole (longer wall - manure & mud accumulation)
  - Bandage or not?
    - Clean & dress w/ antibiotic (powder)
    - Plastic bag taped over claw (to keep clean)
    - No, if soaked w/ urine or manure
    - Leave open + drying agent (Koppel"
    - Clean & drying agent BID or EOD
    - Simple sole abscess heal nicely w/o bandaging
  - NSAIDS - "Bute" (for pain) (10 mg/kg/d)
  - Wood block on unaffected claw to keep wt. on affected one (attach by epoxi & allow to wear off in a couple of weeks)
  - White line diz
    - Drain (remove hoof right above abscess to allow drainage out wall instead of at ground surface)
    - If draining from coronet, expose entire tract (or septic navicular bursitis m/ occur)
    - Heel abscess as above; if separation of hoof from laminae; remove old hoof in stages
  - Prognosis:
    - Good - dramatic relief in 24 hrs, recover in 7-10 ds
    - If no improvement reevaluate

---

**90% of lameness; FB/Laminitis/Cracks**

| CS: Lameness |
| Dx: Pare out sole, Hoof testers, Rads |
| Rx: Drainage, NSAIDs, Wooden block |

**Predisposing factors:**
- Filthy environment
- Corkscrew claw (pg 160)
- Inadequate foot care
- Puncture wounds
- Trauma

**DDx**
- Fractures
- Stifle injury (p 166)

**IVRA** (intravenous regional anesthesia, Bier block)
- Tourniquet below tarsus or hock
- Inject anesthetic into superficial veins

---

**Toe**

- Front of sole/dors. region (toe, anterior)
- Lameness rapid & severe
  - 3-legged lame
  - Heat, swelling, localized pain

**Heel**

- Plant/palm. (heel, posterior)
- No frog (unlike horse) & thick heels so navicular bursae rarely affected
- M/ travel up sensitive laminae & separate hoof from laminae
  - New heel growth over laminae
- Lameness - slower & less severe
  - Heat, swelling, localized pain
  - M/ drain above coronet of heel

**White line diz**

- Type of subsolar abscess
  - Junction betw. hoof & sole
    - Common site of infec., more so than horses
    - Infection tracts under sole, up laminae & at coronet
  - Hind limbs - plantar lateral side
  - Front limbs - dorsomedial toe
- Lameness
  - Pus m/b released at coronary band (like "gravel" in horses)

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**157**
### Foot Disease

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<td>Mk 499; C3T 865; Br 362; VCL 36; S-O 21; Pic 101; L 171; DC 379</td>
<td>• Dors. or dorsoabaxial hoof wall</td>
<td>• Crack in horn - M/b no lameness - Infection - Purulent discharge - Lameness - Chronic no indication of recovery Sequela • Infection of coffin (dist. interphalangeal) joint</td>
<td>• History, CS • Hoof testers to verify cause of lameness • Blood from crack indicates sensitive laminae involvement • Palpate coronary band routinely (dirt can hide)</td>
<td>• Rarely need Tx if not into laminae - Trim foot, shorten toe - If cosmetic care requested: Remove broken horn - Fill crack w/methyl methacrylate, Embedded staples - Seal prox. end of crack w/ hot iron • Infection - Clean out &amp; widen w/ hoof groover - If abscess: pair out; if dry m/ fill w/ acrylic; if draining leave open - ABs • Wooden block on unaffected claw if crack from coronet to ground Prevention: • Varnish or apply thick oil to hoof wall</td>
</tr>
<tr>
<td>Dry hoof (loss of periopel) CS: Crack ± Lameness Dx: Hoof testers, Palpate coronary band Tx: Rest; Infec.: Widen, ABs, Wooden block</td>
<td>• Types - From bearing surface proximally - From coronary band distally - Infected or not - Front feet &gt; rear, beef bulls • Causes - Dryness to hoof due to loss of periopel (waterproof stratum externa) - Sandy soil wears - Age; late summer &amp; fall - Trauma to coronet</td>
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<td>Horizontal Cracks</td>
<td>• Adult dairy cows • Following systemic infec. w/ fever - Severe systemic illness, metritis or mastitis, nutrition - Completely inhibits horn growth • Horizontal separation of hoof (loss of continuity of hoof wall parallel to coronet) - All 8 claws usually affected</td>
<td>• Initially inflam. of coronary band &amp; slight lameness • Recovery • Then encircling depression of hoof wall, except at heel • Thimbling: separation of dist. hoof (mos to a yr later when groove is close to ground) - Severe pain</td>
<td>• History, CS</td>
<td>• Remove as much dist. hoof as possible (thimble) w/o entering sensitive laminae - &quot;Dub&quot; toe as short as possible - Repeat if necessary Prognosis: • Good: 4-6 wks to grow out &amp; fall off</td>
</tr>
<tr>
<td>Fissure/Sand cracks, Fissure ungulæ horizontalis, Thimbling, Thimble toe Mk 499; C3T 865; S-O 215; Pic 102; L 170</td>
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<td>Adult dairy, Systemic illness + Fever CS: Depression to Thimbling, Lame Tx: Foot trim + Time</td>
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Foot rot, Interdigital necrobacillosis, Interdigital phlegmon, "Foul-in-the-foot"

Mk501, C3T69; IM 1173; Br 356; BR-hb 342, 227; Br 509; 867; Pic 96; L 151; DC 360

***

**Foot rot, Interdigital necrobacillosis, Interdigital phlegmon, "Foul-in-the-foot"**

- **Common**
  - Inflam. of interdigital SQ tissue
  - Hindlimbs most common
  - 1 or more feet affected
  - #1 lameness in young stocker & fattening units
  - Dairy - young heifers
  - Cause - Infectious
  - **Fusobacterium necrophorum**
  - Bacteroides nodosus & B. melaninogenicus, fungus
  - Fusobacterium ubiquitous in environment
  - Trauma - skin broken, bact. invade
  - Wet environment, or
  - Dry, hard ground causing abrasions
  - Local immunity? Digit seldom affected twice
  - Predisposing: short heels & long toes

- **Lameness**
  - Sudden onset, moderate to severe
  - Fetlock & pastern held flexed w/ little wt. on toe
  - Deep tissue: Interdigital space swollen & painful (m/ spread claws), palmar > dors.

- **Complications**
  - Septic arthritis
  - Tenosynovitis

- **History, CS, foul odor**

  **DDx**
  - FB (p 157)
  - Stable foot rot (p 159)
  - Interdigital hyperplasia (coms) (p 160)
  - Other causes of lameness
    - Sole ulcers (p 156)
    - Sole abscesses (p 157)

  **Prevention**
  - Reduce trauma (move off stibble & stones)
  - Attempt to keep feet dry
  - Foot baths, 5% formalin, 10% copper sulfate or 10% zinc sulfate weekly

  **Tx**
  - ABs, Debridement
  - Foot baths, Feed additives

**Deep/SQ, Common, F. necrophorum, Stockers**

CS: Lameness, Smelly, Rotten Interdigital fissure, Swelling

Dx: Hx, CS, Odor

Tx: ABs, Debridement

**Prevention**: Foot baths, Feed additives

**Stable foot rot, "Scald"**

Interdigital dermatitis, Chronic necrotic pododermatitis, "Slurry heel"

Mk501; IM 1416; Br 510; Br 357, C3T 868; Pic 100; L 158

***

- Supf. inflam. of interdigital skin
- **Bacteroides nodosus** agent?
  - Not part of natural farm flora, can be eradicated
  - F. necrophorum increases severity
  - 60% of herd m/ be affected
  - Hind feet
  - Predisposing
  - Wet stable, standing in slurry

- **Interdigital eczema**, esp. betw. bulbs
  - Secretions cozing from dorsal commissures of cleft, then dry crust
  - No lameness, but sensitive to touch
  - Little swelling
  - 2° Erosion of heels, undermines heel horn
    - Lame (sensitive gait, cowhocked stance, oversized lat. claw)
    - 2° sole ulcer - lat. claw

- **History, CS**
- **Lab confirmation difficult**

**Prevention**
- Turn out to pasture (usually spontaneously resolves)
- Footbaths BID - 5% copper sulfate or 3% formaldehyde
- ABs for severe infections
- 2° heel erosions
  - Paring of claw to shift weight to medial claw
  - Affix block to medial claw

**Superficial infections**
- Formalin foot bath (3%) for 1 wk

**Mild cases**
- Usually rapid healing, 2-4 days
- ABs: Penicillin, sulfonamides, tetracyclines (shortens course of diz)

**If necrotic areas present:**
- Clean & debride
  - Remove necrotic interdigital mass
  - Koppertox®, Copper sulfate (5%)
  - AB bandages
  - Wire claws together
  - Clean environment

**Suppurative arthritis or tenosynovitis**
- Surgical removal of claw
  - But if > 80% of digit removed culled w/ in 1 yr
  - Surgical drainage & arthrodesis of coffin joint in valuable animals

**Prognosis**
- Good - once necrotic tissue is removed or sloughs, heals rapidly usually
- Poor - if arthritis or tenosynovitis

**Surgical drainage**
- But if > 80% of digit removed culled w/ in 1 yr
- Surgical drainage & arthrodesis of coffin joint in valuable animals

**Formalin foot bath (3%) for 1 wk**
### Foot Disease

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
</table>
| Corkscrew claws, Curled toe | • Lat. hind claws, bilat. (hereditary)  
• > 5 yrs-old  
• Inherited conformation, stiflet varum or acquired due to chronic lameness in opposite limb  
• Growth of abaxial horn underneath sole | • Corkscrew claw (toe twists)  
- Walking on abaxial wall  
- Lameness, rolling gait  
- Sequelae  
- Sole ulcers  
- Osteolysis of pedal bone | • Visualization | • Once established, little hope to resolve  
• Trimming to control gross abnormalities  
- Electric rotary hoof sander  
- Remove bulk of abaxial surface  
- Remove corkscrew at toe |
| Corns, *** Quittor; Hyperplasia interdigitalis, Interdigital fibroma | • Common in beef & adult dairy  
• Hindfeet >> forefeet; Bull > cow  
• Causes  
  - Chronic irritation  
  - Overfinishing (overweight) (corn)  
  - Moist, filthy environment, infection  
  - Splayed toes predispose  
  - Hereditary?  
• Normally only one animal, if more suspect virus (warts) | • Corn: Proliferative lesion of skin dors. & plant/palm, to interdigital space  
- Thickening of skin  
- Traumatized by claws  
• ± Lameness  
- Once halfway down interdigital space, lameness  
- Infected, ulcerative or traumatized => lameness  
- Palmar/plantar - pinched by claw (pain)  
- Prevention  
  • Cull if hereditary  
  • Routine foot trimming  
  • Clean, dry environment | • History, CS  
• Hyperplasia  

DDx  
• 1° wound infec.  
• Warts (p 160)  
• Foot rot (p 159)  
• Trauma | • Small: m/spontaneously regress  
- Clean, dry environment  
- Clean & bandage if ulcerative or infected  
• Cull or Sx if conservative Tx is not effective  
• Surgical removal  
  - Use IVRA w/ tourniquet  
  - Fusiform incision around base of mass, my extend between 2 digits, remove fat pad if redundant  
  - Tight AB bandage (fig. 8) 2 wks  
  - Wire toes together m/b, then remove sutures  
  • Recurrence, so counsel owners  
  - Cauterization of underlying tissue (antimony trichloride or copper sulfate)  
  - Cryosurgery also effective  
  - Commercial or autogenous wart vaccines if numerous animals affected  
  - Foot trim (shorten toe, preserve heel)  
  • Radical excision (cautery for hemostasis)  
  - Bandage, dry clean environment |
| Verrucosa granulosa | • Proliferative lesion  
• Usually above bulbs of heel, plantar  
• Fusobacterium necrophorum + fungus  
• Filthy, moist environment  
• Long toes keep heel in water  
• Hindfeet | • Wartlike growth  
- Mattted, dried serum  
- Rarely lameness  
- Prevention  
  • Cull if hereditary  
  • Routine foot trimming  
  • Clean, dry environment  

Above bulbs, Long toe  
CS: Wartlike  
Tx: Trim, Sx | • History, CS |
Septic pedal arthritis

**Common, Deep sepsis**
- Very serious condition
- In coffin joint, navicular bursa or synovial sheaths
- Cause - extension from:
  - Interdigital lesions (joint supf. in dors. cleft)
  - Septic sand cracks (located slightly abaxial to insertion of extensor tendon, joint supf. here also)
  - Abscesses of white line into coffin joint or navicular bursa
- Sole ulceration

**Very lame, very painful**
- Coronet swollen, inflamed & painful
- Interdigital granulation tissue, pus drainage
- Stop lactation

**History, CS**
- Rads can help
  - Offset each digit (oblique)
  - Osteomyelitis in P2-3 & sepsis in P1-2

**DDx**
- Foot rot (bilat. swelling)(p 159)
- Stable foot rot (p 159)

**Prognosis**
- Guarded

**Factors - amputation**
- Value of animal
- Size (2000 lb. hard time on 1 digit)
- Usually < 1200-1400 lb. dairy cows

**Coffin joint, Navicular bursa, Synovial sheaths**
Extension of interdig. dizes, Sole abscess/Ulceration

**CS/Dx:** Very painful, Swollen coronary

**Tx:** Amputate claw (< 1200 lbs)

**Gangrene, Fescue foot gangrene, Ergot gangrene**

**See Gen pg 264**
- Dry gangrene of lower legs & feet
- Rear limbs especially
- Consuming tall fescue (*Festuca arundinacea*), toxin in stems & leaves
- Ergot infested feeds (Claviceps)
- Cold temperatures contribute
- High levels of nitrogen in soil
- CS w/10-14 ds of grazing

**Initially hindlimb lameness**
- Local heat, swelling, severe pain
- Cold pasterns, red coronary band
- Line of demarcation between hook & claw - fetlock or pastern
  - Skin below dry, gangrenous & eventually sloughs
  - Tail & ears also
- Unable to walk or stand

**History, CS**
- Tall fescue in pasture
- Claviceps-infested feed

**DDx:**
- Early: Foot injury, foot rot (p 159), laminitis (p163)
- Late: "Alkali d" (selenium toxicosis) (p 228)
  - Frostbite (p 163)
  - Foot rot (p 159)
  - Trauma

**Amputation of digit**
- Cutting skin flap & doing proper closure causes less healing time
- Dors. incision in middle of claw, not middle of leg
- Lift skin flap from hoof (circumferentially)
- Amputate through dist. end of P1
  - Cannot go higher than 1/3 of P1 (artery, nerves to other digit)
  - Angle cut so skin flap can be sutured axially
  - Gigli wire: start wire in straight, then turn to angle cut, cutting through flexor tendons & ligate digital vessels
- IVRA best anesthetic
- Tight bandage, if see bleeding, put more on & wrap tighter
- If cannot remove all infected tissue, don't close completely
- Drainage

**Prevention:**
- Mix legumes & growing low toxic strains of tall fescue (mowing doesn't help!)

**Remove from pasture**
- Antibiotics, slow recovery
- Once necrosis: Slaughter

**Foot rot (bilateral swelling)(p 159)**

**Stable foot rot (p 159)**

**Prognosis:**
- Guarded
## Laminitis

<table>
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<tr>
<th>Condition</th>
<th>Facts/Cause</th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Fractures of P3</strong>&lt;br&gt;Mk 498; C3T 879; C2T 856; IM 1334; Br 362; DC 380; S-O 301; Pic 104; L 215, 229&lt;br&gt;**</td>
<td>Common&lt;br&gt;Trauma: Medial front claw usually&lt;br&gt;Articular &amp; transverse usually - DDF distracts fragments&lt;br&gt;<strong>Often bilateral</strong>&lt;br&gt;Cause poorly understood&lt;br&gt;Foreign body penetration, osteomyelitis</td>
<td>3-legged lameness, lay down a lot, reluctant to get up&lt;br&gt;Cross legged (to keep weight off med. claw)&lt;br&gt;Incr. digital pulse&lt;br&gt;Heat in foot</td>
<td>Hoof testers&lt;br&gt;Rads - definitive Dx &amp; location - Special angles to see process fxs (may be hard to see due to little displacement)&lt;br&gt;Retake in a couple of wks bec. lines more pronounced w/ remodeling</td>
<td>Wooden block on unaffacted claw (keep wt. off affected claw)&lt;br&gt;Penetrating FB fxs: Surgical removal of loose or necrotic fragments&lt;br&gt;Claw amputation last resort, no use if bilateral</td>
</tr>
<tr>
<td><strong>Common, Often bilateral</strong>&lt;br&gt;CS: 3 legged, Cross legs&lt;br&gt;Dx: Hoof testers, Rads&lt;br.Tx: Wooden block, Amput. last resort</td>
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<tr>
<td><strong>Cannon bone fx</strong>&lt;br&gt;Condylar/ articular fx&lt;br&gt;C3T 879; Br 373; VCL 150; Mk 498; IM 1331; S-O 303&lt;br&gt;***</td>
<td>Very common, fused Mc/Mt III &amp; IV&lt;br&gt;#1 - Distal physeal fxs - Calves &lt; 3 mo&lt;br&gt;Salter-Harris type II dist. end, bit of metaphysis still attached by periosseum on concave side&lt;br&gt;Shaft fxs&lt;br&gt;Cause - Pulling calf (need half hitches below &amp; above fetlock; if just one hitch, do below fetlock)&lt;br&gt;Trauma</td>
<td>Looks hyperextended&lt;br&gt;Mild to severe lameness&lt;br&gt;Swelling &amp; crepitation</td>
<td>CS - effusions&lt;br&gt;Fx movement &amp; crepitation (sound of fx ends rubbing together)&lt;br&gt;Rads - 4 views: DP, LM, MO &amp; LO&lt;br&gt;Look very carefully for fissure fxs&lt;br&gt;Fissure fxs of cannon bone subtle &amp; easy to miss - If suspect, immediate rads</td>
<td>Reduce (let. recumbency w/ concave side upward, gravity helps, mL need calving jack)&lt;br&gt;Half leg cast (include foot, but not stifle)&lt;br&gt;Add cast in half for use another 4-5 wks&lt;br&gt;Fetlock Luxation&lt;br&gt;Laminitis&lt;br&gt;Fx movement &amp; crepitation&lt;br&gt;Fissure fxs of cannon bone&lt;br&gt;Swelling &amp; crepitation&lt;br&gt;CS effusions&lt;br&gt;Rads</td>
</tr>
<tr>
<td><strong>Physeal fxs, Calf pulling</strong>&lt;br&gt;CS: Lame, Swelling, Crepitation&lt;br&gt;Dx: Hx, CS, Rads&lt;br.Tx: Reduce &amp; cast • Px: Good</td>
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</tbody>
</table>
Laminitis, Founder, Pododermatitis aseptica diffusa, Aseptic pododermatitis

- Not as dramatic as in horses
  - No rotation
  - Subclinical usually
  - Hindlimbs more commonly involved (opposite of horse)
- Dairy heifers/cows (hi-conc diet) or steers on hi-CHO diets
- Causes
  - #1 Endotoxins (vasoactive)
    - Cell walls of gram neg. bacteria
    - Killed by lactic acidosis
- Pathophysiology in laminae
  - Uncoupling of laminae betw. hoof & P3 (breaks down) due to ischemia, degeneration, inflam., pain & necrosis from:
    - Vasocostriction leading to arteriovenous shunting (from laminae to deep structures of foot)
    - Coagulopathy leading to thrombosis
- Most get better
- Founder (annular) rings - horizontal lines on hoof wall reflect old bous of laminitis
- Causes (see box)

Endotoxins, Fat postpartum heifer
CS: Subclinical, Lameness, "Slipper foot"
Dx: Hx, CS, Hoof testers
Tx: Treat cause, Banamine®

Frostbite

- Calves born in cold (windchill factor -18° C (< 0° F))
- Feet & other extremities, ears, tail, teats, scrotum & dist. limbs
- Damaged tissue more susceptible to cold in future

- Less marked than horse
- Anorexia, depression
- Reluctance to move
- Diarrhea
- Posture: all legs under body or fore- & hindlimbs extended forward, arched back
  - Leg crossing or narrow walking indicates medial claw only affected
- Recumbent
  - "Slipper foot" (chronic)
    - Long hooves, turned up at toe
    - Heavy ridging on wall
  - Sole softens & turns yellow

Subclinical
- No abnormal gait or posture
- Soft horn, bloodstained & yellow, waxy appearance

Sequelae
- White line diz
- Sole ulcers
  - Sole has more blood w/laminitis, so bleeds easy when paring (arteriovenous shunts)

- Arterial blood pressure depressed (opposite of horse)
- Hoof testers, pain over entire sole, esp. over toe

CHRONIC:
- Hoof growth & rings in hoof wall
- Herd
  - High incidence of midlactation lameness, white line diz & sole ulcers

Causes:
- #1 Fat heifers right after calving (fed high conc. & kept on concrete surfaces)
- Grain founder: overload of grain (wheat, corn, barley >> oats), incr. lactic acid bacter., low pH (lyses gram neg. bacter., release of endotoxins)
- Sustained hi-CHO fed over long time (subacute or subclinical)
- Colonic torsion (breakdown of mucosa allows endotoxins into portal circulation)
- Retained placenta: postpartum laminitis (always serious)
- Pleuropneumonia
- Septic metritis
- Endotoxemia (always serious)

- History, Cs

- Usual too late
- Emergency: thaw rapidly in warm water (100-111°F)
  - Analgesics (thawing painful)
  - Do not massage during thawing
  - Avoid premature debridement
  - Damage & areas left exposed (not bandaged)
  - Supportive care (high protein, high calorie, vitamin supplementation)
  - Restrain to prevent self mutilation
- No treatment once Cs

- Emergency - acute
- Tx cause
  - Grain overload - mineral oil
  - Rumenotomy if early
  - Septicemia - ABs
- Get moving to incr. circulation in feet
  - Medical Tx controversial (Steroids, anthistamines, anti prostaglandins [NSAIDS])
  - Banamine® (analgesic & decreases endotoxins)
- Chronic - repeated trimming

Prevention:
- Slow feed changes
- Trim entire herd 2 x/yr

CS: Devitalized/Sloughed ears, Hooves
Tx: Usually too late

**
<table>
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</thead>
<tbody>
<tr>
<td><strong>Tarsal hydrarthrosis, &quot;Bog Spavin&quot;</strong></td>
<td>- Chronic distention of tibiotarsal (TT) &amp; prox. intertarsal (PIT) joints</td>
<td>- Fluid distention TT &amp; PIT joints</td>
<td>- History, CS</td>
<td>- Salvage (get another bull)</td>
</tr>
<tr>
<td></td>
<td>- Common in &quot;postlegged&quot; cattle</td>
<td>- Little or no lameness - M/ tread w/ hind limbs &amp; lie down more</td>
<td>- Radiographs</td>
<td>- Aspirate fluids</td>
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<td></td>
<td>- Also cattle confined in stanchion w/ concrete floors w/ no exercise</td>
<td></td>
<td>- No findings</td>
<td>- Inject corticosteroids - relief for wks-mos</td>
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<td></td>
<td></td>
<td></td>
<td>- Dorsomedial pouch of TT joint</td>
</tr>
<tr>
<td>CS: &quot;Postlegged&quot;, Fluid distention, No lameness</td>
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<td></td>
<td>Prevention - Exercise &amp; plywood on stanchion floor</td>
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<tr>
<td>Tx: Drain &amp; Steroids</td>
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<tr>
<td><strong>Septic tarsitis</strong></td>
<td>- Infectious arthritis - 1 of joints of polyarthritis in navel ill</td>
<td>- Severe lameness</td>
<td>- History, CS</td>
<td>- Noninfectious: rest</td>
</tr>
<tr>
<td>C3T 876; VC/L 169; L 306</td>
<td>- Mycoplasma</td>
<td>- Joint stiffness</td>
<td>- Palpation for pain</td>
<td>- Infectious arthritis</td>
</tr>
<tr>
<td>***</td>
<td>- Haemophilus</td>
<td>- Swelling</td>
<td>- Arthrocentesis</td>
<td>- Systemic antibiotics</td>
</tr>
<tr>
<td></td>
<td>- Penetration wounds</td>
<td></td>
<td>- Cultures often negative</td>
<td>- Joint lavage</td>
</tr>
<tr>
<td></td>
<td>- Extension of tarsal cellulitis</td>
<td></td>
<td>- Radiographs</td>
<td></td>
</tr>
<tr>
<td>Navel ill, Penetration, Cellulitis</td>
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<tr>
<td>CS/Dx: Lame, Swelling</td>
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<tr>
<td>Tx: ABs, Lavage</td>
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<tr>
<td><strong>Luxations of tarsal joints</strong></td>
<td>- Frequent (cattle &amp; horses)</td>
<td>- Obvious 3-legged lameness</td>
<td>- History, CS</td>
<td>- Reduction</td>
</tr>
<tr>
<td>S-O 307</td>
<td>- TT (tibiotarsal), PIT (prox. intertarsal) &amp; TMt (tarsometatarsal) joints</td>
<td>- Limb deformity</td>
<td>- Crepitation if fx's</td>
<td>- Sometimes impossible in talocrural luxation (m/ have to cut collateral lig.)</td>
</tr>
<tr>
<td>**</td>
<td>- Not DIT (dist. intertarsal) joint bec. it doesn't cross the entire tarsus (4th tarsal bone interrupts)</td>
<td>- Displacement of tibia cran. &amp; dist. in talocrural luxation (worst)</td>
<td>- Radiographs for fx's</td>
<td>- Immobilization - Full limb cast (up around stifle) - Snug to minimize motion</td>
</tr>
<tr>
<td>Frequent; TT, PIT &amp;TMt joints</td>
<td>- If no accompanying fx's or damage to tarsocrural joint, they can be successfully treated</td>
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<tr>
<td>CS/Dx: 3-legged; Deformity</td>
<td>- Cause: severe wrenching or twisting (sudden slip or fall)</td>
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<tr>
<td>Tx: Reduce &amp; Cast</td>
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<tr>
<td><strong>Capped hock</strong></td>
<td>- Acquired bursa formed due to chronic trauma</td>
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<tr>
<td>BM&amp;S 871; Pic 118</td>
<td>- CS: No lameness, Fluctuant swelling (hardens w/ time)</td>
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<td></td>
<td>- Dx: Hx, CS</td>
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<td></td>
<td>- Tx: Stop trauma: put out to pasture (summer), well-bedded straw (winter)</td>
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</tbody>
</table>
### Tarsal Cellulitis/ Hygroma

- Common in cattle
- Lat. side of tarsus
- Chronic irritation & trauma (inadequate bedding in housed cattle on concrete)
- False bursa (sac of fluid on tarsus) m/b
- Bulge on lat. side, usually hard unless bursa or abscess develops
  - Sac of fluid, synovial-like, clear & yellow, some viscosity
- Abrasion m/b w/ abscessation
- Cellulitis above & below hock
- No lameness unless invades joint
- Swelling if into tibiotarsal joint
- No swelling if in dist. tarsal joints
- History, CS
- Radiograph to see if invaded joint

**Prevention (important)**
- More bedding, etc.; drain bursa early

### Tibial Fxs

- Cows - try to fix (horses - shoot)
  - Thick skin so doesn't compound medially
  - Cattle will lie down & look after themselves (horses don't)
- Midshaft oblique or spiral most common
  - Also prox. & dist. epiphyseal fxs
- Invariably override
- Traumatic cause
- 3-legged lameness
- Swelling & tenderness
- History, CS
- Radiographs

- **Midshaft, Override**
  - CS/Dx: 3-legged, Rads
  - Tx: Thomas-Schroeder splint

### Femoral Fractures

- Distal physes in neonates - Dystocia or trauma
  - Capital (slipped) physes (SH-type I)
  - Adults are salvaged, Rare, "Mac truck" trauma
  - Younger the better
  - Wt. & comminution important Px factors

- 3-legged lameness
- Shortened limb
- Hock held higher than other
- Downer cow
- Dimpling of musculature over fracture
- M/b swelling
- History, CS
- Palpation - excessive movement of distal limb
- Crepitation m/b (auscultation)
  - Patella loose, med. to lat.
- Slipped capital physis in young, difficult to Dx
- Radiograph - definitive Dx
- Unfortunately many portable (handheld) units can't penetrate adults

**Prognosis**
- Poor, withhold Px in calves until Tx attempted in simple, uncomplicated fxs
- Poor: complicated or compound fxs

- Salvage for adults
  - Confine & time
  - Calves salvage, confinement or Sx
  - Femoral head ostectomy
  - Px depends on age, weight, location
- Poor - salvage adults
- Guarded - physis Fxs

### Calves: Physeal Fractures

- CS/Dx: 3-legged, Short limb
- Tx: Adults-Salvage; Calves-Internal fixation
# Pelvic Limb

## Gonitis - Synovitis & DJD of stifle

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</tr>
</thead>
<tbody>
<tr>
<td>DJD of stifte</td>
<td>• #1 hindlimb lameness • Inflammation of stifte • Overweight &amp; straight legged</td>
<td>Lameness • Shortened stride, dragging hooves • ± Distention • Partial condemnation at slaughter</td>
<td>History, CS</td>
<td>• Tx cause: collat. lig - rest &amp; imbrication</td>
</tr>
<tr>
<td>Br 383; VCL 162; C3T 877; Br 527; Pic 114; BM&amp;S 878; L 302</td>
<td><em>•</em></td>
<td></td>
<td>Radiographs - Initially no signs</td>
<td>• Rest</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• DJD: Chronic degeneration</td>
<td>• No Tx for DJD, progressive</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>• Osteophytes, subchondral bone defects</td>
<td>• Aspirin, phenylbutazone (for pain)</td>
</tr>
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<td></td>
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<td></td>
<td>• Postmortem:</td>
<td>• Sx for smaller animals can be tried</td>
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<td></td>
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<td></td>
<td>eburnation (bone surface is worn &amp; shiny)</td>
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**2nd to foot as cause of lameness, #1 HL lameness**

**Tx:** Tx cause, Rest

## Cran. cruciate rupture

| Br 383; C3T 875; Pic 114; BM&S 878; L 282 | **•** Uncommon • Bulling, slip & fall - Acute tearing of ligament - Severe chronic DJD due to instability in tearing cruciate ligament - cranial cruciate prevents tibia moving cranially in relation to femur |

**CS:** Lame, Effusion, Instability

**Dx:** Drawer sign, Rads

** Tx:** Imbrication

## Patellar luxation

| VC/L 162; Br 377; L 274 | **•** Rare • Lateral >> med. luxation in calves • Unable to fix stifte joint • Congenital |

**DDx:** Femoral n. paralysis

**Tx:** Imbrication

## Upward fixation: stiff hindlimb, jerky action, intermittent catching in extension, then stringhalt flexion

**Tx:** Medial patellar desmotomy

## Infectious gonitis: rare, in calves part of polyarthritis

**Tx:** ABs, joint lavage

## Prognosis

**Sx:** Pull patella back into trochlear groove

**Imbricate to tighten tissue

**Guarded

## Prognosis

**Poor to guarded w/ Sx**
<table>
<thead>
<tr>
<th>Coxitis, Hip dysplasia</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pic 113, VC/L 154; Br 382; DM&amp;S 880; L 204</strong></td>
</tr>
<tr>
<td>#2 hindlimb lameness, Adults, Bilateral</td>
</tr>
<tr>
<td>CX: &quot;Rolling gait&quot;, Drag hooves • Tx: None</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Coxofemoral luxation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Br 375; VC/L 198; C37 676; S-O 324; Pic 108; DM&amp;S 881; L 269</strong></td>
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<tr>
<td>Common in cattle, shallow acetabulum &amp; no accessory ligament as in the horse</td>
</tr>
<tr>
<td>2-5 yr-old cows associated w/ parturition (maximum ligament relaxation)</td>
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<tr>
<td>Slippery floors</td>
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<tr>
<td>Obturator nerve paralysis</td>
</tr>
<tr>
<td>Milk fever, Dystocia</td>
</tr>
<tr>
<td>Breeding accidents</td>
</tr>
<tr>
<td>Position of femur</td>
</tr>
<tr>
<td>Craniodorsal most common (80%)</td>
</tr>
<tr>
<td>Caudoventral into obturator foramen (assoc. w/ obturator nerve paralysis)</td>
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</tbody>
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<thead>
<tr>
<th>Pelvic fractures</th>
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<tbody>
<tr>
<td><strong>Mk 498; VC/L 153; Pic 112; Br 374; DC 400; S-O 332; S-N 269</strong></td>
</tr>
<tr>
<td>Rare, except tuber coxae</td>
</tr>
<tr>
<td>&quot;Knocked down hip&quot;, tuber coxae fracture classic injury in cattle</td>
</tr>
<tr>
<td>- Hitting &quot;hook&quot; on door frame</td>
</tr>
<tr>
<td>Other fractures: Wing &amp; shaft of illum, tuber coxae, symphys pubis, obturator foramen, acetabulum &amp; ischiium</td>
</tr>
<tr>
<td>- Trauma in all cases - &quot;Splits&quot; (acetabular fxs)</td>
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</tbody>
</table>

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<tr>
<td><strong>Pic 113, VC/L 154; Br 382; DM&amp;S 880; L 204</strong></td>
</tr>
<tr>
<td>#2 hindlimb lameness after stifle</td>
</tr>
<tr>
<td>Usually DJD, rarely infectious</td>
</tr>
<tr>
<td>Adults usually, calves - hip dysplasia</td>
</tr>
<tr>
<td>Bilateral commonly</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Prognosis: Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tx: none</td>
</tr>
<tr>
<td>Salvage</td>
</tr>
<tr>
<td>Emergency win 24 hrs</td>
</tr>
<tr>
<td>Adults - Reduction in vain</td>
</tr>
<tr>
<td>- Closed tried first 24 hrs</td>
</tr>
<tr>
<td>- Open reduction if valuable animal</td>
</tr>
<tr>
<td>- Relaxation common as animal rises</td>
</tr>
<tr>
<td>- Shackles above hocks 24-48 hrs</td>
</tr>
<tr>
<td>- Keep on firm footing (well bedded)</td>
</tr>
<tr>
<td>Calves: femoral head osteotomy m/ be considered</td>
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</tbody>
</table>

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<td><strong>Br 375; VC/L 198; C37 676; S-O 324; Pic 108; DM&amp;S 881; L 269</strong></td>
</tr>
<tr>
<td>Lameness: Leg rotated laterally w/ toe-out, hook-in, stifle-out</td>
</tr>
<tr>
<td>- Craniodorsal - shorter limb</td>
</tr>
<tr>
<td>Recumbent, unable to rise, lie extended &amp; abducted slightly</td>
</tr>
<tr>
<td>Sequela: Downer cow</td>
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<thead>
<tr>
<th>Prognosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guarded - dorsocranial</td>
</tr>
<tr>
<td>Poor - ventrocranial &amp; ventrocaudal</td>
</tr>
<tr>
<td>Recumbent - worse prognosis</td>
</tr>
<tr>
<td>&gt; 24 hr poor due to soft tissue damage (joint capsule torn, then pushed into muscles)</td>
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</tbody>
</table>

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<tbody>
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<td><strong>Mk 498; VC/L 153; Pic 112; Br 374; DC 400; S-O 332; S-N 269</strong></td>
</tr>
<tr>
<td>&quot;Knocked down hip&quot; - tuber coxae</td>
</tr>
<tr>
<td>- Little lameness or problems</td>
</tr>
<tr>
<td>- M/b sequestra &amp; fistulous tract</td>
</tr>
<tr>
<td>Other fractures:</td>
</tr>
<tr>
<td>- Downer cow</td>
</tr>
<tr>
<td>- Ilial shaft fxs - very lame</td>
</tr>
<tr>
<td>- Symphysal or obturator foramen fxs</td>
</tr>
<tr>
<td>- Lame in both limbs</td>
</tr>
<tr>
<td>Complications</td>
</tr>
<tr>
<td>- Severance of iliac arteries</td>
</tr>
<tr>
<td>- Coxitis (DDJ of hip - acetabular fxs)</td>
</tr>
<tr>
<td>- Reduction of pelvic diameter in cows</td>
</tr>
<tr>
<td>Other hip fxs: Downer cow; Poor Px</td>
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</tbody>
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<thead>
<tr>
<th>Tuber coxae fractures</th>
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<tbody>
<tr>
<td><strong>Leave, resolving in 2-3 weeks</strong></td>
</tr>
<tr>
<td>- Sx: remove fragments if draining</td>
</tr>
<tr>
<td>Other pelvic fractures</td>
</tr>
<tr>
<td>- No surgical method developed</td>
</tr>
<tr>
<td>- Box stall confinement 3 mo. (up to a year)</td>
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<tr>
<td>- Cull</td>
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<table>
<thead>
<tr>
<th>Prognosis</th>
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</thead>
<tbody>
<tr>
<td>Good for tuber coxae</td>
</tr>
<tr>
<td>Poor - other fxs</td>
</tr>
<tr>
<td>Condition</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>Gastrocnemius rupture</td>
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<tr>
<td>Peroneus tertius rupture</td>
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<tr>
<td>Serratus ventralis rupture</td>
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<tr>
<td>Contracted flexor tendons **</td>
</tr>
<tr>
<td>Curled calf disease, Arthrogryposis</td>
</tr>
<tr>
<td>Lacerated tendons (C3T 880; DC 389; S-O 395)</td>
</tr>
<tr>
<td>Tenosynovitis (BM&amp;S 870; DC 385; L 383)</td>
</tr>
<tr>
<td>Bursitis/hygroarn, Carpus: Acquired bursa formed due to chronic trauma; Usually not into joint, Some m/b related to B. abortus infec.</td>
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</tbody>
</table>
**Radial fractures**

Mk 498; VC/L 115, 125, IM 1331, BM&S 881; DC 400; S-N 261; S-O 309

- **Uncommon**
- **High energy injuries** (Mack truck)
- **Transverse, oblique** (most common), comminuted, open or closed
- **Open fxS uncommon** (med. surface)
- **Proximal fx worst**, esp. if articular
- **Adult cattle better Px than horses** bec. will lay down

**Cast & Thomas splint**

Olecranon fractures (Ulnar)  

Mk 498; S-O 312; IM 1331; BM&S 881; DC 400

- Olecranon serves as lever arm for triceps, not a weight bearing bone
- **Direct trauma** (kicked)
- Distracted or nondistracted
- Articular or nonarticular
- **Salter type I of growth plate**

Like radial nerve paralysis - "Dropped elbow"

Tx: Rest - Bone plating

**Humeral fractures**

Mk 498; Br 373, IM 1331; BM&S 881; JDC 400; S-N 281

- **Uncommon**
- **"Mack truck" trauma** (bone thick, short & covered by muscles)
- **Middle third**, dist. segment displaced caudally
- **Rare to compound**
- **RADIAL N. DAMAGE** main concern (travels in brachial groove), Trauma to severance

**Scapular fxs**

Mk 498; IM 1335; L 323

- **Rare**, Most - simple, Spine, Supraglenoid tubercle, Neck, Glenoid cavity; Trauma
- **CS**: Lameness - mild to nonweight bearing, Shortening of cran. stride
- **Dx**: Direct palpation, Close observation of swelling, Crepitation, Rads definitive Dx
- **Tx**: Bone sequestra - surgical removal, Stall rest in sling: nonarticular fxS (bony union in several mo.)
- **Px**: Good - nonarticular; Poor - dist. neck fxS, glenoid fossa fxS

**Prognosis**

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- **Easy to Dx**
- **Radiographs for type**

- **Like radial nerve paralysis**
- "Dropped elbow", leg dragging, swings from shoulder
- Unable to extend elbow
- Variable heat, pain & swelling

**Prognosis w/ Sx**

- **Good** - nondisplaced, nonarticular fx
- **Guarded** - nondisplaced, articular fx
- **Guarded** - internal fixation
- **Guarded to poor** - physeal fxS

Calves < 6 mo

- **Stall confinement 6 wk**
  - Bandage forearm to thoracic wall
  - Dropped elbo remain, but can support weight
  - Intermedullary pinning
  - **ASIF nailing & bone plating**
  - Pin migration races healing
  - Plating
  - **Adult - salvage**
    - Confining in sling 6-8 wk
    - PVC pipe splint to prevent flexural contracture

**Prognosis**

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- **Salvage or stall rest**
  - Young, if mid shaft fx, can probably fx
- **Full-limb casts w/ Thomas splints**
  - NO full-limb casts alone
  - Bone plating in young
- **Proximal fxs**
  - Distal fractures full limb cast alone m/b

- **Prognosis**
  - Guarded to poor

- **Salvage or stall rest**
  - Rest & full leg splint
  - Nondistracted, nonarticular fxS
  - Absolute stall rest 6-8 wk
  - Bone plating
  - Comminuted, articular or distracted
  - Narrow dynamic compression plate (contour)
  - Almost instant improvement
  - Stall confinement until heal, drain 12-48 hr
  - Physeal fx: Fig. 8 band wiring or bone screw

**Prognosis**

**Radial fxs**

- **Easy to Dx**
- **Radiographs for type**

- **Like radial nerve paralysis**
- "Dropped elbow", leg dragging, swings from shoulder
- Unable to extend elbow
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**Prognosis w/ Sx**

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- **Guarded** - nondisplaced, articular fx
- **Guarded** - internal fixation
- **Guarded to poor** - physeal fxS

- **History, CS, Manipulation**
- **Radiographs** - extent of fx

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- **Guarded** - internal fixation
- **Guarded to poor** - physeal fxS

- **History, CS, Manipulation**
- **Radiographs** - extent of fx

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Joint Injuries & Joint Disease

Joint Injuries & Joint Diz (BR 522, 1441; Br 381, 383)

- **Group of disorders characterized by cartilage degeneration**
  - Cartilage has a limited potential for healing
  - Superficial defects of cartilage do not heal
  - Full thickness defects heal by granulation tissue to a weaker cartilage type

- **Causes**
  - Trauma: single incidence or repeated ("wear & tear")
  - Capsulitis & synovitis: Type 1 synovial membrane damage or Type 2 (fxs, or direct trauma to cartilage)
  - Direct cartilage damage (fxs); OC osteochondrosis; Joint instability/luxation; Age; Infections
  - All of above cause synovitis (inflam. joint capsule)
    - Starts a vicious cycle of cartilage damage
    - Chronic process leads to chip fxs & cartilage fragments which further leads to more synovitis
    - Progresses to DJD (degenerative joint diz)/osteoarthritis/osteoarthrosis

**Pathophysiology: Trauma/Infection** - self-perpetuating vicious cycle leading to DJD

- Complex & not fully understood
- Lack of correlation betw. pathological changes & clinical significance
- Direct trauma results in cartilage, chondrocyte & bone damage & causes synovitis
- Infectious arthritis: WBC's protease & collagenases cause destruction of cartilage & synovitis

**Synovitis:** inflammation resulting in release of damaging products
- Lysosomal enzymes & prostaglandins: degrade proteoglycans in articular cartilage
- Prostaglandin syntheses (local): degrade proteoglycans & suppress synthesis of proteoglycans & glycosaminoglycans by chondrocytes
- Synthesis of interleukins: initiates destruction of chondrocytes
- WBCs release destructive enzymes & O2 free radicals: degrade hyaluronic acid & proteoglycans

**Effects of damaging products**
- Loss of proteoglycans that hold water & hydrate cartilage
  - Decrease elasticity & resistance to compression
- Decrease hyaluronic acid which bind proteoglycans & lubricates joint
- Increase enzymes that break down cartilage matrix

**Results in softened cartilage which is more prone to damage** (vicious cycle leading to DJD)

**Proteoglycans** (mucopolysaccharides)
- Linear hyaluronic acid (HA) molecule
- Glycosaminoglycans (GAG) side chains (numerous)
  - Repeating units of disaccharides
  - Polyionic nature (negative charge propels each other to form tense meshwork holding large amounts of water)
  - Provides cartilage w/ resistance to compression
- Glycoprotein attach glycosaminoglycans to HA
**Condition** | Facts/Cause | Presentation/CS | Diagnosis | Treatment
--- | --- | --- | --- | ---
Traumatic synovitis/capsulitis<br>BR 527; Br 383 ** | • Synovitis: inflam. of synovial membrane <br>• Capsulitis: inflam. of fibrous joint capsule <br> - Type 1: w/o significant articular cartilage damage <br> - Type 2: w/ cartilage damage <br> - Leads to osteoarthritis (DJD) <br> - Stifle, hip, hock & carpus <br> - Cause: trauma, fx, infection <br> - Pathophysiology: synovitis (see above), leads to DJD w/o treatment | • Lameness, variable <br> • Distention of joint <br> - Fibrotic thickening of joint capsule <br> • Pain acutely <br> • Heat | • Effusion: digital palpation, compare to other limbs <br> • Pain on flexion tests <br> • Block out joint <br> • Radiographs: DX 1° from 2° <br> - Type 1: Minimal or none <br> - Type 2: Bone or lig. damage <br> • + Intrasyovial block <br> - Synovial fluid for analysis at time of block <br> • Arthrocentesis <br> - $\downarrow$ Viscosity (diluted hyaluronic acid) <br> - $\downarrow$ Protein <br> - WBCs | - Emergency: stop inflam. Type 1 before cartilage damage; Type 2 slow continued damage, once DJD irreversible <br> - Rest important - 2-3 months <br> - Phenylbutazone (decr inflam. & decr. Pgf production), 10 mg/kg OP initially then 5 mg/kg, or <br> - Aspirin 100 mg/kg PO BID <br> - Severe 1° synovitis: above Tx + <br> - Corticosteroids IA: 1 injection to reduce damaging inflam. Most potent antiinflam. drug <br> - Depo-medrol® (methylprednisolone acetate) or Vetalog® (triamcinolone acetonide) <br> - Changes usually irreversibly <br> - Palliative Tx in valuable breeding animal <br> - Can be hereditary <br> - Inspect diet <br> - Avoid overfinishing <br> - Prognosis: <br> - Good if type 1 (no radiographic changes) <br> - DJD - too late <br> **

Trauma: Cycle of cartilage breakdown => DJD CS: Lameness, Swelling, Pain Dx: Hx, CS, Rads (cartilage damage) Tx: Before DJD - Rest, NSAIDs, Steroids DJD, Degenerative joint disease, Degenerative arthropathy, Osteoarthritis Mk 496; IM 1281; C3T 876; Br-hb 225, 547; BR 1441, 146; Br 382; DC 393; L 291 ** | • Degeneration of articular cartilage w/ periarticular remodeling <br> • Hip & stifle mainly <br> - Synovitis <br> - Fxs <br> - Infection <br> - Osteochondrosis | • Lameness - Pain <br> • Heat (infec. arthritis > 2° DJD) <br> • Joint effusion <br> • Slowly progressive history <br> • Bony enlargements <br> • Atrophy, m/ lead to condemnation at slaughter | • History, CS <br> • Intra-articular anesthesia <br> • Radiographs <br> - Squaring off of joint margins <br> - Osteophyte production (periarticular osseous remodeling) <br> - Subchondral irregularity (indicates cartilage damaged over it) | • Changes usually irreversibly <br> • Palliative Tx in valuable breeding animal <br> - Can be hereditary <br> - Inspect diet <br> - Avoid overfinishing <br> - Prognosis: <br> - Too late Cartilage degeneration CS: Lameness Dx: Hx, CS, Rads (Osteophytes) Tx: Too late - Tx when synovitis | - Eburnation, white & shiny appearance to subchondral bone due to chronic trauma | **

Predisposing factors: synovitis & DJD <br> - Overweight <br> - Poor conformation: straight legged <br> - OC (osteocondrosis) <br> - Subchondral bone cysts in stifle <br> - Inherited predisposition <br> - Joint instability following trauma <br> - Nutritional <br> - HI P low Ca diet, copper defc, fluoride poisoning (decr. strength of subchondral bone) <br> - Forced tracion of breech birth (vascular damage to hip) <br> - Type 1: Minimal or none <br> - Type 2: Bone or lig. damage <br> - + Intrasyovial block <br> - Synovial fluid for analysis at time of block <br> • Arthrocentesis <br> - $\downarrow$ Viscosity (diluted hyaluronic acid) <br> - $\downarrow$ Protein <br> - WBCs <br> - Squaring off of joint margins <br> - Osteophyte production (periarticular osseous remodeling) <br> - Subchondral irregularity (indicates cartilage damaged over it) <br> - Synovial fluid <br> - Neutrophilia, Hemorrhage, Elev. proteins, $\downarrow$ viscosity (diluted hyaluronic acid) <br> • Postmortem: <br> - Eburnation, white & shiny appearance to subchondral bone due to chronic trauma
# Arthritis

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
</table>
| Adult septic arthritis, Infectious arthritis | • Bacterial infection in a joint, also viral & fungal  
• Cartilage damage  
• Cause  
  1. Penetrating wound  
  2. Hematogenous (esp. young)  
• Less common, assoc w/  
• Chronic reticuloperitonitis  
• Septic metritis  
• Sole, liver abscesses  
• Intercapsular pododermatitis  
3. Iatrogenic (joint aspiration or injection)  
• #1 site: distal interphalangeal joint  
  - Fetlock  
  - Tarsus, stifle & hip from hematogenous spread  
• Pathogens: *A. pyogenes*, *E. coli*, *Staph* & *Strep* spp, *Fusobacterium necrophorum*, *Bacteroides melaninogenicus* (anaerobic), *mycoplasma*, *chlamydia*  
• Pathophysiology - devastating  
  - Rapid cartilage damage due to release of enzymes; hi WBCs, fibrin & bacteria  
  - Invasion of bacteria - inflammation  
  - PMNs & fibrin, enzymes & protenaceous debris  
  - Loss of GAGs (protects cartilage) | • 3 legged lameness  
• Joint effusion (swelling)  
• Heat  
• Periarticular swelling (edema & cellulitis to fibrosis)  
• Fever - low grade  
• Progresses rapidly  
• Open drainage m/b  
  - If draining often not sore (pressure of distension causes pain)  
• Anorexia & milk drop  
• Complications:  
  - Recurrence  
  - Chronic synovitis & DJD | • CS & synovial fluid (pos. culture not necessary)  
• Flexion - severely painful  
• Synovium collection before ABs!  
  - C&S (culture & sensitivity)  
  - EDTA - WBC count & differential  
  - WBCs (most PMNs) + TP  
  - WBCs > 30,000/μl  
  - > 90% PMNs  
  - TP > 2 g/100 ml  
• Low viscosity & decr. in mucoi clot  
• Cloudy  
• Positive bact. culture diagnostic  
  - Usually negative so doesn't R/O  
• Radiographs  
  - Early (< 14 ds usually not helpful)  
  - No bony changes  
  - Soft tissue swelling/Effusion  
  - R/O Fxs or osteomyelitis  
  - Later cartilage & bone changes  
  - Periosteal proliferation  
  - Narrowing of joint space (cartilage damage)  
  - Subchondral bone lysis  
  - Arthroscopy, cartilage damage - Sx done in horses, refer to surgical facility if economics dictates for cattle | • Emergency  
1. Sterile synovial fluid collection 1st  
2. Start on broad spec. ABs  
IV not IA, 3 wks past resolution (Na ampicillin)  
  - Change if C&S dictates  
  (usually can't isolate bact.)  
3. Drainage (removes bacteria, WBCs & destructive products (lysosomes)  
  - Needle lavage  
    - Before fibrin plugs (14-16 gauge), aseptic technique  
    • Balanced electrolyte sol. - 0.1% Betadyne® (> 5 L)  
    • Single needle: distend joint then aspirate out, repeat until fluid is clear, Silastic catheters m/b placed & sutured to skin for repeated lavage  
    • Through & through lavage (2 needles in joint, periodically block outflow to distend joint)  
    • Repeat lavage daily, stop when cell counts stabilize at 10-15,000/ml  
  • Arthrotomy, debride & lavage: if fibrin occludes needles  
  • Irrigualion suction drains - until synovia sterile, days to weeks  
4. Sterile support bandages, watch for strike  
  - Immobilize only 6 hrs/d or reduced range of motion  
5. NSAIDs: "Bute" (phenylbutazone) 9 mg/kg PO, maintenance 4.5 mg/kg PO EOD (every other d) (analgesia & antiinflam. [block prostaglandin synthesis]) |
**Neonatal septic arthritis/ Osteomyelitis, Polyarticular septic arthritis, "Joint ill", "Navel ill", Septic arthritis, Infectious arthritis**

- **Systemic, Hematogenous, Navel ill, FPT CS:** Sick, Lameness, Swelling
  - Dx: Hx, CS, Synovial fluid, Zinc sulfate
  - Tx: Systemic ABs, Lavage, Bandages
  - Px: Poor

- **Chlamydia psittaci**
  - BR-hb 437, BR 1143
  - **Chlamydia psittaci**
    - In soil & manure
    - Endemically or epidemically in sheep, goats & calves
    - Major importance to sheep industry
    - Enters through umbilical stump

- **Haemophilus somnus**
  - Calves, Feedlot, Septicemic diz: TEMA. Lungs. Joint infections in those that have averted fatal septicemia, Septic arthritis hock & stifle, Swollen joints & tendon sheaths, Poor condition, Stiffness

**Chlamydia polyarthritis**

- **BR-hb 437, BR 1143**

- **Similar to adult septic arthritis**
  - Early Dx vital bec. of cartilage damage
  - Flexion - severely painful
  - Synovial fluid BEFORE ABs!
    - WBCs (most PMNs) + TP
      - WBCs > 30,000/μL
      - > 90% PMNs
    - TP > 2 mg/ml
  - Pos. culture definitive, Negative common & doesn't R/O sepsis
  - Assume infec. if WBCs & TP (synovial fluid)

- **Radiographs:** not helpful acutely
  - Early - soft tissue swelling, effusion
  - If no bone lesions re-rad in 7 ds
  - Periosteal proliferation (DJD)
  - Narrowing of joint space
  - R/O Osteomyelitis (see below)

- **Blood culture m/b early in course of diz**

- **FPT - zinc sulfate turbidity test for passive transfer**

- **Emergency** (remove, tact. enzymes & material)
  - **#1 Systemic ABs 2-3 wks**
    - If no gram stain, start on b'd. spec. ABs, penicillin, ampicillin, tetracyclines, Change if C&S dictates
    - If no affect in 1-2 ds, more aggressive
  - **Joint lavage (remove material)**
  - **Needle lavage early**
    . Balanced electrolyte sol. + ABs
  - **Arthrotomy, debridement & lavage:** Penrose drains or suction drains to keep open, more helpful in stifle than complex carpus & tarsus
  - **Sterile support bandages**
  - **Rest (for cartilage to heal & strengthen)**
  - **NSAIDs (don't exceed recommended doses [ulcers])**
  - **Supportive care: fluids for enteritis**
  - **IV plasma if FPT**

- **Prognosis**
  - **Poor/grave**

- **Prevention**
  - **Colostrum** early after birth

- **Haemophilus somnus**
  - Calves, Feedlot, Septicemic diz: TEMA. Lungs. Joint infections in those that have averted fatal septicemia, Septic arthritis hock & stifle, Swollen joints & tendon sheaths, Poor condition, Stiffness

- **History, CS**
  - Culture - easily seen
  - Giemsa stained smears for elementary inclusion bodies
  - FA, rising titers

- **Tetracycline (20 mg/kg IM/ SQ EOD) 3 treatments**
  - Tylosin
  - Erythromycin
  - Do not medicate feed or water - reluctant to eat or drink

- **No vaccine**
# Osteomyelitis

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<td><strong>Hematogenous</strong>&lt;br&gt;(neonatal) osteomyelitis&lt;br&gt;Mk 556; C3T 681; IM 1287; BR-hb 224; BR 521; Br 392; DC 385 **</td>
<td>- Closely associated w/ septic arthritis&lt;br&gt;- Hematogenous most common&lt;br&gt;- Navel ill - usually spreads to joint, but can go to metaphysis/osteomyelitis&lt;br&gt;- Salmonella spp., Pasteurella, Actinomyces pyogenes, E. coli&lt;br&gt;- Pathophysiology - Bact. to metaphysis (sluggish blood flow), physis &amp; epiphysis, M/ spread to joint&lt;br&gt;- Bone necrosis &amp; sequestrum formation&lt;br&gt;- FPT (failure of passive transfer)</td>
<td>- Early nonspecific&lt;br&gt;- ± Systemic signs&lt;br&gt;  - Depression, listless, pyrexia (fever)&lt;br&gt;  - M/ only be slightly off&lt;br&gt;- Severe lameness w/ cellulitis &amp; phlegmon&lt;br&gt;  - M/b draining tracts&lt;br&gt;  - Recumbency due to systemic illness or multilimb lameness</td>
<td>- Palpate for pain over metaphysis&lt;br&gt;- Lab: inflammation&lt;br&gt;  - Blood cultures&lt;br&gt;  - WBCs - elev. or lowered w/ lt. shift&lt;br&gt;  - Elev. plasma fibrinogen&lt;br&gt;- Zinc sulfate for FPT&lt;br&gt;- Radiographs&lt;br&gt;  - Acute: no changes - check for fx&lt;br&gt;  - Lytic changes (loss of bone density)&lt;br&gt;  - Sclerotic margins of lytic areas&lt;br&gt;  - Sequestrum (piece of bone in lytic area) w/ involucrum (surrounding envelope)&lt;br&gt;  - Endosteal &amp; periosteal thickening</td>
<td>- Tx any navel ill, pneumonia, septicemia&lt;br&gt;- Plasma transfer if FPT&lt;br&gt;- Sx treat umbilical infection&lt;br&gt;- Broad spec. ABs - high levels 3-4 wks&lt;br&gt;- Bandage support&lt;br&gt;- If no response - Local debridement &amp; irrigation&lt;br&gt;- Prognosis - Poor esp. if multiple sites - Recurrence if all involved tissue not removed&lt;br&gt;- Prevention - Colostrum</td>
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<td><strong>Hematogenous, Septic joints, FPT</strong>&lt;br&gt;CS: ± Sick, Lame&lt;br&gt;Dx: Hx, CS • DDx: Septic arthritis&lt;br.Tx: Tx Navel ill, ABs, Debridement</td>
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<td><strong>Adult osteomyelitis</strong>&lt;br&gt;C3T 681; BR 651; Br 392; DC 396 **</td>
<td>- Suppurative bact. infec. of bone&lt;br&gt;- Direct trauma to bone&lt;br&gt;  - Hematogenous spread rare&lt;br&gt;- Bone necrosis &amp; sequestrum formation&lt;br&gt;- Actinomyces (Corynebacterium) pyogenes most common</td>
<td>- Lameness, wound&lt;br&gt;  - Postural deformities&lt;br&gt;  - Heat&lt;br&gt;  - Drainage m/b&lt;br&gt;  - ± Fever&lt;br&gt;  - Osteomyelitis of vertebrae&lt;br&gt;  - M/b neurologic signs &amp; lameness</td>
<td>- Assume osteomyelitis if wound &amp; excessive pain&lt;br&gt;  - Palpate for pain over site&lt;br&gt;  - Lab: inflammation&lt;br&gt;  - WBCs - elev. or lowered w/ lt. shift&lt;br&gt;  - Elev. plasma fibrinogen&lt;br&gt;- Radiographs&lt;br&gt;  - Acute: no changes - check for fx&lt;br&gt;  - Osteomyelitis 10-14 d to see&lt;br&gt;  - Lytic changes (loss of bone density)&lt;br&gt;  - Sclerotic margins of lytic areas&lt;br&gt;  - Sequestrum (piece of bone in lytic area) w/ involucrum (surrounding envelope)&lt;br&gt;  - Endosteal &amp; periosteal thickening</td>
<td>- Emergency&lt;br&gt;  - Sx&lt;br&gt;  - Surgical lavage, debridement &amp; curettage (remove infected bone)&lt;br&gt;  - Drains &amp; sterile bandages&lt;br&gt;- Broad spec. ABs - high levels 2-5 wks&lt;br&gt;- Limb support&lt;br&gt;- PBZ (phenylbutazone) for pain&lt;br&gt;- Prognosis - Good</td>
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<td><strong>Trauma</strong>&lt;br&gt;CS: Lameness, Wound&lt;br&gt;Dx: Wound &amp; Excessive pain&lt;br.Tx: Emerg., Debride, ABs, Support, PBZ</td>
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Physeal dysplasia, "Physitis", "Epiphysitis"
1M 1250; BR 1437; Bri93; **

Enlargement of growth plates
- Long bones
- Young, rapidly fattening cattle
- 5-12 mo
- Hindlimbs > FL
- Carpus & fetlock esp.
- Cause - not exactly defined
  - Overnutrition
  - Copper defc (molybdenosis) in young growing cattle on pasture
  - Calves raised on slatted floors
  - Compression trauma to part of physeal blood supply (metaphyseal) on med. side (weight bearing) m/ cause premature closure

Symmetrical swelling
- Metaphyseal faring (enlargement of ends of long bones)
- Weight loss in beef cattle (9-18 mo)
- Pain in enlarged area in lame calves or yearlings
- Palpate swelling - warmth
  - Mild pressure - none, mod. pain
  - Deep palpation - severe pain
- Radiology (possible findings)
  - Metaphyseal flaring
  . Widening of metaphysis
  - Sclerosis & lysis
- Lab
  - Usually normal
  - Hi ALP (alkaline phosphatase), but typical of growing animal

"Epiphysitis" - misnomer bec. no active inflammation
- Dysplasia of growth plate better term (growth plate, not epiphysis)
- Misnamed rickets - not related to Vit. D defc

Sprains variable:
- Mild sprain m/ go unnoticed
- Moderate sprain: some laxity in joint
- Severe sprain: instability of joint, m/b luxation of joint, extensive swelling, tenderness, lameness & weakness

Sprains & Luxation
IM 1283; L 218, 267

Sprain - stretching or tearing of support ligg. of a joint; Mild sprain: few fibers torn, integrity not lost; Moderate sprain: Part of ligg. torn w/ some loss of function
- Severe sprain: complete loss of function of ligg. w/ separation of ends
- Luxation: dislocation of joint
- Subluxation: partial dislocation
- Loss of integrity of 1 or more ligg. (severe sprain); Avulsion fxs of attachment of lig.
- Pathophysiology
- Instability leads to synovitis which leads to DJD

Sprains & Luxation
- Obvious nonweight bearing lameness
- Postural deformity
- Dislocation of joint
- Instability of joint

Sprain - Variable opening of joint
- History, CS
- Radiographs
- In stressed position

DDx:
- Catastrophic fx
- Osteomyelitis (p 174)
- Supplicative joint diz (p 172)

Sequela
- Synovitis/DJD
  (degen. joint diz)

Instability leads to synovitis & DJD
CS: Sprain-Variable; Lux.-3 legs, Deformed
Dx: Hx, CS, Rads
Tx: Prevent synovitis, Cold, Stabilize, Rest

Prevention
- Correct diet - copper
- Rest & lightweight cast
- Copper related - diet changes

Noncopper - salvage before more weight loss

Copper related - diet changes
- Cold water or ice as soon as possible (reduce hemorrhage & minimize swelling)
- More severe: heavy wraps or cast & stall confinement

Cold water or ice as soon as possible (reduce hemorrhage & minimize swelling)
- Phenylbutazone (up to 4 mg/kg OP or IV BID)
- Reduce inflammation & relieve pain
- 4. Rest
- Prevent synovitis & DJD
- 1 reduce swelling
- Cold water or ice as soon as possible (reduce hemorrhage & minimize swelling)
- 2. Stabilize or immobilize joint
- Mild: 4-sheet cotton dressing w/ flannel wrap; few days
- More severe: heavy wraps or cast & stall confinement

Pathophysiology
- Instability leads to synovitis
- DJD
- Sequela
- Synovitis
- DJD (degen. joint diz)

Prevent synovitis & DJD
- 1 reduce swelling
- Cold water or ice as soon as possible (reduce hemorrhage & minimize swelling)
- 2. Stabilize or immobilize joint
- Mild: 4-sheet cotton dressing w/ flannel wrap; few days
- More severe: heavy wraps or cast & stall confinement
- 3. Pain relief
- Phenylbutazone (up to 4 mg/kg OP or IV BID)
- Reduce inflammation & relieve pain
- 4. Rest
**OCD MUSCULOSKELETON**

**Osteochondrosis (OC), Dyschondroplasia & Osteochondrosis dissecans (OCD)**

**Condition**
- Low significance in cattle, prod - dairy, bull breeding problems
- Failure in endochondral ossification
  - Fast growing cartilage thickens & ossification is delayed
  - Focal areas of deep cartilage dies & necroses
  - #1 site in stifle
- Manifestations
  - 1. Articular cartilage
    - OC (osteochondrosis): defect of articular cartilage
    - OCD (osteochondrosis dissecans): OC w/ dissecting flap of cartilage, m/ remain attached or separate (joint mice), m/ calcify
    - Subchondral cysts (not always OC)
  - 2. Metaphyseal physis (growth plate)
    - Physitis/epiphysitis (not always OC)
- History
  - Males > females
  - Feedlot steers (9%)
  - Middle aged dairy bulls (12%) affects breeding
- Cause: cartilage maturation abnormalities - ill defined, multifactorial (meaning we don't know!)
  - Fast growing young + other factors
  - Overnutrition (high energy/protein diets)
  - Concrete floors >> clay floors
  - Trauma: causing or affecting abnormal cartilage (disrupt blood supply?) mounting, head butting

**Facts/Cause**

**Presentation/CS**
- Variable lameness depending on joint, age, weight
- Asymptomatic
- Mildly progressive lameness
- Variable swelling (distention of joint/tendovaginitis)
- Weight loss
- Milk prod.
- Sequela
  - DJD (degenerative joint dz)

**Diagnosis**
- History, CS
- Regional nerve & joint blocks to localize (used in horse)
- Radiology
  - Rads of opposite limb bec. often bilat.

**Treatment**
- Conservative
  - Rest
  - Restricted feed intake
  - NSAIDs for comfort
  - Arthroscopic Sx - Debridement

**Prevention:**
- Do not overfeed
- Check for mineral balancing diets (copper/calcium/zinc) horses

**COMMON SITES**
- Stifle
  - #1 Lat. troclear ridge of femur
  - Condyles of femur & tibia
- Prox. end of humerus
- Dist. end of radius
- Condyles of atlanto-occipital joint

**Failure of cartilage ossification, Fast growing males**

**CS:** Variable lameness & Swelling

**Dx:** Hx < CS, Rads

**Tx:** Rest, Diet, NSAIDs - Sx

**DDx**
- Septic arthritis (p 172)
- Osteomyelitis (p 174)
- Bone abscess
- True bone cyst

**Failure in endochondral ossification**
- Fast growing cartilage thickens & ossification is delayed
- Grows past its nutritional supply
- Soft, thickened cartilage prone to traumatic fissures
  - Fissure m/ cause a cartilage flap
  - Or m/ heal over, forming a cyst that m/ communicate w/ joint
- Cyst m/ also be formed by retention of abnormal cartilage
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<td>Facts/Cause</td>
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<td>-----------------------------------------------------------------------------</td>
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<tr>
<td>Pinkeye, Infectious bovine keratitis (IBK), Infectious ophthalmia</td>
<td>- Common, economic losses &lt;br&gt; - <em>Moraxella bovis</em>&lt;br&gt; - Gram neg. cocccobacillus &lt;br&gt;- Pili to bind to corneal epithelium &lt;br&gt;- Contagious, many in herd &lt;br&gt;- Spreads rapidly in herd &lt;br&gt;- Calves (&lt; 1 yr) &gt; adults &lt;br&gt;- Herefords &amp; Hereford crosses; least susceptible are Charolais &amp; crosses, Angus &lt;br&gt;- Factors associated w/ IBK &lt;br&gt;- Light eyelid pigment &lt;br&gt;- Ultraviolet light - Sunlight &lt;br&gt;- Face flies (Musca spp); irritant &amp; vector &lt;br&gt;- IBR &amp; mycoplasma intac. potentiate &lt;br&gt;- Dust &amp; other mechanical irritants &lt;br&gt;- Vit A deficiency (summer months)</td>
</tr>
<tr>
<td>Moraxella bovis, Contagious, Herefords&lt;br&gt;C3: Conjunctivitis, Corneal edema, Blindness&lt;br&gt;Tx: Linquamyacin LA-200</td>
<td>**</td>
</tr>
<tr>
<td>IBR, ***&lt;br&gt;Conjunctivitis form, Infectious&lt;br&gt;Bovine Rhinotracheitis C3T 837; IM 1367; BR 1061</td>
<td>- See pg 252; Herpesvirus; Several animals infected, 1° eye manifestation or assoc. w/ resp. or reproductive form &lt;br&gt;- CS: Conjunctivitis (white plaques, necrosis [ulcers], ocular discharge [serous to mucopurulent]), 2° Keratitis (corneal edema, neovascularization). Corneal ulcers rare. &lt;br&gt;Anterior uveitis (hyptopy, iris congestion, miosis), resolves in 4-5 wks, Fever, Anorexia, ♦️ Milk prod., Abortions wks after conjunctivitis</td>
</tr>
<tr>
<td>Pasteurella spp (C3T 837): **See pg 63; calves, conjunctivitis, rhinitis, pharyngitis &amp; pneumonia&lt;br&gt;Tx: aimed at pneumonia, Systemic ABs</td>
<td>- See pg 63; calves, conjunctivitis, rhinitis, pharyngitis &amp; pneumonia</td>
</tr>
<tr>
<td>Mycoplasma spp (C3T 837; IM 1369): Epizootic conjunctivitis, summer (calves &amp; face flies) CS: mild - serous discharge, conjunctival hyperemia; Dx: swabs moistened w/ Hayflick broth</td>
<td>- See pg 63; calves, conjunctivitis, rhinitis, pharyngitis &amp; pneumonia</td>
</tr>
<tr>
<td><strong>Other causes of conjunctivitis</strong> (C3T 837): C. pyogenes, Leptospira spp., Acinetobacter spp., Moraxella ovis, Aspergillus spp., Adenovirus, Tuberculosis, Bluetongue virus</td>
<td>- See pg 63; calves, conjunctivitis, rhinitis, pharyngitis &amp; pneumonia</td>
</tr>
</tbody>
</table>
Infectious uveitis ***
CST 837; Br 718; DC 461
• Neonatal septicemia - E. coli, Corynebacterium spp., Klebsiella, Listeria, Salmonella, Strep. spp., FPT (failure of passive transfer) • CS: Corneal edema, episcleral vascular injection, cloudy ocular media, constricted pupil, iris congestion; Septicemia CS (fever, swollen joints, umbilical abscess, pneumonia, enteritis, endotoxemia)
• Adult: Uncommon, Systemic Infec.: mastitis, metritis, endocarditis, TEME • CS: Fibrinous anterior uveitis, CS of supplicative diz; TEME - posterior uvea lesions; Secuelea synechiae & choriodial scars • Tx: Systemic ABs & support, Topical ABs or AB/steroid (if no ulcers) + 1% atropine QID

MCF head & eye form. * (Malignant catarhal fever) (CST 838; IM 1369): See pg 10; Hi fever, conjunctivitis, miosis, corneal edema, exudate in anterior chamber • Tx: fatal, isolate & no sheep

BVD-associ. congenital ocular diz ★★ (CST 838; IM 1369): fetus in 2nd trimester • CS: cerebellar hypoplasia/ocular lesions (retinal dysplasia, microphthalmia, cataracts, born blind, nystagmus)

Listeriosis monocytogenes (CST 838; IM 1370): encephalitis & ocular CS (facial paralysis, ptosis, conjunctivitis, med. strabismus, blindness, uveitis w/ hypopyon • Dx: Isolate at necropsy • Tx: Bov spec. ABs early

Retrolubbar leukosis * (CST 838; IM 1370; DC 445): M/ cause unilat. or bilat. exophthalmia, chemosis & exposure keratitis • PX: grave

Cancer eye, Ocular squamous cell carcinoma (OSCC)
Mk 298; CST 847; IM 1392; BR-hb 679; Br 1721; DC 460; S-J 1195; S-T 293; S-N 63) ***
• #1 neoplasm of cattle & all large animals economically
• Benign & malignant, premalignant stages
• 30% regress spontaneously
• Cause, multifactorial, assoc w/:
  - Herefords, white-faced, Hereditary, Sunlight, Dust, Hi nutrition
• Peak age 7-8 yr
• Common sites: Conjunctiva (Lat. limbus (corneoscleral junction), Lower eyelid margin, 3rd eyelid (nictitating membr.), Med. canthus of eye, Cornea

#1 $ tumor - Herefords, Condemned carcasses
CS: Benign, Malignant (Irregular, Necrotic)
Dx: Hx, CS, Lab
Tx: Remove (Scrape, Enucleation), Slaughter

Facial nerve paralysis: *** Cause: trauma or middle ear infections can result in keratoconjunctiva sicca (dry eye) due to disruption of innervation to lacrimal gland & inability to close eye
IM 1172; DC 438; N-L 162

Eyeworm, Thelaziasis
Mk 304; CST 838; BR 1276; Br 755; IM 1390
• Thelazia spp. T. glauca, T. skrjabini, T. meseri (most harmful), < 1" long, in 1/3 of all cattle In USA, Face fly, Musca autumnalis, common vector (feeds on eye excretions, deposits worm) Found invading lacrimal gland & ducts, gland of 3rd eyelid, nasolacrimal ducts, on cornea, in conjunctival sac, under eyelids
• CS: Asymptomatic typical in USA; Europe & Asia - conjunctivitis, photophobia & keratitis
• Dx: Visualization, Incidental finding during surgery
• Tx: Not usually necessary (asymptomatic), if found mechanical removal following instillation of local anesthetic, ABs/steroid ointment for inflammation, Levamisole & Ivermectin

Bovine cornea tougher than other species

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### Parasites

**Lice, Pediculosis, Lousiness**  
Mk 816; C3T 886; IM 1422; Br 250, 682; Br 1291; Pic 34

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Winter</strong> - N. USA &gt; Summer</td>
<td><strong>Pruritus</strong> (scratching, nibbling &amp; biting)</td>
<td><strong>Damalinia</strong> (order Mallophaga)</td>
<td><strong>History, CS</strong></td>
<td><strong>Topical insecticides</strong></td>
</tr>
<tr>
<td>Transmission: Direct contact</td>
<td><strong>Damage to hides</strong>, roughened hair coat, alopecia, excoriation, unthrifty appearance</td>
<td><strong>Biting louse</strong> (chewing mandible)</td>
<td><strong>PE: Observation</strong></td>
<td>- Winter: Pour on, dust, powders</td>
</tr>
<tr>
<td>Life cycle: entirety on host, 2-4 wks</td>
<td><strong>Restless, irritable</strong></td>
<td><strong>Haematopinus</strong>, Solenopotes, Linognathus (order Anoplura)</td>
<td>- Part hairs on head, face, ears, neck, back topline, dewlap, escutcheon, tail base &amp; tail switch</td>
<td>- Summer: Sprays &amp; dips</td>
</tr>
<tr>
<td>Ova on floor m/hatch in 2 wk in warm weather</td>
<td><strong>Lose weight</strong> - less eating</td>
<td><strong>Sucking louse</strong> (retractable stylet mouth parts)</td>
<td>- Nits (louse eggs attached to hair)</td>
<td>- 2-3 Tx 2 wk apart will cure</td>
</tr>
<tr>
<td><strong>Species specific, live on host</strong></td>
<td><strong>Anemia</strong> (w/ large number of sucking lice)</td>
<td><strong>Louse eggs</strong> (nits) on hairs (pale, transparent &amp; oval)</td>
<td></td>
<td>- Retreat for eggs</td>
</tr>
</tbody>
</table>

**Winter; Direct contact**  
CS: **Pruritus**, Hide damage, Anemia  
Dx: Hx, CS, PE (Lice/Nits)  
Tx: Insecticides, Ivermectin - Sucking

**Strongyloidosis**, *Pelodera strongyloides*, Rhabditic dermatitis (Mk 810; BR 1272):  
*Rare, Pelodera (Rhabditis) strongyloides*, Transm.: contact w/ wet, infected, decaying bedding  
CS: **Pruritus**, Pustules, extremities, ventr. abd. & thorax, perineum, Alopecia  
Dx: Nemalode larvae, Skin scrapings, Bedding  
Tx: Eliminate bedding, Spontaneous recovery, Dip or spray w/ insecticides

**Stephanofilariasis, Filarial ***dermatitis**  
Mk 81; C3T 890; IM 1428; BR-hb 491; BR 1278; Br 754; DC 249; Pic 36  
**Little economic importance**  
- **Stephanofilaria stilesi**, adults 1/4", found in dermis at base of hair follicles  
- Female horn fly (Haematobia irritans) - intermediate host  
- West & SW, all USA, beef breeds  
- Minor economic importance

**Trombiculidiasis, Chiggers, Harvest mite, Leg itch**  
C3T 896; IM 1422; BR-hb 505; BR 1302  
**1- Late summer & fall**  
- Trombiculid larvae of mites  
- **Pruritic dermatitis**  
  - Dist. limb, face, muzzle, neck, ventr. chest, abd.  
  - Crusts, excoriation, edema, exudations  
  - Skin scrapings: macerated in isotonic saline sol., microscope for adults & microfilaria  
- **Skin biopsy**  
- **Skin bioptys**  
- **No Tx recommended**  
  - because not economically important, spontaneous remission in 2-3 years

**Economics** - tremendous damage to hides  
- Pour on ivermectin gets both sucking & biting lice  
- Follow local laws for withdrawal times & tissue residue tolerance
Mange, ***
Barn Itch

**Choriopptic mange**, leg, foot tail, scrotal mange
Symbiotic scab
DC 247

- **Choriopptic bovis** - round bodies, long legs & short, unsegmented pedicles
  - Surface dwelling - hypersensitivity
- **Most common cattle mange**
  - Winter stabled dairy - NE USA
  - "Leg mange" if starts on legs

**Psoroptic mange**, Common scabies, Body mange

- **Psoroptic ovis** - round bodies & segmented pedicles, Life cycle 10-12 d
  - Feedlot & range cattle
  - Central & western states
  - Eradication from sheep in USA

**Sarcoptic mange**, Barn itch, head mange

- **Sarcoptes scabiei var bovis** - Round bodies, terminal anus, short legs & long, unsegmented pedicles
  - Burrowing
  - **Reportable**
  - Uncommon in ruminants, important in pigs
  - Can be transmitted to man
  - Transmission: direct contact (m/b fomites)

**Demodex, **
Follicular mange, Demodicosis, Demodectic mange

- **Rare**
- **Demodex spp** - cigar shape w/ short, stubby legs
  - Normal resident of skin, live in hair follicle & sebaceous glands, not contagious diz
- **Rare in lg. animals**
- Holstein dairy cattle most commonly
- Transmission: cow to calf at nursing
  - Possible hereditary predisposition

Psorergatic mange (cattle itch mite)

- **Rare**
- **Nonpruritic, scaling**

Reportable, Damages skin, Hypersensitivity, 2° bact. infec.
CS: Pruritus, Econ. losses (Hide damage, ↓ Body condition, ↓ Milk prod.
Dx: Hx, CS, Multiple skin scraping/biopsy
Tx: Insecticides, Ivermectin • Reportable disease

**Skin scrapings (easy)**

**Location**
- **Choriopptic & sarcoptes in stratum corneum**
- **Psoroptic in hair follicle**
- **Demodex in hair follicle & sebaceous glands**

**Reportable diz USDA**
- Isolate, quarantine & Tx
  - Ivermectin SQ, Dipping

**Report to feds**
- Crotoxphos (spray 0.25%) once
- Lime sulfur 2% 4 wkly Tx
- Ivermectin

**Pruritus, papules, pustules, crusts, scabs**
- Generalized crusting dermatosis
- **Starts on withers**, spreads to entire body
- Death in untreated calves & yearlings m/b
- Chronic or acute in young dairy during winter

**Skin scrapings**

**Vacuum cleaner, filter sampling, ear swabs > skin scrapings or biopsy**

**Usually asymptomatic so not treated**
- Negative (trichlorfon) whole body dipping 3 Txs EOD
- Severely affected culled

**Minimal lesions & low economic loss, so usu. none**
### Dermatology

<table>
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<tr>
<th>Cattle grubs, Hypoderma bovis (Heel fly, Warble fly)</th>
<th><strong>Facts/Cause</strong></th>
<th><strong>Presentation/CS</strong></th>
<th><strong>Diagnosis</strong></th>
<th><strong>Treatment</strong></th>
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<tbody>
<tr>
<td><strong>Condition</strong></td>
<td><strong>History, CS</strong></td>
<td><strong>&quot;Gadding about&quot;/Summer: run from swarms of heel flies</strong></td>
<td><strong>History, CS</strong></td>
<td><strong>Pour-on insecticides shortly after heel fly season</strong></td>
</tr>
<tr>
<td><strong>Hypoderma bovis</strong></td>
<td><strong>Economic loss</strong></td>
<td><strong>&quot;Gadding about&quot;/Summer: run from swarms of heel flies</strong></td>
<td><strong>Intradermal skin test, early Dx</strong></td>
<td><strong>Completed before larvae reach spinal cord or esophagus (before Oct 15th in Oklahoma)</strong></td>
</tr>
<tr>
<td><strong>Warbles, H. bovis</strong></td>
<td><strong>Damage to meat &amp; hide</strong></td>
<td><strong>Warbles/Spring (cysts) on back, firm &amp; raised w/ a breathing hole</strong></td>
<td><strong>History, CS</strong></td>
<td><strong>Sx remove (NEVER squeeze parasite or m/ cause hyperallergic reaction)</strong></td>
</tr>
<tr>
<td><strong>Hypodermatosis</strong></td>
<td><strong>Economic loss</strong></td>
<td><strong>OPS kill in fall</strong></td>
<td><strong>History, CS</strong></td>
<td><strong>Sx remove (NEVER squeeze parasite or m/ cause hyperallergic reaction)</strong></td>
</tr>
<tr>
<td><strong>Mk 780; C3T 889; J1M 1139, 1429</strong></td>
<td><strong>&quot;Gadding about&quot;/Summer: run from swarms of heel flies</strong></td>
<td><strong>H. bovis - weakness &amp; ataxia in hindlimbs, paralysis</strong></td>
<td><strong>History, CS</strong></td>
<td><strong>Sx remove (NEVER squeeze parasite or m/ cause hyperallergic reaction)</strong></td>
</tr>
<tr>
<td><strong>- North</strong></td>
<td><strong>Economic loss</strong></td>
<td><strong>H. bovis (esophagus)</strong></td>
<td><strong>History, CS</strong></td>
<td><strong>Sx remove (NEVER squeeze parasite or m/ cause hyperallergic reaction)</strong></td>
</tr>
<tr>
<td><strong>- South</strong></td>
<td><strong>&quot;Gadding about&quot;/Summer: run from swarms of heel flies</strong></td>
<td><strong>H. lineatum (esophagus)</strong></td>
<td><strong>History, CS</strong></td>
<td><strong>Sx remove (NEVER squeeze parasite or m/ cause hyperallergic reaction)</strong></td>
</tr>
<tr>
<td><strong>- Conomological Loss</strong></td>
<td><strong>Warbles/Summer (hatched larvae penetrating skin, dist. limbs, painful, exude yellow serum)</strong></td>
<td><strong>Warbles/Spring (cysts) on back, firm &amp; raised w/ a breathing hole</strong></td>
<td><strong>History, CS</strong></td>
<td><strong>Sx remove (NEVER squeeze parasite or m/ cause hyperallergic reaction)</strong></td>
</tr>
<tr>
<td><strong>- Damage to meat &amp; hide</strong></td>
<td><strong>Warbles/Summer (hatched larvae penetrating skin, dist. limbs, painful, exude yellow serum)</strong></td>
<td><strong>Warbles/Summer (hatched larvae penetrating skin, dist. limbs, painful, exude yellow serum)</strong></td>
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<td><strong>Warbles/Spring (cysts) on back, firm &amp; raised w/ a breathing hole</strong></td>
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<td><strong>Sx remove (NEVER squeeze parasite or m/ cause hyperallergic reaction)</strong></td>
</tr>
<tr>
<td><strong>- South</strong></td>
<td><strong>Warbles/Spring (cysts) on back, firm &amp; raised w/ a breathing hole</strong></td>
<td><strong>Warbles/Spring (cysts) on back, firm &amp; raised w/ a breathing hole</strong></td>
<td><strong>History, CS</strong></td>
<td><strong>Sx remove (NEVER squeeze parasite or m/ cause hyperallergic reaction)</strong></td>
</tr>
</tbody>
</table>

### Life cycle 9-12 months

- **Heel fly** season, late spring or early summer
- Attach eggs to hair of cattle (lower limbs)
- Eggs hatch, enter skin & migrate
- H. bovis to spinal cord region in epidural fat
- H. lineatum to esophagus
- Stay over winter 2-4 months
- 2nd migration to back Jan - Feb
- Cysts breathing holes in skin
- Warbles (cysts) around larvae
- 3rd stage emerge & drop to ground, 1-3 months flies emerge
- Adults live < 1 week (chase cattle's heels)

### Cutaneous onchocerciasis, Worm nodule
diz

| **Mk 808; C3T 889; IM 1427; BR-hb 489; BR 1276** |
| **Onchocerca spp.** |
| **- Adults - normally live in ligamentos nuchae or gastroplenic lig., 2" long** |
| **- Microfilaria: migrate into dermis** |
| **- Ventral midline, facial area** |
| **- Culicoides intermediate host** |
| **- L3 (3rd stage larvae) enter host through lesions by feeding vector** |
| **- Tropical & subtropical** |
| **Most asymptomatic** |
| **- SQ nodules (1" diameter)** |
| **- Brisket (#1), stiffe & lat. thigh** |
| **- Dermatitis similar to demodectic mange or pox** |

### Screw worm

| **Screw worm myiasis** |
| **See Gen 271; Blowfly lays eggs on wound of live animal, larvae eat live tissue, producing liquefactive necrosis of tissue; hot, humid weather** |
| **CS: Cavernous lesion filled w/ larvae** |
| **Dx: Hx, CS, Maggots in wounds** |
| **Tx: Reportable, eradicated in USA, occasional cases on Texas border of Mexico** |

---

**SKIN - EYE - MAMMARY**

- **Pour-on insecticides shortly after heel fly season**
  - Completed before larvae reach spinal cord or esophagus (before Oct 15th in Oklahoma)
  - Sx remove (NEVER squeeze parasite or m/ cause hyperallergic reaction)

- **Surgical excision of individual nodules**
- **Ivermectin**
**Dermatophilosis, Cutaneous streptotrichosis**

Mk 787; C3T 894; IM 1411; BR-hb 337; BR 857; DC 228; Derm 196

- Common supf. bact infec.
- Contagious diz
- Dermatophilus congolensis (gram +, branching aerobic organism)
  - Zoosporae germinate in moist damaged skin to form mycelium
  - Mycelium proliferates in living skin
  - Suspected in soil, but can't be isolated
- Transmission: Direct contact w/reservoir host, fomites or insects, crusts
  - Crusts contain org., up to 42 mos.
  - Accounts for repeated outbreaks
- Predisposing factors
  - Macerated/trammatized skin
  - Rainy season (wet damages skin)
  - External parasites
  - Nonhygienic conditions

Bacteria; Damaged skin + Zoosporae
CS: Crusts & Pus, "Paintbrush"
Dx: Hx, CS, Smear - "Railroad tracks"
Tx: Topical bath - Keep dry

**Dermatophytosis, Dermatomycoses**

- See pg 185; This fungal diz ("Ringworm") is mentioned here because of similarity of name w/Dermatophilus (bacteria)

**Dermatophytosis, Cutaneous abscesses**

Mk 66; IM 1251; BR-hb 241, 275; C3T 896; BR 553, 655; Br 579; Pic 39; S-J 138; DC 476; Derm 133

- Rare in cattle, Common in sheep & goats
- Actinomyces (Coronetbacterium) pseudotuberculosis (gram pos, pleomorphic rod)
- Herd problem, sporadic
- Cen. & S. California
- Late summer to winter

**Folliculitis/Furunculosis**

Mk 828; IM 1413; C3T 896; BR-hb 240; BR 550; Derm 126

- Rare in cattle, common in goats & sheep; Inflam. of hair follicles (folliculitis [inflam. of hair follicle], furunculosis [inflammation of follicle & surrounding dermis]), #1 Staph, trauma & poor hygiene
- CS: Tail & perineum lesions, less common on scrotum & face, pruritis & pain variable
- Tx: topical cleaning, drying, systemic ABs, Chlorhexidine 5-7 days, then 2x/week until resolves

**Prognosis**

- Good
- Poor if > 50% of body

**Prevention**

- Remove underlying factors
  - Moist conditions, parasites that damage supf. layers of skin
  - Ear tags for parasites
- Keep dry

**DDx:**
- Mange (p 181)
- Ringworm (p 185)
- Pseudorabies (p 141)
- Proliferative, suppurative crusts
  - Pus under yellow crusts
  - "Paintbrush" appearance (pus matted hair)
- Painful, not pruritic
  - Hair breaks & falls off (infected area)
- Rump & topline, dist. extremities

**(txual)**

- LA 200 2 doses 48 hrs apart

- LA 200

- LA 200

- LA 200

- LA 200
# Miscellaneous

## Wounds

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-J 144; BM&amp;S 1102; S-O 154, 167 ***</td>
<td>Trauma to skin</td>
<td>Abrasion: scraping of surface</td>
<td>Wound</td>
<td>Opened wounds  - Remove devitalized tissue &amp; hair  - Close wound (healing by 1° intention)  - Clean &lt; 6-8 hrs =&gt; primary closure  - Leave open (healing by 2° intention) or delay closure: extensive destruction, gunshot, bites, excessively dirty, infected  - Bandage, ABs</td>
</tr>
<tr>
<td>Wounds</td>
<td>Opened or closed</td>
<td>Contusions: disrupted tissue w/o complete separation of surface</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Abrasion: scraping of surface</td>
<td>Laceration: opening of surface</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Laceration: opening of surface</td>
<td>Avulsion: tears w/ loss of tissue, opened</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Photodermatitis

(IM 1294; C3T 904; BR 546) • See Tox pg 232, pathological sunburn to light colored skin caused by 1° photosensitizing or 2° hepatotoxic substances

** • See Musc pg 163: Uncommon in healthy animal, Ears, tail, teats & scrotum affected | Tx: Thaw tissue rapidly in warm water (100-111°F), analgesics & massage, supportive care |

## Frostbite

(Mk 627; IM 1498; S 291; BR-hb 556; BR 1465; DC 237; Derm 68) • See Musc pg 163: Uncommon in healthy animal, Ears, tail, teats & scrotum affected

** • Tx: Gentle antiseptic soaps (chlorhexidine) & astringent rinses (aluminum acetate) BID - TID; Severe cases - diuretics (Lasix® [furosemide]) & frequent massage (reduce edema); When dry = dusting w/ powder BID - TID (reduce friction) • Px: heals in 4-12 wks |

## Intertigo

(C3T 901): Supf. inflam. dermatosis of opposed skin causing friction, maceration & moisture & irritation; 2° bact. infec. Dairy (edema of udder at parturition) • Cs: Supf. inflam. dermatosis or contact betw. udder & medial thigh - erythema, oozing, crustng, 2° bact., severe - necrosis & foul odor • Tx: Gentle antiseptic soaps (chlorhexidine) & astringent rinses (aluminum acetate) BID - TID; Severe cases - diuretics (Lasix® [furosemide]) & frequent massage (reduce edema); When dry = dusting w/ powder BID-TID (reduce friction) • Px: heals in 4-12 wks |

## Hematoma

(C3T 902; S-O 157): Circumscribed area of hemorrhage into tissue; Cause: sudden blunt or prolonged (ear shaking) trauma ** • Cs: Acute onset, fluctuant, SQ, ± pain; stiffe, ischial tuberosity, lat. thorax, point of shoulder, middle of back • Dx: Hx, CS, PE, Needle aspiration for blood • Tx: allow to heal |

## Gangrene

(C3T 902; Br-hb 241; BR 689, 554; DC 237; Derm 67) • Causes: external pressure (pressure cores), internal pressure (severe edema), burns (thermal, chemical, friction, electrical), frostbite, snake bite, vasculitis, ergotism, fescue toxicity, infec. Salm., MCF, BHM, Bovine lumpy skin, Staph., Clostridium • Cs: Moist gangrene: putrefaction, decubital ulcers (pressure points), swollen, discolored, foul necrotic areas; Dry: mummification |

## Burns

(C3T 902; Br 764; BM&S 1102; BR 334; DC 235; Derm 67) • Rare: thermal (fires), electrical (electrocution, lightening), friction (rope burns), chemical (topical or caustic Rx) • Cs: 1° Supf. - erythema, edema, pain; 2° entire epidermis (erythema, edema, pain, vesicles); 3° epidermis & dermis & appendages (necrosis, ulcerations, anesthesia, scarring); 4° skin + fascia, muscles & tendons; Rope burns - watch for circumferential scarring acting as a tourniquet • Tx: Cetrimide (0.5%) in lanolin daily, Topical ABs |

## Chemical toxicosis

*(C3T 904): Selenium, Molybdenum, Arsenic, Mercury, Chlorinated napthalene, Polychlorinated & Iodinism*
**Ringworm, Dermatomycosis**

- **Mycotic - fungal**
  - *Trichophyton verrucosum* (gram + branching, aerobic organism)
  - *Saprophyte in soil*
  - Calves >> acuits
  - Winter stabled animals anytime

- **Ringlike lesions (as spread centrifugally)**
  - Multifocal lesions
  - Alopecia (hair breaks & falls off)
  - Scaling
  - Crusting excessive - Wartlike
  - Head, around eyes, neck, shoulders & sides of thorax
  - No pain or pruritus

- **CS - alopecia & crusts**
  - Fungal cultures (of broken hairs at Dermatomycosis (gram + branching, aerobic organism)
  - Multifocal lesions
  - Alopecia (hair breaks & falls off)
  - Scaling
  - Crusting excessive - Wartlike
  - Head, around eyes, neck, shoulders & sides of thorax
  - No pain or pruritus

- **DDx**
  - *Mange* (p 181)
  - *Dermatophilus congolensis* (p 183)
  - *Pseudorables* (p 141)

- **Self limiting; 6-12 wks, or when let out to pasture in spring**
- **Fungal products topical to decr. spread**
- Betadyne®
- thabendazoie hb 447; Br 1164; Br 680; DC 226
- *Systemic Tx controversial, Griseofulvin, not recommended*

**Trichophytton, Winter stabled**

**CS: Ring lesions (Crusts, Alopecia)**

**Dx: Hx, CS, Cultures, Scrapings**

**Tx: Self limiting, Antifungals**

**Mycetoma, Granulomatous skin infec.** (C3T 892, BR-hb 242, BR 556, IM 1421)

- **Eumycotic mycetoma**
  - Rare; Fungi, Penetrating wound, Drechslera spp, Helminthosporium spp
  - CS: Nasal granulomas, ulcerative, suppurrative & fibrilotic, Ulcerative nodules (rump, thigh, tail, ears &/or vulva)
  - Tx: None reported

- **Actinomycotic mycetomas**
  - *Mycetomas caused by bacterial granulomatous infec (Nocardia, Actinomyces & Actinobacillus) entering through wounds*
  - *CS: Swellings, Draining sinuses, Granules*
  - *Dx: Cytology, culture, biopsy*
    - Nocardia: beaded, gram pos. branching filaments & bacillary forms
    - Actinomyces: small filaments, rods & cocci, gram pos.
    - Actinobacilli: gram neg. bacilli
  - *Tx: Iodides, sulfonamides, tetracyclines, triple sulfas, streptomycin, penicillin, isoniazide - variable results*

**Pythiosis, Phycomycosis**

- **C3T 893**
  - Rare; Fungus - *Pythium spp.* (Hyphomycetes), Aquatic fungi w/ aquatic motile zoospores, Summer & fall in tropical & temperate areas
  - *CS: SQ fungal infec. (Dist. extremities or ventrums) focial ulceration dermal thickening, draining tracts, watery, purulent exudation, periarticular swelling*
  - *Dx: Biopsy & culture, multifocal pyogranulomas (branching hyphae) surrounded, Cultured on Sabouraud's dextrose agar*
  - *Tx: Not enough data, Sx extirpation & amphotericin B in horses (too expensive in cattle)*

**Aspergillosis**

- **C3T 893**
  - Rare: Ubiquitous in soil, skin, monocromorphic mold, microconidia (spores); Predisposing; stress, prolonged AB therapy, Immunodeficiency
  - *CS: Primary dz of Resp., Gl, Mastitis, Abortion; Skin rare (SQ granuloma)*
  - *Dx: repeated isolation bcz. common flora of skin*
  - *Tx: None reported in large animals*

**Mycotoxicosis** *(C3T 906): Ergotism, Fescue toxicosis, Stachybotryotoxicosis*
### Virus

**Viral dz w/ skin lesions** (C3T 899): Generalized viral dzs that have skin lesions as part of their presentation

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
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</thead>
<tbody>
<tr>
<td><strong>Bovine papular stomatitis:</strong> See pg 8; Worldwide, papules, crusts on muzzle, nostrils, lips, Self limiting</td>
<td>picornavirus, highly contagious dz; Skin CS: vesicles on mouth, muzzle, nostrils, coronet, interdigital space, udder &amp; teats; hooves m/b sloughed</td>
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<tr>
<td><strong>Foot &amp; mouth dz</strong> See pg 11;</td>
<td>picornavirus, highly contagious dz;</td>
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<td><strong>Vesicular stomatitis:</strong> see pg 11; Rhabdovirus, identical to foot &amp; mouth dz; Reportable</td>
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<td><strong>Bluetongue:</strong> See pg 10; mainly sheep dz, indistinguishable from vesicular stomatitis &amp; foot-&amp;-mouth dz</td>
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<td><strong>Rinderpest:</strong> see pg 9; Exotic, highly contagious dz of ruminants &amp; swine</td>
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<td><strong>Malignant catarrhal fever:</strong> See pg 10, sporadic, highly fatal systemic dz; Skin CS: erythema, scaling, necrosis, ulceration of muzzle, face, udder, teats, vulva &amp; scrotum; oozing necrosis of perineal, axillary, inguinal &amp; back regions</td>
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<tr>
<td><strong>Infect. bovine rhinotracheitis (IBR):</strong> See pg 62; Herpesvirus 1, Resp/Enteric/CNS/Abortions; Skin lesions: erythema (&quot;red nose&quot;), pustules, necrosis &amp; ulceration of muzzle &amp;/or vulva</td>
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<td><strong>Pseudorabies:</strong> See pg 141; rapidly fatal dz, herpesvirus, intense pruritus &amp; frenzied rubbing, chewing, kicking affected skin</td>
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<tr>
<td><strong>BVD:</strong> See pg 22; pestivirus, GI/Resp/Chronic dz; Skin CS: Erosions, necrosis of muzzle, lips, nostrils, vulva, prepuce, coronet &amp; interdigital space; M/b alopecia of perineum, thighs &amp; neck</td>
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</table>

### Bovine pseudolumpy skin dz (C3T 899; DC 230; Derm 108): Herpesvirus 2; • CS: multiple, slightly raised plaques & nodules, supf. in skin, central depression & supf. necrosis

| Pseudocowpox, Milker's nodules, Paravaccinia | **Mk 823; C3T 898; IM 1418; BR-hb 434; BR 1135; Br 322; DC 276; Derm 102*** | Mild infection of udder & teats • Parapoxvirus (related to BPS) • Widespread, worldwide • Slowly spreads through herd • Little immunity develops (re-infects on subsequent lactations) • Common in U.S. & difficult to distinguish from pox lesions | Small red papules on teats & udder to vesicles or pustules • Scab (removed w/o pain), granulation beneath scabs, heals from center • Horseshoe or circular ring of scabs • M/ persist for mos, rough teats • Deep ulceration rare • Also on udder, med. thigh or scrotum • Incr. incidence of mastitis | CS: Scabs confused w/ others • Horseshoe scab pathognomonic • Electron microscope for viral particles (sure!) • Control spread • Hygiene • Segregation | PH

#### Public health
- Man - infected - painless, but itchy, purplish red nodules on fingers & hands, disappear in weeks

### Cowpox (Mk 823; C3T 898; Br-hb 433; BR 1133; Br 322; Derm 99) • Extremely rare, reported in Europe, Poxvirus, related to vaccinia & smallpox • CS: Raw ulcers, Scabs on teats & udder; Public health

#### Public health
- Man - infected - painless, but itchy, purplish red nodules on fingers & hands, disappear in weeks

### Treatment
- Control spread
- Hygiene
- Segregation

### Prognosis
- Good
### Bovine herpesvirus

**Herpes virus**  
CS: Teat ulcers; 2nd mastitis  
Dx: Hx, CS, Histo, Virus isolation  
Tx: Segregate; Cannulate

**Impetigo, Udder acne**  
Mk 667; C3T 895; BR-hb 235; BRS 41, 617; DC 255, 276; Derm 121

**Contagious, Milkers spread**  
CS: Pustules, Denuded areas  
Tx: AB ointment, Clean & Dry  
Px: Good  
Control: Teat dip

### Teat chapping & cracking

- High incidence of 2nd mastitis  
- Bovine herpesvirus 2

- Acute, swollen, tender teats  
- Vesiculation & sloughing  
- Severe ulcerations of teat  
- Dark brn/blk scab (crack & bleed)  
- M/ involve teat scab (predisposes to mastitis)  
- Milk production

- Sequela:  
  - Mastitis

- Pustules on udder & teat (often on udder near base of teat)  
- Break open, leaving denuded areas  
- Pruritus & pain rare  
- 2nd infection  
- M/ spread to teats, ventr. abd, thighs, perineum & tail

- CS, usually treat w/out culture

### Mammary tumors

- BR 617; DC 260: rare in cattle

### Udder abscesses

- Incise & drain when near surface & chronic; Beware! (vessels); pack wound w/ gauze containing a counterirritant (iodine) for 2 days, then daily washing w/ antiseptic solutions

---

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### Skin Facts/Cause

<table>
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</table>
| **Hives, Urticaria, Nettle rash** | *Wheals*: transient swellings in skin or mucous membranes (plaque-like eruptions)  
- Localized edema in dermis  
- Angioedema: swelling of SQ  
- **Type I hypersensitivity**  
  - Cause  
    - Drugs: (pen & sulfas, oxytetracycline, chloramphenicol, neomycin, diethylstilbestrol, carboxymethylcellulose)  
    - Biologicals: Vaccines & toxoids, Lepto, B abortus, F&M dz, shipping fever, Salm.  
    - Physical trauma, hypodermiasis  
    - Feeds: pasture plants, moldy hay, potato  
    - Stinging nettles  
    - Milk allergy (unique to cattle)  
    - Insect bites blamed, but rarely cause  
  - Precipitating or intensifying factors  
    - Pressure, sunlight, heat, exercise, psychological stress, genetic abnorm.  
  - **Pathophysiology** (see box)  

- **Presentation/CS**  
  - Wheals or plaques appear few min or hr w/ exposure to agent  
    - Elevated, distinct shapes (round, serpentine, flat-topped, m/b depressed in center)  
    - Neck, body & upper limbs  
  - Angioedema  
    - Variable pruritus  
    - Variable exudation  
    - Severe, m/b preceded by fever, anorexia or dullness  
    - Advanced - plaques on mucous membranes of mouth, nose, conjunctiva, rectum & vagina  
    - Gen. disappear as rapidly as appear (w/in few hours)  

- **Diagnosis**  
  - Wheals, Cold  
    - Pit w/ pressure, DDx from other nodular dzs  
    - Intradermal skin testing in horses  

- **Treatment**  
  - Spontaneously recover w/o Tx  
  - Avoid allergen  
    - Change feed & see if better  
  - **Short acting corticosteroids** (CCS): Prednisone or prednisolone (2 mg/kg IM/IV)  
    - Dexamethasone (0.1 mg/kg IV/IM)  
  - Antihistamine rarely valuable  
  - **Epinephrine if life threatening**  

### Pathophysiology

- Wheals result from vasodilation & leakage of fluids from small vessels  
- Immunological & nonimmunological factors trigger release of mediators from mast cells & basophils that cause wheals  
- Immunological Type I hypersensitivity (IgE) most common immunological cause

### Develop & Suddenly disappear

- CS: Wheals, ± Exudation, ± Resp.  
- Dx: Hx, CS, Pit w/ pressure  
- Tx: Spontaneous recovery, Steroids, Epinephrine

### Milk allergy

- Unique to cattle  
- During drying off period  
- Cause? Genetic predisposition to engorgement of udder (Channel Island breeds [Jersey])  
- Milk protein into circulation  
- Type I hypersensitivity

- **Urticarial rash**, localized or general  
  - Muscle tremors  
  - Ataxia, restlessness  
  - Dullness  
  - Mania  
  - Resp. distress in some cases

- History, CS  
  - Engorged udder  
  - Interdermal injection of cow's milk - edematous swelling

### Prevention

- Avoid milk retention during drying out period
Atopy (C3T 901): genetic pruritic dermatitis due to hypersensitivity to inhaled allergens, presumptively Dx in Suffolk sheep

Contact dermatitis
IM 1411; C3T 903; DC 234; Darm 68

***

- Irritant & allergic forms
- Irritant more common
- Urine & feces, wound secretions, caustic substances (acids, alkalies), crude oil, diesel fuel, turpentine, parasiticides, irritant plants, wood preservatives, bedding, filthy environment

- Erythema, edema & vesicles
- Erosion, ulceration & crusting
- Lichenification & hyperpigmentation
- Dist. extremities, muzzle & ventrum (contact areas)

- History, CS
- Provocative exposure test
- Remove from all possible sources for 7-10 days, clears up
- Expose to suspected agent & look for dermatitis
- Repeat for positive ID

- Eliminate possible exposure
- Wash gently w/ water until clears up

Food hypersensitivity: Rare, wheat, soybean, rice bran, clover hay • CS: pruritic skin, w/or w/o wheals • Dx: hypoallergenic diet 4 wks then re-administer original diet: CS in 1-7 ds • Tx: Avoid offending foodstuffs

Contact • Irritant & allergic forms • Erythema, edema & vesicles • Lichenification & hyperpigmentation • Dist. extremities, muzzle & ventrum (contact areas)

Nutritional, endocrine & keratinization abnormalities (C3T 911; Br 220)

Starvation (C3T 911): Total starvation (marasmus), near total protein defc. (kwashiorkor), low protein intake - cachectic, susceptible to infec., dull, dry, brittle hair coats

High fat milk replacement diet (C3T 911): calves, 15-20% fat, alopecia, scaling dermatosis (muzzle, eyes, ear, limbs) • Tx: reduce fat to 10% & Vit E suppl. cures

Vit. C defc (C3T 911; BR-hb 550; BR 1449; DC 250): rare, calves in fall & winter; Healthy; severe scaling, crusting, alopecia, erythematous, pruritic legs • Tx: 1-2 SQ injections of ascorbic acid

Vit. A defc (IM 1064; C3T 911; BR-hb 548; BR 1442; BR 220; DC 189): Uncommon, poorly supplemented concentrates w/ little greens • CS: Ocular, CNS, Repro, skin (rough, dry, faded < shaggy hair coats; widespread seborrhea; overgrown, dry, brittle, cracked hooves

Selenium/Vit. E defc (Br 222): See pg 78; eye alopecia, dull, dry, brittle coat, generalized dry, flaky seborrhea • Tx: Vit E/Se injection cures in 2-4 wks, biannual injection

Cobalt defc. (C3T 912): rough, faded, hair coats

Copper defc/Molybdenosis (C3T 912; DC 250): See pg 89; rough, dry, lightened hair coats, exfoliative pododermatitis w/ heel cracks; masked or spectacled appearance • Tx: copper suppl.

Zinc defc (C3T 912; Br 224; DC 250, 508; L 411): prone to infec. (pododermatitis), dull, rough, faded coat w/ scaling, crusting, alopecia (face, ears, neck, mucocutan. junction, dist. limbs)

Hypothyroidism (C3T 912): only endocrine dermatosis; genetic, 1° or 2° iodine defc, mortality in neonates, born weak, generalized hypotrichosis, alopecia, diffuse hyperkeratosis, puffy, thick skin

Mercury, Arsenic, Chlorinated naphthalene, Polybrominated & polychlorinated biphenyl (C3T 904) See Tox. All have dermatologic CS
### Skin Disorders

#### Cutaneous neoplasia (C3T915): ** In descending order of incidence: Papilloma, squamous cell carcinoma, melanoma, mast cell tumor

<table>
<thead>
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<th>Diagnosis</th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Warts,</strong> Papillomatosis, Papillomavirus, Verrucae **</td>
<td><strong>Virus - Papovaviridae, not proven for interdigital papillomatosis</strong>&lt;br&gt;<strong>Infectious</strong>&lt;br&gt;<strong>Transmission:</strong> Direct contact, fomites &amp; possibly insects&lt;br&gt;<strong>Different types of warts</strong>&lt;br&gt;- Spontaneously regress - typical warts on animals &lt; 2 yr&lt;br&gt;- Do not regress - atypical, &quot;rice grain&quot; &amp; interdigital - all ages</td>
<td><strong>Typical warts (fibropapillomas)</strong>&lt;br&gt;- Head, neck, shoulder &amp; back, abd.&lt;br&gt;- Teats &amp; penis, vagina&lt;br&gt;- Problem on penis of young bulls&lt;br&gt;- Dystocia if on vaginal mucosa&lt;br&gt;<strong>Atypical warts:</strong> Low, flat, circular &amp; nonpedunculated&lt;br&gt;- Delicate, frond-like projections&lt;br&gt;- Papillomas in GI tract&lt;br&gt;<strong>&quot;Rice grain&quot; warts on teats - all ages</strong>&lt;br&gt;- Interdigital papillomatosis&lt;br&gt;- Chronic problem of housed dairy cattle&lt;br&gt;- Interdigital space, esp. hindlimb&lt;br&gt;- Assoc. w/ pain, lameness, wt. loss, ↓ milk, ↓ estrus detection</td>
<td><strong>History, CS</strong>&lt;br&gt;- Periocular&lt;br&gt;<strong>Biopsy/histology</strong>&lt;br&gt;- Vulva&lt;br&gt;- Ulcerative &amp;/or proliferative&lt;br&gt;- Metastasis is not common</td>
<td><strong>Vaccinate w/ suspension of ground wart tissue, virus killed w/ formalin</strong>&lt;br&gt;- Good for prevention, not Tx of common warts&lt;br&gt;- Not for atypical &amp; &quot;rice grain&quot; warts &amp; interdigital papillomas</td>
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<td><strong>Squamous cell carcinoma, (SCC)</strong></td>
<td><strong>Malignant neoplasia</strong>&lt;br&gt;<strong>Cause?</strong> UV light on light skin&lt;br&gt;- Viral warts or follicular cysts&lt;br&gt;- Hot branding&lt;br&gt;- Adults to aged cattle&lt;br&gt;- Breeds: Herefords &amp; Ayrshire (poorly pigmented)</td>
<td><strong>Nonpigmented skin at mucocutaneous junctions</strong>&lt;br&gt;- Periocular&lt;br&gt;- Vulva&lt;br&gt;- Ulcerative &amp;/or proliferative&lt;br&gt;- Metastasis is not common</td>
<td><strong>Radical excision TOC</strong>&lt;br&gt;- Radiation therapy&lt;br&gt;- Cryosurgery&lt;br&gt;- Hyperthermia&lt;br&gt;- Radiation therapy</td>
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<td><strong>Melanoma</strong></td>
<td><strong>Rare, &lt; 2% of all bovine tumors, Dark-haired predisposes (Angus), usually young cattle, m/b a congenital lesion</strong>&lt;br&gt;<strong>CS Usually benign (but can metastasize), well-differentiated, solitary or multiple, black to gray, freq. ulcerative, subQ, anywhere (head, neck, dist. limbs)</strong>&lt;br&gt;<strong>Tx:</strong> Surgical excision, if feasible</td>
<td><strong>Uncommon, Malignant, Poor pigmentation</strong>&lt;br&gt;- CS: Mucocutaneous junction&lt;br&gt;- Tx: Radical excision</td>
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**Note:**
- **Papillomas of teats, penis, head, neck & dewlap spontaneously regress**
- **Atypical & "Rice grain" warts & interdigital papillomas do not spontaneously regress**
- **Surgical removal** when maximum size so doesn't stimulate recurrence & growth
- **Topical agents:** podophyllin
- **Isolate affected**
- **Disinfect environment** (formaldehyde or lye)

**Prognosis:**
- **Good**
- **Poor if > 20% of body affected**
Mast cell tumors (Mk 882; IM 1435; C3T 917; BR-hb 243; BR 557; DC 232) • Uncommon in cattle, Cause: unknown; arise from cutan. mast cells; majority malignant & metastatic; 6 mo-7 yr
* • CS: Multiple usually, 1/4 - 16" in diameter, firm to fluctuant, dermal or SQ± alopecia or ulcerative

Cutaneous lymphosarcoma
* • See pg 268 • Rare malignancy in cattle, 1-4 yrs • CS: Multiple SQ nodules (Urticarial or ringworm-like); 1/2 - 3" in diameter; anywhere, esp. neck & trunk, animal healthy initially • Dx: History, GS, Biopsy • Tx: None, Freq. spontaneously regress • Px: Poor: remission usually followed by relapse & fatal internal involvement

Hemangioma
C3T 917; BR-hb 244; BR
** • Uncommon in cattle; Benign tumors of endothelial cells of blood vessels; Cause: unknown; Mature animals, but m/ be congenital • CS: Single or multiple, anywhere on body, Black-red/gray soft, sessile to pedunculated masses on back (1/5-1"), recurrent profuse hemorrhage

Cysts
IM 1437; C3T 918 ** • Uncommon in cattle; Benign lesions, epithelial wall w/ keratinous contents, Types: epidermal, dermoid & dentigerous • CS: Single or multiple, Firm to fluctuant, Circumscribed, smooth & round • Tx: Surgical excision

Congenital & hereditary skin dizs * (C3T 907; BR-hb 244; BR 559; Br 150): no specific therapy for most

Hypotrichosis (C3T 907; Br 150): Less than normal amount of hair, Congenital & Acquired (Illness [BVD], nutritional defc [iodine], or condition during pregnancy)

Hypertrichosis (C3T 907): More than normal amount of hair; Hereditary in European Friesian cattle; Abnormally curly hair - congenital in Ayrshire & Hereford cattle

Ichthyosis (C3T 907): Congenital generalized thickening of skin due to excessive keratin in Friesian, Brown Swiss & red poll cattle. No hair, large, thick, horny scales w/ deep fissures, stillborn or die shortly after birth. Ichthyosis congenita: milder form, Pinzgauer, Holstein & Chianiana: viable w/ hyperkeratosis & assoc. cataracts & small ears

Cutaneous asthenia, collagen dysplasia, dermatosparaxis, cutis hyperelastica, Ehlers-Danlos syndrome (C3T 907): Congenital collagen dize (hyperextensive & fragile skin) resulting in gaping wounds & thin cutan. scars; Usually fatal due to septicemia

Aplasia cutis, epithelogenesis imperfecta (C3T 909): Focal ulceration w/ absence of epithelium • Px: variable: Severe/die (septicemia); mild cases m/ heal or surgical Tx

Epidermolyis bullosa (C3T 909): Hereditary bullous eruptions & ulcerations in response to trauma to face, extremities, mouth or over joints; mortality high due to 2nd septicemia

Hereditary zinc defc (C3T 909): Parakeratosis, lethal autosomal recessive • CS in few wks of birth - progressive alopecia & scaling, diarrhea & rhinitis • Tx w/ zinc replacement
### Mastitis

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
</table>
| **Mastitis**<br>Mk697; C3T762; IM1181; BR-hb 251, BR 563, Br 259, 305; DC 279 *** | - Most costly diz in adult dairy (1/3 of all dizs) - Milk production - Economic losses $200/cow, 2 billion/yr USA - 10% loss of total production - 40% of all cows - Will continue b/c of difficulty in controlling environmental pathogens - **Causes** - Milking hygiene (75%) - Equipment malfunction (20%) - Cow factors (5%) - **Defense** - 1st line is teat canal - Cell mediated: normally 0.5-20,000 cells/ml (less more susceptible to mastitis) | - Subclinical & clinical mastitis - **Diagnosis** (somatic cell count) - Individual, examine before milking - Abnorm. milk - Hot udder (swelling, heat & edema) - SCC/culture - **Herd - subclinical cases** - **Presentation/CS** | | | |-
| **Contagious mastitis**<br>VC/M 475 | - **Staph. aureus** (7-40%), Strep. agalactiae, Mycoplasma spp. Corynebacterium bovis, Strep. dysgalactia | | | | |-
| **Environmental mastitis** | - Bact. in environment other than mammary gland, do not need infected glands to perpetuate diz, therefore can’t eliminate mastitis - Major mastitis on modern, well managed dairy farms - **Coliform** (gram neg., E. coli, Klebsiella spp, Enterobacter spp, Setaria, Pseudomonas, Proteus) - **Transmission**: Milking time (milking equipment, nursing calves or milker’s hands) | - **Presentation/CS** | | | |-
| **Contagious/ environmental** | - **Overlap**: Bacteria on mammary gland or in environment Strep. uberis, Strep. dysgalactiae, Staph. aureus | | | | |-
| | | | | | |

---

**SKIN - EYE - MAMMARY**

1. **Prevention rather than Tx most effective**
   - **Herd problem**
   - **Total dry period therapy routinely done**
   - Infusion of long-acting ABs in all quarters during dry period

2. **Control contagious mastitis**
   - **Hygiene during milking** - Predip
   - **Pre-dip**
   - Feed right after milking to keep cow standing as teat canal closes
   - Antibacterial teat sealant when drying off
   - Decr. trauma to teat, decr. potential for backflow of milk (esp. contaminated)
   - **Tx mastitis cases**
   - **Isolate infected & milk last** (serve as source of contamination) sterilize cluster after affected cows
   - Properly functioning milking equipment

3. **Control environmental mastitis**
   - **Sanitation of environment**
   - **Predipping**
   - Feed right after milking to keep cow standing as teat canal closes
   - Antibacterial teat sealant when drying off
   - Decr. trauma to teat, decr. potential for backflow of milk (esp. contaminated)
   - **Tx AB of little use for environmental mastitis**
   - **Oecr. trauma to teat, decr. potential for**

---

**#1 economically; Cause: Contagious & Environmental**

**CS**: 90% subclin.; **Clinical** (Acute, Chronic, Gangrenous)

**Dx**: CS, SCC, Culture

**Tx**: Herd over indiv. (Hygiene, Dry cow therapy, Isolate, Cull)
### SUBCLINICAL mastitis
- 90% of all mastitis
- #1 cause of production loss (10-26% milk loss)
- Causes:
  - Contagious: *Staph. aureus*, *Strep. agalactiae*
  - Envir.: *Strep. spp.* (*S. uberis, S. dysgalactiae*)
- Milk grossly normal
- No visible inflammation
- In time - fibrosis of mammary tissue, firmer, larger gland
- ↓ Milk production
- No CS since subclinical
- ↑ SCC (somatic cell count) > 250,000/ml
- CMT (Calif. mastitis test)
- Routine culture of all quarters

### CLINICAL mastitis
- Further divided into acute, chronic & acute gangrenous mastitis
- Milk grossly abnormal
- Gargets (milk clots)
- Serum w/ fibrin
- Udder inflammation
- Redness, fever, swelling & pain

#### 1. Acute mastitis
- Exacerbation of chronic or a new infection
- Swollen, painful gland (difficult to walk)
- Abnormal milk (clots or flakes, watery, serous or purulent)
- Systemic CS, mild or severe
  - Anorexia, Depression, Elev. temp.
  - Toxic mastitis (coiliform/*S. aureus*)
  - M/ have low serum Ca & paraplegia (resembling milk fever, no response to parenteral Ca)
- Palpation for mastitis
  - Inflamed, hot, swollen
  - Supramammary & inguinal
- SCCs chronically elevated
- Asymmetry due to fibrosis, but no heat

#### 2. Chronic active mastitis
- Intervals of no CS
- Assoc.: *S. agalactiae*, coliforms, *S. aureus* & *Salm. dublin*
- Intervals or no CS
- Intermittent acute mastitis manifestations (see above)
- ↓ Milk prod. over time due to destruction of gland alveoli & ducts
- SCCs chronically elevated
- Asymmetry due to fibrosis, but no heat

#### 3. Acute gangrenous mastitis
- Uncommon
- See *Staph. aureus* pg 194

### Prognosis
- Environmental: eliminated in ds - 3 wks, except *Klebsiella*
- Contagious: tend to persist as subclinical infection

### Tx as above
- Milking hygiene (teat dipping, 1 towel)
- Dry cow therapy (ABs all quarters)
- Semiannual test & maintain milking machines

### Tx herd as above
- Milking hygiene (teat dipping, 1 towel)
- Dry cow therapy (ABs all quarters)
- Treat clinical mastitis cases
- Test & maintain milking machines
- Cull repeated mastitis cows
- Sanitize environment (esp. bedding)
- Feed right after milking

### Individual cows Tx
- Frequent (QID minimum) stripping of quarter & injections of oxytocin QID
- Subacute: intramammary Tx after each milking for 3 days
- Acutely affected: systemic & intram. ABs minimum of 3 days
- Percutaneous: systemic & intramammary ABs, oral fluids & anti-inflammatory drugs (aspirin, Banamine®)
  - Severe: hydrotherapy (spray quarter 15-30 min BID)
  - Fresh cow/ first lactation heifers: diuretics for edema
- If no response in 7-10 ds won't respond
  - Cull
# Mastitis

<table>
<thead>
<tr>
<th>Condition</th>
<th>Fact/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Drug withdrawal times</th>
<th>Treatment</th>
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<tr>
<td>Intramammary preparations &amp; compatible systemic ABs</td>
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<tr>
<td>Intramammary</td>
<td>Compatible systemic Rx Dose</td>
<td></td>
<td>Drug withdrawal times</td>
<td></td>
<td>Treatment</td>
</tr>
<tr>
<td></td>
<td>Ampicillin (Hetacxin®)</td>
<td>Procake pen G</td>
<td>20,000 IU/kg SID IM</td>
<td>Milk: 96 hrs</td>
<td>Meat: 14 ds</td>
</tr>
<tr>
<td></td>
<td>Penicillin</td>
<td>Ampicillin</td>
<td>10 mg/kg SID IM</td>
<td>Milk: 96 hrs</td>
<td>Meat: 6 ds</td>
</tr>
<tr>
<td></td>
<td>Novobiocin</td>
<td>Amoxicillin</td>
<td>10 mg/kg SID IM</td>
<td>Milk: 96 hrs</td>
<td>Meat: 6 ds</td>
</tr>
<tr>
<td></td>
<td>Cloxacillin or Penicillin &amp; novobiocin, Penicillin</td>
<td>Penicillin</td>
<td>12 mg/kg SID IM</td>
<td>Milk: 96 hrs</td>
<td>Meat: 28 ds</td>
</tr>
<tr>
<td></td>
<td>Penicillin</td>
<td>Oxymethocillin</td>
<td>12.5 mg/kg SID IM</td>
<td>Milk: 96 hrs</td>
<td>Meat: 28 ds</td>
</tr>
<tr>
<td></td>
<td>Penicillin</td>
<td>Erythromycin</td>
<td>12.5 mg/kg SID IV</td>
<td>Milk: 96 hrs</td>
<td>Meat: 14-28</td>
</tr>
<tr>
<td></td>
<td>Penicillin</td>
<td>Penicillin</td>
<td>200 mg/kg SID PO</td>
<td>Milk: 72 hrs</td>
<td>Meat: 10 ds</td>
</tr>
<tr>
<td></td>
<td>Penicillin</td>
<td>Potentiated sulfonamides</td>
<td>24 mg/kg EOD</td>
<td>Milk: 72 hrs</td>
<td>Meat: 12 ds</td>
</tr>
<tr>
<td></td>
<td>Oxytetracycline</td>
<td>Oxytetracycline</td>
<td>10 mg/kg SID IV</td>
<td>Milk: 96 hrs</td>
<td>Meat: 28 ds</td>
</tr>
<tr>
<td></td>
<td>Penicillin</td>
<td>Sulfonamides</td>
<td>200 mg/kg SID PO</td>
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<td></td>
<td>Penicillin</td>
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<td>24 mg/kg EOD</td>
<td>Milk: 72 hrs</td>
<td>Meat: 28 ds</td>
</tr>
</tbody>
</table>

- **Staph. mastitis**: Mk 688; C3T 763; IM 1187; VCM 432; 484, 496, 503, 529; BR-hb 251; BR 563; Br 296, 343; DC 260  
  
1. **#1 cause of mastitis** in most dairies bc:  
- Both acute & chronic mastitis  
- Responds poorly to Tx  
- Easily transmitted at milking  
- Contag./Envir. (udder/body) contaminant  
- Adult udder infection  
- Cow to cow via milking machines, hands, homies  
- Introduced into herd by newly infected animals  
- Individual cases indicate subclinical problem in other herd members  
- Exotoxin  
- Chronic - walled off bact., hard to treat  
- Gangrene due to alpha toxin causing vasoconstriction, ischemia & desquamation of tissue  

2. **Usually chronic is subclinical**  
- Occasional clinical flare-ups (usually mild, moderate)  
- Udder swollen, firm, redness, heat & pain (m/b up mammary vein)  
- Flakes & clots in milk initially  
- Purulent or watery milk  
- **Severe mastitis** occasionally (esp. at parturition/first mo of lactation)  
- Systemically ill  
- Anorexic, depressed, ✫ milk prod., toxemia, ✫ temperature  
- **"BLUEBAG"** - gangrene  
- Gland red, swollen & warm (early)  
- Few hrs. later gland cold, secretions watery & sanguinous  
- Dilute blue discoloration from teat to areas of gland  
- Area sloughs in 10-14 days  
- 2nd infec. invade sloughed area = necrosis & continual sloughing  
- Systemic CS (anorexia, dehydration, depression, fever)  
- Moist gangrene, teat & udder cozes bloodtinged serum (thrombosis of large veins)  

- **History, CS**: Elev SCC (somatic cell count)  
- Strep >> Staph  
- Culture all clinical cases, purchases, fresh & heifer cows routinely  
- Microabscesses, necrosis  

- **Herds Tx more important than individual**  
- Individual Tx of little or no value  
- Stop transmission basis of control  
- Sanitation (see preceding pg)  
  
  - Single towel, hygiene workers & machine  
  - Teat dipping, postmilking  
  - Machine function checked routinely  
  - Segregate infec. from clean cows  
  - Cull infected cows, or  
  - Separate pos. & neg. groups  
  - Milk pos. last, cull as value goes down  
  - Dry cow Tx, hi % of failures, still use bec. helps eliminate Strep. agalactiae; not Staph. aureus  

- **Individual cows**  
  
  - Lactating cow Tx limited (abscesses in gland hard for antibiotics to reach)  
  - Dry off when no longer profitable & Cull  
  
- **Blue bag**: amputating affected teat facilitates drainage & sloughing (weeks)  

- **Recovered cows often sold for slaughter**  

---  

**No.1 mastitis, subclinical, contagious, Exotoxin**  
- **CS**: Chronic subclin., Toxemic, "Blue bag"  
- **Dx**: Hx, CS, SCC, Culture  
- **Tx**: Herd (hygiene, dip & isolate), Cull  

---  

**Public Health**  
- Some Staph. produce enterotoxins in stored milk products which can multiply  
- Food poisoning  

**Meat**  
- 28 ds  
- 14 ds  
- 12 ds  
- 10 ds  
- 7 ds  
- 6 ds  
- 4 ds  
- 2 ds  
- 1 ds
### Strep. mastitis

**Strep. agalactiae**
- Highly contagious
  - Obligate inhabitant of mammary gland, **thus it can be eliminated from herd**
  - Cow to cow transmission
  - Doesn't invade mammary tissue, damages epithelium, causing PMN outpouring, blockage, fibrosis & decre. secretion

**Environmental Strep.** (S. dysgalactiae & S. uberis)
- Lower infec. rate bec. not contagious
- Can't be eliminated from herd (environment)

**Strep. agalactiae**
- Usually subclinical
  - Occasional flare-ups
  - Similar signs to Staph.

### S. agalactiae (Contagious; m/b eliminated)

**CS:** Subclinical w/ flare ups
**Dx:** Hx, CS, SCC, Culture
**Tx:** Sanitation, Teat dip, Dry/Lactating - Pen G

### Coliform mastitis;
- Gram-neg.
  - Environmental mastitis
    - *E. coli*, Enterobacter aerogenes, Klebsiella pneumoniae, Pseudomonas aeruginosa, Pasteurella multocida, Setaria spp.
  - Acute clin. mastitis in early lactation
  - Transmission:
    - From environment (not like *Staph. aureus*, *Strep. agalactiae*)
    - Milking wet udders incr. incidence
    - Low cell counts (SCC) in udder, predispose
    - Single quarter usually
    - Inflammation destroys coliforms & releases endotoxins

### Acute clinical mastitis
- Uniform swelling of affected quarter
- Watery milk
- Subclinical infection uncommon

**Toxic shock:**
- Acute, m/b peracute - death
- High fever, anorexia, depression, milk ceases, rapid weight loss
- Recumbency
- Pulmonary hypertension
- Abortion
- Diarrhea
- Death (5%)

**History, CS**
**SCC (somatic cell count)**
**Culture**

### History, CS
**SCC (somatic cell count)**
**Culture**

### Strep. agalactiae
- Elimination possible 1-2 years
  - Milk hygiene, 1 towel, gloves
  - Teat dipping
  - Dry or lactating cow AB therapy
  - Intramammary penicillin G, highly effective (withholding times)

**Environmental Strep. spp.** (S. uberis)
- Can't be eliminated bec. environmental
- M/ be more resistant to penicillin, other choices: chlorotetracycline, oxytetracycline, cephalosporin, Na cloxacillin
- Routine dry cow therapy
- Sanitation of environment
- Sanitize envir. over indiv. cow Tx

### Sanitize envir. over indiv. cow Tx
- Milking hygiene, individual paper towels, premilking teat dip? Postmilking dip does not prevent infec.
- Sanitize environment
  - Bedding: sand better than shavings or sawdust
  - Feed right after milking to keep cow standing while teat canals close

**Individual cow mastitis**
- Spontaneous recovery (most cases)
  - Intramammary infusion
  - Severe: Endotoxin/mediator shock
    - Milk out every 2 hrs or allow calf to suckle (decr. endotoxins & infam. mediators & bacteremia)
    - IV ABs, sulfamethazine or oxytetracycline
    - Intramammary ABs, following complete milking (cephalosporin, ampicillin, aminoglyc., polymyxin B)
    - IV fluids (initially 5-10 L/hr 2 hrs; then 5 L/hr)
    - Aspirin or Banamine® (cause abomasal ulcers)
## Mastitis

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<tr>
<td><strong>Mycoplasma mastitis</strong>&lt;br&gt;Mk 689; CST 783; IM 1190; VC/M 475; BR-hb 251; BR 563; Br 298, 342; DC 283</td>
<td>- <em>Mycoplasma bovis</em>&lt;br&gt;- Probable systemic phase (rapid spread to other quarters &amp; to joints)&lt;br&gt;- Extremely contagious</td>
<td>- Possibility of explosive outbreaks&lt;br&gt;- Usually severe mastitis&lt;br&gt;- Secretions watery to purulent&lt;br&gt;- Spreads from quarter to quarter&lt;br&gt;- Tannish-brown milk, sandy flakes that float&lt;br&gt;- Milk secretions m/ cease until next lactation</td>
<td>- History, CS&lt;br&gt;- Nonresponsive mastitis&lt;br&gt;- Neg. milk cultures using standard microbial methods&lt;br&gt;- Fibrosis &amp; alveolar cell atrophy</td>
<td>- Eradication program&lt;br&gt;- Serial herd cultures&lt;br&gt;- Slaughter or segregate for life&lt;br&gt;- No Tx&lt;br&gt;- Do not respond to therapeutic Tx</td>
</tr>
<tr>
<td><strong>Extremely contag., Systemic phase (joints)</strong>&lt;br&gt;CS: Outbreaks, Severe mastitis, Joints&lt;br&gt;Dx: Nonresponsive to Tx&lt;br&gt;Tx: No response to Tx, Elimination</td>
<td>- Chronic carriers</td>
<td>- History of nonresponsive mastitis&lt;br&gt;- Negative milk cultures</td>
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<tr>
<td><strong>Salmonella mastitis</strong>&lt;br&gt;CST 764; IM 1191</td>
<td>- Rare; <em>Salmonella dublin</em>, Public health problem, Neonatal health&lt;br&gt;- Chronic, acute, or subclinical, Occasional flare-ups similar to chronic coliform mastitis&lt;br&gt;- Dx: ELISA assay for S. dublin antibody levels&lt;br&gt;- Tx: Cull carrier cows (public health &amp; neonates)</td>
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<tr>
<td><strong>Corynebacterium bovis mastitis</strong>&lt;br&gt;Mk 689; CST 764; IM 1191; Br 297</td>
<td>- Rare; Colonize teat canal, but cause little pathology; Consistent culturing indicates ineffective teat dipping. Questionable if protective to other infec. by raising SCC&lt;br&gt;- CS: Asymptomatic, mild inflammation&lt;br&gt;- Dx: Mild elev. SCC, Culture&lt;br&gt;- Tx: Routine teat dipping prevents infection</td>
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<tr>
<td><strong>Leptospira mastitis, &quot;Flabby bag&quot;</strong>&lt;br&gt;CST 764; Br 298, 569</td>
<td>- Rare; Hematogenous dissemination; Causes vasculitis&lt;br&gt;- CS: <em>Milk drop syndrome</em>: abrupt termination of milk secretion, leakage of blood in milk (brownish orange), Flaccid udder (<em>&quot;Flabby bag&quot;</em>)</td>
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<td><strong>&quot;Summer mastitis&quot;, &quot;August bag&quot;</strong>&lt;br&gt;CST 764; Br 301, 543; VC/M 512</td>
<td>- Rare; Common in N. Europe, reported in Florida; Dry cow &amp; parturient heifers; mixed infec. (<em>Actinomyces pyogenes</em> + anaerobic bact.&lt;br&gt;[Peptococcus indicolus]). Transmission: teat canal or biting flies (horn fly)&lt;br&gt;- CS: Distended, swollen teat, hard gland, foul, thick ylww secretion, fever; Acute: toxemia - shock, DIC (disseminated intravascular coagulation), abortion &amp; death&lt;br&gt;- Dx: Hx, CS, Destroyed udder, Extensive necrosis of mammary tissue, abscesses &amp; fistulous tracts; Abortions&lt;br&gt;- Tx: Salvage; Prevention: Fly control, prophylactic dry-cow therapy</td>
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<tr>
<td><strong>Other mastitic agents</strong>&lt;br&gt;IM 1191; VC/M 571, 572; Br 763, DC 292</td>
<td>- Considered atypical, rarely problems (<em>Cryptococcus neoformans, Bacillus cereus</em>, Nocardia spp, Mycobacterium, Clostridium spp, Candida spp, Pseudomonas, Setaria (check hot water supply))&lt;br&gt;- Zoonotic implications: <em>C. neoformans</em>, Leptospira spp. &amp; Nocardia spp., so handle infected samples w/ care</td>
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**Other Information:**
- **Emergency Treatment:** Immediate treatment is crucial to prevent long-term complications.
- **Prevention:** Regular teat dipping, good sanitation practices, and early identification of infected cows are key to preventing mastitis.
- **Supportive Care:** Provide adequate nutrition, electrolyte support, and hydration to help the cow recover.
- **Monitoring:** Regular monitoring of milk quality and temperature can help detect mastitis early.

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**Additional Notes:**
- Mastitis can lead to significant economic losses due to reduced milk production, increased veterinary costs, and decreased consumer trust.
- Early intervention with antibiotics and proper management practices can significantly improve outcomes.
- Mastitis is often a multifactorial disease, with infection being just one of many factors affecting mastitis in dairy cows.
Milk collection technique
- Sterile tubes, 15 ml, tight fitting seal
- Foremilk collection samples (better than during milking because more organisms)
- Wash udder & teat, let drain, dry w/ single use paper towel
- Strip each teat 2 or 3 times (initiates milk let down & removes some streak canal contaminants)
- Individual quarter samples (identify infected quarters, 1 or all 4)
- Quarter samples together - identify infected animals
- Scrub teat end & orifice until clean w/ 70% alcohol, using separate cotton ball or gauze for each
- Clean 2 quarters furthest away, then closest
- Fill horizontally-held tube 1/2 full & seal (do not touch teat to tube)
- Clean thoroughly dry hands between cows (germicidal sol.) or use disposable gloves

Transport collected milk
- Process ideally in 15 to 30 min. (sure!)
- Cool to 39.2-41° F (4-5°C) if > 30 min. to processing
- Freezing reduces no. of bacteria
- CMT, WMT & Gelatin-based assay can be performed on frozen samples
- Avoid repeated freezing & thawing
- Storage at 39.2°F (4°C) for 1 wk or frozen will not affect isolation of most common mastitis pathogens

Routine milk culture: determines cause of clinical mastitis in a herd
- Culture all infected quarters
- Freeze or refrigerate before culture
- Culture before therapy
- Antibody susceptibility testing for future Tx
- Do routinely or at least whenever unusual mastitis
- 25-30% will be negative
- Coiform mastitis: short duration, cow's defense controls
- Coiform mastitis: most common cause of mastitis even in herd with chronic Staph. or Strep. infection
- Culture m/ reveal presence of S. agalactiae, S. aureus or Mycoplasma

Transport collected milk
- Process ideally in 15 to 30 min. (sure!)
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80% of cows w/ SCC > 200,000 are infected

Checking for mastitis - strip cup or strip plate - first milk used, so clean udder. Should see coagulation.

Plating milk samples
- Mix milk sample (gently inverting or shaken)
- Do not vortex samples for SCCs (m/ rupture cells)
- Sterile swab swirled at bottom of tube (if contacts anything else, hand or counter top, throw away. Calibrated loop for estimating # of bacteria)

Streaking samples: a number of techniques
- 4 quadrants - BBA plate (5% bovine blood agar)
  - Divide bottom of plate into 4 & mark them A, rt. cran.; B, rt. caud.; C, lt. cran.; D, lt. caud.)
  - Open lid, streak a milk line from appropriate qtr. in center of quadrant, then streak side to side across quadrant, repeat for other quarters.
  - CAMP test for S. agalactiae: m/b done at same time
- Sterile S. aureus hemolysis streaked across quadrants of blood agar plate
- Streak milk as in 4 quadrant tech.
- S. agalactiae causes synergistic ß hemolysis

Herd cultures:
- Culture all cows in herd
- Done when contagious bact. suspected (Strep. agalactiae, S. aureus, Mycoplasma bovis)
- ID infected cow for isolation &/or Tx (S. agalactiae)
- Composite samples (all 4 quarters)

Selective survey cultures:
- Testing on basis of elev. SCCs
- Incr. chance of finding infected animal w/ less testing, but misses some positive animals

Bulk-tank milk cultures
- Monthly cultures of bulk-tank to monitor herd
- Inexpensive monthly monitor of herd mastitis status
- Negative test indicates no or low presence of pathogens
- Swab samples over entire blood agar plate

Interpreting test results
- Single colony of S. agalactiae, S. aureus, or Mycoplasma spp. diagnostic for intramammary infection (all assoc. w/ gland, not environ., highly contagious)
- Other isolates m/ be contamination from environment, confirm cause by:
  - Conc. of bacteria in sample
  - Purity of culture
  - Intramammary inflammation (elev. CMT)
  - Organism on repeat sampling
<table>
<thead>
<tr>
<th>Abortion - poisonous plants</th>
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<tbody>
<tr>
<td>Acon</td>
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<tr>
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Poisonings

Diagnosis of poisonings
(Br 601, 609)

- Sudden death
- History of circumstances & sequence of events & progression of signs
- Postmortem
  - Always performed
  - Presence or absence of lesions, both important
- Chemical analysis - Lab:
  - Tissues usually frozen
  - No preservatives such as formalin added
  - Live animal
    - 10 ml of whole blood
    - 50 ml of urine
    - 200 g of feces
  - Dead animal
    - 5 ml of serum
    - 10 ml of whole blood
    - 50 ml of urine
    - 100 g of liver, kidney, spleen & body fat
    - Half of the brain
    - 500 g of rumen or stomach contents
  - If in doubt about tissue, call lab prior to collecting
  - Environmental samples: water, feed, pasture content, etc.

Treatment of poisonings

- Prevent continued absorption & assist elimination
  - Lavage & laxatives (removes unabsorbed material & limits absorption
  - Antidotes: some have, others don’t
  - Detoxifying agents (assist metabolism & protect organs)
  - Fluids (maintain kidney perfusion & excretion)
  - Skin
    - Bathe w/ large volumes of water
  - Oral route
    - Activated charcoal (1-2 g/kg mixed w/ 10-20 ml of water)
  - Toxins in small intestine
    - Laxatives (sodium sulfate or magnesium sulfate)
    - Mineral oil (mild laxative & protectant)
    - Gastrointestinal binding agents (milk & raw eggs, prevent absorption)
  - Fluids (Calcium, 5% dextrose & large volumes of electrolyte sol.)
    - Provide energy & conjugation material
    - Maintain cell membrane & intracellular balances
    - General nonspecific detoxification
    - IV use maintains adequate urine flow
    - Colonic lavage
    - Hemodialysis
    - Symptomatic & supportive Tx
  - Positive respiratory assistance (give time to Tx & recover)

- Control body temperature (blankets, heating pads or ice baths)
- Detoxification
  - Antidotes if agent known
  - Rumenotomy to remove toxins
  - Corticosteroids (dexamethasone 0.1-2.0 mg/kg)
  - Lactated Ringer’s (> 40 ml/kg IV) Na containing polyionic fluids
- Acid base disturbances
  - Lactated Ringer’s safest if acid-base status is unknown (10 ml/kg/hr)
  - Measure w/ CO₂ apparatus or blood gas machine
    - Metabolic acidosis most common in toxicity
    - Sodium bicarbonate (1.3%) administered slowly over hours (Dose: kg BW x 0.6 x base deficit)
    - Alkalosis - sodium chloride (0.9%, 10 ml/kg/hr) usually sufficient
- Analgoic agents for resp. depression
  - Short lived, monitor patient continuously
    - Doxapram (5-10 mg/kg) pentylenetetrazol (6-10 mg/kg)
    - M/ induce convulsions
    - Resp. support preferred in CNS depression
- Convulsions
  - Diazepam (Valium® 0.5-1.5 mg/kg IV or IM), phenobarbital, pentobarbital sodium
Emergency kit (keep stocked & readily available)

Equipment
- Endotracheal tubes (several sizes)
- Gauze & rolls of tape
- IV catheters & stylets
- Compression bag (AMBU bag) or mech. respirator
- Hypodermic needles
- Syringes
- Stethoscope
- Stomach tubes (several sizes)
- Thermometers
- Urinary catheters (various sizes)
- Venostomy kit

Parenteral medications
- Amphetamines
- Atropine sulfate
- Barbiturates (phenobarbital, pentobarbital)
- Calcium borogluconate
- 5% dextrose
- Diazapam
- Lactated Ringer's
- Normal saline
- 2-PAM (protapam chloride, pralidoxine)
- 5% sodium bicarbonate

Oral medications
- Activated charcoal
- 5% Dioctyl sodium sulfosuccinate (DSS) (1/2 L/450 kg)
- 20% Magnesium sulfate solution
- Mineral oil

Miscellaneous
- Oxygen
## Metals & Metalloids

### Arsenicals

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<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
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<td>Arsenicals</td>
<td>- Pesticides - main source - Herbicides, defoliants, insecticides, rodenticides, slug/snail baits</td>
<td>- Acute - sudden death - Severe colic - Weakness, trembling, ataxia - Salivation - Diarrhea - hemorrhagic w/ mucosal shreds - Rapid HR - Collapse &amp; death</td>
<td>- History of exposure - Postmortem - GI degeneration, necrosis, perforation - Kidney, liver, lung degeneration - No CNS damage</td>
<td>- Remove source - Mineral oil &amp; saline purgatives PO - Na thiosulfate PO (20-30 g/300 ml of H2O) - Antidote: BAL (British Anti-Lewisite, Dimercaprol) IM 3 mg/kg - Succimer® (DMSA, 2,3-Dimercaptosuccinic acid) chelating agent, expensive - Correct acidosis, hypocalcemia, hypokalemia</td>
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<tr>
<td>****</td>
<td>- Organic arsenicals (MSMA &amp; DSMA) - Inorganic arsenicals: Na arsenite</td>
<td>- Eating contaminated foliage - Not accumulative - Mech: binds to -SH enzymes - Rapid HR - Rapid death - Gi</td>
<td>- No other heavy metal has this rapid GI signs (severe)</td>
<td>- DDx: Thallium (p 208), Lead (p 152), Enteric diz, Caustics, Irritant Plants, Pesticides, Urea (p 204), Monensin (p 203), Blister beetle (p 214)</td>
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</table>

#### Pesticides on foliage
- CS: Rapid death - GI
- Dx: Hx - Rapid death
- Tx: Na thiosulfate - BAL
- Px: Grave

#### Lead
- *****
- See pg 152: Uncommon, 31 inorganic poisonings; Lead paints, Batteries, Leaded Gases, Crankcase oil; **Enters brain**, Binds -SH enzymes
- CS: CNS - stagger, blind, maniacal, convulsions, death; GI - bloat, colic, diarrhea
- Dx: Incr. blood levels > 0.3 ppm, Basophilic stippling of RBCs
- Tx: Ca EDTA, Thiamine, Supportive; Rumenotomy
- Px: Poor if neurological involvement

#### Mercury, Hg
- Mk 1676; IM 1906; BR-hb 564; BJR 1486
- Tox 121; Br 614
- Rare, Mercuric fungicide treated grains historically, Banned for years; Concern in contaminated water - fish
- CS: CNS (staggering, blindness, weakness, vomiting, diarrhea, ulcerative stomatitis)
- Dx: Exposure, Kidney levels
- Tx: Sodium thiosulfate IV or w/ BAL, Meat danger to humans, report to Feds

#### Iron toxicity
- Mk 1673; IM 1906; Tox 197; C1T 502
- Seen mainly in newborn pigs given supplemental iron, pigs more susceptible if Vit E/Selenium deficiency

### Metabolism

#### Thiosulfate
- BAL
- Thiosulfate
- Treatment
- Remove source
- Mineral oil & saline purgatives PO
- Na thiosulfate PO (20-30 g/300 ml of H2O)
- Antidote: BAL (British Anti-Lewisite, Dimercaprol) IM 3 mg/kg
- Succimer® (DMSA, 2,3-Dimercaptosuccinic acid) chelating agent, expensive
- Correct acidosis, hypocalcemia, hypokalemia

### Prognosis:
- Grave

---

**Note:** The classification of metals and metalloids in this document is based on their toxicity and classification criteria as presented in the text.
**Copper poisoning**

**Molybdenum deficiency**

C3T 338; IM 1230, 1904; BR nb 583; BR 1485; B&R 1466; Br 613, 263; DC 506; Ptc 217; Pa 90

- Cu: Mo > 10:1; Excess Cu or Mo deficiency
- Sources: Anthelmintic drenches, Improperly formulated rations, Low levels of Mo (molybdenum) or sulfate in diet (Mo not supplemented in feed), Fungicides, mollusksicides, footbaths
- "Sink organ" - Cu stored in liver

**Hemolytic crisis (massive release of stored Cu from liver)***

- Cu blood levels > 2 ppm,
- Postmortem:
  - "Blackberry Jam" spleen
  - "Port-Wine" urine

- Often Tx not successful
- Chelating agent (D-penicillamine)
- Supplement molybdenum
- Na sulfate

**Prevention:**

- Top-dressing pastures w/ 1 oz Mo/acre
- Mo supplementation or restrict Cu intake

**Prognosis:**

- Sheep - poor

---

**Copper Deficiency**

**Molybdenum Toxicity**

- See pg 89, Cattle > sheep, Cu:Mo < 2:1 toxic, Excess Mo or Defc Copper, Sources: soil, mining, Mech: Unknown
- CS: Foul diarrhea, Wasting Diz, Ataxia, Anemia, Depigmentation, Osteoporosis, fractures, Rough hair coat
- **Dx:** Response to Cu Tx; Lab: Cu & Mo in forage, Liver < 10-30 ppm Cu, Mo > 5 ppm
- **Tx:** Cu sulfate (oral), Cu glycinate (SQ)
- **Px:** good response to Cu supplementation

---

**Monensin, Lasalocid, Ionomophore AB Toxicity**

**Uses of Monensin**

1. Anticoccidial for chickens & cattle
2. Feed additive in cattle to incr. feed efficiency
   - Microflora produce more propionic VFAs
   - Decrease intake while maintaining weight gain
   - Reduces feedlot bloat & acidosis, preventative against tryptophan-induced atypical bovine pulmonary emphysema
3. Sheep & pigs as growth promoter

**Horse > Cattle; Coccidial ABs**

**CS:** Multiple systems - Heart failure
**Dx:** CS, Hx, PM
**Tx:** No antidote, Remove source

**Acute toxicity** (similar in all species)

- Multiple organ systems
  - Transient drop in feed intake
  - Acute 24-36 hours
    - Anorexia, depression
    - Weakness, ataxia
    - Dyspnea
    - Diarrhea
  - Subacute - related to cardiac failure
  - Several wks
    - Dyspnea, hydrothorax, ventr. edema
    - Stilted gait, ataxia, recumbency & death w/o struggle

**CS, History**

- Postmortem:
  - Cardiac muscle, kidney, liver lesions
  - Heart & skeletal muscle (tongue)

- Lab:
  - Increased ASP & CPK

**No antidote that will reverse CS**

**Remove source from other animals**
<table>
<thead>
<tr>
<th>Feed Additives</th>
<th>TOXICOLOGY</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Condition</strong></td>
<td><strong>Facts/Cause</strong></td>
</tr>
<tr>
<td><strong>Urea toxicity</strong></td>
<td><strong>Ammonium toxicity</strong></td>
</tr>
<tr>
<td><strong>Urea</strong></td>
<td>Urea not poisonous</td>
</tr>
<tr>
<td><strong>toxicity</strong></td>
<td>Ammonium (NH₃) is toxic</td>
</tr>
<tr>
<td><strong>Ammonium</strong></td>
<td>Sources: NPN (Nonprotein nitrogen)</td>
</tr>
<tr>
<td><strong>toxicosis</strong></td>
<td>- Feed additive (1-3%) for cattle</td>
</tr>
<tr>
<td><strong>NPN</strong> (Nonprotein nitrogen poisoning)</td>
<td>- Cheap supply of protein nitrogen</td>
</tr>
<tr>
<td><strong>forage toxicity</strong></td>
<td>- Urea most common source, also biuret, ammonium compounds (rice hulls, cottonseed, bonemeal, etc.)</td>
</tr>
<tr>
<td><strong>Bovine Bonkers</strong></td>
<td>&quot;Lick-tanks&quot;: liquid supplements combine urea &amp; molasses</td>
</tr>
<tr>
<td>Mk 1693 IM 1070, 1916; C37231; CT 393, 1089; BR-hb 582, 585; BR 1522, 1524; Br 616; DC 503; VC/N 154; Tox 341; N-L 99</td>
<td>- Fertilizer (animals eat or drink)</td>
</tr>
<tr>
<td><strong>Facts/Cause</strong></td>
<td><strong>Presentation/CS</strong></td>
</tr>
<tr>
<td><strong>• Urea not poisonous</strong></td>
<td><strong>• Acute CS in 20-60 min</strong></td>
</tr>
<tr>
<td><strong>• Ammonium (NH₃) is toxic</strong></td>
<td><strong>• Rapidly progressive</strong></td>
</tr>
<tr>
<td><strong>• Sources: NPN (Nonprotein nitrogen)</strong></td>
<td><strong>• Highly fatal</strong></td>
</tr>
<tr>
<td>- Feed additive (1-3%) for cattle</td>
<td><strong>• Muscle tremors initially</strong> (face &amp; ears)</td>
</tr>
<tr>
<td>- Cheap supply of protein nitrogen</td>
<td><strong>Dyspnea, salivation, gasping</strong></td>
</tr>
<tr>
<td>- Urea most common source, also biuret, ammonium compounds (rice hulls, cottonseed, bonemeal, etc.)</td>
<td><strong>Terminal convulsions to death</strong></td>
</tr>
<tr>
<td>&quot;Lick-tanks&quot;: liquid supplements combine urea &amp; molasses</td>
<td>- W/ in 2 hrs in cattle</td>
</tr>
<tr>
<td>- Fertilizer (animals eat or drink)</td>
<td><strong>Survivors recover in 24 hrs w/ no sequela</strong></td>
</tr>
</tbody>
</table>

**Excess NPN to ammonium**

CS: Acute, Rapid, "Bonkers", Convulsions, Death

Dx: Hx, CS, Diet, Ammonia smell, Lab, PM

Tx: Difficult (rapid), Relieve bloat, Fluids

**Ruminants**

- Incr. in rumen pH
- **Ammonia**
  - Urea → NH₃ + CO
- **NPN (nonprotein nitrogen)**
Salt poisoning, Water deprivation, Sodium toxicity
Mk 1358, 1726; IM 1229, 1062; C1T 396; BR-hb 568; BR 1499; Br 697; DC 440; VC/N 55; Tox 368; N-L 99

**

Water deprivation
- CS: GI, CNS
- Dx: Hx, CS, Na >160 mEq/L
- Tx: Difficult, IV fluids, Lasix®
- Px: Grave, Most die

Iodine toxicity
Mk 1472; IM 1905, 212t; C3T 904; C1T 398; BR-hb 570; BR 1505; Br 225; Tox 340; DC 250, 506l

**

- Essential element, present in thyroid hormone
- GRAS (generally regarded as safe) food additive
- DDI (ethylene diamine dithiodiacetate) feed additive, except for dairy cattle in production
- Used typically as antiseptic, antifungal, antibacterial; toxicity common w/ Tx
- Expectorant, stimulates vagus nerve
- Antifibrotic drug for lumpy jaw (Actinomyces bovis); Nal, KI

- GI tract: Vomiting, Diarrhea, Abd. pain, Anorexia, Mucous in feces
- CNS
  - Blindness
  - Convulsive seizures
  - Partial paralysis
  - Drag rear feet or knuckling of fetlock
- Die w/in 24 hrs of CS

- CS, Hx of limited water intake
- Na conc. in plasma & CSF >160 mEq/L
- Postmortem: m/b no lesions
  - Cerebral edema
  - Gastric inflam. or ulceration
  - Edema of skeletal mm.
  - Hydropericardium

- Difficult, most die
- IV fluids, induce diuresis & correct gradually, if too fast can cause cerebellar edema
- Lasix® (furosemide, 1.0 mg/kg) loop diuretics, incr. Na secretion

- CS, History of high levels
- Remove source, it is rapidly excreted

- Essential element, GRAS
- CS: Lacrimation, Scaly skin, Lameness
- DX: Hx, CS
- Tx: Remove source
- Px: Good

Prognosis:
- Good
# Insecticides

## Condition

<table>
<thead>
<tr>
<th>Organo-phosphates, OPs</th>
<th>Carbamates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute (w/in an hour)</td>
<td>Insecticides similar to carbaryl</td>
</tr>
<tr>
<td>- Colic, uneasy &amp; anxious</td>
<td></td>
</tr>
<tr>
<td>- Patchy sweating</td>
<td>- Not toxic w/ normal use</td>
</tr>
<tr>
<td>- Diarrhea (freq. urination &amp; defecation)</td>
<td>- Mech: like OPs, except reversible</td>
</tr>
<tr>
<td>- Salivation, lacrimation</td>
<td></td>
</tr>
<tr>
<td>- Dyspnea (resp. secretions)</td>
<td></td>
</tr>
<tr>
<td>- Followed by:</td>
<td></td>
</tr>
<tr>
<td>- Muscle tremors &amp; contraction, ataxia &amp; collapse</td>
<td></td>
</tr>
<tr>
<td>- Tetany (sawhorse stance)</td>
<td></td>
</tr>
<tr>
<td>- Hyperexcitability or depression of CNS</td>
<td></td>
</tr>
<tr>
<td>- Usually no convulsive seizure</td>
<td></td>
</tr>
<tr>
<td>- Miosis (constricted pupil)</td>
<td></td>
</tr>
<tr>
<td>- Bronchoconstriction, pulmonary edema</td>
<td></td>
</tr>
<tr>
<td>- Death from respiratory failure</td>
<td></td>
</tr>
</tbody>
</table>

## Facts/Cause

<table>
<thead>
<tr>
<th>Organo-phosphates, OPs</th>
<th>Carbamates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increasing use bec. reduced half life (less environmental contamination in comparison to CHC [chlorinated hydrocarbons])</td>
<td></td>
</tr>
<tr>
<td>- Parathion, dichlorvos, malathion, rotenone, ruelene, Trichlororfen (ascarids &amp; bots)</td>
<td></td>
</tr>
<tr>
<td>- Absorbed by all routes, skin, oral, resp.</td>
<td></td>
</tr>
<tr>
<td>- Contaminated feed or water</td>
<td></td>
</tr>
<tr>
<td>- Interaction w/ phenothiazine tranquilizers, succinylcholine, physostigmine, neostigmine carbamates</td>
<td></td>
</tr>
<tr>
<td>- Similar CS &amp; mech. to carbamate poisonings, except irreversible</td>
<td></td>
</tr>
<tr>
<td>- Mech:</td>
<td></td>
</tr>
<tr>
<td>- Irreversible inhibition of acetylcholinesterase (AChE) (so acetylcholine accumulates &amp; causes overstim.)</td>
<td></td>
</tr>
<tr>
<td>- Overstim. of parasym pathetic ANS, skeletal mm. &amp; CNS</td>
<td></td>
</tr>
</tbody>
</table>

## Diagnosis

<table>
<thead>
<tr>
<th>Organo-phosphates, OPs</th>
<th>Carbamates</th>
</tr>
</thead>
<tbody>
<tr>
<td>History, CS</td>
<td>CS: Parasymp. ANS stim. - Salivation, Miosis, Ataxia</td>
</tr>
<tr>
<td>Response to atropine therapy</td>
<td>Dx: Hx, CS, Atropine response</td>
</tr>
<tr>
<td>Lesions:</td>
<td>Tx: Atropine</td>
</tr>
<tr>
<td>- None or nonspecific</td>
<td></td>
</tr>
<tr>
<td>- GI contents</td>
<td></td>
</tr>
<tr>
<td>Label:</td>
<td></td>
</tr>
<tr>
<td>- Cholinesterase (ChE) levels in blood</td>
<td></td>
</tr>
<tr>
<td>- Stomach or rumen contents</td>
<td></td>
</tr>
</tbody>
</table>

## Treatment

<table>
<thead>
<tr>
<th>Organo-phosphates, OPs</th>
<th>Carbamates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency (rapid progression)</td>
<td>Like OPs</td>
</tr>
<tr>
<td>- Atropine treats muscarinic effects (0.1 mg/kg IV). Admin. to effect (myosis &amp; absence of salivation)</td>
<td>- 1 Tx of atropine usually enough (because reversible)</td>
</tr>
<tr>
<td>- Repeat SQ every 2 hrs m/b necessary (irreversible action of OPs)</td>
<td>- No need for 2 PAM, but it doesn't hurt if can't DDx from OPs</td>
</tr>
<tr>
<td>- Doesn't affect nicotinic signs, muscle fasciculations &amp; muscle paralysis</td>
<td></td>
</tr>
<tr>
<td>2 PAM (protopam chloride) 20 mg/kg IV every 4-8 hours</td>
<td></td>
</tr>
<tr>
<td>If dermal route bath w/ soap &amp; water</td>
<td></td>
</tr>
<tr>
<td>Oral route</td>
<td></td>
</tr>
<tr>
<td>- Activated charcoal by nasogastric tube, mineral oil</td>
<td></td>
</tr>
<tr>
<td>- Osmotic laxatives (magnesium sulfate)</td>
<td></td>
</tr>
<tr>
<td>IV fluids</td>
<td></td>
</tr>
<tr>
<td>M/b respiratory support</td>
<td></td>
</tr>
<tr>
<td>Contraindicated: morphine, succinylcholine &amp; phenothiazine tranquilizers</td>
<td></td>
</tr>
</tbody>
</table>

## 2 PAM

- Carbamate
- Insecticides similar to carbaryl
- Not toxic w/ normal use
- Mech: like OPs, except reversible

## Same as OPs, except reversible

- Irreversibly blocks AChE - CNS, pANS stim.
- CS: Parasymp. ANS stim. - Salivation, Miosis, Ataxia
- Dx: Hx, CS, Atropine response
- Tx: Atropine

## DDx:

- CHC (convulsive seizures, no respond to atropine)
- Carbamate
- Fog fever
- Urea
- Nitrate
- Hypomagnesemia

Like OPs

- 1 Tx of atropine usually enough (because reversible)
- No need for 2 PAM, but it doesn't hurt if can't DDx from OPs

See OPs (above)
### Chlorinated hydrocarbons

**Chlorinated hydrocarbons** (HCH)  Organochlorine insecticides

**Mk** 1668; IM 144, 294; C3T 51; BR 151; BR-hb 576; VC/N 152; Tox 286; N-L 120, 212

- **Use curtailed bec. of persistence in environment (DDT [prototype])**
  - Only lindane, methoxychlor & toxaphene approved for use around livestock
  - Sources - contaminated feed or water
  - Recommended levels no problem
  - Diffuse stimulant of CNS
  - Stress - Incr. epinephrine - Incr. lipolysis - Incr. release of stored CHC

**Stimulation or depression of CNS**

- Depression
  - Alternates w/ muscle activity
- Fascication (muscle twitching)
- Convulsive seizures (unlike OPs)
- Death during severe seizure
- Fever
- Dehydration, anorexia

### Organochlorine insecticides

**Organochlorine insecticides**

- Sources - contaminated feed or water
- Death during severe seizure
- Fever
- Dehydration, anorexia

**Stimulation or depression of CNS**

- Depression
  - Alternates w/ muscle activity
- Fascication
  - Muscle twitching
- Convulsive seizures (unlike OPs)
- Death during severe seizure
- Fever
- Dehydration, anorexia

### Decreased use, DDT, Lindane - Diffuse CNS stim.

**CS:** CNS stim./Depression - Convulsions

**Dx:** CS, HX

**Tx:** Symptomatic, Lavage, Valium®

### Metaldehyde

**Mk** 1676; IM 1912, BR-hb 580; BR 1520; BR 614; VC/N 154; Tox 250; N-L 121, 211

- Rare, most common in dogs, also sheep
- Molluscid - slug & snail bait
- Snar@! looks & tastes like dog food
- Palatable to dogs & other animals, reported in dog, cat, sheep & children
- Mach: Unknown
- Irritant to GI mucosa
- Liver, metabolic acidosis

#### Acute onset w/in 3 hrs

- Vomiting, Colic, Diarrhea, Dyspnea, Tachycardia, Frothing mouth
- CNS: tremors, hyperesthesia, spasms, head pressing, convulsions, leg paddling
- Death, acute: Resp Failure

#### Analyze stomach contents for acetaldehyde (breakdown product of metaldehyde)

#### History, CS

- Levels in blood, serum or urine from live animals

#### Lab:

- Postmortem:
  - Absence of specific lesions
  - ppm of CHC in liver & brain tissue

#### DDx (lg animal)

- Meningitis (p 151)
- Lead (Pb) (CNS) (p 152)
- Rabies (p 144)
- OPs (p 206)
- Carbamate (p 206)
- Polioencephalomalacia (p 140)
- TAME (p 144)
- Bovine Ketosis (p 33)
- Urea (p 104)
- Salt poisoning (p 205)

### PCP, Penta

**Pentachlorophenol**

**IM** 1631; **Mk** 1696; **BR** 1521; **DC** 507

- Rare, Wood treatment, fungicide, molluscid & insecticide, Not street drug called PCP (angel dust), Incr. O2 demand - blocks oxidative ATP formation
- CS: Fever, Gasping, Dehydration, Sweating, Salivation, Incr. HR & RR, Muscle tremors, Convulsions, Death
- Tx: Cool animal, Remove source, Fluids, Anticonvulsants

#### History, CS

- Death, aqne of esp. Fragrance
- Failure
- Death, aqne of esp. Fragrance
- Failure
- Death, aqne of esp. Fragrance
- Failure

#### NO specific antidote

#### Symptomatic

- Sedate to minimize muscle tremors (diazepam)
- Emesis/gastric lavage (Na bicarbonate)
- Fluids (Na lactate) for hydration & acidosis

#### DDx: Lead, CHC, Mercury, Urea

### Sedative

- Oral
- Lavage & purgative, heavy mineral oil, activated charcoal
- Barbiturate, chloralhydrate or Valium®, if excitatory CS
- Remove stress from envir.

### Sedative

- Intravenous fluids or gastric tube

---

**207**
<table>
<thead>
<tr>
<th>Herbicides (IM 1910)</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Herbicides</td>
<td>Routinely sprayed on pastures grazed by animals, <strong>Used properly few toxic problems</strong>, toxicities due to accidents</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Phenoxy Herbicides

- **2,4 D, Silvex**
  - Phenoxys; 2,4 D; Silvex®
  - **Phenoxy Herbicides; Tox 261**
  - By themselves relatively nontoxic, but increase palatability &/or an increase in nitrate or cyanide contents of plants; do not allow access to sprayed pastures for at least a week

### Arsenicals

- **Dinitro compounds**
  - Mk 1656; BR-hb 577; BR 1517
  - Dinitrophenol & dinitrocresol - highly toxic; readily absorbed through skin & lungs; **CS:** fever, dyspnea, incr. HR, convulsions followed by death & rapid rigor mortis
  - Tx: No antidote, cool animal & sedate to control hyperthermia; phenothiazine tranquilizers m/ potentiate; atropine contraindicated

- **Dipyridyls, Paraquat**
  - Mk 1656; IM 1910, 932; BR-hb 577; BR 1518; Tox 260, 262
  - Rare: Desiccant herbicides, Toxic effect - free radicals in tissues, Mainly in dogs & cattle
  - CS: Tissue irritation (mouth lesions, skin & cornea), GI, centrilobular necrosis of liver, Resp. (dyspnea, pneumonia)
  - Tx: w/ 24 hours, Oral absorbents (activated charcoal), Cathartics, Fluids, Vit E/Se supplementation, Mannitol or Lasix®, O2 contraindicated
  - Px: Guarded to grave

- **Na Chlorate**
  - Mk 1657; Tox 251
  - Rare: Seldom used anymore as herbicide, Accidentally added to feed as salt (mistaken for Na chloride) (NaCl) (Looks & tastes like table salt)
  - Causes conversion of Hb to methemoglobin
  - Tx: 1% Methylene Blue IV, sodium thiosulfate

- **Barium**
  - Tox 290
  - Barium carbonate. Rarely used currently as a rodenticide
  - CS: colic, diarrhea, hemorrhage, depression & prostration
  - Tx: Symptomatic (charcoal, diuresis, IV potassium)

- **Strychnine**
  - IM 1912; BM&S 268; Br 125; Tox 284; N-L 121
  - Rarely found today, Indole alkaloid; Used for rodents & coyote control; **No rational for its use**
  - Stim. CNS by interfering w/ inhib. spinal neurons
  - CS: Uncontrolled reflex activity, Generalized extensor rigidity, Tonic seizures
  - Tx: Control seizures (phenobarbital), Inactivate unabsorbed arsenic (tannic acid or potassium permanganate)

- **Thallium**
  - Mk 1723, IM 2123, 2181; BR 549; Tox 349
  - Rare, banned as a rodenticide, general cellular poison affecting all species
  - CS: GI (hemorrhagic), Resp (dyspnea), CNS (seizures) & integument (alopecia)
  - Tx: Controversial, potassium salts (inr. secretion), Hydration

- **Sodium fluoracetate (1080)**
  - Mk 1723; VC/N 153; Tox 289
  - Rare, Highly toxic. Use restricted to licensed exterminators, banned on federal lands
  - Used to control coyotes
  - Blocks Kreb's cycle ("jamming"), decr. ATP; Affects cardiac conductions
  - CS: Cardiac collapse, CNS stimulation - death in convulsions
  - Tx: No specific antidote, Calcium gluconate, Glycerol monocacetate
  - Px: Grave once CS
ANTU M
C3T388

- Rare, Alpha-naphthyl thiourea (exclusive rodenticide), Bait in sausage or bread, also in water, Incr. permeability of pulmonary capillaries
- CS: Pulmonary edema "drowns in own fluid"
- Tx: No specific Tx, Emetics early before edema

Zinc phosphide, Zn3P2
Mk 1724; IM 1912; C3T 388; BR-hb 579; BR 1520; VC/N 154; Tox 384

- Rare: For licensed pest control, grain mix (Kilrat®; Goph-rid®; Mr. Rat®); Tox.: Release of phosphine gas on contact w/ water
- CS: GI, Resp. failure, muscle tremors, moderate excitement, mania
- Tx: NO specific Tx, Gastric lavage w/ 5% sodium bicarbonate (raise pH to delay formation of gas), Symptomatic

Phosphorus
Mk 1722; IM 932; C3T 388; BR-hb 563; BR 1486; Tox 288

- Rare (rarely used), Garlic odor, Protoplasmic poison, liver damage
- CS: Biphagic, apparent recovery, 2nd phase, Hepatoencephalopathy (CNS) - death
- Tx: Symptomatic

Pyrimilin, "Vacor"
VC/N 154; Tox 291

- Rodenticide, Not currently available, Mech.: Vit. B antagonism, destroys pancreatic cells & depresses glucose uptake by cells
- CS: CNS: incoordination, weakness (altered conducting velocity in peripheral nerves)
- Tx: May recover spontaneously if protect from self trauma & supportive care, Nicotinamide

Ethylene glycol poisoning, Antifreeze poisoning
Mk 1648; IM 1076, 1913, 997; BR-hb 586; BR 1530; Tox 317

- See Oxalate poisoning
- 1º dogs & cats, 1º Ig. animal - ruminant
- Source
  - Antifreeze (Sweet tasting alcohol)
- Metabolized to oxalic acid
- Oxalic acid combines w/ calcium in kidney to form insoluble calcium oxalate crystals in renal tubules
- CNS
  - Hind limb ataxia
  - Salivation
  - Depressed sensorium
  - Loss of menace response
  - Nystagmus
  - Tonic clonic seizures
- Same as in oxalate poisoning
  - Azotemia
  - ↑ serum creatine, hypophosphataemia, hypocalcemia, acidosis, hyperosmolality, ↑ glutamyl transaminase
  - Isolate ethylene glycol w/in 1st hrs in GI
  - Postmortem:
    - Slight swelling of kidney
    - Oxalate crystals in kidney
- Early (w/in 12 hr of exposure)
  - 20% ethanol at a rate of 50 ml/hr
  - Activated charcoal
  - NaHCO IV
  - Replace fluids

Metabolized to oxalate - Combines w/ Ca - pcpt in renal tubules
CS: CNS
Dx: Azotemia
Tx: 20% ethanol, Activated charcoal

DDx:
- Metaldehyde (p 207)
- Renal failure (p 100)
- Oxalate poisoning (p 224)
### Toxic Gases

**Condition**

<table>
<thead>
<tr>
<th>Toxic gases (IM 660; Tox 369)</th>
<th>1° in closed housed animals (outside they blown away)</th>
</tr>
</thead>
</table>

**Facts/Cause**

- **Ammonia (NH₃)**
  - IM 660; C3T 267; Br hb 287; BR 531; Br 796; DC 95; Tox 369
  - #1 toxic air pollutant in housed facilities
  - Closed housing
  - Excrement decomposing on solid floors
  - Pungent ammonia odor

- **Carbon dioxide (CO₂)**
  - Mk 1361; IM 660; C3T 680; Tox 371
  - Improbable deleterious levels ever reached
  - Sources: energy metabolism, fuel burning, decomposed manure
  - Present in atmosphere normally at 300 ppm

- **Hydrogen sulfide (H₂S); Manure gas; Slurry gas**
  - Tox 372; IM 660, 293; VC/N 155; Br 795
  - Colorless, heavier-than-air
  - "Rotten egg" smell
  - Liquid manure holding pits underneath animal housing
  - H₂S retained in liquid
  - When liquid agitated prior to pumping it out, gas is released (m/b 1000 ppm)
  - > 500 ppm eminent threat to life, respiration

- **Liquid manure pits, "Rotten eggs"**
  - CS: Asphyxia
  - Tx: Humans -> Artificial respiration

**Presentation/CS**

- **Carbon dioxide (CO₂)**
  - Improbable deleterious levels ever reached
  - Sources: energy metabolism, fuel burning, decomposed manure
  - Present in atmosphere normally at 300 ppm

- **Hydrogen sulfide (H₂S); Manure gas; Slurry gas**
  - Colorless, heavier-than-air
  - "Rotten egg" smell
  - Liquid manure holding pits underneath animal housing
  - H₂S retained in liquid
  - When liquid agitated prior to pumping it out, gas is released (m/b 1000 ppm)
  - > 500 ppm eminent threat to life, respiration

**Diagnosis**

- **Carbon dioxide (CO₂)**
  - History
  - Field observation (sniff the air)

- **Hydrogen sulfide (H₂S); Manure gas; Slurry gas**
  - History, CS
  - Blood PCO₂

**Treatment**

- **Carbon dioxide (CO₂)**
  - Adequate ventilation
  - Sanitation (remove feces)

- **Hydrogen sulfide (H₂S); Manure gas; Slurry gas**
  - Public Health:
    - Human asphyxiation when cleaning out holding pits:
      - Artificial respiration

**Prevention**

- **Carbon dioxide (CO₂)**
  - Remove animals & humans before agitating manure pit
  - Ventilate area

- **Hydrogen sulfide (H₂S); Manure gas; Slurry gas**
  - Public Health:
    - Human asphyxiation when cleaning out holding pits:
      - Artificial respiration

**Notes**

- #1 air pollutant of housed cattle - Decr. growth rate
**Carbon monoxide, CO, Smoke inhalation**
*IM 593; Tox 374; DC 95*

- Rare
- Odorless, colorless, poisonous gas
- Unvented fuel burning heaters
- Exhaust fumes
- Competes w/ Oxygen to bind to Hb (hemoglobin) (affinity 250x Oxygen)
- Forms carboxyhemoglobin (blocks O2 pick up & release)
- Produces tissue hypoxia

**Hypoxia**
- Rapid death w/ high exposures
- Lower exposures:
  - Drowsiness
  - Disorientation
  - Incoordination
  - Dyspnea
  - Coma

- History (fuel burning heaters), CS
- Cherry red blood

*Fresh air*

---

**"Silo gas", Nitrogen dioxide/ Tetroxide (NO2)**
*IM 660, Tox 376; DC 102*

- "Silo gas"
  - Brown/yellow gas, ‘chlorine odor’
  - Heavier than air, settles down chute
  - Outbreaks in housed cattle near silo chute
- "Silo filler’s dizziness" in humans
- Pathology:
  - NO2 + water = corrosive nitric acid, lung damage (high water content)
  - Edema & fibrosis
- Irritated mucous membranes
- Salivation, lacrimation
- Dyspnea, tachypnea
- Cough
- Fever
- SQ emphysema
- Coma
- Paralysis
- Chronic: Pneumonia

**History, CS**
- Silo inspection
- Auscultation: decreased breath sounds & crackles
- Postmortem:
  - Lung lesions (fibrosis, edema, hemorrhage)

- Adequate ventilation - Oxygen
- Remove from closed housing (animals still may die)
- Sedation: ↓ Oxygen need
- Diuretic - Lasix® (furosemide)
- ABs for 2nd infection

---

**Heavier than air + water => Corrosive acid**
**CS: Lung damage (dyspnea)**
**Tx: O2**

---

**Rare, 250 x affinity of O2**
**CS: Hypoxia - Death**
**Dx: Cherry red blood**
**Tx: Fresh air**
**Petroleum TOXICOLOGY**

<table>
<thead>
<tr>
<th>Smog, Sulfuroxides (SO₂, SO₃)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facts/Cause</td>
</tr>
<tr>
<td>Smog (Sulfur oxides + H₂SO₄)</td>
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<tr>
<td>Smog major factor in air pollutants</td>
</tr>
<tr>
<td>Deaths of man &amp; animal</td>
</tr>
<tr>
<td>Cattle &amp; horses in urban environments</td>
</tr>
<tr>
<td>SO₂, SO₃</td>
</tr>
<tr>
<td>Diagnosis</td>
</tr>
<tr>
<td>History (urban area)</td>
</tr>
<tr>
<td>CS</td>
</tr>
<tr>
<td>Treatment</td>
</tr>
<tr>
<td>No specific Tx</td>
</tr>
</tbody>
</table>

**Facts/Cause**
- Smog (Sulfur oxides + H₂SO₄)
- Smog major factor in air pollutants
- Deaths of man & animal
- Cattle & horses in urban environments

**Presentation/CS**
- Eye irritation & salivation
- Emphysema
- Respiratory distress

**Treatment**
- No specific Tx

**Urban areas**
- CS: Eye, Respiratory
- Tx: No specific Tx, Move? write your congressman

**Smoke inhalants**
- IM 661, 593, 1643; DC 94
- Barn fires
- Pathophysiology:
  - Smoke toxicity
  - CO toxicity (carbon monoxide poisoning)
  - Alveolar damage, interstitial edema, hypoxia & 2° bronchopneumonia
- Oral burns
- Conjunctivitis
- Laryngospasms
- Respiratory problems (cough, stridor, tachypnea)
- History, CS
- Bronchoscopy
- Transtracheal wash
- Patent airway (intubation, tracheostomy)
- O₂ therapy (up to 100%), careful because O₂ m/ cause lung damage
- IV fluids (monitor for pulmonary edema)
- ABs for 2° pneumonia
- Bronchodilators (aminophylline)
- relieve soot-induced laryngospasms

**Barn fires**
- CS: Oral burns, Respiratory, Conjunctivitis
- Dx: Bronchoscopy
- Tx: Open airway, O₂, ABs, Fluids, Bronchodilators

**Methane (CH₄)**
- IM 660
- Not poisonous, only problem if displaces Oxygen (87-90% of atmosphere, sure!) to cause anoxia
- Danger: explosive, lighter than air & spark can blow a barn sky high

**Hydrogen cyanide gas** (prussic acid) (VC/N 156): plant sources & burning insulation material; stop cellular respiration, Convulsive seizures terminally
## Petroleum products, Petroleum hydrocarbons

**Mk 1696; C3T 407; IM 1076; 1919; BR-hb 586; BR 1528; Tox 215; DC 5041**

<table>
<thead>
<tr>
<th>Cattle 1°, Sweet crudes</th>
<th>Petroleum breath</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS: Topical, GI, Resp</td>
<td>Oil in lungs + GI</td>
</tr>
<tr>
<td>Tx: Depends on damage</td>
<td>Lab</td>
</tr>
</tbody>
</table>

- All susceptible, cattle 1°
- Source of hydrocarbons
  - Containers, Spills, Mines
  - Gasoline + Pb (leak)
  - Incendio vehicles
- Properties:
  - Sweet crude (kerosene, gas, naphthalene)
  - Irritant
  - Oily, some penetrate skin
- Naphthalene contaminations: which compounds cause what irritation (e.g., chlorinated naphthalene causes bovine hyperkeratoses)

### Polybrominated biphenyls (PBB)

**IM213; BR-hb 586; BR 1527; Tox 223**

- Catastrophe in Mich. in 1973
- PBB (a fire retardant) was supplied in red bags labelled “Firemaster” & a feed ingredient, magnesium oxide, was supplied in brown bags labelled “Nutrimaster.” Due to a red bag shortage PBB was then supplied in brown bags, confused w/ “Nutrimaster” & added to feed. CS: decr. milk, lameness, wt. loss. 18,000 cattle, 3,500 swine, 1,200 sheep & 1,500,000 birds were destroyed & buried. Subsequent health problems were blamed erroneously on PBB. Interesting story, we can assume they found some red bags. See movie "Bitter Harvest"

### Polychlorinated biphenyls (PCB)

**Tox 223**

- Excessive residue problem in milk & animal tissue used for human consumption
- PCB (Aroclor®) used as oil in transformers, condensers & paints, flame retardant, heat transfer systems. Leaks of heat transfer systems has gotten into feed. Dx: Chemical identification of PCB residues in body fat of liver tissues. Farmer knows of problem usually when letter from a regulatory agency informs him. His & veterinarian’s problem is to identify source. Saving feed samples in quart jars from each batch bought would be a big help.

### Nicotine

**IM 1879; C2T 86; BR-hb 573; BR 1509; Tox 248**

- See pg 239
- Uses:
  - Anthelmintic
  - Horticulture spray
- Mech
  - Initial stimulation then blockade of nicotinic receptors
- Initial parasympathetic stimulation
  - Excitement, salivation, rapid resp., diarrhea, irritation of mouth
  - Followed by depression & paralysis
  - Ataxia, tachycardia, shallow, slow resp., flaccid paralysis, coma & death from resp. paralysis
- History (exposure)
  - CS (CNS)
  - Nicotine odor
- Usually unsuccessful
  - Oral tannic acid, potassium permanganate
  - Artificial resp. helps, but impractical
**Rodenticides**

**Condition**
- IM 1911; VC/N 153; Tox 275, 294
- Toxicity rare in livestock
- Accidental contamination of a batch of feed
- Occasional access to bulk-packed rodenticides
- Palatable because often formulated with grain
- Few rodenticides selective, most designed to kill mammals
- Baits & tracking powders (walks through & ingests while cleaning)

**Facts/Cause**
- Toxicity rare in livestock
- Accidental contamination of a batch of feed
- Occasional access to bulk-packed rodenticides
- Palatable because often formulated with grain
- Few rodenticides selective, most designed to kill mammals
- Baits & tracking powders (walks through & ingests while cleaning)

**Presentation/CS**
- Presentation
- Hematoma formation
- Ecchymosis (small hemorrhagic spot, petechiae) in mucous membranes
- Epistaxis
- Hematuria, rarely melena

**Diagnosis**
- Exposure
- CS or large vessel hemorrhagic diathesis
- Prolonged PT (later also ↑ APTT)
- No other abnormalities of clotting profile (norm. platelet count, plasma fibrinogen)
- Anemia
- Hypoproteinemia

**Treatment**
- Vit. K1 SQ every 6 hours until PT normal
- Not K3
- Fresh plasma
- Whole blood transfusion

---

**Anticoagulants** (Warfarin, coumarins)

**Condition**
- IM 1210, 1911; C3T 383; BR-hb 579; BR 1250 Tox 276; DC 61, 506
- Source
- Rodenticides
- Tx of navicular diz in horses
- Mechanism
- Inhibition of Vit K (necessary for production of clotting factors II, VII, IX & X)
- Thrombin formation depressed
- Potentiated by
- Vit K deficiency
- Concurrent protein bound therapy

**Facts/Cause**
- Warfarin, Diphacinone, Brodifoxoum, Bromadiolone
- Source
- Rodenticides
- Tx of navicular diz in horses
- Mechanism
- Inhibition of Vit K (necessary for production of clotting factors II, VII, IX & X)
- Thrombin formation depressed
- Potentiated by
- Vit K deficiency
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**Presentation/CS**
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- Anemia
- Hypoproteinemia

**Treatment**
- Vit. K1 SQ every 6 hours until PT normal
- Not K3
- Fresh plasma
- Whole blood transfusion

---

**Blister Beetle toxicity**

**Condition**
- Mk 1643, IM 1895; C3T 413; BR-hb 820; BR 1610; Tox 437
- Rare in cattle; Horses >>> sheep & cattle
- Blister beetle (Epicaura spp), Swam in alfalfa during harvest, In bailed hay, 4 g of dried beetles m/b lethal, Storage of hay or pellets doesn't reduced toxicity, Southwest
- Cantharidin: potent irritant, Contact damage, vesiculo (blister) formation of mucous surfaces of GI, kidneys, Produces nephritis, cystitis, hyperemia & ulceration of GI mucosa
- CS: Endotoxin shock, Renal failure (renal tubular damage), Hematuria, Found dead pasture, Colic, Depression, Salivation, Diarrhea (melena), Dyspnea, Skin (see vesicles), Stiff gaited
- Dx: Hx (alfalfa), CS, Find beating in alfalfa, Cantharidin in urine or stomach (chromatography), Hypocalcemia, Leukocytosis, Incr. PCV & TP (hemocoagulation), BUN & creatinine
- Tx: No specific antidote, Shock Tx (IV fluids), Tx hypocalcemia, Mineral oil & activated charcoal, Diuretics m/b, Analgesics for abd. pain (xylazine), ABs controversial

**Facts/Cause**
- Rare in cattle; Horses >>> sheep & cattle
- Blister beetle (Epicaura spp), Swam in alfalfa during harvest, In bailed hay, 4 g of dried beetles m/b lethal, Storage of hay or pellets doesn't reduced toxicity, Southwest
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- Hematoma formation
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**Diagnosis**
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- Prolonged PT (later also ↑ APTT)
- No other abnormalities of clotting profile (norm. platelet count, plasma fibrinogen)
- Anemia
- Hypoproteinemia

**Treatment**
- Vit. K1 SQ every 6 hours until PT normal
- Not K3
- Fresh plasma
- Whole blood transfusion

---

**Anticoagulant - Inhibits Vit. K**

**CS: Bleeding**

**Dx: CS, Hx, Prolonged PT, Anemia**

**Tx: Vit. K1**

**Facts/Cause**
- Rare in cattle; Horses >>> sheep & cattle
- Blister beetle (Epicaura spp), Swam in alfalfa during harvest, In bailed hay, 4 g of dried beetles m/b lethal, Storage of hay or pellets doesn't reduced toxicity, Southwest
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- Anemia
- Hypoproteinemia

**Treatment**
- Vit. K1 SQ every 6 hours until PT normal
- Not K3
- Fresh plasma
- Whole blood transfusion

**Prognosis:**
- Good if early Dx & prompt adm. Vit. K1

**Prevention:**
- Limit access to rodenticides
- Careful monitoring of Warfarin Tx

---

**DDx:**
- DIC (thrombocytopenia) (p 85)
Venomous snake bites

- Rattlesnakes usually - Bites from copperheads & water moccasins usually innocuous to livestock
- Only in warm season, not winter
- Pit vipers
  - Copperhead (Agkistrodon)
  - Cottonmouth (Agkistrodon piscivorus)
  - Rattlesnake (Crotalus)
    - Mojave green rattlesnake (C. scutulatus)
    - Massasauga or pygmy rattlesnake (Sistrurus)
- Elapines
  - Eastern or Texas coral snakes (Micrurus)
  - Arizona or Sonoran coral snake (Micruroides)
- Toxic principle
  - Coral snakes: neurotoxic - resp. paralysis
  - Pit vipers: hemotoxic, necrotizing & anticoagulant (some neurotoxin)
- Identification
  - Pit vipers - pit organ on each side of eye
  - Rattlesnakes - rattle; broad, flat head
  - Coral snakes - bands of yellow, red & black (Yellow bands in contact w/ red bands), short fangs
  - "Pseudo" coral snakes - black bands bordering yellow bands on both sides
- Rarely fatal in adult equid or bovid

- Teeth marks usually not found
- Marked edema & erythema at site
- Skin discoloration common w/ rattlesnakes. infreq. w/ copperheads
- Necrosis
- Intense pain
- Muzzle bites
  - Swollen nasal passages
  - Dyspnea
  - Local tissue necrosis
  - Cardiac, neurologic & resp.
  - CS rare, except w/ Mojave green rattlesnake
    - Paralysis, convulsions & death
  - Coral snakes
    - Pain & swelling minimal
    - Systemic neurologic signs predominate
  - CS delay of hours for coral snakes

- History
- CS (bite wounds)

- Rattlesnakes (Pit viper), Coral (Elapines) CS:
  - Red, edematous nose
  - Dx: Hx, CS
  - Tx: Penicillin, Tetanus, NSAIDs

"Red on Yellow - Kill a Fellow"

- Penicillin
- Tetanus antitoxin
- NSAIDs for pain & edema, not early aggravate possible thrombocytopenia
- Immediate cool hydrotherapy (minimize edema)
- Warm hydrotherapy (once edema formed to remove fluid)
- Thorough cleaning, disinfection & irrigation
- Antivenin (Micrurus) win 2 hour of bite
  - Rarely warranted except in calves & usually to late to do any good
  - Administer if see bite by large diamond back rattlesnake IV
  - Have epinephrine for anaphylactic shock ready
  - Tracheostomy if dyspnea from swollen nose

DDx:
- Abscesses
- Spider bites
- Clostridial cellulitis
- Allergic reaction to insect bites or stings
### Fluorosis

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluoride, Fluorosis</td>
<td>Mk 1651; C3T 398; C2T 454; 1M 1309, 1905; Br 621; Tox 221; L 412</td>
<td>• 1st dairy cattle (most sensitive)</td>
<td>• Acute/rare (large accidental ingestion)</td>
<td>• No specific Tx</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Chronic fluoride =&gt; fluorosis</td>
<td>- Decreased cell resp. by enzyme inhibition</td>
<td>- Remove animals from source</td>
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<tr>
<td></td>
<td></td>
<td>- Horses, sheep &amp; swine; all susceptible</td>
<td>- Resp/cardiac failure</td>
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<td>- Source</td>
<td>- CNS/clinical convulsions (excitement, weakness, depression)</td>
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<td></td>
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<td>- Industry related (Fe &amp; Al smelters &amp; fertilizer plants)</td>
<td>- GI diarrhea/vomit (nausea, wt. loss, salivation) severe gastroenteritis</td>
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<td>- Contamination of pasture water</td>
<td>- Urinary incontinence</td>
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<td>- Soil (acid), legumes, plants (esp. leaves), grains</td>
<td>- Decr. milk production</td>
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<td>- &lt; roughage, rock phosphates</td>
<td>- Death</td>
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<td></td>
<td></td>
<td>- Mineral mix overdose</td>
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<td>- Rodenticides</td>
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<td>- Accumulates if increasing or constant amounts ingested</td>
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<td>- Slowly eliminated from body</td>
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<td>- Stored in bone &amp; teeth (calcified tissue)</td>
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<td>- Effects formation &amp; remodeling of bone</td>
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<td>- Young most susceptible due to developing bone &amp; teeth</td>
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<tr>
<td>Dairy, Contaminated pastures, Accumulates</td>
<td>CS: Acute (rare) - Resp., Cardiovascular</td>
<td>• Chronic/Teeth &amp; bone</td>
<td>• History (exposure)</td>
<td>• Oral aluminum sulfate, Ca, Fe, Mg reduce bone fluoride</td>
</tr>
<tr>
<td>Chronic - Bone, Teeth</td>
<td></td>
<td>- Exostosis, sclerosis &amp; osteoporosis</td>
<td>• CS (teeth, bone, lameness)</td>
<td>- Supplement w/ phosphorus to avoid osteoporosis &amp; fractures</td>
</tr>
<tr>
<td>Dx: Hx, CS, Lab</td>
<td>• Tx: No specific Tx</td>
<td>- 1st on med. side of prox. metatarsal bones then mandible, metacarpals &amp; ribs</td>
<td>• Lab analysis for fluoride</td>
<td>- Balance high fluoride water w/ low fluoride</td>
</tr>
<tr>
<td>Px: Irreversible dental lesions, Prevention key</td>
<td></td>
<td>- Spurring &amp; bridging of joints</td>
<td>- Feed &amp; water (&gt; 30 - 40 ppm dairy)</td>
<td>- Grains &lt;= roughages</td>
</tr>
<tr>
<td>Levamisole</td>
<td>Br 618</td>
<td>• Anthelmintic against lung worms &amp; GI worms (not effective against arrested Ostertagia)</td>
<td>DDX: • Any skeletal problem</td>
<td></td>
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<tr>
<td>**</td>
<td></td>
<td>• Pour-on, oral drench, feed, injectable &amp; sustained release bolus</td>
<td>• Neoplastic</td>
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<td>• Nonteratogenic so safe for use in pregnant cows</td>
<td>• Degenerative arthritis</td>
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<tr>
<td></td>
<td></td>
<td>• Therapeutic index is low compared to other anthelmintics, nicotinic effect</td>
<td>• Nutritional</td>
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<tr>
<td></td>
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<td>• CS of toxicity: Frisky for a few minutes, salivation, bradycardia, muscular</td>
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<tr>
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<td>tremors, death from resp. failure; Inflammation at injection site</td>
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<tr>
<td>Formaldehyde;</td>
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<td>• Used in foot baths, poisonings assoc. w/ inadequate drinking water</td>
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<tr>
<td>Formalin</td>
<td>BR-hb 585; BR 1528; Br 614</td>
<td>• CS of toxicity: Mild (salivation, inflammation of buccal mucosa), Severe</td>
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<td>(dullness, abdominal pain, weak pulse, coma, death)</td>
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<td>• Tx: Symptomatic therapy; do not leave cattle unattended near source</td>
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<tr>
<td><strong>Carbon tetrachloride</strong></td>
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<tr>
<td>C2T 860; BR-hb 573; BR 1507</td>
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<tr>
<td><strong>Fluke treatment</strong></td>
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<tr>
<td>Volatile, colorless liquid</td>
<td></td>
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<tr>
<td>Mechanism of toxicity</td>
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<tr>
<td>Alters selective permeability of membranes, allowing escape of coenzymes</td>
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<tr>
<td><strong>Commonly acute</strong></td>
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</tr>
<tr>
<td>Anorexia, depression, drowsiness</td>
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<tr>
<td>Staggering, incoordination</td>
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<tr>
<td>Bloody feces</td>
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<tr>
<td>Constipation followed by diarrhea</td>
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<tr>
<td>Cardiovascular collapse, fibrillation</td>
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<tr>
<td>Death within 24 hrs</td>
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<tr>
<td><strong>History (defluking)</strong></td>
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</tr>
<tr>
<td>CS (CNS &amp; GI)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Similar to ammonium toxicity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oral activated charcoal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saline purgative</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IV calcium borogluconate (1 ml/kg 23% sol)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5-10% dextrose</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B vitamins</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Charcoal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vit B</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Hexachlorophene</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>C2T 861; BR-hb 573; BR 1509</td>
</tr>
<tr>
<td>*</td>
</tr>
<tr>
<td><strong>Phenol</strong></td>
</tr>
<tr>
<td>Antitrematodal drug (flukes), disinfectant, soil &amp; plant fungicide</td>
</tr>
<tr>
<td>Mechanism: uncouples oxidative phosphorylation, inhibits resp. enzymes, damages cell membranes</td>
</tr>
<tr>
<td><strong>Fever</strong></td>
</tr>
<tr>
<td>Depression or hyperexcitability</td>
</tr>
<tr>
<td>Muscle tremors</td>
</tr>
<tr>
<td>Tetanic spasms, convulsions</td>
</tr>
<tr>
<td>Sudden resp. failure - death</td>
</tr>
<tr>
<td><strong>History (exposure)</strong></td>
</tr>
<tr>
<td>Any level of CCl4 suspicious in feces, stomach, blood or tissue</td>
</tr>
<tr>
<td>Oral poisoning: oral activated charcoal &amp; saline cathartics</td>
</tr>
<tr>
<td>Dermal: Wash with soap &amp; water</td>
</tr>
<tr>
<td>Cold water sprays &amp; enemas to control fever</td>
</tr>
<tr>
<td>Phenobarbital to control convulsions</td>
</tr>
<tr>
<td>Volume diuresis w/ IV fluids to speed elimination</td>
</tr>
<tr>
<td>Charcoal</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Aminoglycoside toxicity</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>C2T 16; C3T 818</td>
</tr>
<tr>
<td><strong>Aminoglycoside</strong></td>
</tr>
<tr>
<td><strong>Broad spectrum ABs used mainly against gram negative bacteria</strong></td>
</tr>
<tr>
<td><strong>Nephrotoxicity</strong> is major concern</td>
</tr>
<tr>
<td>Related to dose &amp; duration of Tx (&gt; 7 ds)</td>
</tr>
<tr>
<td><strong>Predisposing factors</strong></td>
</tr>
<tr>
<td>- Dehydration &amp; hypovolemia</td>
</tr>
<tr>
<td>- Renal insufficiency</td>
</tr>
<tr>
<td>- Metabolic acidosis</td>
</tr>
<tr>
<td>- Concurrent furosemide (Lasix®) Tx</td>
</tr>
<tr>
<td>- Severe sepsis or endotoxemia</td>
</tr>
<tr>
<td>Ototoxicity rarely seen in food animals</td>
</tr>
<tr>
<td><strong>Nonoliguric renal failure</strong></td>
</tr>
<tr>
<td><strong>Proteinuria</strong></td>
</tr>
<tr>
<td>Sediment changes due to tubular injury</td>
</tr>
<tr>
<td><strong>History (nitrofurazone Tx)</strong></td>
</tr>
<tr>
<td>CS (CNS)</td>
</tr>
<tr>
<td>Stop administration</td>
</tr>
<tr>
<td>Treat renal failure</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Nitrofurans, Furazolidone, Nitrofurazone</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>C2T 860; Br 224, 614; Tcx 334</td>
</tr>
<tr>
<td><strong>Nitrofurazone</strong></td>
</tr>
<tr>
<td>Synthetic broad spectrum ABs</td>
</tr>
<tr>
<td>Illegal for use in cattle in USA</td>
</tr>
<tr>
<td>- Still sometimes used in calves w/ diarrhea (nitrofurazone)</td>
</tr>
<tr>
<td><strong>Anorexia</strong></td>
</tr>
<tr>
<td>Hyperexcitability</td>
</tr>
<tr>
<td>Intermittent convulsions</td>
</tr>
<tr>
<td>Weakness, total paralysis &amp; death</td>
</tr>
<tr>
<td>Tremors, circling</td>
</tr>
<tr>
<td><strong>History (nitrofurazone Tx)</strong></td>
</tr>
<tr>
<td>CS (CNS)</td>
</tr>
<tr>
<td>Stop Tx</td>
</tr>
<tr>
<td>Acepromazine</td>
</tr>
<tr>
<td>Polioencephalomalacia (p 140)</td>
</tr>
<tr>
<td>Nervous coccidiosis (p 150)</td>
</tr>
<tr>
<td>Vit A defc (p 142)</td>
</tr>
<tr>
<td>Meningitis (p 151)</td>
</tr>
<tr>
<td>Brain abscess (p 140)</td>
</tr>
</tbody>
</table>

DDx:
- Enterotoxemia (p 250)
- Enteric/toxemic colibacillosis (p 18)
- Lead or mercury toxicity (p 152)
- Water deprivation (p 205)
- OPs (p 206)
Poisonous Plants

Generally not palatable, Overgrazing, Contaminated hay
CS: Confusing, Similar signs for different plants
Dx: CS, Hx of ingestion, ID plants
Tx: Prevention, Symptomatic (few antidotes)
Prevention: Don't overgraze, Supplement feeds

### Poisonous substances
- Poisonous substances themselves to livestock (alkaloids & oxalates)
- Harmless substances transformed by decomposition or ingestion (nontoxic amygdalin in choke cherries changed to toxic prussic acid)
- Substances absorbed from soil into plant (milkvetch accumulates selenium)
- Substances making animal hypersensitive (St. John's wort causes photosensitization)
- Miscellaneous substances (toxic metals: fluoride, arsenic)

### Toxicity of plants
- Palatability (influences how much eaten, herbicide or fertilizers/make more palatable)
- Available nonpoisonous forage: will eat instead of nonpalatable toxic plants usually
- Stage of development: usually more toxic when immature, some when mature
- Drought or freezing (stress) commonly incr. toxicity
- Soil (e.g., some toxic on selenium soil, but good on other soils)
- Moisture contents: drying m/incr., decr. or leave toxicity the same
- Parts of plants: some more toxic than others (seeds, leaves, stems or roots)
- Toxic substances
  - Some lethal in small amounts, others require large amounts
  - Some accumulate in animal while others don't

### Animal factors
- Species: some toxic to certain species, others toxic to all
- Young usually more susceptible than adults
- White animals - photosensitization
- Variability of susceptibility of individual animals
- Stressed animals more susceptible (temperature, exertion)
- Fasted animals more susceptible
- Horses are more selective grazers than cattle (indiscriminate eaters)

### Management factors
- Overgrazing most common cause of poisonings, have to eat poisonous plants
- Turning hungry animals into new pasture, eat first thing they see
- Early turn out onto range, toxic plants often 1st to "green up" (low larkspur, lupine, death camas)
- Crowding animals, let spread out
- Driving hungry animals quickly
- Inadequate nutrients
- Feeding contaminated hay
- Grazing during dangerous seasons
- Spraying or fertilizing pasture m/↑ palatability of toxic plants
- Grazing snow covered fields, taller toxic plants m/b only available feed (tall larkspur or lupine)

### Facts
- Rule of thumb: poisonous plants usually not palatable
  - Usually eat only when nothing else (drought, early spring)
  - When mixed w/ hay or grain
- Economics
  - W. USA 3-5% annual deaths for cattle, horses & sheep
  - Poor weight gain & poor reproduction
- Variables
  - Plants vary in toxicity
  - Animals affected (some OK for cattle & horses, but kill sheep)
  - Conditions of poisonings:
    - Some nutritious, except during certain seasons when they are poisonous
    - Some nutritious unless only thing eaten (choke cherry)

### Miscellaneous
- Poisonous to livestock (alkaloids & oxalates)
- Harmless substances transformed by decomposition or ingestion (nontoxic amygdalin in choke cherries changed to toxic prussic acid)
### Treatment - poisonous plants
- Tx less satisfactory then for chemical poisonings
- Therefore prevention is key to control
- Usually symptomatic bec. few antidotes
- Absorbents - activated charcoal
- Astringents (bismuth subnitrate) constrict intestinal capillaries (prevent further absorption)
- Stimulate elimination
  - Stomach pump
  - Emetics
  - Purgatives
  - Diuretics
- Treat symptoms
  - Cramps & convulsions - sedative & depressants
  - Depression & paralysis - stimulants

### Diagnosis of poisonous plants
- Requires more than just identification of plant, need proof of ingestion also
- Suspected plant poisonings:
  - Sudden onset of illness w/ no apparent cause (after turned out into new pasture)
- ID plant:
  - Check pasture, especially fence rows, ditches & springs for poisonous plants
  - Check GI for plant material in those that die
  - Collect plants & send to local county agent for ID
  - Press & dry between 2 pieces of paper
  - Send between 2 pieces of stiff cardboard
- Detailed record of events
  - If alive: observe & record CS

### Prevention key to controlling
- **DON'T OVERGRAZE**
- Remove plants:
  - Remove animal from pasture during poisonous season for certain plants
  - Put on range when sufficient growth of desirable forage
  - Spread out herd & slowly move so they can be selective
  - Drive animals slowly w/ full stomachs & bed down in safe areas
- **Supplement forage** or extra hay during poisonous seasons (prefer over nonpalatable poisonous plants)
- Mineral supplements, mineral deficiencies m/ stimulate to eat poisonous plants (e.g., high nitrates have salty taste)
- Check hay for too many weeds (e.g., oleander)
- **No hungry animals into new pastures**, will eat anything
  - Don't throw lawn clippings where animals can eat (e.g., oleander)
  - Salt & phosphorus blocks (supplement & spread livestock out)
- Adequate water supply
- Keep off sprayed or fertilized land for 2 weeks
- Feed supplements when snow covers all forage except tall toxic plants
- Supplement during drought or reduce numbers
- Fence uncontrollable areas

### Clinical signs m/b confusing
- Similar signs for different plants
- Incomplete or nontypical CS of poisonings by usually nontoxic plants
<table>
<thead>
<tr>
<th>Plant</th>
<th>Proper name</th>
<th>System</th>
<th>Value</th>
<th>Toxin</th>
<th>Season</th>
<th>Loc.</th>
<th>Habitat</th>
<th>Species</th>
<th>Fact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arrowgrass</td>
<td>Triglochin</td>
<td>Blood</td>
<td>Hi</td>
<td>Glycoside</td>
<td>Sp</td>
<td>W</td>
<td>Wet areas</td>
<td>Ox/Shp/all</td>
<td>HCN - bright red blood</td>
</tr>
<tr>
<td>Astragalus</td>
<td>Astragalus</td>
<td>NS</td>
<td>Hi</td>
<td>Se</td>
<td>Sp/S/Fall</td>
<td>W/NW</td>
<td>Valley/mts</td>
<td>Ox/All</td>
<td>Locoweed</td>
</tr>
<tr>
<td>Bermuda grass</td>
<td>Cynodon</td>
<td>NS</td>
<td>Hi</td>
<td></td>
<td></td>
<td>SW</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black locust</td>
<td>Robinia</td>
<td>Low</td>
<td>Glycoside</td>
<td>Any</td>
<td>MW/E</td>
<td>Cultivated</td>
<td>Ox/All</td>
<td>Bone marrow depression</td>
<td></td>
</tr>
<tr>
<td>Bracken fern</td>
<td>Pteridium</td>
<td>Blood</td>
<td>Hi</td>
<td>?</td>
<td>Sum/Fall</td>
<td>All</td>
<td>Mts</td>
<td>Ox/Eq (CNS)/All</td>
<td>Abortions, Weak calves, RP</td>
</tr>
<tr>
<td>Broomweed</td>
<td>Gutierrezia</td>
<td>Repro</td>
<td>Hi</td>
<td>Sp</td>
<td>SW</td>
<td></td>
<td></td>
<td>Ox</td>
<td></td>
</tr>
<tr>
<td>Chokecherry</td>
<td>Prunus</td>
<td>Blood</td>
<td>Hi</td>
<td>Glycoside</td>
<td>Sp/Sum</td>
<td>W/MW/E</td>
<td>Valley/Fthl/Mts</td>
<td>Ox/Sheep/All</td>
<td>HCN gas released</td>
</tr>
<tr>
<td>Cockleburr</td>
<td>Xanthium</td>
<td>GI/NS</td>
<td>Mod</td>
<td>Other?</td>
<td>Sp/Sum</td>
<td>MW/E</td>
<td>Waste/cultiv</td>
<td>All</td>
<td>Two leaf stage (toxic)</td>
</tr>
<tr>
<td>Death camus</td>
<td>Zygadenus</td>
<td>NS</td>
<td>Mod</td>
<td>Alkaloid</td>
<td>Sp</td>
<td>W</td>
<td>Valley to Mts</td>
<td>Sheep/All</td>
<td>Onion-like</td>
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<tr>
<td>Dock</td>
<td>Rumex</td>
<td>Renal</td>
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<td>Oxalate</td>
<td></td>
<td>All</td>
<td>Waste/cultiv</td>
<td>Sheep</td>
<td>Hypocalcemia</td>
</tr>
<tr>
<td>Dogbane</td>
<td>Apocynum</td>
<td>Renal</td>
<td>Low</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elderberry</td>
<td>Sambucus</td>
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<td>Low</td>
<td>Glycoside</td>
<td></td>
<td>MW/E</td>
<td>Valley/Mt</td>
<td>?</td>
<td>HCN</td>
</tr>
<tr>
<td>Ergot</td>
<td>Claviceps</td>
<td>NS</td>
<td>Hi</td>
<td></td>
<td></td>
<td>SW</td>
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<tr>
<td>Fiddleneck</td>
<td>Amsinkia</td>
<td>Liver</td>
<td>Hi</td>
<td>Alkaloid</td>
<td></td>
<td>W/All</td>
<td></td>
<td></td>
<td>Hypocalcemia</td>
</tr>
<tr>
<td>Greasewood</td>
<td>Sarcobatus</td>
<td>Hi</td>
<td>Oxalate</td>
<td></td>
<td>Sp</td>
<td>W</td>
<td>Valley/Plains</td>
<td>Ox/Sheep</td>
<td>Hypocalcemia</td>
</tr>
<tr>
<td>Groundsels</td>
<td>Senecio</td>
<td>Low</td>
<td>Alkaloids</td>
<td>Sp/Sum</td>
<td>All</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Halogeton</td>
<td>Halogeton</td>
<td>Kidney</td>
<td>Hi</td>
<td>Oxalate</td>
<td>Fall/wint</td>
<td>W</td>
<td>Waste</td>
<td>Sheep/Ox</td>
<td>Hypocalcemia</td>
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<td>Jimsonweed</td>
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<td>Alkaloid</td>
<td>?</td>
<td>MW/E</td>
<td>Waste areas</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Larkspur</td>
<td>Delphinium</td>
<td>Gen</td>
<td>Hi</td>
<td>Alkaloid</td>
<td>Sp</td>
<td>W</td>
<td>Low; Hi (Mts)</td>
<td>Ox/All</td>
<td>#1 cattle poisoning in W CNS</td>
</tr>
<tr>
<td>Locoweeds</td>
<td>Astragalus</td>
<td>NS</td>
<td>Hi</td>
<td>Se</td>
<td>Sp/S/Fall</td>
<td>SW/W</td>
<td>Valley/Mts</td>
<td>Ox/Eq/All</td>
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<td></td>
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<td>NS</td>
<td>Hi</td>
<td>Se</td>
<td>Sp/S/Fall</td>
<td>SW/W</td>
<td>Foothills/Mts</td>
<td>Eq/All</td>
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<tr>
<td>Lupine</td>
<td>Lupinus</td>
<td>NS/Rep</td>
<td>Hi</td>
<td>Alkaloid</td>
<td>Fall</td>
<td>W</td>
<td>Valley/P/FHill/Mt</td>
<td>Ox/Shep/All</td>
<td>&quot;Crooked calf&quot;</td>
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<tr>
<td>Milkvetch</td>
<td>Astragalus</td>
<td>Hi</td>
<td>Se</td>
<td></td>
<td>Fall</td>
<td>W</td>
<td>Foothills/Mts</td>
<td>Ox/All</td>
<td>&quot;Blind staggerings&quot;</td>
</tr>
<tr>
<td>Plant</td>
<td>Scientific Name</td>
<td>Ailments</td>
<td>Season</td>
<td>Alkaloid/Glycoside</td>
<td>Oxalate</td>
<td>Nitrate</td>
<td>Tannin</td>
<td>Alkaloids</td>
<td>Sp/Sum</td>
</tr>
<tr>
<td>---------------------------</td>
<td>-----------------</td>
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<td>--------</td>
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<tr>
<td>Milkweed</td>
<td>Asclepias</td>
<td>Card/Vas/Hi Alkal/Glyco</td>
<td>Sp/Sum</td>
<td>SW</td>
<td>Valley/Plains</td>
<td>Sheep/All</td>
<td></td>
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<td>Nightshades</td>
<td>Solanum</td>
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<td>Hi</td>
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<td>All</td>
<td>SW</td>
<td></td>
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<tr>
<td>Oak</td>
<td>Quercus</td>
<td>Renal/Hi Tannin</td>
<td>Sp/Fall</td>
<td>All</td>
<td></td>
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</tr>
<tr>
<td>Oleander</td>
<td>Nerium oleander</td>
<td>Card/Gl Mod Glycoside</td>
<td>All</td>
<td>W/S</td>
<td>Ornamental</td>
<td></td>
<td>Cattle/All</td>
<td></td>
<td></td>
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<tr>
<td>Pigweed</td>
<td>Amaranthus</td>
<td>Ren/Hep Low Oxalate</td>
<td>W/MW</td>
<td>W</td>
<td>Ox</td>
<td>Ox/All</td>
<td>Ox</td>
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<td>Ox/All</td>
</tr>
<tr>
<td>Poison hemlock</td>
<td>Conium</td>
<td>CNS Hi Alkaloid</td>
<td>Sp</td>
<td>W/MW/E</td>
<td>Waste/Valley</td>
<td></td>
<td>Cattle/All</td>
<td>Ox/All</td>
<td></td>
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<tr>
<td>Ponderosa pine</td>
<td>Pinus</td>
<td>Repro Hi ?</td>
<td>Sp/Fall/Win</td>
<td>W</td>
<td>Plains/Mts</td>
<td>Ox</td>
<td>Ox/All</td>
<td>Ox</td>
<td></td>
</tr>
<tr>
<td>Princes' plume</td>
<td>Stanlea</td>
<td>CNS/MS Mod Se</td>
<td>?</td>
<td>W</td>
<td>Valley/Plains</td>
<td></td>
<td>Cattle/All</td>
<td>Ox/All</td>
<td></td>
</tr>
<tr>
<td>Ragwort</td>
<td>Senecio</td>
<td>Hepatic Hi Alkaloid Sp/hay</td>
<td>SW</td>
<td>All</td>
<td>Cultivated</td>
<td>All</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Rattlebox</td>
<td>Sesbasnia</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Rhododendron</td>
<td>Rhododendronan</td>
<td>GI, CNS Low Oxalate</td>
<td>Any</td>
<td>SW/MW/E Valley to Mts</td>
<td>Ox/Eq/All</td>
<td>Ox/All</td>
<td>Ox</td>
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<td>Ox/All</td>
</tr>
<tr>
<td>Rhubarb</td>
<td>Rheum</td>
<td>Renal Mod Oxalate</td>
<td>?</td>
<td>SW/MW/E</td>
<td>Waste areas</td>
<td>Ox/All</td>
<td>Ox/All</td>
<td>Ox</td>
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</tr>
<tr>
<td>Senecio</td>
<td>Senecio</td>
<td>Liver/NS Little Alkaloid</td>
<td>Sp/Sum</td>
<td>MW/E</td>
<td>Waste areas</td>
<td>Ox/All</td>
<td>Ox/All</td>
<td>Ox</td>
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</tr>
<tr>
<td>Sneezeweed</td>
<td>Helenium</td>
<td>Blood Low Glycoside</td>
<td>Wet areas</td>
<td>W/MW/E</td>
<td>Grasses</td>
<td>Ox/All</td>
<td>Ox/All</td>
<td>Ox</td>
<td></td>
</tr>
<tr>
<td>Sweet clover</td>
<td>Melilotus</td>
<td>Blood Low Dicoumerol</td>
<td>Wint. (hay)</td>
<td>ME/E</td>
<td>Waste/cultivar</td>
<td>Ox</td>
<td>Ox/All</td>
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<tr>
<td>Sorghums</td>
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<td>Blood Low Glycoside</td>
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<td>W/MW/E</td>
<td>Wet</td>
<td>Ox/All</td>
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<td>Tall fescue</td>
<td>Festuca</td>
<td>Blood Low Nitrate</td>
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<td>Cultiv/Wet</td>
<td>Ox</td>
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<td>Tobacco</td>
<td>Nicotiana</td>
<td>CNS Low Alkaloid</td>
<td>?</td>
<td></td>
<td>Spring</td>
<td>Ox/All</td>
<td>Ox/All</td>
<td>Ox</td>
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<td>Water hemlock</td>
<td>Cicuta</td>
<td>CNS Mod ?</td>
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<td>Spring</td>
<td>Ox/All</td>
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<td>Yew</td>
<td>Taxus</td>
<td>Card/NS/Gl Low Alkaloid</td>
<td>Spring</td>
<td></td>
<td>Ornamental</td>
<td></td>
<td>Cattle/All</td>
<td>Ox/All</td>
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</tbody>
</table>
### Plant Accumulators

**Cyanide (HCN), Hydrocyanic acid, Prussic acid**  
Mk 1647; IM 1882; CST 367, 344, 347; 365, 393; CIT 456; BR-ht 588; BR 1533; BR 613; DC 506; Tox 400; N-L 100

#### Facts/Cause
- **Cyanogenic glycosides**  
  - Hydrocyanic acid (prussic acid, HCN gas) released on hydrolysis
- **Very rapid-acting poisons**
- **Susceptibility**: cattle > sheep/goats > equine > swine
- **Sources**
  - Plants (see box)
  - Many plants safe low levels usually (Johnson, Sudan grasses, Sorghum)
  - Damage (wilted, trampled, drought) cause glycoside to change to HCN
  - Leaves &/or seeds >> fruit or stem
  - Immature, rapidly growing
  - Fresh >> hay
  - Rodenticides
  - Industry (metal cleaning, electroplating)
- **Not cumulative** (must eat a lot in hr/hrs)
- **Mechanism of action:**
  - **Cellular hypoxia** (cytotoxic anoxia)
  - Binds iron (Fe) & stops cellular respiration (stops electron transport, binds w/ cytochrome oxidase)
  - Hemoglobin can't release oxygen (bright red blood)
  - Result: ↓O2 at tissue level & ↓ATP

#### Presentation/CS
- **Found dead** (rapid action w/in min.)
  - CS in rapid succession
  - Excitement & muscle tremors
  - Dyspnea, salivation, lacrimation, voiding of feces & urination
  - Stagger & go down, gasp for breath
  - Clonic convulsions m/t due to anoxia
  - Dilated pupils
  - Bright red mucous membranes
  - Survival over 2 hrs usually recover

#### Diagnosis
- **Hx (exposure), CS**
  - Clots slowly or not at all
  - Red mucous membranes then cyanotic after respiration stops
  - **Bitter almond** odor - GI
  - GI, lung hemorrhage
  - "Picrate paper" test
    - Filter paper wettet w/ NaHC03 & picric acid in 100 ml of H20
    - Crush leaves or rumen contents in picric, cork tube & heat
    - Brick red color in minutes indicates HCN
- **Lab**
  - Preserve specimens for lab:
    - Quick freezing, or
    - 1-3% mercuric chloride (HgCl2)
  - Urea poisoning (ammonia smell & CNS CS)
  - OPs/Carbamate

#### Treatment
- **Na nitrate + Na thiosulfate IV**
  - 10 ml 20% Na nitrite + 30 ml 20% Na thiosulfate IV to 1000# animal
  - Na nitrate breaks HCN bonds forming cyanmethemoglobin
  - Na thiosulfate IV (HCN to thiocyanate & excretion)
- **Methylene blue IV**

#### Prevention:
- Keep hungry ruminants away from sorghum plants less than 2’ tall or damaged
- Keep away from chokecherry clippings

#### Plants
- Pyrus malus
- Triglochin maritima
- Lotus corniculatus
- *Prunus* spp.
- Zea mays
- *Sambucus canadensis*
- *Linum* spp.
- *Hydrangea* spp.
- Phaseolus lunatus
- *Sorghum* spp.
- *Hoezus lunatus*
- Vicia sativa
- *Trifolium repens*

#### Bound hemoglobin - Hypoxia
CS: Resp. distress - Rapid death
Dx: Bright red blood, Almond odor, > 200 ppm
Tx: Na Nitrate, Na thiosulfate

#### POISONOUS PLANTS

### Cyanide plants
- **Apple**
- **Arrow grass**
- **Birdsfoot trefoil**
- **Cherries, choke cherries, apricot, peach**
- **Corn, maize**
- **Elderberry**
- **Flax**
- **Hydrangea**
- **Lima bean**
- Poison suckleya
- **Sorphan grass, Johnson grass**
- **Vetch seed**
- **White clover**
**Arrowgrass, Triglochin**  
Mk 1647; Tox 455; PP/Mt 11; PP/USA/C 26, 501  
- *Triglochin maritima & T. palustris*  
- Toxic principle: hydrocyanic acid  
- **Description**  
  - Grasslike plant, 1-3' tall  
  - Leaves: basal, 6-18” long, slightly fleshy  
  - Flowers: small, bunched along upper stem  
- Sheep & cattle, all susceptible  
- Poisoning: in hay or in Spring drought w/ little other forage  
- Thiocyanates (1-5-vinyl-2-thiooxazolidone glycoside), plant goitrogens  
- Goitrogenic plants or excess iodine (kelp) eaten by pregnant animal  
- Hyperplastic goiter  
  - Neonates, most common thyroid disorder in horses & small ruminants  
  - Inhibit thyroid hormone production (constant TSH stimulation of pituitary)  
- Goiter - enlarged thyroid (m/not be present)  
  - Hypothyroidism  
  - Incoordination  
  - Poor suckle response  
  - Poor righting reflex  
  - Hypothermia (lower metabolic rate)  
  - Tendon contracture &/or rupture  
  - Retarded bone development  
  - Young born normal then skeletal lesions, esp. tarsus, in weeks  

**Chokecherry**  
Mk 1647; Tox 455; PP/Mt 44  
- *Prunus virginiana*  
- Cattle & sheep, all susceptible  
- Toxic principle: hydrocyanic or prussic acid  
- Poisoning: good forage usu., poisons in early spring when other vegetation scarce, must consume a lot quickly (not cumulative), end of summer not poisonous, fruit OK, but pits poisonous  
- **Description:**  
  - Large shrub or tree  
  - Leaves: dark green, 2-4” long oval w/ pointed tip, saw-toothed margins  
  - Flowers: small, yellow-white, dense clusters  
  - Fruit: dark red to black (3/8”)  

**Thiocyanates (SCN), Goiter**  
Mk 283; C3T 297; IM 11451, 1303;  
B&R 1174, Tox 58, 378  
- Thiocyanates (1-5-vinyl-2-thiooxazolidone glycoside), plant goitrogens  
- Goitrogenic plants or excess iodine (kelp) eaten by pregnant animal  
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  - Neonates, most common thyroid disorder in horses & small ruminants  
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  - Tendon contracture &/or rupture  
  - Retarded bone development  
  - Young born normal then skeletal lesions, esp. tarsus, in weeks  

**Thyroid stimulating hormone response test**  
- 1 d-old 5 IU of TSH IV  
- Peak of T3 w/in 1-3 hrs if normal  
- Thyroid hormone supplementation (iodine)  
  - If hormone level low  
  - No way to reverse developmental lesions  

**Plants w/ goitrogenic compounds Mustard family (Cruciferae)**  
- *Brassica spp*  
  - Rape seed, Mustard, Kale, Broccoli, Cabbage & Turnip  
- *Glycine max*  
  - Soybean  
- *Linum usitatissimum*  
  - Flax
## Oxalate

### Condition
- Oxalate
- Mk 1709, IM 1885; Tox 387; C1T 364; C1T 438; BR-hb 590; BR 1539; Br 615; DC 508t; PP-US/C 33, 235, 241; PP/Mt 24)

### Facts/Cause
- **Oxalic acid** (HOOC-COOH)
- Unpalatable
- **1° Cattle**, sheep occasionally eat
  - West USA (greasewood & halogeton)
- **Source**
  - Plants, palatable to livestock
  - Leaves > seeds > stem
  - Alkaline deserts (Idaho, Nev, & Utah)
  - Greasewood (N. Dak. to Tex. to Cal.)
  - Fungi (Aspergillus & Penicillium) produce oxalates on plants
  - Household & industrial products (rust removers, bleaches & tanning cmpds)
  - **Ethylene glycol**
- **Pathophysiology**
  - Toxic principle: combines with ionic Ca => insoluble precipitates
  - **Hypocalcemia** - tetany
  - Crystallize in vessels => vascular necrosis & hemorrhage & edema
  - **Renal tubule blockage** => anuria, uremia & elec. imbalances
  - Some rumen microbes can detoxify plants
  - Tolerance increased if small amounts grazed
  - Large amounts overwhelm microbes (hungry animals)

### Presentation/CS
- 2-6 hrs after ingestion
- Colic, restlessness, up & down
- Depression, ill-thrift due to chronic renal damage
- **Muscle weak** (paresis)
  - Irregular gait
  - Head drops downward
- **Labored, rapid breathing**
- M/b convulsions
- **Frequent urinations**
- Blood froth around mouth
- Death often w/in 10 hr

### Diagnosis
- CS, History & Postmortem
  - Lab
    - Hypocalcemia (↓ blood Ca)
      - ↑ GOT, GPT, LDH
      - ↑ BUN, creatine
      - Electrolyte imbalances
      - Urinalysis: crystals
  - Postmortem
    - Aseptic & hydrothorax
    - Diffuse hemorrhages
    - Swollen, edematous kidneys
    - Histopath
      - Oxalate crystals in renal tubules

### Treatment
- No treatment

#### Control:
- Don't overgraze
- Allow time to adapt to oxalate plants

#### Prevention:
- Electrolyte imbalances
- Urinalysis: crystals

#### DDx:
- Grain overload (p 25)
- Rumenitis (p 24)
- Hypocalcemia
- Milk fever (p 148)
- Starvation

### Oxalate plants
- Dock
- Fireweed
- Greasewood
- Greasewood
- Halogeton
- Lamb's quarters
- Pigweed
- Purslane
- Russian thistle
- Sorrel

### Halogeton plants
- Halogeton glomeratus
- Distribution: heavily grazed, salty soils
- Sheep > cattle
- Fall & early winter
- Description
  - Stem: thick, juicy, branching from base
  - Leaves: thick, succulent, 1/4-1/2" long, tipped w/ weak spines
  - Flowers: greenish, inconspicuous
  - Fruit: winged, mistaken for flowers
- Looks like Russian thistle or tumbleweed

### Greasewood
- Sarcobatus vermiculatus
- Spring, succulent, good forage if w/ moderate amount of other forage to prevent poisoning
- Description
  - 3-5" tall
  - Erect, woody, highly branched
  - Stems: smooth, white bark, spines
  - Leaves: single or pairs, fleshy, round in x-section, long & narrow, 1/4 - 1/4" long
  - Flowers: small, dense cone clusters
  - Fruit: small, encircled by wing
L-tryptophane/lush forages, Fog fever
Atypical interstitial pneumonia, ARDS

- See Resp pg 67, ARDS; Adults from sparse forage to lush green pasture, L-tryptophane converted to 3-methylindole [Pneumotoxic compound]
- CS: Acute severe resp. CS (dyspnea, grunt, mouth breathing), No coughing, 30% die in 2 days, pcp by exercise, SQ emphysema
- Dx: Adult herd/new pasture, Resp. distress, No coughing, Auscultation (soft sounds), PM (hyaline membranes, multinucleated giant cells)
- DDx: Acute resp. distress syndrome (ARDS), Moldy sweet potato poisoning & perilla mint toxicity, Parasitic bronchitis, Anaphylaxis
- Tx: None may be best because handling may kill, Removing doesn't prevent new cases
- Px: Guarded: 30% die, recovery - some poor doers
- Prevention: Slowly introduce to lush pasture, Prophylactic medicine (Monensin) before putting on pasture

Perilla mint toxicity
IM 658, 1888; C3T 368; Tox 996; DC 101

- SE USA
- Causes interstitial pneumonia, ARDS
- Perilla frutescens (perilla, purple mint, wild coleus, beefsteak plant)
- Weed in waste areas
- Some cows like taste
- Toxic principles 3 furans
- Fall, flowering stage

- Fatal pneumonia/ARDS
  - Severe dyspnea (head extended)
  - Expiratory grunt
  - Froth from mouth
  - Incr. RR & HR
  - Constipation
  - Rapid to death 1-3 ds

- History, CS
- Auscultation: crackles & consolidation
- Postmortem: Swollen lungs, separated lobules
  - Square stems in rumen

DDx:
- Fog fever (p 67)
- Moldy sweet potatoes (p 67)
- BRSV (p 64)
- Pasteurella pneumonia (p 255)

Prognosis: Poor, survivors m/ have permanent fibrosis of the lungs

Weed, Square stem, Mint aroma
CS: ARDS (Dyspnea, Rapid death)
Dx: Hx, CS, Auscultation, PM
Tx: None (stress kills) • Px: Poor

Moldy sweet potato toxicity
IM 658; DC 101

- ARDS. Sweet potato + fungus = pneumotoxin; Intoxication, not allergy to fungus; Damages cells; Cows not nursing calves
- CS: in 1 d of exposure - death in 2-5 ds, Acute resp. distress (dyspnea, grunts, extension of head & neck, deep coughing)
- Dx: Hx, CS, Adventitious lung sounds, crackles; Postmortem: Lungs - wet, firm & large, uncollapsed, emphysema, hyaline membrane
- Tx: Tx not investigated
- Px: Gravel

Moldy hay toxicity, "Farmers lung"
**

- See Resp pg. 68; Inhaling organic dust, Moldy hay - spores of Thermophilic actinomycetes (Micropolyspora & Thermoactinomyces)
- Wet summers (moldy hay) & cold winters (housed cattle), Spores - hypersensitivity - destroys alveoli; Confined adult cattle (dairy)
- CS: Animals in diff. stages: Acute resp signs: Coughing, dyspnea, tachypnea, transient fever
  Chronic: Fibrosis, Wt. loss & coughing over several winters
- Dx: History & CS, Auscultation: cranioventr. crackles; Postmortem: grossly normal lungs, small gray spots of lymphocytes
- Tx: Remove moldy hay ($), Corticosteroids (Dexamethasone .04 mg/kg IV)

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### Selenium Toxicosis

**Condition**
- Cattle, sheep & horses (all susceptible)
- Trace amounts of selenium required
- 5-40 ppm in plants for toxicosis
- Arid & semiarid areas (requires < 20" annual rainfall)
- "Accumulator" (obligate) plants require Se & m/ contain > 1000 ppm
- "Converter" (facultative) plants don't require Se, but absorb it
- Commonly grazed & cause poisoning
- Western 1/3 of USA (Colorado, Neb., S. Dakota & Wyoming)
- "Accumulator" (obligate) plants require Se & m/ contain > 1000 ppm
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**Facts/Cause**
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- 5-40 ppm in plants for toxicosis
- Arid & semiarid areas (requires < 20"
- "Accumulator" (obligate) plants require Se & m/ contain > 1000 ppm
- "Converter" (facultative) plants don't require Se, but absorb it
- Commonly grazed & cause poisoning
- Western 1/3 of USA (Colorado, Neb., S. Dakota & Wyoming)

**Presentation/CS**
- Acute (rare, nec. avoid plants, unpalatable)
- Sudden death (respiratory failure, Pyrexia, Incr. RR, Dyspnea, Frothy nasal discharge, Dilated pupils
- Abnormal postures &/or gait, Recumbency, Diarrhea (dark & watery), Polyuria, Death
- Chronic "alkali diz"
- Weight loss, depression
- Lameness
- Abnormal hoof conformation
- Coronary band inflam. & breakage, grows down & sloughs
- "Bobtailed" diz, hair loss - mane & tail
- Repro. compromise (soft testicles)
- Chronic "blind staggers" (controversy if caused by Se)
- Aimless wandering or circling
- Incoordination
- Forelimb weakness
- Dyspnea
- Blindness
- Death

**Diagnosis**
- Exposure & CS
- Lab
  - Se blood levels 1-2 ppm in "alkali" diz; 1.5-4 ppm in "blind staggers"
  - Elev. ALT (SGPT), AST (SGOT), ALP
  - Conc. of Se in hair & urine
- Postmortem:
  - Kidney degeneration
  - Hepatic necrosis
  - Erosions of articular cartilage
- Se levels in tissue
  - Kidney > Liver > Pancreas

**Treatment**
- Acute: no treatment
- Remove from plants

**Prevention:**
- Diet < 5 ppm
- Arsenic (arsenilic acid) application to feed reduces absorption???

**DDx:**
- Acute
  - Pneumonia (p 62)
  - Anthrax (p 247)
  - Infreq. necrotic hepatitis
  - Enterotoxemia (p 250)
  - Pasteurellosis (p 255)
  - Other poisonings
- Chronic
  - Frostbite (p 163)
  - Fluoride poisoning (p 216)
  - Laminitis (p 163)
  - Thallium toxicosis (hair loss also) (p 208)

### Plants accumulate from Se soils - CNS

**CS:** "Alkali diz" (lame) - "Blind staggers"

**Dx:** Blood/Hair/Feed levels

**Tx:** Remove from plants

#### Astragalus spp., Milkvetch, Poisonvetch
- Toxic principles: as a group have 3 distinct toxic principles: Se, an unknown for loco plants, & Nitrogen compounds
- Cattle, sheep, horse, all species
- Description
  - Low growing
  - Woody tap root
  - Leaves pinnately compound
  - Flowers: white to purple, rounded keel petal (lower most petal)
  - Difficult to ID species of astragalus
  - Oxytropis, point locoweed, point vetch (so closely resemble astragalus that some botanist treat as the same)
  - Unpalatable, garlic odor

#### Se Plants
- Obligate Se indicator plants (often > 1000 ppm)
  - Goldenweed
  - Milk vetch
  - Poison vetch
  - Prince's plume
  - Woody aster
  - Facultative Se-indicator plants
  - Broomsnake weed
  - Groundsel varieties
  - Gumweed
  - Aster

#### Prince's plume
- Stanleya pinnata, Toxic principle: Selenium
- Unpalatable, questionable if livestock will even eat
- Description
  - Bush 1.5-5" tall
  - Leaves thickened & leathery, 2-8"
  - Flowers: numerous on upper 0.5-1.5" of stem
Slobbers

Slafamine, Moldy red clover; Black patch diz

- Red clover (Trifolium pratense) or other legumes parasitized w/ Fungus
- Rhizoctonia leguminicola
  (Fungus – dark brown)
- Wet weather or high humidity
- Toxin:
  - Slafamine (alkaloid)
  - Parasympathomimetic
  - Swainsonine alkaloid also m/b
- Cattle, sheep, goats & horses
  - Addictive
  - Eastern & central USA

Legume + Fungus - Parasympathomimetic
CS: Prolonged, Excessive salivation
Dx: Hx, CS (slobbers)
Tx: Remove source & wait 3 ds

Slobbers

- Salivation (copious) in 30 min - 1 hr
  - Lasts for over 3 days
- Anorexia
- Freq, urination
- Watery diarrhea
- Longer exposure: decr. milk, bloat, stiff joints, abortions & sometimes death

Gossypol toxicosis, Cottonseed toxicity

- Cottonseed - cheap high protein, high fiber, high digestibility feed
  - Contains gossypol
- Gossypol - cardiotoxin - gradual destruction of heart muscle in calves
  - Most common in bottle raised calves on starter rations of cottonseed meal

- Calves
  - Sudden death
  - Respiratory dyspnea
  - Depression, anorexia, hemoglobinuria
  - Mortality
- Adults
  - Repro problems
  - Sterility in bulls (reversible)
  - Testicular size
  - Conception in cows

- History, CS (slobbers)
  - Salivation (copious) in 30 min - 1 hr
  - Lasts for over 3 days
  - Anorexia
  - Freq, urination
  - Watery diarrhea
  - Longer exposure: decr. milk, bloat, stiff joints, abortions & sometimes death

- History, Clinical signs (CS)
  - Feed analysis < 400 ppm deadly to calves, > 10,000 ppm m/ not affect adults
  - Tissue analysis

- Prognosis:
  - Good: complete recovery w/in 96 hrs usual after forage removed
  - Fatalities rare

Gossypol toxicosis, Cottonseed toxicity

- Prognosis:
  - Poor, survivors m/b chronic poor doers

Prevention:
- Chem seed treatment for areas free of diz
  - Precautionary feeding of red clover to a few animals first

Cheap feed - Calves < 4 mo, Cardiotoxic
CS: Sudden death, Resp. dyspnea
Dx: Hx, CS, Feed analysis
Tx: No response to Tx Px: Poor
#### Blood

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<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
</table>
| **Bracken fern toxicosis**      | - *Pteridium aquilinum* (bracken fern, western bracken), *Pteris aquilina*  
- Throughout USA in forests (NW/MW)  
- Toxic principle: unknown in ruminants  
  - **Bone marrow depletion** (aplastic anemia) in ruminants  
  - Platelets & WBCs  
  - Accumulates over 1-3 mo  
  - Not thiamine leading to thiamine defc (B1) as seen in horses bee. B1 synthesized in rumen  
  - Palatable  
- **Enzootic hematuria** (see Circ.)  
- Suspected to be due to bracken fern  
- *Hemorrhagic syndrome* (platelet loss)  
  - Melena, epistaxis, mucosal petechiae, hematuria  
  - Bleeding from body orifices & insect bites  
  - CS ≥ 2 wk after grazing  
  - Temp. elevation  
  - Laryngeal edema, dyspnea  
  - Chronic infections of multiple systems due to lack of WBCs  
  - Usually fatal (death 1-3 ds after CS)  
  - Enzootic hematuria  
  - Neoplastic syndrome of urinary tract  
| **Lab**                         | - Platelet < 40,000 per ml (200,000 normal)  
- Profound leukopenia  
- Anemia less severe than thrombocytopenia due to longer half life of RBC  
- Die before anemia usually  
- No confirmatory test  
| **DDx**                         | - Acute septicemia (p 258)  
- Anthrax (p 247)  
- Mycotoxicosis (p 185)  
- Sweet clover (p 229)  
- Trichloroethylene extracted soybean meal  
- Leptospirosis (p 257)  
- Babesiosis (p 91)  
| **Prevention**                  | • Usually fatal once CS  
- Batyl alcohol (has reversed some cases)  
- No drug stim. bone marrow production  
| **Prognosis**                   | *Bone marrow depletion*  
*CS: Bleeding syndrome & Infections*  
*Dx: ↓ platelets & WBCs*  
*Tx: Fatal - Batyl alcohol*  

**Bracken Fern** *(Pteridium)*  
*Description*  
- Fernlike  
- Broad, triangular fronds  
- Fruiting bodies: small circular dots on underside of leaves

**Batyl OH**
Moldy sweet clover toxicosis

Mk 1682, 1733; IM 1211, 1894; C3T 355; C11 449; BR 583; BR 1546; Tox 398; DC 61; PP/Mt 40

- Rare (not commonly used for hay)
- Melilotus spp. (sweet clover)
- Moldy hay (esp. small bales) or silage
- Toxin: Dicoumarin synthesized from coumarin in clover hay by mold, Palatable
- Grazing fields OK (no mold)
- Cattle in northern plain states, All spp. susceptible
- Winter on moldy hay
- Consumption over long time
- Rapidly absorbed from GI
- Crosses placenta - calves in die

Mechanism: coagulopathy
- Inhibition of Vit. K (like Warfarin poisoning)
- Vit. K necessary for prod. of clotting factors (II, VII, IX & X)
- Thrombin formation depressed

Swellings (shoulders, thighs, neck, back & chest) due to SQ hemorrhage
- Hemorrhage where body traumatized (brisket, tuber coxae, carpi)
- Hematoma formation, Ecchymoses
- Epistaxis
- Periarterial swelling
- Hematuria
- No fever
- Death rate high bec. progresses before CS noted

- History (exposure), CS
- Prolonged PT time (later also APTT)
- No other abnormalities of clotting profile (normal platelet count, fibrinogen
- Anemia
- Hyponatremia
- Fever
- Chem. analysis for dicoumarin - feed, blood & liver (absence doesn't R/O dx)

- Remove source
- Vit. K1 (1.1-3 mg/kg IM) every 6 hrs until PT normal, Not K3
- Fresh plasma
- Whole blood transfusion

Prognosis:
- Poor: often Dx too late
- Good if early Dx & prompt Vit.

Prevention:
- Easily by careful forage preparation &/or inspection of hay & silage
- Discard moldy portions

DDx:
- DIC (thrombocytopenia) (p 85)
- Bracken fern poisoning (p 228)
- Mycotoxicosis (p 185)
- Clostridial dix (Blackleg) (fever) (p 244)
- Septicemia (fever) (p 258)
- Liver failure (p 34)
- Dicoumerol (Warfarin) (p 214)

Sweet Clover (Melilotus)

Description:
- 2-6" tall
- Highly-branched
- Leaves: 3 finely toothed, ovoid leaflets
- Flowers: white or yellow, 1/4" long, pealike, racemes (along stem)
- Widespread distribution by roadsides, fields, waste places
# Cardiotoxins - Nitrate

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<tr>
<td>Cardio-glycosides, Cardiotoxic plants</td>
<td>• Toxic principle&lt;br&gt;- Cardiac glycosides (CG) [principle agents]&lt;br&gt;- Yew - alkaloids&lt;br&gt;- All species susceptible&lt;br&gt;- Cardiac &amp; GI CS</td>
<td>• Rapid: CS - 4-12 hrs of ingestion, Death in 12-24 hrs (sublethal dose CS persist for 2-3 ds)&lt;br&gt;- Depressed &amp; weak to comatose&lt;br&gt;- Fasciculation &amp; trembling&lt;br&gt;- Cardiac&lt;br&gt;“Thumps”: incr. pounding HR&lt;br&gt;- Fibrillation - terminal event&lt;br&gt;- Cold extremities&lt;br&gt;- Open mouth breathing&lt;br&gt;- ↑ rate &amp; depth of respiration&lt;br&gt;- Hemorrhagic nasal discharge&lt;br&gt;- GI CS (except in Yew)&lt;br&gt;- Cardiac&lt;br&gt;- Colic</td>
<td>• CS &amp; History of exposure&lt;br&gt;- Prolonged auscultation: bradycardia, tachycardia, dropped beats, heart block, auricular fibrillation, ventricular tachycardia &amp; ventricular fibrillations&lt;br&gt;- ECG not necessary&lt;br&gt;- PM not pathognomonic - Rumen content</td>
<td>• Rid GI of plant only effective Tx&lt;br&gt;- Rumenotomy: empty &amp; wash&lt;br&gt;- Ruminal transplantation&lt;br&gt;- No antidote?&lt;br&gt;- As in digitalis poisoning&lt;br&gt;- Atropine + propranolol (extremely carefully)&lt;br&gt;- TLC (tender loving care)&lt;br&gt;- Remove from source</td>
</tr>
</tbody>
</table>

**Cardiotoxic plants**
- Oleander (Nerium oleander) (CG)<br>- False helbore (Veratrum sp.)<br>- Foxglove (Digitalis purpurea) (CG)<br>- Indian hemp (Apocynum sp.) (CG)<br>- Lily of the Valley (Convallaria) (CG)<br>- Milkweed (Asclepias sp.) (CG)<br>- Yew (Taxus sp.) (alkaloid)

**Oleander toxicosis** (IM 1881; DC 508t)
- Nerium oleander<br>- Ornamental hedge west coast & S. USA<br>- #1 cardiotoxic plant<br>- Toxic principle<br>- Cardiac glycoside similar to digoxin<br>- All parts, seeds most<br>- Lethal dose cow or horses 30-40 dried leaves<br>- Bitter taste: Ingested when given in hedge clippings mixed w/ grass clippings (palatable)<br>- Heart effects<br>- $ force of contraction<br>- $ rate of contraction<br>- $ excitability<br>- $ automaticity

**Milkweed, Asclepias**
IM 1881; Tox 364; PP/Mt 36; 267
- #1 sheep, all species affected<br>- Toxic principle: Cardioactive glycosides & an alkaloid<br>- Unpalatable: bitter taste - consumed when only thing or when mixed in hay<br>- Broad-leaved milkweed generally cardiogenic & GI<br>- Narrow-leaved gen. neurologic<br>- Description<br>- 4' tall<br>- Milky sap<br>- Leaves: few to many, narrow to broad<br>- Flowers: whitish to purple, waxy, umbrella clusters

**DDx**
- Infec. gastroenteritis<br>- Castor bean (p 235)<br>- Arsenic poisoning (p 202)

**Prevention:**
- Keep out of hay
Nitrate/ nitrite poisoning, Oat hay poisoning

- Acute - rapid onset
- **Tissue anoxia**: anxiety, polyneuropathy, **dyspnea**, rapid, weak pulse
  - Cyanotic mucous membranes
  - Muscle tremors, weakness, ataxia, exercise intolerance
  - Terminal anoxic convulsions
- Die w/in hrs to a day w/o Tx
- Chronic - slow onset
  - Abortion + resorption ("lowland abortion")
  - ↓ body weight
  - ↓ milk prod.

**Plant accumulators of nitrate**
- *Sorghum* - Johnson grass, Sudan grass
- Small grain pastures (oats [worst cereal grain], barley, wheat, rye)
- *Fireweed*
- *Brassica* (rape, turnips)
- *Rumex spp.* (dock)
- *Datura spp.* (jimsonweed)
- *Solanum spp.* (nightshade)
- *Melilotus* (sweet clover)
- *Amaranthus spp.* (pigweed, redrot)
  - Canada thistle, Cheeseweed, Lamb's quarters, Russian thistle, Smartweed, Wild sunflower

**Blood chocolate brown** (Met-Hb)
- Cyanotic mucous membr.
- Exposure (fertilizer easy Dx)
- Lab
  - Measure methemoglobin
  - Add 1 part blood to 20 parts PO4 buffer (pH 6.6) to preserve Met-Hb
  - Forage, plant, H2O, soil, ruminal fluid, serum, blood, urine, fetus
  - (freeze samples)
- **NO3 Field test** (see box)

**DDx:**
- Chlorates (herbicide, Met-Hb also)
- Cyanide (bright red blood) (p 222)
- Urea (p 204)

**NO3 field test**
- Stock solution in brown bottle
  - 0.5 g diphenylamine in 20 ml water + 80 ml sulfuric acid
- Working solution
  - Equal parts stock sol. w/ 80% sulfuric acid
- Drop of working sol. to split stem at a node or joint
  - Deep blue color in 10 sec indicates 2% or higher nitrate
- Poisoning possible w/ 1%

**Prevention:**
- Check level in feed
- Dilute w/ other feed
- Ensile feed
- Cut forage late in a sunny day
- Test a few animals on forage 1st

**Met-Hb - Hypoxia - Rapid**

**CS:** Dyspnea, Weakness, GI, Convulsions, Abortion

**Dx:** Chocolate blood, Cyanosis - NO3 field test

**Tx:** Slow IV Methylene Blue
### POISONOUS PLANTS

<table>
<thead>
<tr>
<th>Hepatotoxic Plants</th>
<th>POISONOUS PLANTS</th>
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<td><strong>Condition</strong></td>
<td><strong>Facts/Cause</strong></td>
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<tr>
<td>Aflatoxin, Aflatoxicosis, Mycotoxicosis</td>
<td><strong>Presentation/CS</strong></td>
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<tr>
<td>Mk 1679; CST355; B&amp;R 1316; Br 613; Tox 403, 416; GI 832; Pa 103</td>
<td><strong>Diagnosis</strong></td>
</tr>
<tr>
<td><strong>Acute</strong> - Death w/no CS</td>
<td><strong>History, CS</strong></td>
</tr>
<tr>
<td>Acute - Death w/no CS</td>
<td><strong>Postmortem: Pale liver, cirrhosis, hemorrhagic enteritis</strong></td>
</tr>
<tr>
<td>Poultry &gt; dogs &gt; swine &gt; horse &gt; calves &gt; cattle &gt; sheep</td>
<td><strong>Lab</strong></td>
</tr>
<tr>
<td>Metabolites of Aspergillus flavus</td>
<td>Decr. BSP secretion, icterus</td>
</tr>
<tr>
<td>Moldy corn, foodstuff</td>
<td>Incr. serum transfase, ALP</td>
</tr>
<tr>
<td>Mechanism</td>
<td>Anemia</td>
</tr>
<tr>
<td>- Supresses messenger-RNA synthesis</td>
<td>Aflatoxin in feed</td>
</tr>
<tr>
<td>- Impaired protein synthesis</td>
<td>Presence of mold doesn't mean aflatoxin present</td>
</tr>
<tr>
<td>- Ability to mobilize fats</td>
<td>UV light - characteristic fluorescence</td>
</tr>
<tr>
<td>- Hepatic necrosis &amp; fatty changes</td>
<td>Greenish yellow &quot;firefly&quot;-like glow (BGF, Bright Greenish Yellow Fluorescence)</td>
</tr>
<tr>
<td><strong>Immunosuppressive</strong></td>
<td><strong>Treatment</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Remove suspected feed</strong></td>
</tr>
<tr>
<td>Moldy corn - Hepatotoxic</td>
<td><strong>Methionine or methionine + cysteine &amp; Na thiosulfate</strong></td>
</tr>
<tr>
<td>CS: Death, CNS, ↓ weight, Rough coat</td>
<td><strong>Incr. protein in diet</strong></td>
</tr>
<tr>
<td>Dx: Feed analysis</td>
<td><strong>Vit. supplementation (A, D, E, K, B complex)</strong></td>
</tr>
<tr>
<td>Tx: Remove moldy feed, Supportive</td>
<td><strong>Aggressively Tx infections (since immune system is compromised)</strong></td>
</tr>
</tbody>
</table>

### Photosensitizing plants, Photodermatitis, "Trefolli dermatitis", "Rape scald" ** **

| **Mk 820; CST 265, 904; IM 1442, 1882; BR-bb 238; BR 546; Br 615, 686; DC 239; L377; Pa 84; GI 824; PP/Mt 44; PP/US/C 171** | **St. Johnswort, Goatweed, Klamathweed** |
| **Sti\(^{1}\), erect, 1-3' tall** | **IM 1887, Tox 403** |
| **Leaves in pairs covered w/ sm. clear to black dots** | **Hypericum perforatum** |
| **Flowers: numerous, bright yellow** | **St. Johnswort, Goatweed, Klamathweed** |
| **Not common, sunburn** | **Hypericum perforatum** |
| **Toxic principle** | **Cattle > sheep > horse** |
| - Exposure to sunlight, plus: | **Unpalatable unless starving, Spring** |
| - Chem. substances deposited in dermal tissue | **Poisonous principle - 1\(^{1}\) photosensitization (fluorescent pigment in "dots")** |
| **1\(^{st}\) photosensitizing plants** | **Ditches, low moist ground** |
| contain photodynamic substances | **Widespread in USA** |
| .. Absorbed from GI & deposited in dermis | **Description** |
| **2\(^{nd}\) Photosensitizing plants** | **Stiff, erect, 1-3' tail** |
| cause hepatic damage preventing clearance of normal chlorophyll breakdown products which are photodynamic & deposited in dermis | **Leaves in pairs covered w/ sm. clear to black dots** |
| - Chemical (phenothiazines, sulfonamides, tetracyclines) | **Flowers: numerous, bright yellow** |

### DDx

**Common sunburn**
Pyrrolizidine alkaloid toxicity, "Ragwort poisoning"

- Extensive livestock loss worldwide
- Poisonous plants:
  - Not very palatable (forage sparse [drought])
  - 1st cut hay, alfalfa or hay cubes
- Cumulative & progressive
- Problem 1-5 mo later (material often no longer on farm to ID)
- In utero infections
- West US (also in pastures throughout US)
- Pathology
  - Alkaloids damage hepatocytes
  - Cause megalocytes & cellular death ⇒ Fibrosis
- Weight loss
- Liver failure
- Hepatoencephalopathy
  - (abnormal behavior, ataxia, wandering, blindness, death)
- ± icterus
- Photosensitization (white areas)
- Abortion

DDx:
- Hepatoencephalopathy
  - Fungal hepatotoxins (p 232)
  - Rabies (p 144)
  - Brain abscess/tumor (p 140)
  - Lead poisoning (p 152)
  - Encephalomyelitis (p 134)
- Wt. loss & jaundice
- Parasitism (p 54)
  - Chronic fasionalisis (p 37)
  - Hepatitis & biliary obstruction (p 37)

Geographic area
- Feed analysis, time consuming & $$$
- Lab: nonspecific
  - Clotting abnormalities
  - GGT, AST (liver enzymes normal or elevated)
  - BSP is prolonged
- Liver biopsy (similar to aflatoxins)
  - Triad: hepatocytomegaly, fibrosis (cirrhosis), bile duct proliferation
- None of above specific for this toxicity so Dx difficult if no longer consuming

Euthanasia once CS
- Remove unaffected cattle from plant source
- Tx for liver failure
  - Sedate (kylazine) for CNS CS
  - 10% glucose IV + methionine
  - Mineral oil + neomycin or lactulose (acid GI ammonia to ammonium)
  - Correct any acidosis slowly
- Sow 5-10% dextrose drip
- Sm. meals 4-6 x/d., molasses
- Vit. B1, folic acid & Vit. K1
  - Grazing, protect from sun

Prognosis:
- Poor to grave: due to fibrosis

Geographical areas
- West US

Hepatotoxic plants

- Pyrrolizidine alkaloids - 2nd photosensitization:
  - Senecio (tansy ragwort [S. jacobea], groundsel [S. vulgaris], ragwort)
  - Crotalaria (rattlebox, rattlweeed, wild pea)
  - Amsinckias intermedia (fiddleneck, fireweed)
  - Helitroium (common heliotrope)
  - Eichium (Viper's bugloss)

Other hepatotoxic plants
- Lantana camara (Lantana)
- Tetradymia spp. (Horsebrush, rabbit brush)
- Gossypium sp. (Cottonseed, contains Gossypol)
- Xanthium sp. (Cocklebur)
- Microcystis aeruginosa (Blue green algae)
- Aspergillus flavus (fungus)
- Amanita phalloides (Death cap mushroom)

Photosensitizing plants
- Hypericum perforatum - St. Johnswort, Klamathweeds
- Brassica (rape)
- Erodium (trefoil)

Prognosis: poor to grave due to fibrosis

Tansy ragwort, *Sceneio jacobea* (Mk 1698; IM 850)

Fibrosis of liver
CS: CS in 2-8 mos, Liver failure, CNS
Dx: Liver biopsy
Tx: Euthanasia

Hepatotoxic plants

Pyrrolizidine alkaloids - 2nd photosensitization:

- Senecio (tansy ragwort [S. jacobea], groundsel [S. vulgaris], ragwort)
- Crotalaria (rattlebox, rattlweeed, wild pea)
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Photosensitizing plants

- Hypericum perforatum - St. Johnswort, Klamathweeds
- Brassica (rape)
- Erodium (trefoil)
Oak Poisoning

**Condition**

- Quercus spp.
- Buds until "green out" in Spring, acorns in Fall
  - SW USA: browsing new leaves in Spring
  - Midwest & NE eating acorns in Fall
    - Windstorms drop acorns
  - #1 Cattle (less selective eating), also sheep, goats, rarely in horses

**Facts/Cause**

- Gradual onset
- Emaciation (anorexia), GI atony
- Constipation then diarrhea (mucus or blood)
- Rough hair coat & dry nose
- Dehydration, icterus
- Oral lesions
- Occasional abortions
- Anuria then polyuria (dilute) PU/PD
- Dehydration, Icterus
- History, CS
- Lab
- Elevated GOT, GPT
- BUN & creatinine elev.
- Elev PCV (dehydration)
- ↑ hemoglobin
- Low urine spec. gravity, granular casts & hematuria
- Occult blood positive

**Presentation/CS**

- Pigweed poisoning (Amaranthus retroflexus), similar lesions (p 234)
- Aminoglycoside poisoning (p 217)

**Diagnosis**

- Pigweed poisoning (Amaranthus retroflexus), similar lesions (p 234)
- Aminoglycoside poisoning (p 217)

**Treatment**

- Remove from oaks
- Stimulate rumen, oils to move through GI
- Fluids (dehydration & acidosis)
- Supplemental feed so don’t continue to eat oak
- Rumenotomy if severe
- Diuresis, acid base balance & serum calcium levels $$$

**Prognosis**

- Poor: Rarely recover once renal dysfunction

**Prevention**

- Prevent exposure
- 10-15% calcium hydroxide/protein supplements in grain ration to protect if exposure can’t be prevented
**Dogbane, Indian hemp**

*C3T 352; IM 11881; Tox 391; PP/US/C 32, 263*

- *Apocynum cannabinum* (Indian hemp, dogbane), *A. androsaemifolium* (Spreading dogbane)
- Cattle, horses & sheep
- CS: Urinary system, cardiac arrhythmias
- Tx: Urinalysis → Crystals in urine
- Toxic principle: alkaloid (Delphine)
- Palatable to livestock, will eat even if other forage is also available
  - Low: Spring, cattle like it
  - Tall: midsummer at about its flowering stage

**Larkspur toxicosis, Delphinium**

*IM 1879; C3T 346, 350, 393; C1T 466; Tox 371; DC 508; PP/M 14, 15, PP/US/C 25

- #1 poisonous plant in W. USA.
- Relatively nontoxic to horses & sheep
- Tall or high larkspur (*Delphinium barbeyi, D. occidentale*)
  - Higher elevations
- Short or low larkspur (*D. nelsonii, D. andersonii, D. geyer*)
  - Plains or low mountain slopes
- Toxic principle: alkaloid (Delphine)
  - Palatable to livestock, will eat even if other forage is also available
  - Low: Spring, cattle like it
  - Tall: midsummer at about its flowering stage

#1 in West cattle - Tasty; Tall & Short

- CS: Nonspecific general, GI, CNS, Resp.
- Dx: Hx, CS
- Tx: None

**Castor bean (ricin) toxicity**

*Mk 1718; IM 11889; C3T 351; Tox 382

- Minor importance; *Ricinus communis* (Oil producing plant from which seeds are harvested)
- Toxin: Ricin: seed-borne protein phytotoxin, potent proteolytic enzyme, antigenic properties
  - Lethal dose 0.1 ug/kg, plant not usually ingested, but seeds in feed as an oil by-product, readily absorbed form GI
- CS: Gastric irritation - profuse, watery diarrhea; anaphylactic shock mlb, Hi fever, depression, incoordination; muscle twitching; pounding heart beat; convulsion before death
- Dx: Hx of ingestion; Seed in feed material; RBC agglutination or precipitation test for ricin
- Tx: Sedation & Tx shock initially; Keep warm; Antihistamines; IV fluid; prevent further absorption: oral laxatives, intest, protecants & activated charcoal

**Dogbane**

- Erect herb
- Woody stem - milky sap
- Leaves: opposite pairs
- Pods hanging in pairs

- No antidote
- Relieve bloat
- Do not disturb animals

**Prevention:**
- Palatable so keep away until flowers
- Spray pastures for 2 successive years

**Castor Bean**

- Description
  - Shrub - 12' tall
  - Stem: reddish - purplish
  - Leaves: large, alternate, deeply palmated, 6-11 lobes
  - Fruit: spiny capsule
  - Seed: large, brown, female tick-like

**Minor importance, GI irritation**

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## CNS - Toxic Plants

### Locoweed

**“Locoweed diz”, Texas loco,**
IM 1977; CST 348, 357;
CIT 458; BR 1554; Tox 368; DC 507t; N-L 100

- **West; Horses > cattle > sheep**
- **Plants:**
  - *Astragalus* spp., not all are toxic, Speke loco, Pursh loco (*A. purshii*)
  - *Oxytropis* spp.
  - *Swainsona* in Australia
- **Toxic principle:** Unknown (m/b barium, selenium, alkaloid or laryrogen)
  - Also Selenium accumulators
- **Unpalatable, starvation**
  - **Addiction** if start eating it
  - Chronic grazing: cattle consume 90% of their weight over 4-6 wks ⇒ CS
- **Spring when little forage, also remains green in late Fall & Winter**

### Facts/Cause Presentation

- **West; Horses > cattle > sheep**
- **Plants:**
  - *Astragalus* spp., not all are toxic, Speke loco, Pursh loco (*A. purshii*)
  - *Oxytropis* spp.
  - *Swainsona* in Australia
- **Toxic principle:** Unknown (m/b barium, selenium, alkaloid or laryrogen)
  - Also Selenium accumulators
- **Unpalatable, starvation**
  - **Addiction** if start eating it
  - Chronic grazing: cattle consume 90% of their weight over 4-6 wks ⇒ CS
- **Spring when little forage, also remains green in late Fall & Winter**

### Presentation

- **CNS (motor & sensory)**
  - Stagger (irregular gait/hypermetric)
  - Depressed (staring gaze)
  - Rough hair coat
  - Dull eyes
  - Emaciation
  - Hyperexcitable when stressed
  - Death if continue to eat
  - Birth defects & abortions

### Diagnosis

- CS, History of prolonged eating

### Treatment

- Remove from plants
- Will selectively seek out plant (addicted)

### Prognosis

- M/ recover, m/ have permanent damage throughout life, m/ show loco signs when stressed

### Prevention

- Keep animals away from loco weed areas
- If must graze such area watch & remove addicted animals

### Unpalatable, Addictive; Toxin ? Chronic grazing Astragalus, Oxytropis

**CS:** CNS - Irregular gait, Rough coat, Emaciation, Depression
**Dx:** Hx, CS
**Tx:** Remove from plant

### Grass tetany, Wheat

- See Neuro pg 146; Hypomagnesemia facilitates NMJ, Tetanic spasms, Lactating beef cow < 7 yrs, low Mg (grow too fast, wheat, barley, oats)
- **Dx:** CS, Hx only. **of need for rapid therapy.** Confirm herd problem - serum or urine Mg sample from multiple animals
- **Tx:** Emergency. IV Milk fever, Ca/Mg combo. Mg oxide orally or SQ, or legume hay m/ prevent relapse
- **Px:** Good if treated early, Guarded if convulsions & tetany
- **Prevention:** Mineral blocks & salt licks, Mg fertilization on pasture (most efficacious way)

### Milkvetch, Vetch toxicosis, Timber milkvetch

- *Astragalus miser,* 1st Cattle, all species; W USA; Toxin: 2-nitro-1-propanol or propionic acid
- **CS:** Acute - Nervousness, Irregular gait, Coma, Sudden death (resp. failure); Chronic - Dullness, Incoordination of hindlimbs, "Goose stepping" & Paresis, Respiratory difficulties, Posterior paralysis
- **Dx:** CS & Hx of ingestion, Dx: Loco weed (no respiratory involvement)
- **Tx:** Symptomatic & supportive
- **Px:** May recover if removed from plant, Continued ingestion ⇒ Death
**Ergotism, Rye staggers**

- Claviceps purpurea, parasitic fungi on grains & grasses
- #1 Rye, oats, wheat & Kentucky blue grass
- Claviceps paspali (Paspalum, Dallis, Bermuda grasses)
- Cattle, sheep, horses
- Warm, moist conditions
- Toxicity
  - Alkaloids: ergotamine, ergotoxine & ergometrine, tremogenic alkaloids
  - Incur. muscle motor activity of uterus
  - Arterial & venous constriction (peripheral vasoconstriction) - gangrene
  - Vascular stasis, thrombosis, gangrene

**Fungus (Claviceps) on grasses & grain**

- Dry gangrene (limbs, nose, ears, tail)
  - Lameness - hindlimbs 1st
  - Swelling & tenderness of fetlock, then darkening & discoloration below fetlock
- Sloughing of hoof
- GI: vomiting, colic, constipation or diarrhea
- CNS - Convulsive - higher daily doses 2-7 d
  - Hyperexcitability, belligerency
  - Muscle tremors to marked ataxia
  - Overstepping & falling
  - Exaggerated hypermetric gait, ataxia (proprioceptive deficit), exacerbated w/ exercise or excitement
- Recumbency
- Convulsion & opisthotonus (dors. recumbency & arched back)
- Abortion in cattle & swine (no solid evidence)

**Phalaris staggers** (IM 1881, 1892, 1119; N-L 2134): caused by ingestion of perennial Canary grass Phalaris tuberosa; Cobalt supplementation can prevent by inactivating neurotoxin; but will not cure syndrome

- Blue-green algae common in bodies of fresh water
  - Microcystis, Anabaena, Aphanizomenon
  - Summer when algae "bloom", forms a thick green scum on water
  - Algae dies, toxin in water - foul, fishy smell
  - Wind blows to shore, drink & die
  - Ruminants more sensitive than monogastrics

**Toxic *** blue-green algae,**

- Algae or algal poisoning,
  - IM 1078, 1890; C3T 292;
  - Tox 384

**Summer bloom - Drink - Die**

- Acute death w/in minutes
  - Rapid onset (15-45 min) & progresses to prostration & death
  - Nausea, vomiting, colic, bloody diarrhea, prostration, muscle tremors, dyspnea, cyanosis, paralysis & death
  - CNS: seizures, prostration m/b
  - Chronic
    - Depression, anorexia, hemorrhagic gastroenteritis
    - Photosensitization
    - Hepatic diz

**Dx:**

- Differentiation from colic, enteritis, laminitis
  - None specific, consider toxicosis, not receiving adequate moisture
  - Clinical signs, history, excluded from other causes

**Prognosis:**

- Grave, die in 24 hrs

**Prevention**

- Organic herbicides or copper sulfate (bluestone) Tx of water to kill
  - Follow label direction to avoid toxicity
  - Fence off water when algae bloom is present
### CNS

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Water hemlock</strong></td>
<td>• Cattle, all susceptible&lt;br&gt;• <em>Cicuta citrata, C. douglasii</em>&lt;br&gt;• Toxin: Alkaloid (<em>Cicutoxin</em>) extremely toxic&lt;br&gt;  - Throughout plant, Hi in root structures&lt;br&gt;  - Leaves esp. toxic in spring before blooming&lt;br&gt;  - 10 oz will kill cattle or horse&lt;br&gt;  - Most: violent toxic plant&lt;br&gt;  - Early spring if low forage&lt;br&gt;  - Aquatic (ditches &amp; streams)&lt;br&gt;  - Public Health: mistaken for wild parsnip, children blowing through hollow chambers like a reed&lt;br&gt;  - Confused w/ Poison hemlock (<em>Cicuta douglasii</em>)</td>
<td>• 6 hrs after ingestion&lt;br&gt;• Death m/b in 1-2 hrs after CS (resp. paralysis)&lt;br&gt;• Muscle twitches, tremors&lt;br&gt;• <strong>Violent grand mal seizures</strong>&lt;br&gt;• Rapid pulse, Incr. RR (tachypnea)&lt;br&gt;• Salivation, frothing at mouth&lt;br&gt;• Dilated pupil, Coma&lt;br&gt;• Birth defects like lupine (spinal curvature &amp; crooked limbs)</td>
<td>• History, CS</td>
<td>• No specific Tx&lt;br&gt;  - Sodato to control convulsions, phenobarbital&lt;br&gt;  - PHENOBARBITAL</td>
</tr>
<tr>
<td>Western hemlock</td>
<td>IM 1886: C3T 58, 346; C1T 467; Br 614; BR-N 606; Tox 364; PP/MT 17; PP/USA/C 373</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Poison parsley</td>
<td>IM 1879, PP/MT 17; PP/USA/C 379; C3T 346; C1T 459, 467; BR-N 608; Br 614; Tox 371</td>
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</tbody>
</table>

**Cicuta, Branched root, Chambers**<br>CS: Grand mal seizures - CNS<br>Dx: Hx, CS<br.Tx: None, Phenobarbital

---

### Poisonous Plants

<table>
<thead>
<tr>
<th>POISONOUS PLANTS</th>
<th>Treatment</th>
<th>Prevention:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Stimulants&lt;br&gt; • Charcoal</td>
<td>• Seldom eaten if appropriate feed available</td>
<td></td>
</tr>
</tbody>
</table>

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**Conium, Tap root, Purple spots**<br>CS: No seizures, CNS<br>Dx: Hx, CS<br Tx: None, Charcoal

---

**Description:**<br>• 2-10' tall<br>• Stem: highly branched stems, hollow; purple spots on lower stem<br>• Unbranched tap root<br>• Leaves: divided (similar to parsley)<br>• Flowers: small, white & umbrella clusters
**Solanum toxicosis, Nightshade, Atropine-containing plants**

*IM 1880; C3T 351; C1T 461, Br 613, 616; BR-hb 611; BR 1892; Tox 360; PP/O 13

**Description:**
- Herb or vine
- Leaves: petioled (stalk), irregularly lobed (variable)
- Flowers: yellow, blue or purple
- Fruit: berry

- *Solanum spp.* (Nightshade), green potatoes; **Toxin**: alkaloids (solanine, belladonna-like), local irritation & anticholinergic properties

- **CS**: CNS: dilated pupil, depression, weakness, progressive paralysis & prostration, m/t death
- **Dx**: Decrease in Purkinje cells in cerebellum; gastroenteritis
- **Tx**: Atropine-like alkaloid (scopolamine); CNS

- **Tx**: No specific antidote, atropine suggested, carefully in large animals, parasympathomimetic (physostigmine or pilocarpine), phenoxythiazine tranquilizers carefully because m/ accentuate anticholinergic affect

**Jimsonweed, Datura**

*Stramonium, Thornapple*

*IM 1880; C3T 351; Tox 369

**Description:**
- 4-5" tall
- Leaves: long petioled (stalk attaching leaves), alternate
- Flowers: solitary, showy, large, tubular, born at fork of stem & branches
- Fruit: spiny capsule

- **Toxic principle**: Atropine-like alkaloid (scopolamine); Distasteful; swine > cattle, sheep & goats
- **CS**: CNS - Depression & parasympathomimetic,
  - Restlessness, irritability, weakness, tachycardia
  - Mydriasis, photophobia, constipation, thirst, incoordination & paresis, respiratory failure, delirium, convulsions
- **Dx**: Drop of urine in lab animal's eye => mydriasis
- **Tx**: Symptomatic - parasympathomimetic (physostigmine); Activated charcoal; Laxatives
  - Convulsions - diazepam (not phenoxythiazine), anticholinergics

**Death Camus, Zigadenus**

*IM 1880; C3T 346; C1T 486; Tox 393; PP/M 26; PP/O 14

**Description:**
- Slender perennial herbs (8-24")
- Onion-like bulb
- Single stem, basal leaves w/ V-shaped cross section
- Flower whitish to yellow - racemes (along stem)

- **Sheep, all classes are susceptible; Open range - Western USA**
  - Very early spring when lack of other forage
  - **Toxic principle**: Alkaloids (zygocone & zygodamene); all parts of plant (esp. bulb) all times, Humans mistake for wild onion, Distasteful
  - **CS**: Salivation, nausea, weakness & staggering, convulsions, coma, death;
  - Resp. distress, incr. RR; Temp incr. then falls below normal; Cardiac
  - **Dx**: Onion (has onion odor)
  - **Tx**: No specific Tx; Symptomatic & supportive
  - **Px**: Severely affected die, Less affected m/ recover

**Nicotine/Tobacco poisoning**

*IM 1879; C3T 360; C1T 473; Tox 248

**WILD TOBACCO**

- Description:
  - Annual, 1-3', sticky
  - Leaves alternate, large on bottom

- **Nicotiana, wild tobacco; Toxin: Nicotine alkaloids**
- **CS**: Nicotine poisoning, Stim of ANS, Paralysis, Death
- **Dx**: Exposure, CS
- **Tx**: None; Activated charcoal
- **Px**: Most will recover, unless massive ingestion

**Hairy vetch, Fava bean**

*IM 1890, 213; Tox 174; PP/US/C 362

- **Vicia villosa**, Horse & cattle, Toxic principle: unknown
  - Nasal discharge, Coughing, Salivation; SQ edema, Alopecia
- **Tx**: No Tx, Freq. refractory to Tx
### Trauma Plants

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<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
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<tbody>
<tr>
<td>Mechanical trauma-producing plants</td>
<td>• Bristle grass, Foxtail, Cheatgrass, Needle grass, Fovert grass, Crimson clover, Cocklebur (Xanthium strumarium)</td>
<td>• Mouth ulcers</td>
<td>• History, CS</td>
<td>• Remove source from environment</td>
</tr>
<tr>
<td></td>
<td>• Common in hay</td>
<td>• Trauma to skin around mouth &amp; eyes</td>
<td>• Visualize</td>
<td>• Remove from animal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Lodge alongside mouth</td>
<td></td>
<td>• Antibiotics</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Salivation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Black locust**

C3T 351; IM 1889; Tox 382; PP/A 43

Description:
- Shrub or tree - 40' tall
- Rough deeply furrowed bark
- Paired spines at base of each leaf
- Leaves odd pinnate - 12" long
- Flowers: white, drooping racemes

**Wild jasmine**

(IM 1454, 1884; B&R 1353; PPUS/C 278; C3T 350)

Description:
- Ornamental shrub, Leaves: alternate lancelet, Flowers: showy, axillary clusters, trumpet shaped - 1" long, Fruit: small berry
- Cestrum diurnum; Toxin: Natural Vit. D3 glycoside, Not recognized by negative feedback Causes excess Ca absorption
- CS: Weight loss over mo., decr. appetite, Lameness, "humped-up" stance, Soft tissue pain on extension
- Dx: Serum Ca elevated, P often normal, Renal failure signs, Elev. BUN, creatinine & phosphorus, decr. Na & Cl • PM: Mineralization of soft tissues (renal cortex, vessels, heart valves, tendons)
- Tx: No specific Tx

**Bitterweed, Bitterweed, Hymenoxys** (C3T 349; IM 1889; Tox 380; PP/O 4)

Description:
- Hymenoxys odorata, Sheep in SW USA, also cattle & horses, Distractful (bitter), m/ develop taste for it, Cumulative
- CS: Depression, anorexia, rumen stasis & tympany, back arched & grinding teeth, Serous nasal discharge, dyspnea, head pressing, tetanic convulsions, Death 24-48 hr
- Tx ?
- Description: Weed 2' tall, Much branched, Leaves: narrow, like stem, Flower: bright yellow
Broom-snakeweed

C3T 347; IM 1884

- Gutierrezia spp.
- Abortion problem in cattle

- Anorexia, Listlessness
- Rough hair coat
- Weight loss
- Diarrhea or constipation
- Vaginal discharge
- Bloody urine
- Abortions in last trimester (60%)
  - Retained placenta (RP)
  - Weak calves

- History, CS

- Tx: Remove plants

Lupine toxicity, Lupinosis **

IM 1879, 1720; Tox 372; PP/MT 33; C3T 345; C1T 458, 466; Pic 214; L 415

- Toxic principle
  - Alkaloid: quinolizidine alkaloid (lupine)
- Sheep - devastating range problem
- Calves - Crooked calves diz (arthrogryposis [rigidity of joints], misaligned, malpositioned limbs, cleft palate, twisted neck or combo)
  - Ingested in early gestation 40-70 d (similar to hemlock)

- Description
  - 1/2-3" tall
  - Leaves: palmately compound 5-7 fingers
  - Flower: blue, white, pink, yellow or blue-white, in loose clusters
  - Fruit: pealike pod

Poison hemlock, astragalus, or oxytropis can also cause crooked calf diz

Abortions ***

Locoweed, Wild tobaccos, Nitrate, Pyrrolizidine alkaloids, Broomsnakeweed, Oak, Ponderosa pine

- Pinus ponderosa; Toxin - Poorly described
- CS: Abortion & retained placenta, Last trimester, Weak calves if born
- Tx: No Tx
- Prevention: Alternate source of feed

Ponderosa pine needle, Pinus toxicity

IM 1886; Tox 401; PP/US/C 119

- Pinus ponderosa

- Description
  - Tree
  - Needles - 7-11" long
  - Ovoid cone 2.5-6" long

- Prevention: Alternate source of feed

Zearalenone **

IM 1893; Tox 410, 412, 413, 420, 422; DC 505

- Rare; Estrogenic chemical produced primarily by Fusarium roseum (mold)
- Natural contamination of corn (most commonly ear corn stored in cribs); also barley, oat, sorghum, wheat & hay
- Cattle more resistant than swine (induced anestrus), Swine 1-5 ppm, cows 50 ppm
- CS: Reduces conception rate
### Grasses

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<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fescue toxicosis</td>
<td>• See Gen. pg 264</td>
<td>• Fescue foot</td>
<td>• Hx (fescue ingestion for wks or mos)</td>
<td>• Usually valuable feed</td>
</tr>
<tr>
<td></td>
<td>• Tall fescue (Festuca arundinacea Schreb)</td>
<td>• Wt. loss (don't move to get food, pain)</td>
<td></td>
<td>• If problems</td>
</tr>
<tr>
<td></td>
<td>• Major forage grass (35 mil. acres in USA)</td>
<td>• Lameness of hindlimbs</td>
<td></td>
<td>• Slaughter - fescue foot or large masses</td>
</tr>
<tr>
<td></td>
<td>• Popular because adaptable to many soil &amp; climatic conditions &amp; can be</td>
<td>• Gangrene of feet &amp; tail</td>
<td></td>
<td>of necrotic fat</td>
</tr>
<tr>
<td></td>
<td>grazed throughout most of winter</td>
<td>• Sloughing of rear hooves</td>
<td></td>
<td>• Remove fescue</td>
</tr>
<tr>
<td></td>
<td>• High quality, but also toxic</td>
<td></td>
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<td>• Good alternate feed</td>
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<tr>
<td></td>
<td>• Major grass in southeast</td>
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<td>• Summer slump often return to normal</td>
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<td></td>
<td>• Single or combination of syndromes if prolonged grazing</td>
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<tr>
<td></td>
<td>• Toxic agent: unknown</td>
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<tr>
<td></td>
<td>• Assoc. with fungus (Acremonium coenophialum) formerly Epichloe typhina</td>
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<td></td>
<td>. Grows inside plant's intercellular spaces (requires special lab procedures to detect)</td>
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<td></td>
<td>• Believed to dechr. prolactin levels</td>
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<td>**            **</td>
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<tr>
<td>Sorghum poisoning,</td>
<td>• Usually valuable forage</td>
<td>• Posterior incoordination</td>
<td>• History of sorghum &amp; CS</td>
<td>• Withdraw Sorghum from diet</td>
</tr>
<tr>
<td>Sudan grass poisoning,</td>
<td>• Grazing Sorghum spp. or hybrid sudan pastures</td>
<td>• Swaying rear limb gait</td>
<td>• No specific tests</td>
<td>• Improve over wk-mo (m' not be complete)</td>
</tr>
<tr>
<td>Cystitis/ataxia syndrome,</td>
<td>• Contain cyanide (mech. unknown)</td>
<td>• Knuckle over</td>
<td>• Urinalysis for cystitis &amp;</td>
<td>• No specific Tx</td>
</tr>
<tr>
<td>Lathyrism</td>
<td>• Worse when rapidly growing or stunted by drought</td>
<td>• Hopping gait</td>
<td>pyelonephritis</td>
<td>• ABs for urinary tract infection</td>
</tr>
<tr>
<td></td>
<td>• Other problems</td>
<td>• &quot;Dribbling&quot; (urinary incontinence)</td>
<td>• Postmortem</td>
<td>Control:</td>
</tr>
<tr>
<td></td>
<td>• Nitrate</td>
<td>• Relaxed perineal mm.</td>
<td>• Wallerian degeneration &amp;</td>
<td>• Diversity diet (Sorghum not complete diet)</td>
</tr>
<tr>
<td></td>
<td>• Spinal demyelination</td>
<td>• Flaccid distended bladder</td>
<td>swelling of axons</td>
<td>Description</td>
</tr>
<tr>
<td></td>
<td>• Teratogenic</td>
<td>• Vulva opens &amp; closes repeatedly</td>
<td></td>
<td>• 4.5' coarse perennials</td>
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<tr>
<td></td>
<td>• Horses almost exclusively, reported in sheep &amp; cattle</td>
<td>• Penis relaxed &amp; protruded</td>
<td></td>
<td>• Leaves 3/4&quot; wide</td>
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<tr>
<td></td>
<td>• Myelomalacia or lower spinal cord</td>
<td>• Cystitis 2nd to urine retention</td>
<td></td>
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<td></td>
<td>• Toxic to CNS</td>
<td>• Scalding of skin &amp; dermatitis</td>
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<tr>
<td></td>
<td>• Wet season - young growing grass</td>
<td>• Pyelonephritis sequela</td>
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<td></td>
<td>**                        **</td>
<td>• Abortions</td>
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<td>**                        **</td>
<td>• Foul from sudan grazed mares</td>
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<td></td>
<td>**                        **</td>
<td>• Articular ankylosis or arthrogryposis</td>
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</table>

**Prevention:**
- Graze other forage
- Where major forage (as in SE U.S.:
  - Test for presence and quantity of endophyte fungus
  - Dilute w/ legumes (unsuccessful)
  - Fungicides (unsuccessful)
  - Fungus free seeds planted

**CNS - Urinary**
- Recovery rare

**Description**
- 4.5' coarse perennials
- Leaves 3/4" wide
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<td>Chediak-Higashi</td>
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</table>
# Clostridial Infection

## Generalized Conditions

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<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
</table>
| **Blackleg, Emphysematous gangrene, Clostridial myositis** | • Peracute, febrile disease  
• Emphysematous & edematous swelling of heavy muscles  
• Cattle & sheep  
• *Clostridium chauvoei* (feseri) - Normal inhabitant of GI tract  
• Latent spores in soil  
• Ingested (?), passes from gut to bloodstream to muscles  
• Endogenous infec. (originate from w/in animal, DDx malignant edema)  
• Develops w/out wounds, but bruising m/ precipitate  
• Outbreaks - few new cases each day up to 10 days  
• Beef breeds mainly - Best animals of a group (healthy, gaining weight)  
• 6 mo-2 yrs (range 6 wk - 12 yr)  
• Summer & Fall, rarely winter | • Sudden onset - few found dead  
• Acute lameness  
• Marked depression  
• Fever initially, then normal or subnormal  
• Edematous & crepitant swellings of hip, shoulder, chest, back, neck, etc.  
• At 1st swelling small, hot & painful  
• Swelling enlarges, crepitation, skin cold & insensitive  
• Prostration & tremors  
• Death in 12-48 hours  
• Lesions m/b only in myocardium & diaphragm | • 1x (sudden death), CS  
• † Skeletal muscle enzymes (CK, AST, LDH)  
• Rapid clotting of blood  
• Postmortem:  
  - Muscles - dark red to black, dry & spongy  
  - Sweetish odor (rancid butter)  
  - Serosanguinous fluid & gas pockets  
  - FA for *C. chauvoei* rapid & reliable  
  - Take samples as soon after death as possible | • Outbreak  
- **Bacterin** to all susceptible cattle (protects in 10 days)  
- **Prophylactic penicillin** to all to prevent new cases for 10 ds, then bacterin protects  
• Individuals  
- Parenteral & multiple injections of penicillin (frequently unsuccessful)  
- **Debridement** &/or fenestration (to reduce swelling, aerate tissue & remove necrotic tissue) |

---

**Cl. chauvoei**, Not from wounds, Outbreaks  
**CS:** Lameness, Gaseous edema, Death  
**Dx:** PM: Dark muscles; FA  
**Tx:** Herd (Bacterin & ABs to all); Individual (ABs, Debride)  
**Px:** Guarded to Poor  

---

**Control for blackleg & malignant edema**  
- **Blackleg/malignant edema bacterin** (*C. septicum* combo w/ *C. chauvoei*)  
  - Calves vac. 2 x 2 weeks apart between 2-6 months (high risk areas)  
  - Revaccinate at 1 & 5 years old (m/b)  
  - Vac. for malignant edema before castration, dehorning in endemic areas  
  - Deeply bury, burn, or remove carcasses from premises
Malignant edema

**Mk 327, C3T 570, 897; IM 1671; BR-hb 288; BR 686; Br 559; Derm 154**

### Acute, generally fatal toxemia
- Cattle, horses, sheep, goats & pigs (man)
- *Clostridium septicum*
  - Often w/ other clostridial spp. (*C. chauvoei, C. perfringens, C. novyi & C. sordelli*)
  - Soil & intestinal inhabitant
- Contaminated wounds containing devitalized tissue
  - Trauma, castration, docking, unsanitary vaccinations & parturition
- Sporadic, individual usually, outbreaks rare

### Edema around wound
- Anorexia, intoxication, high fever
- Soft local lesions around wound
  - Edema - pit on pressure
  - Spread rapidly
  - Gas accumulation uncommon
- Parturition trauma of vulva
  - Marked edema of vulva
- Severe toxemia (iii)
  - Death in 24-48 hours

### DDx Similar to black leg
- History (wound), CS
- Postmortem
  - Similar to Black leg
- Lab:
  - FA staining
    - If specimen taken ≥ 24 hrs of death insignificant bec. invades from intest.

### C. septicum, Contaminated wounds
- CS: Fatal toxemia, Edema around wound
- Dx: DDx from blackleg, FA
- Tx: Emergency - Hi dose pen, Sx incision • Px: Poor
- Control: Vaccinate, Wound hygiene; Carcass disposal

### Emergency
- Hi doses of broad spectrum ABs early in dx (20,000 IU/kg IM BID penicillin)
  - Inject into periphery of lesion to check spread, affected tissue will still slough

### Surgical incision to provide drainage
- Debridement &/or fenestration to reduce swelling, aerate tissue & remove necrotic tissue
- Local irrigation w/ 3% hydrogen peroxide

### Prognosis:
- Poor

### Control (see above)
- Vaccinate
- Hygiene
- Debride all wounds
- Dispose of carcasses
  - If injection/infection problems: Inject penicillin along w/vaccine
### FPT - Anthrax

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>Failure of passive transfer, FPT</td>
<td>• Born w/out circulating immunoglobulins</td>
</tr>
<tr>
<td></td>
<td>• Colostrum (first milk) contains high % of immunoglobulin (passive transfer), protection against pathogens</td>
</tr>
<tr>
<td></td>
<td>• #1 cause of death in 1st wk</td>
</tr>
<tr>
<td></td>
<td>• Absorption 1st 12-18 hrs of life</td>
</tr>
<tr>
<td></td>
<td>- Specialized intest. epith. cells, absorb large proteins intact (immunoglobulins)</td>
</tr>
<tr>
<td></td>
<td>- Cells replaced in 36 hrs, 18 hrs better cut off for limit of Colostrum intake</td>
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<tr>
<td></td>
<td>- Stress (steroids) m/ cause premature closure of specialized cells</td>
</tr>
</tbody>
</table>

### Generalized Conditions

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can't be determined by PE</td>
<td>• Tx clinical diz</td>
</tr>
<tr>
<td>Lab - Immunoglobulins</td>
<td>• If less than 24 hours feed Colostrum (Zinc sulfate test)</td>
</tr>
<tr>
<td>1) Zn sulfate turbidity field test, 1 hr</td>
<td>• Over 24 hrs - plasma or serum transfusion (20-40 ml/kg IV)</td>
</tr>
<tr>
<td>2) Single radioimmune diffusion test - takes 24 hrs</td>
<td>• If concurrent disease, not as successful</td>
</tr>
<tr>
<td>3) Na sulfite turbidity test - field test (1 hr)</td>
<td>Prevention: Colostrum, Colostrum, Colostrum</td>
</tr>
<tr>
<td>4) Refractometer (total serum protein)</td>
<td>• Feed Colostrum automatically w/o test</td>
</tr>
<tr>
<td>- &lt; 5 g/dl inadequate, 5-6 questionable, &gt; 6 passive transfer</td>
<td>• Make sure suckle in first 6 hrs of life</td>
</tr>
<tr>
<td>5) GGT elevated</td>
<td>- Leaving calf w/ dam gets better absorption</td>
</tr>
<tr>
<td>- Field tests at 12 hours old (takes 6 hours to get immunoglobulins into blood)</td>
<td>- More difficult to monitor if nurse mother</td>
</tr>
<tr>
<td>- If failure give Colostrum</td>
<td>• If not, force feed w/ bottle (preferable over stomach tube) (better absorption)</td>
</tr>
<tr>
<td></td>
<td>• 2 L Colostrum in 1st 4 hours after birth</td>
</tr>
</tbody>
</table>

### Prevention:
- Feed Colostrum automatically w/o test
- Make sure suckle in first 6 hrs of life
  - Leaving calf w/ dam gets better absorption
  - More difficult to monitor if nurse mother
- If not, force feed w/ bottle (preferable over stomach tube) (better absorption)
- 2 L Colostrum in 1st 4 hours after birth

### Colostrum
- Colostrum bank (freeze Colostrum from 1st milkings)
  - Thaw or microwave & feed
- Colostrometer: measures specific gravity (immunoglobulin levels) < 1.050 assoc w/ low immunoglobulin

### Presentation/CS
- Bacteremia - Dyspnea - Diarrhea - Anorexia, depression - Weakness - Injected sclera
- Survivors of bacteremia m/ get:
  - Septic arthritis
  - Meningitis
  - Panophthalmitis

### Sequelae:
- Survivors of bacteremia m/ get:
  - Septic arthritis
  - Meningitis
  - Panophthalmitis
- Survivors of bacteremia m/ get:
  - Septic arthritis
  - Meningitis
  - Panophthalmitis

### Note:
1. 1st time heifers have lower Colostrum, also individual differences from cow to cow
Anthrax, Splenic Fever, Charbon, Milzbrand, Woolsorter’s diz

**Isolated areas in U.S.** (S. Dakota, Ark., Missouri, Louisiana, Texas & Calif.; last reported epidemic in 1950’s)
- Mostly in Africa, less commonly in Asia
- Sheep & cattle > horse, goats
- Bulls > cows
- Older animals > young - overgraze

**Bacillus anthracis**
- Normal flora of alkaline soils, Lg gram pos., cap~ulated, nonmotile, spore forming
- Spores extremely resistant
- Virulence factors (Capsule + EF, LF, PA)

**Pathophysiology**
- Spore ingestion (#1), inhalation or cutaneous penetration
- Lesions of reticuloendothelial system & vasculature destruction (tissue damage thru out body, diffuse edema, resp failure causes death usu., acute renal failure, damage vessels of CNS)
- Enzootic after climatic changes (heavy rainfall, flooding preceded by drought)
- Ingest. of contaminated animal origin feed (tankage, bonemeal)
- Worldwide outbreaks, animal products
- Predators of dead animals, problem where endemic
- Main reservoir is alkaline soil, animal origin feeds, in fertilizers of anim. wastes & wool products

**Acute > subacute >> chronic**
- Sudden death #1 CS
- Marked temperature elevation
- Excitement, then depression & muscle tremors
- Resp. & cardiac distress
- Stagger, convulsion, death (respiratory failure - 1-3 days)
- M/b blood from orifices
- Hematuria, Off feed
- Bloody diarrhea
- $\text{Milk production}$(blood tinged milk)
- SQ edematous swellings m/b
- Die in 1-3 days, convulsions, resp. distress

**Chronic infection rare in cattle**
- Edematous swellings

**Difficult to Dx**, esp. in new area
- History (area), CS
- Incomplete rigor mortis
- Black, tarry, bloody discharge from all orifices
- Do only partial necropsy (look for above w/o opening carcass)
- Lab:
  - Blood from jugular in leak proof container (ear is not a good specimen)
  - Dried blood swab
  - Staining & culture (capsule)
  - ELISA, Animal inoculation
- String of pearls

**Public Health - man**
- Cutaneous lesions (malignant pustules or malignant carbuncles), infec. through broken skin
- World wide outbreaks, animal products
- Predators of dead animals, problem where endemic
- Main reservoir is alkaline soil, animal origin feeds, in fertilizers of anim. wastes & wool products

**Outbreaks, Bacillus (spores), Animal origin feeds, Alkaline soil**
- CS: Sudden death, Resp., Staggering
- Dx: Bleeding, incomplete rigor, NO necropsy
- Tx: Fatal, ABs, Stop outbreak (Vaccinate herd)
- Px: Fatal - Control - Feds, Quarantine, Bury deep

**247**

**Control:**
- Annual prophylactic vac. (in endemic areas, Stern vac)
  - Vaccinate 2-4 wks before expected outbreaks
  - Live vaccine (so no antibiotics w/in 7 ds of vaccine)
- Notify federal agents
- Rigidly enforced quarantine (2 wks after last Dx case)
- Cremate or bury deep (2 m) all dead animals, bedding & manure (quicklime [Ca oxide] over carcass)
- Isolate sick
- Disinfect area

**Postmortem:**
- Only 1 carcass if necessary, safely, in easily disinfected environment, gloves & face masks
- Carcass nonautolyzed
- Black, tarry, bloody discharge from all orifices
- If opened (DON’T) - splenomegaly (excessively - 2 to 4 times normal)
- Incomplete rigor mortis
- Blood fails to clot
- Mucosal hemorrhages
- Edema noted throughout body, gelatinous edema present
Circulatory Shock

**Facts/Cause**
- Severe insufficiency in capillary perfusion
  - Resistance to blood flow
  - Widespread pooling of blood
  - Marked hypotension
  - Inadequate CO (cardiac output)
  - Inadequate blood volume
- Most common clinical shock assoc.
  - GI tract, infection, vascular strangulation w/bowel necrosis
- Conditions
  - Severe neonatal diarrhea
  - Salmonellosis
  - GI obstruction w/w stranguation
  - Septic mastitis
  - Peritonitis
  - Deep wounds & abscesses
- Complex systemic diz usually
  - Gram negative bacteria plus
  - Loss of intravascular fluids
- Uncommon causes
  - Hemorrhagic
  - Traumatic
  - Cardiogenic

**Presentation/CS**
- Rapid, weak pulse
- Heart sounds
- Pale, cold & dry mucous membranes
- Muscle weakness, depressed sensation
- Cold skin, esp. extremities
- Oliguria or anuria

**Diagnosis**
- History, Clinical signs
- Prolonged CRT (≥ 3 sec)
- CVP (central venous pressure) - water manometer in jugular vein
- Metabolic acidosis
- Postmortem:
  - Widespread hemorrhage

**Treatment**
- Emergency
- Replace fluid volume - Large volumes
  - Blood transfusion
  - Plasma or plasma expanders
  - Lactated Ringer's (electrolyte solution)
  - Empirical: 20-40 ml/kg conservative, 100-300 ml/kg q3h, monitor patient's response

**Drugs:**
- Dopamine (Intropin®) or dobutamine (Dobutrex®) safe, cardiotimulatory
- Steroids after fluid volume corrected
- Dexamethasone or prednisolone (tissue perfusion by arterial vasodilation)
- Broad spectrum ABs in all shock, except hemorrhagic & cardiogenic
- Penicillin G + aminoglycosides
- Mannitol IV to encourage urine flow & minimize cerebral edema
- Sodium bicarbonate to minimize acidosis (determine total CO2 or blood gases) (in older cows beware, acidosis lasts only short time, then alkalosis)
- Empirically: 1 mEq/kg by slow IV
- Banamine® (fight endotoxins)

**Pathophysiology:**
- Molecular diz - metabolic derangement
  - Anaerobic glucose metabolism => metabolic acidosis
    - Lactic acid, amino acids, fatty acids & phosphoric acids
    - Disrupts lysosomal membranes
    - Lytic enzymes cause cellular death
    - ATP (energy) production
    - Disrupted protein synthesis & cell membrane pump, decreasing ability to combat shock

Low tissue perfusion - #1 Endotoxins
CS: Rapid pulse, Pale, Weak, Cold, Anuria
Dx: CRT ≥ 3 sec, Acidosis
Tx: Emerg. - Fluids, Steroids, ABs, Bicarb
Classification of shock

- **Vasculogenic**: sequestration of blood in widely dilated vessels
  - Endotoxins
    - Septic mastitis
    - Peritonitis
    - Deep wounds & abscesses
    - E. coli
    - Strangulating GI obstruction
    - Septicemia
    - Liver diz
    - Diarrhea
  - Vasoactive agents of anaphylaxis
  - Severe, prolonged vasoconstriction from catecholamines
  - CNS trauma or paralysis causing vasomotor paralysis

- **Hypovolemic**: marked depletion of extracellular volume
  - Water & electrolyte loss
    - Diarrhea (neonatal, salmonellosis)
    - Acute intestinal obstruction
    - Sweating
    - Diuresis
    - Emesis
    - External or internal hemorrhage (rare)
  - Plasma exudation to outside or into body cavities

- **Cardiogenic**: loss of effective cardiac pumping action
  - Ineffective cardiac filling
  - Right ventricular dysfunction
  - Cardiac tamponade
  - Constrictive pericarditis
  - Hydropericardium
  - Positive pressure ventilation (PPV)
  - Restricted ventricular emptying
  - Cor pulmonale
  - Increase vascular resistance
  - Ruptured chordae tendineae
  - Cardiac dysrhythmias
  - Toxic myocardial depression

**Treatment:**

- **Replace fluid volume - Large volumes**
  - Blood transfusion: 20-40 mg/kg whole blood + 2-6 x this amount of balanced electrolytes
  - Plasma or plasma expanders (Dextran 70®) + electrolyte solutions (expensive)

- **Electrolyte solutions**: Lactated Ringer's preferred over normal saline when large quantities given, except if hyperkalemia exists
  - Ideal: monitor fluids by CVP, give until CVP reaches 5-10 cm H2O
  - Empirical: 20-40 ml/kg conservative, 100-300 ml/kg sometimes required, monitor by patient's response
  - Hypertonic solution (tonicity 8x plasma - 2400 mOsm/L)
    - Indications: trauma (esp. head trauma to prevent edema), hemorrhage, sepsis or GI fluid loss
    - Contraindication: dehydration, uncontrolled hemorrhage
    - Dextran 70® initially followed by balanced electrolytes in 30 min

- **Drugs**
  - Dopamine (Intropin®) or dobutamine (Dobutrex®) safe
  - Catecholamines generally contraindicated, except in anaphylactic shock
  - Steroids (CCS) after fluid volume corrected
    - Dexmethylasone or prednisolone (tissue perfusion by arterial vasodilation)
  - **Broad spec. ABs** in all shock, except hemorrhagic & cardiogenic
    - Penicillin G
  - Heparin: to treat or prevent DIC
    - Mannitol IV to encourage urine flow & minimize cerebral edema
  - Sodium bicarbonate to minimize acidosis (determine total CO2 or blood gases)
    - Empirical: 1 mEq/kg by slow IV
  - NSAIDs (Banamine®) fight endotoxins
# Enterotoxemia

## Generalized Conditions

### Condition

**Clostridial enterotoxemia**

- **Type C, Hemorrhagic enteritis**
  - *Clostridium perfringens* types C & D
  - Severe enteritis, dysentery, toxemia & hi mortality
  - Young calves, lambs, pigs & foals
  - Well fed calves < 2 wks-old
  - Beta toxin - Endotoxin derived from gram negative bacterial cell walls
  - Released into circulatory system
  - Effect caused by release of PGI2 & TXA2
  - Effects on cardiovascular function, respiratory system & GI changes

**Cl. perfringens, Hemorrhagic enteritis, Endotoxins**

- CS: Dysentery, Sudden death
- Dx: Hx, CS, PM - Gram positive
- Tx: Ineffective if CS • Prevention (Vaccine)

**Type A enterotoxemia**

- Causes "yellow lamb" diz; in calves suspected of causing 2 forms: 1. Intravascular hemolysis & capillary damage (uncommon) 2. Acute abdomen syndrome (sporadic)
- CS: Acute abdomen: bloat, colic, anorexia, depression w/o diarrhe or sudden death; sometimes diarrhe 1st week of life
- Recovery, then acute abdomen in 1-2 wks
- Dx: Hx, CS, PM: Abomasitis, abomasal erosions & ulcerations, grayish-black fluids in stomach

**Type B enterotoxemia** (IM 887; C3T 573; BR 694): Not reported in North America

**Type D enterotoxemia** (Mk 326; IM 888; C3T 574; BR 697) • *Clostridium perfringens* Type D, Sheep & goat diz. Rarely in cattle. Suspected in well-nourished beef calves nursing high producing cows grazing lush pasture & in sudden death syndrome in feedlot cattle (but lack supporting evidence)

### Facts/Cause

- Clostridium perfringens types C & D
- Severe enteritis, dysentery, toxemia & hi mortality
- Young calves, lambs, pigs & foals
- Well fed calves < 2 wks-old

### Presentation/CS

- Commonly in 1st days of life
- Acute diarrhea, dysentery
- Abdominal pain
- Convulsions
- Opisthotonus
- Sudden death m/b in few hrs
- Rarely some recover after few ds - Stunted & unthrifty

### Diagnosis

- Hx (sudden death), CS
- Postmortem:
  - Hemorrhagic enteritis & ulcerations of mucosa, deep blue-purple
  - Gram stain for gram + rods
  - Toxin detection of filtrates

### Treatment

- Tx usually ineffective if CS
- Hyperimmune serum
- ABs PO
- Outbreak in newborns from unvaccinated dams - Administer antiserum immediately after birth
- NSAIDs: flunixin meglumine (Banamine®) suppresses release of deleterious elements, especially if prior to onset of endotoxemia

### Prevention

- Vaccination of pregnant dam in last 3rd of pregnancy
- Initially 2 doses one month apart then annually

### NSAIDs
### Anaphylaxis

- Immediate (type I) hypersensitivity to antigens to which the body was previously sensitized
- Degranulation of mast cells & basophils (histamine, bradykinin, serotonin, prostaglandins, etc.)
  - Vascular permeability (edema)
  - Smooth muscle constriction
  - Exocrine gland secretion
- Lungs major target
- Precipitating agents
  - Vaccines
  - Drugs, Blood
  - Hypoderma spp., Bee stings, insect bites

#### Type I hypersensitivity - Antigen
- CS: Urticaria, Pruritus, Resp. distress, Shock
- Dx: Hx, CS, Auscultation
- Tx: Emerg. - Epinephrine, Steroids, Benadryl®

#### History; CS
- Urticaria
- Pruritus (itching)
- Bronchospasm & hypotension
  - Severe acute dyspnea
  - Flaring of nostrils
  - Extension of head & neck
  - Open-mouthed breathing
  - Hyperpnea
  - Abduction of elbows
  - Stertor
  - Shivering
  - Salivation, Frothing at mouth
  - Diarrhea
  - Edema
  - Nystagmus
  - Cyanosis

#### Sequelae:
- Hypotensive shock
- Resp. distress

#### Emergency
- Epinephrine IM/SQ
- Steroids IV/IM (dexamethasone)
- Benadryl® (diphenhydramine) IM/IV
- Other Tx
  - NSAIDs
  - Diethylcarbamazine
  - Shock doses of fluids (40 ml/kg/hr) w/ Na bicarbonate
  - Aminophylline (bronchodilator)
  - Diuretics
  - O₂ Tx
  - Tracheostomy
## IBR - BVD

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>IBR</strong></td>
<td>Herpesvirus 1 (BHV 1) - Older carriers</td>
<td>Large outbreak in less than 3 weeks</td>
<td>CS - resp., abortions, enteric diz, &quot;Red nose&quot;</td>
<td>Non-specific (palliative) - Most recover in 2 weeks</td>
</tr>
<tr>
<td><strong>Infectious bovine rhinotracheitis</strong></td>
<td>1° reservoir for younger animals (latent infection in neural tissue)</td>
<td>1) Upper resp. tract</td>
<td>Antibody titer only good indication of exposure</td>
<td>Reduce stress, high quality feed, fresh water</td>
</tr>
<tr>
<td><strong>&quot;Rednose&quot;</strong></td>
<td>Contagious - aerosol of viral particles - Found in semen, nasal &amp; resp. secretions</td>
<td>• Rhinitis &amp; tracheitis</td>
<td>Viral isolation (nasal fluids early in diz)</td>
<td>ABs in feed &amp; water - 2° diz in feed lots (oxytetracycline, sulfas, etc.)</td>
</tr>
<tr>
<td></td>
<td>Short IP - 3-7 days</td>
<td>• Conjunctivitis</td>
<td>Serum Neutraliz. Test - TOC</td>
<td>Ideally isolate, difficult in feedlot &amp; intensive dairy situation</td>
</tr>
<tr>
<td></td>
<td>&gt; 6 months old (passive immunity worn off)</td>
<td>• &quot;Red nose&quot; - hyperemia of muzzle</td>
<td>Auscultation of lung, normal w/ just IBR</td>
<td>1° isolate young calves</td>
</tr>
<tr>
<td></td>
<td>Stress due to weaning, crowding, vaccination, etc., Intensively managed animals, dairy or beef</td>
<td>• Ulcers &amp; plaques - mucous membranes</td>
<td></td>
<td>Herd outbreak</td>
</tr>
<tr>
<td></td>
<td>Corticosteroids (endogenous &amp; exogenous can cause recrudescence &amp; shedding)</td>
<td>• Initially temp, 106-107° F</td>
<td></td>
<td>Separate large group, to decr. exposure</td>
</tr>
<tr>
<td></td>
<td>2° bacterial pneumonia</td>
<td>• Salivation &amp; anorexia</td>
<td>Corticosteroids contraindicated (increases development of diz)</td>
<td>Stop breeding until IPV signs return to normal</td>
</tr>
<tr>
<td></td>
<td>- Virus destroys mucous membrane of trachea, allowing bacteria to enter</td>
<td>• Recover in 10-14 days, majority w/o Tx</td>
<td></td>
<td>Pxn: Good, most recover in 2 wks</td>
</tr>
<tr>
<td></td>
<td>Morbidity &lt; 5%, usually due to bronchopneumonia</td>
<td>Rarely corneal edema</td>
<td>Recovery = long term immunity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Erosion &amp; necrotic diphtheritic membrane in nasal cavity &amp; trachea</td>
<td>2° bronchopneumonia</td>
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<tr>
<td></td>
<td>Drop in milk production</td>
<td>Pasteurella - 10% more severe CS</td>
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<tr>
<td></td>
<td>Color &quot;red&quot;</td>
<td>Nasal discharge, mucopurulent</td>
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<td></td>
<td></td>
<td>Conjunctivitis w/ serous ocular discharge</td>
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<td>Wt loss &amp; recovery prolonged</td>
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</tbody>
</table>

### DDx:
- Pleuritis (p 72)
- Pleural effusion (e.g., hardware diz) (p 72)
- Fog fever (p 67)
- Pulmonary edema (p 67)
- Laryngitis (p 61)
- Tracheitis (p 61)
- Lungworms (p 69)
- Pink eye (178)

### Vaccines:
- **IM - MLV** (intramuscular) feedlot cattle
  - Can cause abortions
  - Ok for young & open females
- **IN - MLV** (intranasal) - breeding herds
  - Will NOT cause abortions - faster immunity?
  - Will not interfere w/ passive immunity

### Vaccination program:
- **Herds:**
  - 1 dose of MLV/IM 6 months = lifelong immunity
  - Large calf pop. (feedlot & dairy):
    - MLV- IN - 1-4 week
    - Revaccinate 3 months
    - Revaccinate 6 months
  - Calves entering feedlot:
    - MLV - IM w/in 24 hours
    - Revaccinate 3 months
    - Revaccinate 6 months

### Contagious, Carriers, Stress, 2° bacteria
- CS: Upper resp., Pneumonia, GI, IPV, Abortion, CNS
- Dx: CS, Hx, Serum neutralization
- Tx: ABs, Isolation • Pxn: Good
Togavirus: Non- & Cytotoxic biotypes
CS: Multisystem viral disease
• Classical BVD: GI (diarrhea/oral) - Recover
• Respiratory: fever, tachypnea - Recover
• Abortions: "Weak calf"
• BVD/MD: Noncytopathic + Cytopathic -> Death

Dx: PE, Hx, CS, PM, Isolation

Tx: 
• BVD & Resp/Repro: Fluids, ABs
• BVD/MD & Chronic infec.: Slaughter

Px: 
• BVD, Resp, Repro: Guarded to Fair
• BVD/MD, Persistent infec.: Grave

Vaccination: 2 injections w/ annual booster

1. Majority - usually unobserved systemic infect. Neutralizing antibodies protect for several yrs.
2. Classical BVD
• Gastroenteritis
• Diarrhea - explosive, watery, m/b blood & mucous
• Dull, depressed, anorexic w/ fever
• DE, RR
• Rumen distension, m/b mild bloat
• Rt. flank splashing sounds (intest. dilatation & fluid)
• Rapid dehydration - elect. & acid/base abn.
• Oral lesions - 75%; m/h develop for 10 days
• Necrotic tongue - hyperemic w/ blunting of oral papillae
• Most recover in 10 days
• If profuse diarrhea m/die w/in 48 hrs.

3. Respiratory signs
• Continuous to intermittent fever
• Tachypnea w/ normal lung sounds (so not pneumonia)
• Recovery in 10 days if no 2° bact. infec.

4. Transplacental infection
• Abortion, cerebellar ataxia, ocular defects
• "Weak calf" syndrome
• Persistently infected & shedding

5. Mucosal dix (chronic BVD, BVD/MD)
• 100% fatality, but low morbidity
• Oral erosion, also nares, teats & vulva
• Total anorexia - cachexia
• Diarrhea - if persistent & severe, die acutely
• Mucopurulent nasal & ocular discharge
• Occasional corneal lesions, 1° corneal edema
• Lameness, erosive coronary band & interdigital space

6. CNS: cerebellar hypoplasia
(See Neuro pg 139)

• Presumptive - PE & PM
• Defin. Dx requires 2-3 weeks
• Serum neutralization test or
• Viral isolation from saliva or feces
• Fetal fluids
• Persistently infected sero-negative, so viral isolation
• Leukopenia
• Dx important to DDx from similar sign in Rinderpest & FMD

• Postmortem:
• Degenerative epith. cells (GI)
• Erosion from mouth to intestine
• Necrosis of lymphoid tissue
• Peyer's patches (dark red necrotic foci in ileum)

DDx:
• Infect. dix w/ oral lesions, diarrhea, fever
• Salmonellosis (p 259)
• Blue tongue (p 10)
• Malig. cattarh of fever (p 10)
• Rinderpest (p 9)
• Wnter dysentery (p 23)
• Parovirus (p 30)
• Vesicular stomatitis (p 13)
• IBR in neonates (p 252)
• Parasitic diseases
• Trichosporon (p 56)
• Sarcocystis (p 225)
• Coccidia (p 260)
• Toxicity
• Chlorinated naphthalene (p 213)
• Heavy metals (p 152)
• Nitrites (p 231)
• Caustic substances

• Flucts (for dehydration)
• Prophylactic ABs
• Good husbandry (fresh water, feed & salt available)
• BVD/MD - cull
• Persistently infected cows - sold to slaughter

Prognosis:
• BVD: Guarded
• Cow that aborts, breeding back: Good to excellent
• Mucosal dix: Grave
  • Euthanasia
  • 100% fatal
  • Persistent infec.: Sold for slaughter

Vaccination - good for dairy herds & beef cow/calf operations, questionable for feedlots
• Modified Live Vaccine (MLV):
  • Immunosuppress. adds to shipping fever
  • Not in pregnant cows - feto-pathic
  • Killed vaccine (KV):
    • Recommend killed vaccine at 6 mos
    • Use only killed in pregnant

Vaccination schedule:
• 1° immunization
  • 2 wks - booster
• Annual revaccination

Breeding farm
• Vac. all breeding age cattle
• Vac. heifers betw. 6 & 14 mos twice (KV) or prior to breeding (MLV)
• Goal is to reduce losses, not eliminate infectious agent
• Vaccinate feedlot cattle in preconditioning period (MLV)

Bovine viral diarrhea (BVD) / Mucosal disease

Mk 166; C3T 432; C2T 485; IM 636; 1806, 1103; BR: Hb 389; Br: 993; Br: 660, 627, 811, 472; DC 85, 197; BM&S 122; GI 765, 774, 789; Pa 54; Pic 50, 485; R-M 254

2. Classical BVD
• Gastroenteritis
• Diarrhea - explosive, watery, m/b blood & mucous
• Dull, depressed, anorexic w/ fever
• DE, RR
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• Occasional corneal lesions, 1° corneal edema
• Lameness, erosive coronary band & interdigital space

6. CNS: cerebellar hypoplasia
(See Neuro pg 139)
### Haemophilus - Pasteurella

#### Condition
- **Haemophilus somnus**, Gram neg.
- Calves, Feedlot, 4-12 months
- 4 weeks after entering feedlot
- **Septicemic diz**
  - TEMA (thromboembolic meningoencephalitis), Tropism for brain (cerebellum & brain stem)
  - Lungs (pneumonia more common)
  - Joint infections in those that have averted fatal septicemia
  - Infertility, metritis, vulvitis, orchitis, conjunctivitis, ostitis, mastitis
- Morbidity low, 2-10%
- Pathogenesis not clear

#### Facts/Cause
- *Haemophilus somnus*, Gram neg. pleomorphic rod or coccolbacillus
- Calves, Feedlot, 4-12 months
- 4 weeks after entering feedlot

#### Presentation/CS
- **Bronchopneumonia**, resp. CS: alone or leading to CNS CS
  - Hacking cough
  - Dyspnea
  - Pleuritis
  - Fever
- **CNS cerebellum & brain stem**
  - Depression
  - Ataxia, paralysis
  - Knuckling at fetlock, fall while walking, interference (proprioceptive deficits)
  - Blindness
- **Recumbency**
  - Opisthotonus, nystagmus, strabismus, head tilt
  - Coma & death - 36 hrs m/b
- **Septic arthritis**, hock & stifle
  - Swollen joints & tendon sheaths
  - Poor condition
  - Stiffness
- **Myocardial abscesses**
  - Found dead, or
  - Fever
  - Respir. distress & depression from left heart failure
- **Retinal hemorrhages** (vasculitis) seen w/ all forms
- Endometrial syndrome (Australia & Europe)
  - Vaginal discharge, rare abortions

#### Diagnosis
- History (feedlots)
  - CS (CNS, resp. & joint diz)
  - Lab:
    - CSF analysis
      - Suppurative exudate (+ PMNs)
      - Elev. protein
      - Xanthochromia
      - *H. somnus* org.
- **Postmortem:**
  - Vasculitis to septic infarcts & abscesses

#### Treatment
- Effective if early (check other feedlot cattle every 2 hours)
- IV ABs at hi levels (double dosages)
- Oxytetracycline (economic)
- Penicillin/streptomycin
- Also thiamine - PEM
- Chlorotetracycline in feed for 10 days (for herd Tx)
- Tx endotoxic shock
  - IV fluids
  - Steroids (dexamethasone)
- Course of disease 2-3 weeks

#### DDx:
- CNS
  - Polioencephalomalacia (p 40)
  - Hypovitaminosis A (p 142)
  - Listeriosis (p 143)
  - Malignant catarrhal fever (p 10)
  - Lead poisoning (p 152)
  - Rabies (p 144)
  - Respiratory
    - *P. haemolytica* (p 255)
    - *P. multocida* (p 255)
  - Mycoplasma
  - Myocardia
    - Sudden death syndrome
    - Anaphylaxis (p 251)
    - Repro. infections
      - Actinomyces pyogenes (p 129)

#### Polioencephalomalacia (PEM)
- Difficult to distinguish clinically from TEMA so give thiamine along w/ ABs

#### Feedlot calves, 4 wks after entering feedlot

#### CS: Resp. + CNS + Joint

#### Dx: Hx, CS, CSF

#### Tx: Hi ABs + Thiamine, Fluids, Steroids
**Pasteurellosis**

** Pasteurella multocida & *P. haemolytica***
- Commensals of nasopharynx
- **Forms**
  - **Shipping fever:** pneumonia in feedlot cattle most common form. 1st cause of death due to undifferentiated resp. diz.
  - Viruses, mycoplasma & stress contribute.
  - 1-2 weeks after shipping.
  - **Enzootic pneumonia**
    - Young dairy & veal calves, 2-5 mo.
    - Crowded/poorly vented housing.
    - Sporadic pneumonia in adult dairy cattle.
    - Localized infections.
    - Abortions.
    - Mastitis.
    - Meningitis.
    - Acute fatal septicemia (rare): in Asia, Africa, in USA in Bison, but considered nonexistent in cattle (only 1 confirmed case in cattle in the US).

**Sequelaes:**
- Localized infections (e.g., middle or inner ear).
- Abortions.
- Mastitis.
- Meningitis.
- Septicemia (hemorrhagic).
- (Absent in USA?)

**Shipping fever & Enzootic pneumonia**
- Fibrinous bronchopneumonia.
- Depression (head hanging).
- Anorexia.
- Fever.
- Dyspnea († & shallow RR).
- Mucoid or purulent nasal discharge (viral component).
- Conjunctivitis.
- Coughing.
- Weight loss/Poor gain.
- Expiratory grunt.
- Rapidly fatal.

**Hx (shipping/crowding)**
- **CS**
- Auscultation:
  - Friction sounds, expiratory grunt, esp. cranioventrally.
- C&S (culture & sensitivity)
- Nasal swabs, bronchoalveolar lavage.
- Postmortem:
  - Cranioventr. consolidation, hemorrhage & necrosis.
  - Airways filled w/ bloody, fibrinous exudate.
  - Fibrinous adhesions betw. lungs & thoracic structures.
  - Histology:
    - Atelectasis, bronchiolitis, fibrinous exudate, PMNs.
    - Oat-shaped "streaming" macrophages.

**Antibiotics (C&S)**
- First line drugs for 3-4 ds.
- Relapse: 2nd line ABs for 3-6 days.
- Naxel®, Micotil®.
- Long-acting - blood levels for 3 ds.
- Oxytetracycline.
- Tilmicosin.
- Reduce stress.

**Prognosis:***
- **Variable** (age, time of year, management).
- Shipping fever - Good/Guarded.
- Good if temperature drops in 3 days (80% response).
- 3-4% case fatality acceptable.
- Enzootic calf pneumonia - Good/Guarded.
- Low mortality w/ Tx.
- Some poor doers on recovery.

**Prevention:**
- Shipping fever
  - Chlorotetracycline in feed (1-4 g/head/d for first 2 weeks postarrival) or
  - Combo: sulfamethazine + chlorotetracycline
  - Adequate dry matter consumption.
- Adequate detection of diz.
  - Vaccinate for IBR & PI-3 before shipping.
  - Reduce stress.
- Enzootic pneumonia
  - Adequate colostrum.
  - Management (housing & ventilation): individual hutches.
  - Vaccines - bacterins & leukotoxoids.

**Stress + Virus + Pasteurella**
- **CS:** Shipping fever, Enzootic pneumonia.
- **Dx:** Hx, CS, Friction rub, Fibrin.
- **Tx:** ABs, Decr. stress.
- **Px:** Good/Guarded.
<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
</tr>
</thead>
</table>
| **Nocardioses**    | - Pyogranulomatous infection  
                      - Nocardia asteroides, N. farcinica, etc.  
                      - Exogenous nocardioform bact.  
                      - Isolated or epizootic  
                      - Soil inhabitant  
                      - **Cause:**  
                        - Environmental contamination (mastitis)  
                        - Iatrogenic foreign body  
                        - Inhalation  
                        - Wound contamination |
| **Multisystemic diz, Mastitis #1, Uncommon** | **Presentation/CS**  
- Bovine farcy (mycetoma) exotic in Africa  
- Draining sinus, granule formation  
- Contamination of wounds, SO lymphatic spread to local lymph nodes  
- Pneumonia (rare)  
- Calves < 6 months old  
- Abortion - rare  
- Mastitis - uncommon (most frequent form of Nocardiosis)  
- Acute (fever & malaise), nonresponsive chronic, subclinical  
- Multiple caseating granulomas  
- Septicemia - rare |
| **Q-fever**        | **Diagnosis**  
- Serological tests, complement fixation, immunofluorescence |
| **Control:**       | **Treatment**  
- Hygiene, relentless culling of cultured & clinically positive cows  
- For all forms guarded to poor |
| **Public health**  | **Tx for humans:**  
- Tetraacycline (TOC) not as effective as against other rickettsia |
| **Stained smears** | **Tx not practical in cattle**  
- Culture (placenta, uterine discharge, mammary secretions, or fetal liver)  
- Serological tests, complement fixation, immunofluorescence |
| **Inapparent in cattle usually** | **Stained smears**  
- Infertility & sporadic abortion in cattle |
| **PH**             | **Tx not practical in cattle**  
- Tetraacycline (TOC) not as effective as against other rickettsia |
| **Public health**  | **For all forms guarded to poor** |
| **Influenza type diz in man** | **For all forms guarded to poor** |
Leptospirosis

**Leptospira serovars**
- Slender spirochete difficult to isolate
- L. hardjo #1, 25% ("reservoir")
- L. pomona 17% (kennewicki)
  - Reservoir hosts: pig & wild animals, L. canicola 10%, L. icterohaemorrhagiae, etc.
- Each adapted to maintenance ("reservoir")
- Persistent infection in kidney & sometimes genital tract (carrier)

**Complex, economically important (stillbirth & abortion)**
- Poorly understood because of difficulty with Dx & control
- Ubiquitous, persistent infections
- Public health - Infective to man, caution

**Transmission**
- Direct, esp. in maintenance host (L. hardjo in cattle)
  - Urine splashing, placental or urine discharge after abortion, venereal, through milk, across placenta
- Indirect (incidental host)
  - Envir. contamination by urine of carrier animal
  - Survives in water wks-mos (warm, moist temperatures), temperate climates in fall & early winter
- Pathogenesis (see box)

**SUBCLINICAL** - most esp. in nonpregnant & nonlactating cows
- Difficult
- IF (immunofluorescence) of urine, fetal lung & kidney or placenta (special labs)
- MAT (microscopic agglutination test), better for acute than chronic
  - Titers ≥ 100 significant
  - 4 fold → 2 weeks apart diagnostic, no value for chronic infection
  - Herd serology more valuable
  - Divide herd into age groups
  - ≥ 300 indicates active infection
  - Bacterial isolation impractical (difficult, expensive & time consuming)

**ACUTE INFECTION**
- Calves, L. pomona
  - High fever
  - Hemolytic anemia
  - Hemoglobinuria
  - Icterus
  - Pulmonary congestion
  - Meningitis occasionally
  - "Milk drop syndrome" or "flabby udder mastitis" - Older dairy cattle, L. hardjo usually
  - Drop in milk prod for 10 days
  - Transient fever (pyrexia)

**CHRONIC INFECTION**
- Fetal infection
  - Infertility
  - Abortion (< 10%, 4 mos to term, esp. 3rd trimester)
  - Stillbirths
  - Premature, weak, infected calves
  - Healthy infected calves
  - M/b related to previous infec.
  - 6-12 wks before
  - Sequela (L. hardjo): retained placenta

**Control:**
- Vaccination
  - Annually in low risk herd
  - Twice yearly in high risk herd
  - Introduced cattle
    - 1 to several Txs w/dihydrostreptomycin IM sid
    - Vaccinate before entering herd
  - Calves: vaccinate ≥ 6 months, 2 doses 1 month apart
  - Problem doesn't prevent L. hardjo kidney carriers

**Prognosis:**
- Calves: high mortality
- "Milk let down" - Good - recovery in 10 days w/o Tx
- Abortion: usually only once

**Pathogenesis:**
- Penetrates mucous membranes & skin; 4-10 ds incubation
- Spreads to liver, kidney, lungs, reproductive (udder, placenta), CSF
- Antibody production stops bacteremia
- Organism persists in kidney (prox. convoluted tubules), CSF, eye, reproductive tract (uterus, male genital tract)

***

**Carriers, Shed in urine - Penetrates skin, $**

CS: Subclin., Acute (Calves - Flabby bag), Chronic (Abortion)
Dx: Difficult, Immunofluorescence, Microscopic Aggl. Test
Tx: Acute (Strepto. or Tetracycl.); Chronic (Vac., Streptomycin)
Control: Vaccine annually or biannually
### E. coli - Leptospirosis

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>E. coli Colibacillosis, Coliform mastitis, Enteric E. coli, Enterotoxigenic colibacillosis, Neonatal septicemia</td>
<td>E. coli - Normal GI flora, in GI soon after birth - Adhere &amp; colonize gut wall (pili - K99, F5) - Mostly colon</td>
<td>Diarrhea/septicemia - Found dead w/o diarrhea - Profuse watery diarrhea, white to yellow - Dehydration - Acidosis - Weakness - Death in 6-12 hours (1-4 days) - Milder forms can’t be differentiated from other causes of diarrhea</td>
<td>Hx, CS</td>
<td>Diarrhea/septicemia - Aggressive Tx - Isolate - Fluid &amp; electrolytes to restore hydration &amp; vigor - Broad spec. ABs</td>
</tr>
<tr>
<td></td>
<td>Calves &lt; 4 ds old (occasionally older) - FPT (failure of passive transfer)</td>
<td>Sequelea - Iritis, hypopyon - Pneumonia - Joints/arthritis - Meningitis - neck rigidity</td>
<td></td>
<td>Mastitis - Hygiene more important than individual cow Tx - Feed right after milking - Individual - Milk out, QID min - Intramammary ABs - IV fluids</td>
</tr>
<tr>
<td></td>
<td>Forms</td>
<td>Mastitis - Acute clinical mastitis - Subclinical infection common - Sequelae - Toxic shock, possibly death</td>
<td>Lab: - Metabolic acidosis - SCC (somatic cell count) in milk</td>
<td>Prognosis: - Once in blood stream - Poor</td>
</tr>
<tr>
<td></td>
<td>Enterotoxin/Septicemia - hypersecretions of electrolytes, fluids, bicarbonate, water (dehydration, electrolyte disturbances &amp; hypoglycemia) - Enterotoxigenic K99 - Septicemia - bacteria &amp; their toxins in blood stream, fever not consistent feature of septicemia in neonates - May enter through umbilicus or orally</td>
<td></td>
<td>Prevention: - Diarrhea/septicemia - Hygiene - Colostrum - Bacterin (K99 + E. coli) 6 &amp; 3 wks before calving to be effective</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Enterotoxigenic K99</td>
<td></td>
<td></td>
<td>Mastitis - Sanitation - Feed right after milking</td>
</tr>
<tr>
<td></td>
<td>Septicemia</td>
<td></td>
<td></td>
<td>Devastating losses</td>
</tr>
<tr>
<td></td>
<td>Mastitis</td>
<td></td>
<td></td>
<td>CS: Diarrhea/Septicemia; Mastitis Dx: Hx, CS, Culture Tx: Aggressive: Fluids, ABs</td>
</tr>
</tbody>
</table>

**GENERALIZED CONDITIONS**

<table>
<thead>
<tr>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diarrhea/Septicemia: GI pg 18 Mastitis: Skin pg 195</td>
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</tr>
</tbody>
</table>
# Coccidiosis

**Coccidiosis**
- Eimeria bovis (cecum & colon)
- Eimeria zuernii (small & large intestine)

**Facts/Cause**
- Called a man-made disease
- Young & stressed animals

**Presentation/CS**
- Mild cases
  - Diarrhea
  - Listless & anorexic for a few days
- Severe
  - Hemorrhagic diarrhea (mucus & sloughed intestine)
  - Fresh, unclotted blood from anus
  - Rough hair coat
  - Tenesmus (protrusion of anus)
  - Myiasis (on soiled hindquarters)
  - Emaciation, dehydration & weakness
  - Die or slow recovery

**Pathogenesis:**
- Extensive destruction of intestinal epithelium
- Villous atrophy, malabsorption & protein-losing enteropathy
- Synergistic with Trichostrongylus colubriformis worm

**Diagnosis**
- History, Clinical signs
- Demonstrate parasite in clinically sick animals
- Coccidia alone not diagnostic
- Oocysts may not be in feces in some clinical infections
- Smears of hemorrhagic stool
- Flotation (Sheather's sugar solution)
- Sporulate in potassium dichromate solution for 1-14 days

**Treatment**
- Difficult to treat & success normally limited
- Anticoccidial drugs (Tx & prophylactic)
  - Amprolium (TOC)
  - Sulfonamides
  - Nitrofurazone (not approved in USA)
- Supportive
  - Fluids
- Helminths (deworm)

**Prevention:**
- Reduce oocysts - hygiene
- Dry (remove feces daily from pens)
- Elevated feed troughs
- Avoid overcrowding
- Coccidiostats in feed before & during stressful periods
- Ionophores (Rumensin® (monensin), lasalocid) as feed additives

**Amprolium**
- Reduce oocysts - hygiene
- Dry (remove feces daily from pens)
- Elevated feed troughs
- Avoid overcrowding
- Coccidiostats in feed before & during stressful periods

---

**Coccidiosis**
- Eimeria, Young & stressed, Destruction of intestinal epith.
- CS: GI (Hemorrhagic diarrhea, Emaciation); CNS (Nervous)
- Dx: Coccidia in sick calf
- Tx: Difficult, Amprolium to sick & exposed
- Prevention: Hygiene, Coccidiostats in feed

**Life cycle:**
- Sporulated oocysts ingested
- Sporozoites released in small intestine & enter epithelial cells
- Meronts (shizonts) formed & become merogony (schizogony)
- Meronts released into gut, penetrate epithelium & repeat process
- 2nd stage merozoites into gut & enter epithelial cells & initiate sexual stage; some become macrogametes, some microgametes which fertilize each other to become unsporulated oocyst
- Sporozont (unsporulated) passes in feces & sporulates (oocyst)

---

**Eimeria, Young & stressed, Destruction of intestinal epith.**

CS: GI (Hemorrhagic diarrhea, Emaciation); CNS (Nervous)

Dx: Coccidia in sick calf

Tx: Difficult, Amprolium to sick & exposed

Prevention: Hygiene, Coccidiostats in feed
<table>
<thead>
<tr>
<th><strong>Sarcocystosis, Sarcosporidiosis</strong></th>
<th><strong>Coccidial protozoan - Sarcocystis</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mk 562; IM 1043, 1511; 1562; C3T 625, 900; C1T 778; BR-hb 456; BR 1101; Br 244; DC 492</td>
<td>Most subclinical</td>
</tr>
<tr>
<td>- 2-host cycles: predator/prey</td>
<td></td>
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<td></td>
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<tr>
<td>- S. cruzi (dog-cattle), S. hirsuta (cat-cattle), carnivore definitive host</td>
<td></td>
</tr>
<tr>
<td>- Sarcocystis into vascular endothelia</td>
<td></td>
</tr>
<tr>
<td>- Shizosoma - merozoites invade muscle to become sarcocysts</td>
<td></td>
</tr>
<tr>
<td>- Carnivores eat meat w/ sarcocysts</td>
<td></td>
</tr>
<tr>
<td>- Transmission: ingestion of sporocysts in carnivore feces by ox</td>
<td></td>
</tr>
<tr>
<td>- $95,000,000 annual loss in USA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Most subclinical</td>
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<td></td>
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<tr>
<td>- Acute diz if overwhelming exposure</td>
<td></td>
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<tr>
<td>- Fever, anorexia</td>
<td></td>
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<tr>
<td>- Emaciation</td>
<td></td>
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<tr>
<td>- Hair loss on tail switch (&quot;rat tail&quot;)</td>
<td></td>
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<tr>
<td>- Pale mucous membranes (anaemia)</td>
<td></td>
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<tr>
<td>- Arrested growth, Death</td>
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<tr>
<td>- Sequela: Abortion</td>
<td></td>
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<tr>
<td>- Chronic</td>
<td></td>
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<tr>
<td>- Edema of limbs, or weight gain</td>
<td></td>
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<tr>
<td>- Hyperexcitability</td>
<td></td>
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<tr>
<td>- Hypersalivation</td>
<td></td>
</tr>
<tr>
<td>- Muscular atrophy</td>
<td></td>
</tr>
<tr>
<td>- CNS: weakness, prostration &amp; death, depression, somnolence (sleepy), blindness, ataxia, odontoprosis, blindness, nystagmus, hyperexcitability, propulsive walking, head pressing</td>
<td></td>
</tr>
<tr>
<td>- Carnivores - asymptomatic</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Coccidia, Predator/Prey cycle</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>CS: Most subclinical; &quot;Rat tail&quot;, Emaciation</td>
</tr>
<tr>
<td>Tx: None, Control (keep dogs away), Monensin</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>**Exotic dizs (NOT in USA) *</th>
<th>**Besnoitiosis, Elephant skin diz (C3T 596; Br 735)</th>
<th>**Tick born fever, Pasture fever (C3T 620; IM 1204; B4 742)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Akabane diz (Mk 333, IM 973; C3T 442; Br 752)</td>
<td>- Mainly in Africa; protozoal parasite (Besnoitia besnoiti)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- CS: Congenital abnormalities - arthrogryposis, torticollis, kypflexis, scoliosis; blind, ataxia</td>
<td></td>
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<tr>
<td></td>
<td>- Tx: None</td>
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<tr>
<td></td>
<td>**Trypanosomiases, Tsatse fly diz, Sleeping sickness, Surra, Nagana (C3T 604; IM 1063; BR-hb 466; BR 1212)</td>
<td>**Heartwater, Cowdriose, Daji (C3T 628; IM 1049; Br 707, 744)</td>
</tr>
<tr>
<td>Only in Africa, first reported in Rift Valley of Kenya, arthropod-borne, viral diz (Phlebovirus) affecting sheep, cattle, goats &amp; humans (people: temporarily incapacitating illness usually; in 2% hemorrhagic fever, anencephalitis &amp; renal diz, possibly fatal)</td>
<td>- Subtropical &amp; tropical areas, Protozoal diz of people &amp; animals transmitted by vectors</td>
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</tr>
<tr>
<td></td>
<td>- CS: Intermittent fever &amp; presence of parasite in blood, causing anaemia, weakness, weight loss, &amp; often hi mortality rates</td>
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<tr>
<td></td>
<td>**Bovine ehrlichiosis, Nofel (C3T 616)</td>
<td>**Africa &amp; 3 Caribbean islands; infectious, virulent, noncontagious tick-borne rickettsial diz of ruminants</td>
</tr>
<tr>
<td>Tropical tick-borne rickettsiosis, seldom recognized or reported</td>
<td>- Tropical tick-borne rickettsiosis of cattle; low mortality, viramia, decc, milk, immobilizes cattle, stiffness or lameness, fever, prolonged recumbency</td>
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<td>- CS: Adult - fever, weight loss; death rare</td>
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<td>**Bovine petechial fever, Ondri diz (C3T 618; Br 743)</td>
</tr>
<tr>
<td>Australia, Asia &amp; Africa; vector (? Culicoides &amp; mosquitoes) transmitted rhabdovirus diz of cattle; low mortality, viramia, decc, milk, immobilizes cattle, stiffness or lameness, fever</td>
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<tr>
<td></td>
<td>- CA: Africa, rickettsiosis</td>
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<tr>
<td></td>
<td></td>
<td>- East &amp; Central Africa; protozoal parasite; Transmission: tick</td>
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<tr>
<td></td>
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<td>- CS: Fever, depression, anorexia, enlarged lymph nodes, photophobia, corneal opacities, constipation then diarrhea, petechiation, anemia, icterus, weakness, recumbency, terminal resp. distress, moist cough &amp; frothy fluid from nose, &quot;turning sickness&quot; (CNS), high mortality</td>
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<tr>
<td></td>
<td></td>
<td>- Tx: Parqueoume IM; 90% recovery</td>
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<tr>
<td></td>
<td></td>
<td>- Prevention: Tick control</td>
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<tr>
<td></td>
<td></td>
<td><strong>Control:</strong></td>
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<tr>
<td></td>
<td></td>
<td>- Don't allow dogs to eat raw meat</td>
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<tr>
<td></td>
<td></td>
<td>- Keep carnivores away from feed</td>
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<tr>
<td></td>
<td></td>
<td>- Rumensin® (Monensin [100 mg/kg 30 d]) prophylactic feeding</td>
</tr>
<tr>
<td>Bovine ephemeral fever (C3T 449; B4 747; Derm 114)</td>
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</tbody>
</table>
**Skeleton**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
</tr>
</thead>
</table>
| Osteomalacia       | Grazing adults in P-defc areas  
|                    | Pregnant & lactating at greatest risk  
|                    | Calcium defc diets                                                          |
| **Osteoporosis**   | **[IM 1310; L 405]: Bone fragility & spontaneous fx; Assoc. w/ copper defc; See Cardio pg 89** |
| **Rickets, Osteodystrophy, Calcium/Phosphorus/Vitamin D defc** | Mx: 487; C1T: 321; IM 1293, 1336; BR-hb 543; BR 1433; L 400  
|                    | Uncommon  
|                    | Detractive mineralization of bone  
|                    | Young, growing animals  
|                    | Not affected: calves on milk diet  
|                    | Weaned  
|                    | Pathophysiology  
|                    | Defc of phosphorus or Vit D  
|                    | Calcium defc & phosphorus excess (nutritional 2°Hyperparathyroidism)  
|                    | Mg, Zn, manganese, Vit A defc also implicated  
|                    | Not enough sunlight (winter grazing, housing)  
|                    | Absence of Vit D supplementation  
|                    | Young grazing green cereal crops in cloudy season  
|                    | Brassica spp. (turnips, swedes, rape)  
|                    | Hypophosphatemia  

**Defective mineralization of bone**  
CS: Lameness, Swellings, Mottled teeth  
Dx: Hx, CS, Tx response, Rads  
Tx: Supplement Ca, P, Vit D

**GENERALIZED CONDITIONS**

<table>
<thead>
<tr>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
</table>
| Loss of condition  
| Pica  
| Lowered fertility  
| Stiffness, creaking joints  
| Shifting lameness  
| Recumbency periods  
| Fractures (knocked down hips & ribs) | • ↑ ALP  
| Radiographs  
| Porous bones  
| Tx response  
| Analysis of diet | • Ca/P ratio in diet  
| Grazing animals - access to mineral mixes  
| (powdered limestone)  
| Dairy - Ca incorporated in diet  
| Ca:P 50:50 incorporated w/ common salt |

**Ca + P**

**Prognosis:**  
• Good for ambulatory patients

**Prevention:**  
• Easy: balanced diet w/ appropriate supplementation (not excess or cause other problems) to growing animals
Hereditary skeletal defects (C1T 98; BR-hb 647; BR 651; IM 1729)

Osteopetrosis • Angus, Hereford & Simmental calves, Autosomal recessive trait, Calves born prematurely at 262 days gestation (Normal 281-292 days)
* CS: Small size & birth weight, Brachygnathia inferior (short lower jaw), Impaction of molar teeth, Misshapen coronoid & condylar processes, Open fontanelle, Thickened cranial bones, Agenesis or hypoplasia of foramen of skull
* Dx: Rads - Bone-within-bone appearance (lack of bone marrow cavities); Lethal

Dwarfism (R-M 182): Bulldog calves (Dexter), Hereditary defect in interstitial growth of epiphyseal, articular, basocranial cartilages resulting in short legs
* Tx: Cull

Arachnomelia (CIT 98) (arachno: spider): Simmental calves - dolichostenomelia (arachnodactyly - abnormal length & slenderess), extreme fragility of long bones, deviation of vertebral axis, arthrogyrosis, brachygnathia inferior, cardiac defects

Brachiognathia inferior or superior (R-M 182): shortness
* of upper or lower jaw (parrot beak/mouth)

Prognathia inferior or superior: abnormal lengthening of jaws

* deviation of spine

Lordosis/sway back: ventral deviation of spine

Hypertrophic
(pulmonary) osteopathy, HO, (HPO), Marie's diz IM 1311
* Rare diz in cattle
* Associated w/ pulmonary diz - 1 case assoc w/ pulmonary lymphosarcoma
1° Abdominal disorders - 1 case assoc. w reticuloenteritis & widespread abscessation
Formation of subperiosteal new bone growth of distal diaphyses of long bones
• Cause unknown

Scoliosis (R-M 183; N-L 260): lateral deviation of vertebral column

Torticollis/"Wryneck" (R-M 183; N-L 271): lat. deviation of neck

Anury (total agenesis) & brachyury (partial agenesis) of caud. part of spinal column (tail missing) (R-M 183)

Adactyly: missing digit (shorthorn) (R-M 184)

Polydactyly: additional digits (R-M 184)

Syndactyly: fusion or nondivision of functional digits (R-M 184), Holstein/Friesian, Angus, Chianina crosses, Simmental

Acroteriasis congenita: born w/ all four legs amputated

Osteogenesis imperfecta: Charolais, Reduction in bone mass leading to spontaneous fx

Hypertrophic
(pulmonary) osteopathy, HO, (HPO), Marie's diz IM 1311
* Rare diz in cattle
• Associated w/ pulmonary diz
* 1° Abdominal disorders
* Formation of subperiosteal new bone growth of distal diaphyses of long bones
* Cause unknown

Nonedematous swelling of extremities
* Warm & throbbing
- Asymmetrical
- Taut skin over dors. cannon bone
- Swelling & joint pain
- Stiff gait
- Pain on manipulation
- Reluctance to move
- Pulmonary signs
- Cough
- Nasal discharge

History, CS
• Radiographs:
  - Periostitis of long bones
  - Generalized soft tissue swelling
  - Ultrasound of abd. & thorax for 1° thoracic or abdominal lesion

Tx & cure 1° problem & HO will disappear

Prognosis:
* Depends on cause & its treatment

Rare, 2° to thoracic or abdominal diz
CS: Swelling of extremities
Dx: Hx, CS < Rads - periostitis of long bones
Tx: Cure 1° diz - HO disappears
**Summer slump, Fescue toxicity**

**Mk 496; IM 1312, 257; C3T 870, 371, BR 1595; Pic 124; Dem 67**

**Facts/Cause**
- Tall fescue (Festuca arundinacea Schreb). *Major forage grass*
  - Popular because adaptable to many soil & climate conditions & can be grazed throughout most of winter
  - High quality, but also toxic
  - Major grass in southeast
- Syndromes of toxicity
  - Fescue foot - late fall or winter
  - Summer slump - most common
  - Fat necrosis
- Single or combination of syndromes if prolonged grazing
- Toxic agent: unknown?
  - Assoc. w/ fungus (Acremonium coenophialum) (formerly Epichloe typhina)
  - Grows inside plant's intercellular spaces (requires special lab procedures to detect)
  - Believed to decr. prolactin levels

**Presentation/CS**
- **Fescue foot**
  - Weight loss (don't move to get food, pain)
  - Lameness of hindlimbs, shift wt. often ll. leg 1st, knuckling of pastern joint, reddening & swelling of coronary band
  - Gangrene of feet & tail
  - Sloughing of rear hooves
- **Summer slump/poor prod.**
  - Reduced feed intake
  - ↓ Weight gain
  - ↓ Milk production
  - Repro problems (conception)
  - Failure to shed winter coat
  - Diarrhea
  - ↑ Temperature
  - Search for shade instead of food (heat intolerance)
- **Fat necrosis**
  - Few clinical signs unless interferes w/ intestines or uterus
  - Chronic bloating
  - ↓ Rumination
  - Reduced feed intake
  - Weight loss
  - Scanty feces
  - Chronic poor doers
  - Dystocia

**Diagnosis**
- Hx (fescue ingestion for wks or mos)
- CS (clinical signs)
- Serum prolactin levels < 67 mg/ml m/b helpful
- Rectal for fat necrosis
- Check soil fertility

**Treatment**
- Usually valuable forage
- It problems
  - Slaughter - fescue foot or large masses of necrotic fat
  - Remove fescue
  - Good alternate feed, rotate w/ other grasses (Bermuda grass)
  - Summer slump - often return to normal

**Prevention:**
- Graze other forage
- If major forage (Southeast)
  - Test for endophyte fungus & in what amount
  - Dilute w/ legumes (unsuccesful)
  - Fungicides (unsuccesful)
  - Fungus-free seeds planted

**DDx:**
- Fescue foot
  - Ergot (p 237)
  - Foot rot (p 189)
  - Frostbite (p 163)
  - Trauma
- Summer slump
  - Molybdenum toxicosis (p 89)
  - OP toxicity (p 206)
  - Internal parasites (p 56)
  - Nutritional defc
- Fat necrosis
  - Lymphoma (p 268)
  - Peritonitis (p 53)
  - Intussusception (p 45)
  - GI obstruction (p 44)
  - GI torsion

**Dilution is the Solution to Pollution**

---

Tall fescue: Valuable forage, Fungus
CS: "Summer slump", Fescue foot, Fat necrosis
Dx: Hx, CS
Tx: Slaughter, Substitute feed
Systemic mycoses

- Superficial skin infections (see skin)
- Environmental mycosis
  - Low virulence, constant inhalation or ingestion exposure
- Pathogenic factors:
  - Immunosuppression
  - Incr. environmental exposure (moldy feed)
  - Prolonged AB Tx (removes competition)
  - Entrance other than resp or GI (mammary, wounds or uterus)
- Sporadic
- Abortion & mastitis most important syndromes
- Potential pathogens to people

Genital infections & abortions
- 2-30% of all infectious abortions
- Aspergillosis ≥ 2/3rds of all fungal abortions
- Mastitis

Hx, CS
- Histopath
- Culture
  - Fungal stains (Wright's, Giemsa's, silver & periodic acid-Schiff [PAS])
  - Yeast stain (WP)
  - Gram's stain

Wet mount exam

Candidiasis, Candidosis, Thrush

- Muco-cutaneous diz, Worldwide, Yeastlike fungus, Candida albicans (common inhabitant of oral mucosa & GI). Implicated in bovine oral, GI, resp. & vaginal infection, abortion & mastitis
- CS: Mastitis; GI: calves w/ forestomach "Thrush" - water diarrhea, anorexia & dehydration; Respiratory: pneumonia, dyspnea moderate, fever
- Dx: Scraping or biopsy of muco-cutaneous lesions, Ovoid budding, Yeast cells (yeast, budding, mycelial & pseudomycelial forms - Gram's stain)
- Tx: Nystatin ointment or Amphotericin B, Iodine for oral or cutaneous infections.

Muromycosis, Zygomycosis

- Fungi of order Mucorales (Mucor, Absidia, Rhizopus, Mortierella, Rhizomucor), inhabitant of soil, manure & rotting vegetation, often 2nd to metabolic disorders or immunosuppression, Granulomatous lesions in several organs, skin, GI, Lymph nodes, Placentitis & abortion in cattle
- CS: Nonspecific, reflecting organ involved, Pneumonia m/b, Anorexia, pyrexia, persistent diarrhea, Neonatal encephalitis
- Dx: Antemortem Dx uncommon; PM: fungal ID, microscopy, FA, cultures (broad, readily collapsing & twisted, nonseptate hyphae in smears or sections)
- Tx: No successful Tx, Surgical excision of supf. lesions, Amphotericin B

Aspergillus

- Ubiquitous in nature, septated hyphae in wet mounts or stained smears, Sporadic, Young debilitated animals
- CS: GI & respiratory forms; > 2/3rds of all fungal abortions
- Dx: Antemortem Dx uncommon

Antifungal drugs in cattle an unexplored field

Mycoses causing little problems
- Histoplasma, dimorphic (molds or yeast). Extremely rare (respiratory) not important
- Coccidioides immitis - dimorphic (mycelia & sporangium [spherical])
- Cryptococcus neoformans - in soil only, yeast form (yeast w/ mucoid capsule, buds)
- Rhinosporidium seebri - tropical or subtropical
- Prototheca spp. algae devoid of chlorophyll

- Candidiasis, Candidosis, Thrush
- Muromycosis, Zygomycosis
- Aspergillus

Abortion
- No specific control measures
- Eliminate moldy feed

Mastitis
- No established treatment
- Many resolve in 2-4 weeks
- No approved intramammary drug in USA
  - Europe intramammary Nystatin

Prospective
- Abortion: Good, most return to normal breeding
- Mastitis: Many resolve spontaneously in 2-4 weeks

Prognosis

- Abortion: Good, most return to normal breeding
- Mastitis: Many resolve spontaneously in 2-4 weeks

265
#1 parasitism
Malnutrition
Bad teeth
Disease

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight loss</td>
<td>• Associated with:</td>
<td>• Weight loss - short or intermediate duration</td>
</tr>
<tr>
<td></td>
<td>1. Anorexia - usually 2° to a 1° disease condition</td>
<td>• Dehydration</td>
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<td></td>
<td>- Loss of appetite (desire to eat) m/b complete or partial</td>
<td>• Electrolyte imbalances &amp;/or acid-base imbalances</td>
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<td>- Differentiate from dysphagia (difficult swallowing) by observation</td>
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<td>2. Increased nutrient demands</td>
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<tr>
<td></td>
<td>- Physiologic (colds, weather, growth, exercise, pregnancy &amp; lactation)</td>
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<tr>
<td></td>
<td>- Pathologic (sepsis, parasitism, burns, peritonitis, surgery or trauma)</td>
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<tr>
<td></td>
<td>- Parasitism #1</td>
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<tr>
<td></td>
<td>• Common cause of weight loss</td>
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<td></td>
<td>• Competition for nutrients</td>
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<td></td>
<td>• Inflammation (increased requirements)</td>
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<tr>
<td></td>
<td>• Malassimilation, malabsorption</td>
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<tr>
<td></td>
<td>• Migration damage to organs or vessels</td>
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<tr>
<td></td>
<td>• Anorexia in advanced stages</td>
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<td>3. Malnutrition</td>
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<tr>
<td></td>
<td>- Poor quality feed</td>
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<td></td>
<td>- Deficient micronutrients</td>
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<tr>
<td></td>
<td>(copper, cobalt [Vit B12] or Vit A)</td>
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<td>4. Poor dentition</td>
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<td></td>
<td>5. Dysphagia (difficult swallowing)</td>
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<td></td>
<td>• Stress of disease increases sympathetic activity</td>
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<td></td>
<td>- Increased epinephrine release, impaired insulin release &amp; enhanced glucagon secretion</td>
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<td></td>
<td>- Hyperglycemia (decreased insulin release, enhanced glycogenolysis &amp; gluconeogenesis)</td>
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<tr>
<td></td>
<td>- Granulomatous enteritis</td>
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<tr>
<td></td>
<td>• Associated w/ malabsorption or malassimilation syndromes</td>
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</tr>
<tr>
<td></td>
<td>• Anorexia absent, good appetite w/ wt. loss</td>
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</tr>
</tbody>
</table>

| Weight loss (p 293) | • Malnutrition                                                                                   | • Note other CS - diarrhea, dysphagia, coughing & polyuria                      |
|                    | • Parasites (p 54)                                                                               | • Treat 1° cause                                                                 |
|                    | • Dental abnormalities (p 7)                                                                     | • Good quality feed                                                             |
|                    | • Pneumonia (p 62)                                                                               |                                                                                  |
|                    | • Viruses                                                                                         |                                                                                  |
|                    | • Diarrhea (p 16)                                                                                |                                                                                  |
|                    | • Deficiencies                                                                                   |                                                                                  |
|                    | • Cryptosporidiosis (p 19)                                                                        |                                                                                  |
|                    | • Lameness (p 155)                                                                               |                                                                                  |
|                    | • GI problems                                                                                    |                                                                                  |
|                    | • Peritonitis (p 53)                                                                             |                                                                                  |
|                    | • Pasteurelosis, septicemia (p 255)                                                               |                                                                                  |
|                    | • Leptospirosis (p 257)                                                                          |                                                                                  |
|                    | • Mastitis (p 192)                                                                               |                                                                                  |
|                    | • Actinobacillosis (p 13)                                                                        |                                                                                  |
|                    | • Actinomycosis (p 13)                                                                           |                                                                                  |
|                    | • Urinary problems (p 93)                                                                         |                                                                                  |
|                    | • Failure of passive transfer (p 246)                                                              |                                                                                  |
|                    | • Fescue toxicity (p 254)                                                                         |                                                                                  |
|                    | • Bovine leukemia (p 268)                                                                         |                                                                                  |
|                    | More complete list see DD pg 293                                                                  |                                                                                  |

**GENERALIZED CONDITIONS**

- **History:**
  - Amount of weight loss (acute loss of 5-10% significant)
  - Dietary Hx, quality of feed, feeding practices, esp. if fed in groups
  - Deworming Hx
  - Enviromental toxic substances

- **Physical exam:**
  - CS of concurrent disease (diarrhea, fever, dysphagia (difficult swallowing),
    abnormal dentition, melena, icterus, dyspnea, tachycardia
  - Can animal eat?
  - Weight or use heart girth measurement
  - Nitroprusside powder test on milk (positive blue reaction is diagnostic of ketonuria &
    ketonemia
  - Rumen pH > 7 indicative of anorexia
  - Check for lice & keds

- **Analyze diet:**
  - Adequate intake
  - Inadequate intake
    • Adequate feed available
    • Anorexia due to 1° disease
    • Inadequate feed available
    • Malnutrition

- **Fecal exam:**
  - Microscopic (floating, sedimentation, Baerman's procedure) - parasite ova
  - Fecal occult blood for melena
  - Diarrhea

- **Lab - CBC, PP (plasma proteins); fibrinogen**
  - Inflammatory process (Incr. WBCs, Incr. PMNs, Incr.
    fibrinogen, Decrease PP - fibrinogen ratic)
  - If anemia, calculate RBC indexes
  - Blood selenium or glutathione peroxidase activity if Se def area

- **Chemistry:**
  - Hypoalbuminemia assoc. w/ internal abscessation, malnutrition, liver, renal, granulomatous bowel disease
**Downer cow**

- Cow unable to rise for 24 hours
- Most sequel to recumbency of parturient paresis
- Incidence incr. w/ incr. time between onset of milk fever & 1st Ca "Tx"
- Recumbency then causes:
  - Muscle damage, or
  - Nerve damage (sciatic or peroneal)
- Other causes of recumbency
  - also cause muscle & nerve damage
  - Metabolic disorders 2nd to milk fever
  - Systemic illnesses
  - Trauma & lymphosarcoma
- Most common betw. 2 ds before parturition & 10 ds after
- Most 5-8 yr-old high producers
- Many have Hx of milk fever

**Sternal recumbency 24 hours after onset**

- BAR (bright, alert & responsive)
- Eating & ruminating. + appetite reduced
- Defecation normal
- Some refuse to rise
- "Creeping" or "crawling" due to frequent attempts to rise, both hindlimbs flexed & displaced caudally

**Nonalert downer cows**

- Severe affecting - lateral recumbency unless supported
- Expiratory moaning
- Mucoid feces

**Sequela:**

- Coxofemoral luxation as struggle to rise

**R/O causes (see list)**

- History, CS
- TPR normal
- PE (sensation, crepitation, pain)
- Proteinuria
- Rectal exam
- Lab:
  - Ca normal after Ca milk fever Tx
  - Phosphorus often remains low (< 3.0 mmol/L)
  - AST, CK usually elevated indicating muscle damage.
  - CK max at 48 hrs then falls.
  - AST remains higher longer
  - Marked proteinuria in 24 hours
  - Postmortem: Hemorrhage & degeneration of upper hind limb & nerves

**Causes**

- #1 sequel to parturient paresis (p 148)
- Recumbency due to
  - Obturator (calving) paralysis (p 137)
  - Pelvic fractures (riding by other cows) (p 167)
  - Fx of femoral neck (p 165)
  - Coxofemoral luxation (p 166)
  - Spinal injury (p 133)
  - Lymphosarcoma of vertebrae (p 135)
  - Metabolic disorder 2nd to milk fever
  - Hypophosphatemia (p 88)
  - Hypomagnesemia (p 146)
  - Hypokalemia (p 306)
  - Hypoprotenemia (p 302)
  - Cerebral edema (p 139)
  - Ketosis (p 33)
  - Liver failure (p 34)
- Systemic illness causing recumbency
  - Mastitis (p 192)
  - Metritis (p 111)
  - Peritonitis (p 53)
- Recumbency causing nerve & muscle damage
  - Muscle damage w/ or w/o compartment syndrome
  - Ischiatric nerve damage (p 136)
  - Peroneal nerve damage (p 137)

**Prognosis:**

- Good if gets up, obviously!
  - Many will rise w/in 2 weeks if eating & drinking & good nursing
  - Poor if complication of mastitis or coxofemoral luxation

**Good footing** (move from slippery area)

- Retreat milk fever (if postparturient)
  - Slow IV Ca, Mg, P & dextrose (monitor heart)
- Phosphorus IV injection (Sodaphos® or Cortosafe® 5% nb)
- Vetibenamine® (tripeleneamine HCl) CNS stimulant IV

**Stimulate to rise** - cattle goad, Knees in side

- If attempts to rise assist by lifting tail
- Lay in lat. recumbency, electrically stimulate tibial nerve w/ goad, roll & stim. other tibial n., few minutes rest & go to rise again
- Lifting devices if all else fails (some resent then counterproductive)

**Supportive care**

- Ca, Mg, P (if all else fails)
  - Shelter, deep bedding
  - Labor intensive
  - Keep in sternal recumbency
  - Change sides ≤ 3 hours
  - Regular feed & water
  - Lifting devices used sparingly

**Milk fever, Recumbency**

- CS: Unable to rise 24 hrs
- Dx: R/Os, Tx milk fever
- Tx: Milk fever Tx, Phos. injec., Goad
- Px: 2 wks to get up

**Footnotes**

- 1. Sternal recumbency 24 hours
- 2. Most sequel to recumency of parturient paresis
- 3. Metabolic disorders 2nd to milk fever
- 4. Hypophosphatemia
- 5. Hypomagnesemia
- 6. Hypokalemia
- 7. Hypoprotenemia

**267**
### Bovine Leukosis

#### GENERALIZED CONDITIONS

<table>
<thead>
<tr>
<th>Bovine leukemia, Bovine lymphosarcoma, Malignant lymphoma</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Four forms: Calf, Thymic, Skin &amp; Adult</strong></td>
<td>✓ Four forms: Calf, Thymic, Skin &amp; Adult - #1 Adult form (enzootic bovine lymphosarcoma) - Bovine leukemia virus (BLV+) assoc. w/ form - Other 3 not associated w/ this virus, cause unknown, very uncommon (sporadic form), incidence unknown</td>
<td>✓ Wt. loss, depression, weakness - Acute generalized lymphadenopathy (deep cervical &amp; parotid inn.) - Neoplasms of heart, spleen, kidney liver &amp; lungs - Fever, tachypnea, coughing, due to space occupying lesion, HR, harsh resp. sounds - Death w/in 2-8 week (once inn. enlarged)</td>
<td>✓ Lab: - Biopsy or aspiration of lymph nodes (distinguish from hyperplasia) - High WBCs - Postmortem shows all organ involvement</td>
<td>✓ None, unsuccessful</td>
</tr>
<tr>
<td><strong>1 • Calf, juvenile, sporadic lymphosarcoma</strong></td>
<td>✓ Rare - 3-6 month-old dairy calves (1 month - 3 years) - Unknown cause, not BLV</td>
<td>✓ Very rare - Beef breeds (Herefords) - 6-24 month-old - Persistent &amp; enlarged thymus (grows in cran. thorax, putting pressure on other organs)</td>
<td>✓ Not easy to Dx - ± Enlargement of peripheral lymph nodes (biopsy) - Normal WBCs - Bloat - Normally diagnosed at postmortem</td>
<td>✓ None, unsuccessful</td>
</tr>
<tr>
<td><strong>1/2 yr, Rare CS: Lnn., Death</strong></td>
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<tr>
<td><strong>2 • Thymic or adolescent lymphosis</strong></td>
<td>✓ Rare - 3-6 month-old dairy calves (1 month - 3 years) - Unknown cause, not BLV</td>
<td>✓ Very rare - Beef breeds (Herefords) - 6-24 month-old - Persistent &amp; enlarged thymus (grows in cran. thorax, putting pressure on other organs)</td>
<td>✓ Not easy to Dx - ± Enlargement of peripheral lymph nodes (biopsy) - Normal WBCs - Bloat - Normally diagnosed at postmortem</td>
<td>✓ None, unsuccessful</td>
</tr>
<tr>
<td><strong>1/2-2 yrs., Rare CS: Bloat, Inn.</strong></td>
<td></td>
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</tr>
<tr>
<td><strong>3 • Cutaneous lymphosis</strong></td>
<td>✓ Rare - Most common of sporadic forms, but still rare - 1-3 years old</td>
<td>✓ Rare - Most common of sporadic forms, but still rare - 1-3 years old</td>
<td>✓ Biopsy of nodules &amp; lymph nodes (neoplastic lymphoectatic infiltration) - Other organs cause own set of CS &amp; disease so hard to diagnose</td>
<td>✓ Regress in a few weeks usually</td>
</tr>
<tr>
<td><strong>1-3 yrs, Most rare form CS: Nodules</strong></td>
<td>✓ Rare - Most common of sporadic forms, but still rare - 1-3 years old</td>
<td>✓ Rare - Most common of sporadic forms, but still rare - 1-3 years old</td>
<td>✓ Biopsy of nodules &amp; lymph nodes (neoplastic lymphoectatic infiltration) - Other organs cause own set of CS &amp; disease so hard to diagnose</td>
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</table>

* = sporadic form
**Adult or Multicentric/Enzootic Lymphosarcoma, LSA**

**Bovine Leukosis**

Bovine leukemia virus (BLV) **

- Elevated WBCs, but leukemia not typical
- Antibody detection
- Agar gel immunodiffusion test
- ELISA
  - Aspiration or incisional biopsies of lymph nodes, looking for neoplastic lymphocytes
  - Not reliable, similar to infection
- Rectal palpation, those w/o enlarged lymph nodes or exophthalmus
  - Multiple tumor masses (≤ 0.5 meter)
  - Uterus, rumen, colon, kidneys
  - Internal iliac lymph nodes
  - Firm (but not hard) & slightly lobulated
- Definitive diagnosis
  - Histopathology

**Symptoms**
- Acute onset of CS
  - Weight loss, ↓ appetite
  - ↓ Milk production
  - Enlarged peripheral lymph nodes (lymphadenopathy)
- CS depending on organ involved
  - Posterior paresis (spinal cord)
  - Exophthalmus (protruded eyeball)
  - Diarrhea or constipation
  - Heart - Jugular pulse
  - Abdominal tumors
  - Repro problems
  - Fever, ± respiratory signs
- Euthanized w/in 3-6 weeks once CS

**Diagnosis**
- Aspiration or incisional biopsies of lymph nodes, looking for neoplastic lymphocytes (not reliable, similar to infection)
- Rectal palpation, those w/o enlarged lymph nodes or exophthalmus
- Multiple tumor masses (≤ 0.5 meter)
- Uterus, rumen, colon, kidneys
- Internal iliac lymph nodes
- Firm (but not hard) & slightly lobulated
- Definitive diagnosis
  - Histopathology

**Control**
- BLV free herds
  - Test & cull (see box)

**Prognosis**
- Grave

**BLV seronegative herds - Impractical**
- Serologically test all cattle over 6 mo at 3 month intervals
- Rapidly remove all positive
- Herd usually BLV free after 2nd or 3rd test
- Done in foreign countries & serological tests frequently incorporated into international trade regulations
- Seropositive animals if kept on same farm:
  - Separated by no less than 10 meters, better to use solid partition
- Costly program, serological testing. Expense is worth it for seronegative herds

**Treatment**
- CS - Cull; Free herd programs

**BLV - Retrovirus (Bovine leukemia virus)**
- Rare, but most common tumor in cattle
- Once infected, infected for life
- Many seropositive, < 5% of seropositive get lymphosarcoma
- Immunosuppression - 2° diz
- > 4 year-old
- Right atrium, Uterus, Abomasum, Kidney, Spinal cord, Spleen, Retrobulbar then other lymph nodes (Iln)
- Economically important
  - Embryo herds for export
  - Bull calves - for studs
- Transmission: contact
  - Blood & milk, colostrum
  - Vector (horseflies, mosquitoes, etc.)
  - Iatrogenic (rectal palpation & blood on obstetric gloves)
- Genetic predisposition? (Some herds higher prevalence)

**BLV seronegative herds - Impractical**
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**Cull**
- $ supportive to get calf or embryo
### Flies

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<th>Presentation/SC</th>
<th>Diagnosis</th>
<th>Treatment</th>
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<tr>
<td><strong>Face flies</strong></td>
<td>• <em>Musca autumnalis</em>                                                                   • Overwinter in buildings   • Females feed on facial secretions (tear fluids, nasal mucus &amp; saliva) - Also blood from wounds &amp; milk from calves’ faces  • <em>Haemotobia irritans</em></td>
<td>• Irritation &amp; mechanical damage to eye tissue</td>
<td>• Looks like house fly - 4 longitudinal stripes on abdomen - Mouthparts sponging labellae w/ rough spines</td>
<td>• Difficult to control   • Insecticide impregnated ear tags best - But only reduces flies up to 80%</td>
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<td></td>
<td>• Range cattle principal host (also horses) - Doesn’t develop in feedlot situations</td>
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<tr>
<td><strong>Horn flies</strong></td>
<td>• <em>Haemotobia irritans</em></td>
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<tr>
<td></td>
<td>• Major cattle pest                                                                    • Reproduce only in bovine feces - Will feed on horses, sheep &amp; goats - Flies can fly 7-10 miles - In south m/ have thousands on 1 animal - Intermediate host of <em>Stephanofilaria stilesi</em> - Causes filarial dermatosis of cattle</td>
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</tr>
<tr>
<td><strong>Horse flies</strong></td>
<td>• Tabanidae family                                                                    • <em>Tabanus &amp; Hybomitra</em> (horse flies), <em>Chrysops</em> (deer fly) - Intermittent feeders - Need blood meal for female for ovipositing - Larvae are aquatic or semi-aquatic - M/ transmit: anthrax, anaplasmosis, tularemia &amp; EIA (horse)</td>
<td>• Painful wound - Wt. loss from irritation &amp; pain - Anemia when large #s feeding - Screw worms concern in S. Mex. &amp; Central America</td>
<td>• Up to 1” long - Blade-like mouthparts of females</td>
<td>• Most difficult to control of all bloodsucking flies because intermittent feeders - Dust bags &amp; back rubbers - Insecticide impregnated ear tags - Check with local regulation officials for specific controls</td>
</tr>
<tr>
<td><strong>Eye irritant</strong></td>
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<tr>
<td><strong>Range cattle</strong></td>
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<tr>
<td><strong>Ear tags</strong></td>
<td></td>
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<td></td>
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<tr>
<td>Stable flies</td>
<td>rrStomoxys calcitrans i</td>
<td>• Feed on most warm blooded animals</td>
<td>• Irritation painful bite</td>
<td>• Looks like house fly</td>
</tr>
<tr>
<td></td>
<td>• Feed once or twice a day</td>
<td>• Wt. loss (inefficient feed utilization)</td>
<td>• Outer of 4 thoracic stripes is broken</td>
<td>• Difficult because only feed once or twice a day</td>
</tr>
<tr>
<td></td>
<td>• Develops in decaying organic matter (grass clippings)</td>
<td>• Blood loss</td>
<td>• Checkered abdomen</td>
<td>• Spray area w/ insecticides</td>
</tr>
<tr>
<td></td>
<td>• Midwestern feedlots mainly (but all over)</td>
<td>• Needle sharp proboscis</td>
<td>• #1 sanitation, clean up decaying matter</td>
<td>• Mechanical vector of anthrax or surra</td>
</tr>
</tbody>
</table>

| Decaying matter | Stars

| House flies | Musca domestica | • Breeds in manure | • Annoyance even though doesn't bite |
| | • Sponge-like nonbiting mouthparts | • Reduce performance | • Sponge-like nonbiting mouthparts |

| Screw | Cochliomyia (Callitroga) hominivorax | • Blowsfly | • Obligate myiasis* |
| | - Screw worms are larvae of blowfly | • Need live tissue, can't feed on dead tissue | • Need live tissue, can't feed on dead tissue |
| | • Eradicated from USA & Mexico | • Eradicated from USA & Mexico | • Eradicated from USA & Mexico |
| | • Sterile males released, females only mate once | • New cases from importation of infected animals & occasional case in areas bordering Mexico (?) | • New cases from importation of infected animals & occasional case in areas bordering Mexico (?) |

| USA free | • Cavernous lesion filled w/ larvae | • Reportable |
| | • Liquefaction necrosis | • Eradication program |
| | • Profuse brownish exudate | • Blowfly bluish to bluish green |
| | • Objectionable odor | • Preserve suspected larvae in 70% alcohol |
| | • Self perpetuating, more eggs laid | • Larvae resemble woodworm |
| | • 2o bacterial infection, toxemia, & fluid loss to death | • Send to eradication officials at PO Box 969 |
| | • Report to eradication officials |
| | • Clip & clean wound |
| | | • "Smears": wound dressing containing lindane o' ronnel (hard to find in USA b/c. of eradication) |
| | | • Prophylactic for other animals - spray on ronnel or dipped in couraphos |
| | | • In cattle, SQ injection of ivermectin |

| Eradicated in USA & Mex. | • Cavernous lesions |
| | • CS: Myiasis - Cavernous lesions |
| | • Reportable |
**Behavior**

**Prolonged suckling** (cross-suckling) or Galactophagia
Mk 924; Br 772

- **Cause:** Weaned early or orphans, group housing
- **CS:** Suckling another animal
- **Tx**
  - Automatic nurses w/ nipples 30 min
  - Tie up calves for 1 hour after bucket feeding (drive diminishes)
  - Supplemental roughage
  - Older sucklers
    - Pointed prong devices to face & nose region (traumatize animal suckling on)
    - Electrical shock devices on head, give animal suckling shock

**Head rubbing**
Mk 921

- **Cause:** Cattle & pigs in chronic confinement: in narrow stalls
- **CS:** Head rubbing
- **Tx:** Freedom from chronic confinement

**Butting**
Mk 922

- **Cause:** Bad disposition
  - People playing w/ head
- **Butting w/ or w/o horns
- **Caution when dealing w/ animal**
Overgrooming (self licking)

**Mk 924; Br 773**

- **Cause:** Stress related
  - Single stall confinement
  - Pruritic diz
- **CS:** Excessive self licking (overgrooming)
- **Clinical sequela:** Hairballs (trichobezoars)
- **Tx:** Freedom, exercise & socialization. Eliminate all causes of pruritus/parasitism before Dx overgrooming

Fighting & mounting

**Br 774**

- **Cause:** Beef animals, especially bulls kept in groups
- **CS:** Fighting & mounting
- **Clinical sequelae:** Bruising & leg injuries
- **Tx:** Keep animals in stable groups
  - Overhead bars or electrical grid to prevent mounting

Tonic immobility

**Mk 923**

- **Anomalous tonic immobility**
- **Downer cows in some cases**
  - Will change from an unwillingness to rise into a pathological condition if allowed to go on for a long time
- **CS:** Unwilling to rise
- **Tx:** Irritate them until they rise

Tongue Rolling

**Mk 923; Br 773**

- **Cause:** Stall confinement
  - Copy other cattle or inherited
- **CS:** Exacerbated extruding of tongue & rolling tongue back into mouth
  - M/b gulping of air
- **Tx only partially successful**
  - Wind-sucking straps on neck
  - Metal ring through frenulum of tongue
  - Salt blocks
  - Freedom & forced exercise
### Lyme Diz - Teat Conditions

<table>
<thead>
<tr>
<th>Condition</th>
<th>Facts/Cause</th>
<th>Presentation/CS</th>
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<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sporadic bovine encephalomyelitis, Buss diz</td>
<td>Rare, See Neuro p 151, <em>Chlamydia psittaci</em>osis - lymphogranuloma group, Pathophysiology: vasculitis</td>
<td>CS: Multisystem diz: fever, anorexia; Resp: nasal discharge, dyspnea, cough; Lameness; GI (initial diarrhea); CNS (encephalitis); Die in 4-10 d</td>
<td>History, CS</td>
<td>Rx: Tetracyclines effective early</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>Rare, but reported in cattle</td>
<td>Cause: not acute pancreatitis as in dog; neoplasia, absence of beta cells &amp; chronic pancreatitis, foot &amp; mouth diz</td>
<td>CS: Hyperglycemia, glycosuria, polydipsia, polyuria, weight loss</td>
<td>Rx: Poor</td>
</tr>
<tr>
<td>Lyme diz</td>
<td>Infectious diz of cattle, man &amp; other animals</td>
<td>- Poorly understood in cattle</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- 1 reported case, several reports of cattle w/ antibodies to organism</td>
<td>- Incidence unknown</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Pathogenesis ? Immune?</td>
<td>- Tick transmitted (Ixodes spp.)</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>- Spirochete - <em>Borrelia burgdorferi</em></td>
<td>- Flexible, helical cells, motile</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Gram-neg. Giemsa</td>
<td>- Visible phase-contrast or darkfield microscopy</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Lameness</td>
<td>Arthritis</td>
<td>Can't culture to Bx</td>
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</tr>
<tr>
<td></td>
<td>Swollen joints</td>
<td></td>
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<tr>
<td></td>
<td>Fever</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Tick, Spirochete (<em>Borrelia</em>)</td>
<td>CS: 1 case: Lameness, Fever</td>
<td>Dx: FA, ELISA</td>
<td>Tx: ? - Antibiotics</td>
<td></td>
</tr>
<tr>
<td>Tularemia</td>
<td>Cattle appear to be resistant, Infectious diz of man &amp; animals, <em>Pasteurella (Francisella) tularensis</em>; Natural host - rabbits &amp; rodents,</td>
<td></td>
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<tr>
<td></td>
<td>Transmission: ticks, fleas, deerflies; Sheep most commonly affected, documented in horse</td>
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</tr>
<tr>
<td>Chediak-Higashi syndrome</td>
<td>Rare, Inherited disorder affecting PMNs &amp; monocytes, Increased susceptibility to infections</td>
<td>CS: Partial albinism (skin &amp; eyes), Coagulation difficulties, Infections, Premature aging</td>
<td></td>
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<tr>
<td></td>
<td>Dx: Hx, CS, Large cytoplasmic granules in PMNs</td>
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</tbody>
</table>
### Supernumerary Teats

**S-O 221; S-N 236***

- **Extra teats**, most commonly caudal to last 2 normal teats; May or m/not have glandular tissue
- **Tx**: May remove for cosmetic reasons or if they interfere w/milking

### Hard Milkers, Contracted Sphincter of Teat Orifice

**S-O 222; DC 263***

- **Congenital or acquired (trauma)**
- **CS**: small stream of milk, prolonged milking time
- **Dx**: History, CS
- **Tx**: Sx - **size of sphincter w/ teat slitter/Lichy teat knife/teat bistoury & insert Larson teat tube for 5-7 days**

### Lactoliths, Milk Stones, Calculi

**S-O 222, S-N 233; DC 267**

- **Foreign body in teat**
- **CS**: Hinders milking
- **Dx**: Hx, CS, Palpate movable object
- **Tx**: Milk out small objects, crush w/ small forceps & milk out, or split orifice & remove

### Polyps of Teat

**S-O 223**

- **Pea-sized protrusions w/in teat sinus**
- **CS**: May interfere w/ milking
- **Dx**: History, CS
- **Tx**: Remove w/ tumor extractor or curette

### Occlusion of Teat Orifice

**S-O 223; S-N 235; DC 267**

- **Congenital or acquired**
- **CS**: No milk flow
- **Tx**: Surgically open

### Teat Spider, Blind Quarter

**S-N 233**

- **Membranous obstruction of teat**
- **Location**: high at base of teat or between teat orifice & base of teat
- **CS**: Hindrance or absence of milk flow
- **Dx**: Hx, CS, Palpate teat, if empty, obstruction high at base; if lower obstruction, milk palpated in teat above obstruction
- **Tx**: Low obstruction: Sx - open w/ teat bistoury or Hudson spiral teat instrument
- High obstruction (no milk in teat) probe a few times, but if can't open allow quarter to atrophy

### Laceration of Teat

**S-O 225, S-N 231**

- **Trauma - superficial or into teat sinus**
- **CS**: Wound, Milk out of opening
- **Tx**:
  - Superficial - suture
  - Wound into sinus
    - Ring block base of teat
    - Freshen edges
    - Suture close
    - Larson type teat tube inserted
    - Remove sutures in 10-14 days

### Amputation of Mammary Gland

**S-O 226; S-M 238**

- **Indication**: severe mastitis refractory to treatment
- **Breeding animal w/ loss of ligamentous udder support**
- **Due to economics animal usually salvaged unless valuable breeder**
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**Colic/Abdominal Pain**

**Common causes:**
- Bloat (accumulation of gas) (pg 26)
- Intestinal gas/abomasal gas in calf
- Traumatic reticuloperitonitis (pg 36)
- Peritonitis (pg 33)
- Uterine tear/retention (pg 110, 33)
- Parturition (pg 33)
- Abomasal torsion/volvulus (pg 38)
- Hepatitis/liver abscess (pg 32)
- Abomasal ulcers (pg 31)
- Cystitis/pyelonephritis (pg 95)
- Intussusception (pg 45)
- Thrombophlebitis
- Intestinal foreign body/obstruction (pg 25)
- Cecal displacement/torsion (pg 44)
- Grain overload (pg 25)
- Right displaced abomasum (pg 38)
- Abomasal impaction (pg 30)
- Abomasal displacement (pg 38)
- Intussusception (pg 45)
- Bloat (accumulation of gas) (pg 26)
- Hypermotility & spasms of gut
- Hernia (pg 48)
- Atresia coli (neonate) (pg 47)

**Uncommon causes:**
- Peritonitis (pg 33)
- Uterine tear/retention (pg 110, 33)
- Intussusception (pg 45)
- Bloat (accumulation of gas) (pg 26)
- Intestinal gas/abomasal gas in calf
- Traumatic reticuloperitonitis (pg 36)
- Peritonitis (pg 33)
- Uterine tear/retention (pg 110, 33)
- Parturition (pg 33)
- Abomasal torsion/volvulus (pg 38)
- Hepatitis/liver abscess (pg 32)
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- Cystitis/pyelonephritis (pg 95)
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- Intestinal foreign body/obstruction (pg 25)
- Cecal displacement/torsion (pg 44)
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- Abomasal displacement (pg 38)
- Intussusception (pg 45)
- Bloat (accumulation of gas) (pg 26)
- Hypermotility & spasms of gut
- Hernia (pg 48)
- Atresia coli (neonate) (pg 47)

**Neonate - Distended &/or Painful Abdomen**

**Common causes:**
- Meconium impactions
- Malformation (atresia coli, recti, ari) (pg 51)
- Enteritis or abomasitis
- Intussusception (pg 45)
- Obstruction (pg 44)
- Volvulus/torsion (pg 45)
- Ruptured bladder (pg 96)
- Torn necrotic urachus (pg 102)
- Peritonitis (pg 53)
  - Devitalized bowel
  - Perforated ulcer
  - Generalized infection
  - Umbilical infec. (pg 102)
- Gas accumulation
  - Ileus (pg 48)
  - Necrotizing enterocolitis
  - Aerophagia
  - Ulcers (pg 31)
  - Congenital tumors
  - Ruptured umbilical vessels (pg 102)
  - Severe hypoproteinemia
  - Ruptured liver
  - Ruptured spleen

**Rare causes:**
- Grain overload (pg 25)
- Water intoxication
- Intest. adhesions/incarceration (pg 46)
- Enterotoxemia (pg 14)
- Intestinal strangulation (pg 42)
- Intestinal neoplasia (pg 43)
- Torsion of descending colon
- Rectal tear (pg 51)
- Rectal prolapse (pg 51)
- Fat necrosis w/ obstruction (pg 50)
- Cholelithiasis (pg 36)
- Ovarian abscess
- Inversion of uterine horn (pg 112)
- Ruptured uterine artery
- Vaginitis (pg 115)
- Renal cysts
- Rupture of prepubic tendon (pg 113)
- Rinderpest (exotic) (pg 12)
- Rabies (pg 145)

**Toxic causes:**
- Plant poisonings (those that cause diarrhea)

**We hope this section will be used as a reference (don't memorize); Ideal method of DDX**
1. Identify clinical syndrome
2. Understand pathophysiology to produce clinical syndrome
3. Determine cause of pathophysiology
4. Determine best case/herd management
Diarrhea (IM 123; Br 121; GI 755; DDX 62)

Common causes:
- Parasitism (pg 21)
- Salmonellosis (pg 20, 22)
- Winter dysentery (pg 22)
- BVD (pg 24)
- Johne’s disease (pg 23)
- Coccidiosis (pg 19)
- Peritonitis (pg 33)
- Collitis/typhilitis (pg 50)
- Abomasal torsion (pg 36)
- Indigestion (pg 28)
- Peritonitis (pg 33)
- Sepsis/toxemia/enterotoxemia (pg 149)
- Intussusception (pg 45)
- Grain overload (pg 25)
- Malignant catarrhal fever (pg 10)
- Liver failure (pg 34)
- Heart failure (pg 76)
- Parasympathomimetics
- Molybdenosis/copper deficiency (pg 89)
- Uremia, Renal failure (pg 95)
- Large doses of xylazine
- Cathartics/laxatives
- Toxins or Poisonous plants

Uncommon causes:
- Giardiasis (pg 19)
- Cecal dilatation (pg 49)
- Liver abscess (pg 36)
- Bluetongue (pg 10)
- Brisket dys (pg 80)
- White muscle dys (pg 78)
- Bovine leukemia
- Intestinal obstruction, partial (pg 44)
- Intestinal tumor (pg 51)
- Traumatic reticulopericarditis (pg 76)
- Vagal indigestion (pg 29)
- Amyloidosis (pg 94)
- Sarcocystosis (pg 123)

Toxic causes:
- Lincomycin
- Arsenic (pg 202)
- Monensin (pg 203)
- Herbicides
- Zinc (pg 215)
- Copper (pg 203)
- Phosphorus fertilizers (pg 215)
- Levamisole (pg 216)
- Aflatoxin (pg 233)
- Nicotine (pg 213)
- Chlorpyrifos (Dursban®)
- Trichothecene
- Sodium bicarbonate
- Propylene glycol
- Sulfur

Plants
- Acorn (oak) (pg 234)
- Selenium accumulator (pg 226)
- Solanum (pg 239)
- Pyrrolizidine alkaloids (pg 232)
- Brassica (pg 231)
- Oleander (pg 230)
- St. John’s wort (pg 233)
- Fungal toxicity
- Pokeweed (pg 241)
- Rattlebox (pg 221)
- Mushroom (pg 233)
- Many more: see IM pg 124

Rare causes: see IM pg 123

Blood, Fibrin &/or Mucous in Feces
(IM 131)

Common causes:
- Intussusception (pg 45)
- Coccidiosis (pg 260)
- Salmonellosis (pg 259)
- Foreign body

Uncommon causes:
- Volvulus of root of mesentery (pg 45)
- Enterotoxemia (pg 250)
- Abomasal torsion (pg 40)
- Malignant catarrhal fever (pg 10)
- Rectal palpation - rectal tears (pg 51)
- BVD (pg 253)

Toxicity:
- Arsenic toxicity (pg 202)
- Warfarin poisoning (pg 214)
- Castor bean toxicity (pg 235)
- Solanum poisoning (pg 239)
- Rattlebox poisoning (pg 233)
- Tung tree poisoning

279
Vomiting, Dysphagia

**Regurgitation/Vomiting**

(IM 134; BR-hb 65; DOX 158)

**Common causes:**
- **Choke** (pg 15)
- **Esophageal trauma** (pg 15)
- **Obstruction of oral cavity/pharynx** (trauma, FB, abscess) (pg 14)
- **Salt toxicity** (pg 205)
- **Mass in rumen/escophagus** (tumor, papilloma)
- **Toxins & poisonous plants** (see below)

**Uncommon causes:**
- **Megaesophagus** (pg 15)
- **Esophageal diverticulum** (pg 15)
- **Hypoderma reaction in esophagus** (pg 134)
- **Hiatal/diaphragmatic hernia** (pg 46)
- **CNS trauma** (pg 132, 138)
- **Meningitis, meningencephalitis** (pg 151)
- **Ruminal lactic acidosis** (pg 25)

**Rare causes:**
- Traumatic reticulitis (pg 38)
- Tetanus (pg 145)
- Peritonitis (pg 53)
- Pseudorabies (pg 166)
- Tick paralysis (pg 142)
- Intestinal neoplasia (pg 51)
- Persistent rt. aortic arch (pg 79)
- Blue tongue (pg 10)
- Rift valley fever (exotic) (pg 246)

**Dysphagia/Difficulty in Swallowing**

(IM 136; BR-hb 63; GI 705)

**Common causes:** Pain, Obstruction, Neuromuscular:
- **Choke (Foreign body)** (pg 15)
- **Oral vesicles, erosions, ulcers**
  - Vesicular stomatitis (pg 11)
  - BVD (pg 12, 253)
  - Bovine papular stomatitis (pg 8)
  - Traumatic or irritant stomatitis (pg 8)
  - Bristle grass/plant awns (pg 8)
  - Oral foreign body (pg 8)
  - Bluetongue (pg 10)
- **Pharyngeal abscess/cellulitis** (pg 14)
- **Snake bite** (pg 242)
- **Actinobacillosis** (pg 13)
- **Actinomycosis** (pg 13)
- **Teeth problems** (pg 7)
  - Periodontal diz (pg 7)
  - Worn/missing teeth (pg 7)
  - Tooth root abcess (pg 7)
- **Calf diphtheria** (pg 9)
- **Mandibular/maxillary fractures** (pg 67)
- **White muscle diz** (pg 78)
- **Ruptured/damaged esophagus** (pg 15)
- **Megaesophagus** (pg 15)
- **Diaphragmatic hernia** (pg 46)
- **Cleft palate** (pg 7)
- **Bovine leukemia**
- **Listeriosis** (pg 143)
- **Botulism** (pg 145)
- **Tetanus** (pg 146)

**Toxic causes:**
- Rabies (pg 144)
- Pseudorabies (pg 141)
- Brain abscess (pg 140)
- Paralysis of masseter m. (mandibular n.)
- Meningitis (pg 151)
- Encephalitis (pg 154)
- Tick paralysis (pg 142)
- Atlanto-axial subluxation (pg 134)
- Otitis media & interna (pg 142)
- Hypocalcemia (pg 148)
- Pituitary abcess

**Plant toxicity:**
- **Larksper** (pg 235)
- **Nitrate accumulators** (pg 231)
- **Helenium** (pg 221)
- **Rhododendron** (pg 221)
- **Castor bean** (pg 235)
- **Cyanogenic plants** (pg 222)
- **Solanum** (pg 239)
- **Tremorgenic toxins** (pg 237)
- **Hymenoxys** (pg 241)
- **Hellabore**
- **Laurel**
- **Azalea**
- **Death camus** (pg 239)
- **Chinaberry**
- **Others:** see IM 135
### Abdominal Distention/Constipation
(IM 132; BR-hb 56, 57; GI 712; Br 112, 121; DDX 11)

**Common causes:**
- Pregnancy (pg 106)
- Bloat (pg 26)
- Grain overload (pg 25)
- Vagal indigestion (pg 29)
- Obesity
- Peritonitis (pg 53)
- Omasal obstruction/foreign body
- Ruptured bladder (pg 96)
- Pelvic mass (tumor/abscess)
- Intestinal obstruction (pg 44)
- Hypocalcemia (pg 148)
- Hysterectomy (pg 231)
- Omental bursitis
- Intussusception (pg 45)
- Anticholinergics
- Ascites
- Hydroeps (pg 113)
- Bovine leukemia
- Abomasal adenocarcinoma
- Perforating abomasal ulcer (pg 31)
- Displacement of intestine, to I. of rumen
- Adhesions of intestines (pg 46)
- Stenosis of duodenum
- Intestinal volvulus (pg 44)
- Atresia ani, rectum, colon or intest. (pg 51)
- Internal herniation (pg 48)
- Torsion of descending colon
- Omental bursitis
- Oral Vesicles, Erosions, Ulcers (IM 138)

**Common causes:**
- Vesicular stomatitis (pg 11)
- BVD (pg 12)
- Actinobacillosis (pg 13)
- Traumatic/irritant stomatitis (pg 8, 240)
- Bristle grass/plant awns (pg 8)
- Oral foreign body (pg 8)
- Bovine papular stomatitis (pg 8)
- Others: see Oral vesicles

**Uncommon causes:**
- Cheek abscess
- Actinomycosis (pg 13)
- Oak (acorn) toxicity (pg 244)
- Malignant catarhal fever (pg 10)
- Caustic or irritant chem. (pg 8)
- Periodontal gingivitis (pg 7)
- Bluetongue (pg 10)

**Rare causes:**
- Calf diphtheria (pg 9)
- Oral neoplasia
- Bovine herpes 2 mammillitis (pg 187)
- Lead toxicity (pg 152)
- Oral Vesicles, Erosions, Ulcers (IM 138)

**Common causes:**
- Liver
- Aflatoxicosis (pg 233)
- Pyrrolizidine alkaloid toxicity (pg 232)
- Fatty liver (pg 32)
- Hemolytic anemia
- Leptospirosis (pg 257)
- Bacillary hemoglobinuria (pg 90)
- Anaplasmosis (pg 92)

**Uncommon causes:**
- Liver
- Liver abscess (pg 36)
- Black diz (pg 37)
- Liver flukes (pg 37)
- Acute hepatitis (pg 34)
- Cholangiohepatitis (pg 35)
- Hemolytic anemia
  - Immune-mediated hemolytic anemia (pg 92)
  - Postparturient hemolytic anemia (pg 88)
- Neonatal erythrolysis (pg 91)
- Transfusion reaction
- Snake bite (pg 242)
- Copper toxicity (pg 203)

**Rare causes:**
- Liver
  - Sarcozystosis
  - Ruptured gallbladder
  - Bilary obstruction
  - Choledolithiasis

### Icterus (IM 141)

**Common causes:**
- Liver
- Aflatoxicosis (pg 233)
- Pyrrolizidine alkaloid toxicity (pg 232)
- Fatty liver (pg 32)
- Hemolytic anemia
  - Leptospirosis (pg 257)
  - Bacillary hemoglobinuria (pg 90)
  - Anaplasmosis (pg 92)

**Uncommon causes:**
- Liver
  - Liver abscess (pg 36)
  - Black diz (pg 37)
  - Liver flukes (pg 37)
  - Acute hepatitis (pg 34)
  - Cholangiohepatitis (pg 35)
  - Hemolytic anemia
  - Immune-mediated hemolytic anemia (pg 92)
  - Postparturient hemolytic anemia (pg 88)
- Neonatal erythrolysis (pg 91)
- Transfusion reaction
- Snake bite (pg 242)
- Copper toxicity (pg 203)

**Rare causes:**
- Liver
  - Sarcozystosis
  - Ruptured gallbladder
  - Bilary obstruction
  - Choledolithiasis

### Dental Cavities, Discolored Teeth (IM 139)

- Fluoride toxicity (pg 216)
- Actinomycosis (pg 13)
- Broken mouth (old teeth) (pg 7)
- Tooth root abscess w/ osteomyelitis (pg 7)
- Periodontal diz (pg 7)
- Black walnut stains
- Osteomalacia, osteodystrophy (pg 7)
- Teeth fx (pg 7)
- Skeletal neoplasia
- Bovine erythropoietic porphyria
- Osteogenesis imperfecta (Friesians) (pg 7)
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### Serous Nasal Discharge (IM 61)

**Common causes:**
- Pneumonia (pg 62)
- Shipping fever (pg 63)
- Enzootic calf pneumonia (pg 66)
- *H. somnis* pneumonia (pg 71)
- Atypical interstitial pneumonia (pg 67)
- Early bacterial pneumonia
- Verminous pneumonia (pg 69)
- IBR (pg 252)
- BRSV (pg 64)
- *Parainfluenza-3 virus* (pg 65)
- Debilitating illness (don't lingually clean nose)
- Trauma - to resp. passageway
- Abscess - oral, pharyngeal, retropharyngeal (pg 14)
- Choke (pg 15)
- Septicemia (neonates)

**Uncommon causes:**
- Pneumonia
- Aspiration (pg 69)
- Inhalation (pg 59)
- *C. psittaci* pneumonia (pg 68)
- Viruses
  - BVD (pg 253, 64)

**Toxic causes:**
- Organophosphate/carbonate (pg 206)
- Ammonia (pg 210)
- Mercury (pg 202)
- Formaldehyde
- Iodine
- Thallium (pg 215)
- Trichloroethylene-extract feed
- Oxalate (pg 224)
- Sneezeweed (pg 221)
- Acorn, oak (pg 234)
- Hailey vetch (pg 239)
- Rubberweed (pg 241)
- Perennial broomweed

**Rare causes:**
- Granulomas
  - "Summer snuffles" (pg 59)
  - Fungal granuloma (pg 58)
- Fungal
  - Phycomycosis, pythiosis (pg 66)
  - Pulmonary aspergillosis (pg 66)
  - Zygomyces, Mucormycosis (pg 66)
- Sarcocystosis
- Winter dysentery (pg 23)
- Rinderpest (pg 12)
- Nasal actinobacillosis
- Pregnancy toxemia
- Buss diz (chlamydial) (pg 70)
- Lymphosarcoma (pg 198)
- Neoplasia
- Bronchobiliary fistula (pg 74)
- Nasal actionbacillosis
- Immune deficiency states

**Purulent Nasal Discharge (IM 63; DDX 107)**

**Common causes:**
- Debilitating illness (don't clean nose w/tongue)
- 2° bact. to viral illness
- Pneumonia (pg 62)
- *Pasteurella* spp
- *H. somnis* (pg 141)
- Lung worms (pg 69)
- Chronic bact. pneumonia
- Calf diphtheria (pg 9)
- Choke (pg 15)
- Trauma
- Abscess
- Septicemia

**Rare**
- *Buetongue* (pg 10)
- Summer snuffles (pg 59)
- Fungal granuloma (pg 58)
- Salmonellosis (pg 259)
- Sarcocystosis (pg 123)
- T.bacterium (pg 70)
- Bronchobiliary fistula (pg 74)
- Zygomycosis, mucormycosis (pg 66)
- Immune deficiency states
- Lymphosarcoma (pg 198)
- Neoplasia
- Phycomycosis (pg 66)
- Nasal actinobacillosis
**Ingesta in Nasal Discharge** *(IM 64; DDX 105)*

Common causes:
- Choke (pg 15)
- Pharyngeal trauma (pg 14)
- Retropharyngeal abscess (pg 14)
- Megaesophagus (pg 15)

Uncommon causes:
- Diaphragmatic hernia (pg 46)
- Lacerated esophagus (pg 15)
- Cleft palate (pg 7)
- Salt toxicity
- Glossopharyngeal nerve paralysis (vagus)
- Tetanus (pg 145)

Rare causes:
- Vascular ring anomaly (pg 79)
- Listeriosis (pg 143)
- Neoplasia - esophagus or rumen
- Congenital defect of Kodiak Island calves

Toxic causes:
- Oleander poisoning (pg 230)
- White snakeroot poisoning (pg 238)
- Sneezeweed poisoning (pg 221)
- Geigeria poisoning
- Rubberweed poisoning (pg 241)

**Epistaxis** *(IM 69; DDX 105)*

Common causes:
- Pharyngeal, retropharyngeal trauma (pg 14)
- Nasal trauma (pg 59)
- Infection of paranasal sinuses (pg 60)
- Foreign body (resp. or upper GI tract)
- Dehorning (adult) (pg 60)
- Caud. vena cava thrombosis (pg 71)

Uncommon causes:
- Granulomas
  - Nasal, atrophic rhinitis (pg 56)
  - Fungal granuloma (pg 59)
- Gunshot
- Skull fractures
- Vesicular stomatitis
- IBR (pg 252)
- BVD (pg 253)
- Malignant catarrhal fever (pg 10)
- Neoplasia (nasal, paranasal sinuses)

Rare causes:
- Acute anthrax (pg 247)
- Black's dz (pg 37)
- Bacillary hemoglobinuria (pg 90)
- Acute renal failure (pg 100)
- Liver fluke dz (pg 37)
- Snake bite (pg 242)
- Endocarditis (pg 81)
- Hemophilia A (VIII deficiency)
  - Factor XI deficiency
- Trypanosomiasis (pg 246)
- Endemic ethmoid carcinoma

**Hemoptysis** *(Bronchial or Pulmonary hemorrhage)* *(IM 69)*

- Aspiration pneumonia (pg 69)
- Caud. vena cava thrombosis (pg 71)
- Foreign body
- Pulmonary aspergillosis (pg 66)
- Thoracic trauma
- Pharyngeal/retropharyngeal abscess/trauma (pg 14)

- Cardiomyopathy in polled Hereford calves
- Pulmonary neoplasia
- Oak/acorn poisoning (pg 234)
- Moldy sweet clover (pg 86)
- Oxalate (Halotetan, Sarcoptes spp.) (pg 224)
- Phylogenous selenium poisoning (Astragalus spp.)
- Warfarin (pg 214)
- Trichlorethylene extract feed
- Arsenic (pg 202)
Neonatal Respiratory Distress (IM 363, 373)

- Airway obstruction
  - Laryngeal edema (pg 60)
  - Choanal atresia
- Tracheal malformation - stenosis, collapse (pg 61)
- Developmental
  - Diaphragmatic hernia (pg 46)
- Pulmonary hypoplasia
- Lung diz
  - Pneumonia (pg 62)
  - Hyaline membrane diz (pg 73)
  - Aspiration syndromes (pg 69)
  - Pulmonary edema, congestion
  - Atelectasis
  - Pulmonary hemorrhage (pg 71)
  - Pneumothorax (pg 73)
  - Transient tachypnea syndrome
- Nonpulmonary causes
  - Severe anemia (pg 62)
  - Hypovolemia (pg 196)
  - Excitation
  - Pleural effusions (pg 72)
  - Pain
  - Birth asphyxia
  - Persistent pulmonary hypertension
  - Metabolic (acidosis, hypoglycemia)
  - Central nervous system problems
  - CHF (congestive heart failure) (pg 76)
  - Endotoxemia/sepsis

Coughing (IM 55, DDX 61)

Common causes:
- Pneumonia (pg 62)
  - Pasteurella spp. (pg 63)
  - Shipping fever (pg 63)
  - Enzootic calf pneumonia (pg 66)
  - Haemophilus pneumonia (pg 71)
  - Atypical interstitial pneumonia (pg 67)
  - Chronic bact. pneumonia w/ abscesses (Actinomyces pyogenes)
  - IBR (pg 252)
  - Bovine resp. syncytial virus (pg 64)
  - Parainfluenza-3 virus (pg 65)
  - Calf diphtheria (pg 61)
  - Abscesses - oral, lingual, laryngeal, bronchial, chest wall, tracheal
  - Trauma
  - Choke (pg 15)
  - Septicemia (neonate)

Less common causes:
- Viruses
  - Rhinovirus (pg 65)
  - Adenovirus (pg 65)
  - Herpes virus DN-599 (pg 65)
  - Pneumonia (pg 62)
  - Inhalat./Aspiration pneumonia (pg 69)
  - Chlamydia psittaci pneumonia (pg 68)
  - Pulmonary embolus of caud. vena cava (pg 71)
- Anaphylaxis (pg 74)
- Milk allergies (pg 188)
- Anthelmintic reaction to dead parasites (pg 134)
- Pneumothorax (pg 73)
- High altitude diz (pg 80)
- Enzootic bovine leukosis (pg 79)
- Left heart failure (pg 79)
- Malignant catarrhal fever (pg 10)
- Pleuritis (pg 72)
- Pleural effusion (pg 72)
- Farmer's lung diz (pg 68)
- FB in pharynx, larynx, trachea, bronchi or lungs (pg 14)

Toxic causes:
- Diaphragmatic hernia (pg 48)
- Sporadic bovine leukosis (pg 268)
- Zygomyces, Mucormycosis (pg 66)
- Pulmonary listeriosis (pg 68)
- Buss diz (exotic) (pg 670)
- Winter dysentery (pg 23)

Rare causes:
- Organophosphate/carbamate (pg 206)
- Levamisole (pg 216)
- Mercury (pg 202)
- Nitrogen dioxide (pg 211)
- Allatoxicosis (pg 233)
Respiratory Distress, Dyspnea (IM 75; Br 128; DDX 82)

Common resp. causes:
- Pneumonia (pg 62)
  - Pasteurella (pg 63)
  - Bacterial pneumonia (pg 63)
  - H. somnus pneumonia (pg 71)
  - Aspiration/FB pneumonia (pg 69)
  - Bovine atypical interstitial pneumonia (pg 67)
  - Parasitic pneumonia (lung worms) (pg 69)
  - IBR (pg 252)
  - Pulmonary edema & emphysema (pg 67)
  - Farmer's lung diz (pg 69)
  - Anemia (pg 89)
  - Hemoglobinuria (pg 89)
  - Hemolytic anemia (pg 89)
- Endotoxemia
  - Coliform mastitis (pg 195)
  - Enteritis (pg 18-25)
  - Salmonellosis (pg 259)
  - Septicemia
  - Metritis (pg 111)
  - Anemia (pg 82)
  - Postparturient hemoglobinuria (pg 89)
  - Hemolytic anemia (pg 89)
  - Anaplasmosis (pg 92)
  - Eperythrozoonosis
  - Iron deficiency (pg 87)
  - Distended abd. organs
  - Bicat - frothy or free (pg 26)
  - Other
  - White muscle diz (pg 78)
  - Anaphylaxis/allergy (pg 251)
  - Neonatal septicemia

Common nonresp. causes:
- Hyperthermia
- Pain
- Acidosis
- Hypovolemic, cardiac, & septic shock (pg 195)
- Fluid & electrolyte loss
  - Acute diarrhea, GI obstruction, etc.
- Electrolyte aberrations
  - Hypocalcemia (pg 148)
  - Hypomagnesemia (pg 146)
- Cardiac failure (Valvular problems, bact. endocarditis, cardiomyopathies, pericarditis) (pg 76)
- CNS (pseudorabies, encephalomalacia, meningoencephalitis, trauma, looping ill)
- Clostridial diz (enterotoxemia, Black's diz, tetanus, bacillary hemoglobinuria, blackleg)
- Choke (pg 15)
- Anthrax (pg 247)
- Salt poisoning (pg 205)
- Pulmonary edema (fluid therapy)
- Tick paralysis, Bee sting, snake bite (pg 142, 242)
- Photosensitization (pg 232)
- Blood transfusion reaction
- Toxoplasmosis (pg 123)

Rare causes: see IM 79

Toxic causes:
- Strychnine (pg 215)
- Sulfur
- Lead (pg 152)
- Selenium (pg 226)
- Organophosphates/carbamate (pg 206)
- Chlorinated hydrocarbons (pg 207)
- Bromide
- Nitrates (pg 231)
- Oxalate, ethylene glycol (pg 224)
- Propylene glycol
- Sodium fluoroacetate (pg 215)
- Potassium
- Arsenic (pg 202)
- Phosphate fertilizers (pg 215)
- Warfarin (pg 214)
- Metaldehyde (pg 207)
- Formaldehyde
- Ammonia (pg 204)
- Hydrogen sulfide (pg 210)
- Copper toxicity (pg 203)
- Levamisole
- Insect fogger pneumonia
- Morensin/Gossypol (pg 203, 229)
- Ergal (pg 237)
- Aflatoxins (pg 233)
- Cynogenic plants (pg 222)
- Moldy sweet clover (pg 229)
- Brassica spp.
- Larkspar (pg 235)
- Haly vetch (pg 239)
- While snakeroot (pg 6238)
- Oleaner (pg 230)
- Nightshade (pg 239)
- Cocklebur (pg 220)
- Lecoweed (pg 236)
- Water hemlock
- Hepatotoxic plants (Senecio, Amsinkia) (pg 232)
- Rubberweed (pg 241)
- Sneezeweed (pg 221)
- Lupine (pg 220)
- Rhododendron (pg 221)
- Fescue (pg 221)
- Milledweed (pg 230)
- Foxglove (pg 230)
- Ryegrass (pg 237)
- Many other poisonous plants (IM 79)
Differential Diagnosis

Cyanosis (IM 84)

Common causes:
- Pneumonia (pg 62)
- Bacterial (Pasteurella, Actinomyces, C. pseudotuberculosis & others) (pg 63)
- Viral (BRSV & others) (pg 64)
- Parasitic pneumonia (pg 69)
- Aspiration (pg 69)
- Pulmonary edema & emphysema (pg 67)
- Heart defects (VSD, tetralogy of Fallot) (pg 79)
- Anaphylaxis (pg 251)
- Bloat (pg 26)
- Toxic methemoglobinemia
- Shock (cardiac, hypovolemic, septic)

Rare causes: (See IM 84)
- Arsenic (pg 202)
- Strychnine (pg 215)
- Nitrate/nitrite (pg 231)
- Organophosphate/carbamate (pg 208)
- Chlorinated hydrocarbons (pg 207)
- Metaldehyde (pg 207)
- Hydrogen sulfide (pg 210)
- Sudan grass
- Locoweeds (pg 236)
- Rhododendron (pg 221)
- Oleander (pg 230)
- Milkweed (pg 230)
- Pigweed (pg 234)
- Lamb’s quarters (pg 224)
- Many other poisonous plants (IM 84)

Uncommon causes:
- Obstruction (nasal passages - neoplasms, granulomas, abscess) (pg 58)
- Laryngeal abscess (pg 61)
- Pneumothorax (pg 73)
- Pulmonary contusions
- Diaphragmatic hernia (pg 46)
- Prematurity (neonate) (pg 73)
- Inhalation pneumonia (smoke) (pg 212)
- Tracheal collapse/stricture, stenosis/rupture (pg 61)
- Hemorrhage (pg 73)
- VSD + pulmonary stenosis (pg 79)
- Postparturient hemoglobinuria (pg 88)
- Clostridial dix (blackleg, tetanus, malignant edema) (pg 145, 244)
- Obstructive urolithiasis (pg 96)

Cyanosis, Neonate (IM 374)

- Respiratory
  - Alveolar hypoventilation
  - CNS trauma or hemorrhage
  - Pneumothorax (pg 73)
  - Diaphragmatic hernia
  - Hypoglycemia or hypocalcemia
  - Drug induced CNS depression
  - Upper airway obstruction (pg 60)
  - Hemorrhage (pg 73)
  - Pleuritis (pg 72)
  - Spinal nerve dysfunction to resp. muscles
  - Hypoplastic lungs?
  - Cardiovascular

- Ventricular septal defect (pg 79)
- Patent ductus arteriosus (pg 79)
- Tetralogy of Fallot (pg 79)
- Truncus arteriosus (pg 79)
- Double outlet rt. ventricle
- Single ventricle
- Eisenmenger complex (pg 79)
- Impaired infusion
  - Pulmonary
    - Pneumonia (pg 62)
  - Edema
  - Atelectasis
  - Shunting
  - Congenital heart defects (pg 79)
  - Pulmonary hypertension
  - Ventricular perfusion mismatch

Stridor (IM 91)

Common causes:
- Calf diphtheria (pg 9)
- Actinobacillosis
- Trauma (oral, nasal, pharyngeal, retropharyngeal, laryngeal) (pg 14)
- Sinusitis (pg 60)
- Foreign body (oral, nasal, pharyngeal, tracheal) (pg 14)
- Anaphylaxis (pg 251)
- Abscess (oral, pharyngeal, retropharyngeal, laryngeal) (pg 14)

Uncommon causes:
- Tracheal stenosis (pg 61)
- Actinomycosis (lumpy jaw) (pg 13)
- IBR (pg 252)
- Malignant catarrhal fever (pg 10)
- Shipping fever (pg 63)
- Enzootic calf pneumonia (pg 66)
- Vesicular stomatitis (pg 11)
- Pulmonary embolism from caud. vena cava (pg 71)
- Nasal granulomas (pg 658)
- Atrophic rhinitis (pg 59)
- Honker syndrome (pg 61)

- Neoplasia
- Inhalation pneumonia (smoke) (pg 212)
- Snake bite, bee sting (pg 215)
- Clostridial infec. (head)
- Thymic lymphosarcoma
- Bovine leukemia

Rare causes: (See IM 91)
**Dysrhythmias, Cardiac (IM 106)**

Common causes:
- Myocarditis/myocardial dz (pg 77)
- Cardiomyopathies (pg 77)
- GI dz
- Valvular heart dz (pg 81)
- Brisket dz (pg 80)
- Excitement
- Fever
- Pericarditis (pg 76)
- Toxemia
- Foot rot (pg 159)
- Cor pulmonale (pg 80)
- Electrolyte abnormalities

**Muffled Heart Sounds (IM 109)**

Common causes:
- Obesity
- Pericarditis (pg 76)
- Lymphosarcoma (pg 79)
- Congestive heart failure (pg 76)
- Pleural effusions
- Abscess (pg 71)
- Emphysema

Rare causes:
- Pneumothorax (pg 73)

**Peripheral Edema/Pleural Effusion/Ascites (IM 103)**

- Heart problems
  - Congestive heart failure (pg 76)
  - AV valve regurgitation
  - Vegetative endocarditis (pg 81)
  - Congenital defects (pg 79)
  - Chronic atrial fibrillation (pg 81)
  - Cardiomyopathy (pg 77)
  - Pericarditis (pg 76)
  - Heart based tumor (pg 87)
- Cor pulmonale
- High altitude dz (pg 80)
- Pleuritis (pg 72)
- Liver dz (pg 34)
- Starvation
- Kidney dz
  - Glomerulonephritis (pg 94)
  - Amyloidosis (pg 94)
  - GI malabsorption

**Syncope/Weakness (IM 111)**

Common causes:
- Congestive heart failure (pg 76)
- Cardiac dysrhythmias
- Myocardial dz (pg 77)
- Congenital heart defects (pg 79)

**Abnormal Peripheral Pulse (IM 117)**

Common causes:
- Toxemia
- Dehydration
- Shock
- Electrolyte imbalances
- Congestive heart failure (pg 76)
- Acid base disorders
- Cardiac dysrhythmias

Rare causes:
- Aortic insufficiency
- Patent ductus arteriosus (pg 79)
- Peripheral arterial venous shunts

**Jugular Venous Distention/Pulsation (IM 113; Br 126)**

Common causes:
- Rt. heart failure (pg 76)
- Pericarditis (pg 76)
- Congestive heart failure (pg 76)
- Rt. AV valve insufficiency
- Cardiomyopathy (pg 77)
- Jugular venous phlebitis/thrombosis (pg 80)
- Heart base tumor/abscess (pg 79)
- Brisket dz (pg 80)
- Cor pulmonale (pg 80)
- Monensin toxicity (pg 78)
- White muscle dz (Se) (pg 78)

Rare causes:
- Myocarditis (pg 77)
- Cardiomyopathy (pg 77)

**Cardiac Murmur (IM 108)**

Common causes:
- Heart problems
  - Degenerative valvular dz
  - Congenital defects (pg 79)
  - Bact. endocarditis (pg 81)
  - Pericarditis (Hardware dz) (pg 76)
  - Anemia (pg 82)
  - Excitement
  - Fever
  - Young animal
  - Lymphosarcoma (pg 79)

Rare causes:
- Myocarditis (pg 77)
- Cardiomyopathy (pg 77)

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Acute Renal Failure (IM 240)
- Septic causes
  - Pyelonephritis (pg 98)
  - Renal necrosis
  - Mastitis (pg 192)
  - Metritis (pg 111)
- Hemodynamic causes
  - Severe bloat (pg 26)
  - Shock (pg 248)
  - Heart failure (pg 76)
  - Renal vein thrombosis
- Toxic plants
  - Oak (acorn) toxicity (pg 234)
  - Amaranthus spp (pg 234)
  - Rumex
  - Halogenated germeratus (pg 225)
  - Greasewood (pg 225)
  - Oxalate (pg 224)
  - Others (see IM 200)
- Drugs
  - Aminoglycosides (pg 217)
  - Oxytetracycline
  - Monensin (pg 203)
  - Sulfanamides
- Chemicals
  - Mercury (pg 202)
  - Arsenic (pg 202)
  - Parquat (pg 208)
  - Ethylene glycol (pg 209)
  - Chlorinated hydrocarbons (pg 207)
  - Endogenous
    - Myoglobin
    - Hemoglobin
    - Mycotoxins
    - Citrinin
    - Ochratoxin

Chronic Renal Failure (IM 205)
- Tubulointerstitial causes:
  - Any cause of acute renal failure (pg 100)
  - Chronic obstruction (pg 96)
  - Chronic pyelonephritis (pg 98)
- Glomerular causes:
  - Amyloidosis (pg 94)
  - Glomerulonephritis (rare) (pg 94)

Dysuria/Stranguria (IM 199)
- Urethral calculi (pg 96)
- Cystitis (pg 96)
- Pelvic bladder
- Hemorrhage into urinary tract
- Urethral swelling (calving)
- Penile or preputial problems (pg 126)
- Sacral fractures
- Spinal cord injury (pg 157)
- Extrudal lymphosarcoma (pg 268)

Hematuria (IM 200)
- Calculi (pg 96)
- Trauma
- Bracken fern toxicity (pg 86)
- Malignant catarrhal fever (pg 10)
- Pyelonephritis (pg 98)
- Infarction of kidney (pg 99)
- Cystitis (pg 96)
- Bladder polyps (pg 84)
- Papilloma (bladder) (pg 84)
- Urethritis (pg 96)

Polyuria (IM 206)
Renal failure - acute & chronic
- Diabetes mellitus/D. insipidus
- Steroid administration
- Fluid administration
- Diuretics
- Salt deficiency
- Salt toxicity (pg 205)
- Hyperglycemia
- Severe CI, K or urea deficiency

Pain on Urination (IM 34)
Common cause:
- Urolithiasis (pg 96)
Uncommon causes:
- Cystitis (pg 95)
- Vaginitis (pg 117)
- Preputial problems (pg 127)
- Pyelonephritis (pg 98)
Bull - Sexual Malfunction (IM 243; Br 484)

Common causes:
- Penile/preputial problems (pg 126)
  - Trauma, hematoma, abscess (pg 126)
  - Deviation (pg 127)
  - Balanoposthitis (pg 127)
  - Paraphimosis (pg 127)
  - Phimosis (pg 126)
  - Penile hair ring
  - Penile-preputial adhesions
  - Persistent penile frenulum (pg 128)
- Papillomatosis (pg 6127)
- Herpes vulvovaginitis (pg 117)
- IBR (infec. B. pustular vulvovaginitis) (pg 117)
- Ruptured urethra (pg 196)
- Urethral calculi (pg 196)
- Prepuce
  - Trauma
  - Preputial stenosis (pg 126)
  - Prolapsed prepuce (pg 127)
  - Abscess/cellulitis
- Foreign body
- Testicles, spermatic cord & scrotum
  - Orchitis (pg 129)
  - Epididymitis (pg 130)
  - Sperm granuloma
  - Spermatocele
  - Testicular degeneration, hypoplasia, atrophy (pg 128)
  - Varicocele (pg 130)
  - Testicular tumors (pg 129)
  - Testicular trauma
  - Cryptorchidism (pg 129)
  - Segmental aplasia

Lack of Libido - Bull

- Malnutrition
- Lameness (pg 155)
- Penile/preputial problems (pg 126)
  - Trauma - hematoma (pg 126)
  - Prolapsed prepuce (pg 127)
  - Loss of penile sensation - Corpus cavernosum vascular shunts
  - Persistent penile frenulum (pg 128)
  - Posthitis (inflam. of prepuce) (pg 127)
  - Vertebral osteophytosis/spondylosis
  - Zinc deficiency (pg 189)
  - Iodine deficiency
  - Psychogenic impotency
  - Epididymitis (pg 130)
  - Orchitis (pg 129)
  - Weaver syndrome (pg 135)

Infertility - Bull (IM 243; Br 484)

- Malnutrition
- Testicles
  - Degeneration (pg 128)
  - Orchitis (pg 129)
  - Hypoplasia/atrophy (pg 128)
  - Cryptorchidism (pg 129)
  - Trauma (pg 126)
  - Tumors (pg 129)
- Sperm
  - Sperm granuloma
  - Hermaphroditism
  - IBR, BVD contaminated semen
  - Abnormalities of spermatogenesis
- Penis/prepuce
  - Balanoposthitis (pg 127)
  - Paraphimosis (pg 126)
  - Trauma
  - Hematoma, hematocoele (pg 126)
  - Penile preputial adhesion (pg 126)
  - Penile deviation (pg 127), corkscrew penis
  - Loss of penile sensation
  - Micropenis, short penis, hypoplasia
  - Persistent penile frenulum (pg 128)
  - Penile hair ring (pg 127)
  - Prolapsed prepuce (pg 127)
  - Papillomatosis, warts (pg 127)
  - Bovine herpes virus-1, IBR - dermatitis
  - Urethra & erectile tissue
  - Urolithiasis (pg 196)
  - Corpus cavernosum vascular shunts
  - Urethral fistula

- Scrotum
  - Frostbite
  - Inguinal scrotal hernia (pg 46)
  - Dermatophilosis
  - Abscess
  - Seminal vesiculitis (pg 130)
  - Varicocele (pg 130)
  - Deficiencies
    - Iodine defc
    - Zinc defc (pg 189)
    - Manganese defc
  - Psychologic impotency
  - Vertebral spondylosis (pg 135)
  - Hereditary
    - Inbreeding
    - Bulls co-twin w/ freemartins (pg 107)
    - Chromosomal abnormalities
    - Segmental aplasia of repro tract
    - Hermafroditism, pseudohermafroditism (pg 113)
    - Short retractor penis m, (Dutch Friesian)
    - Weaver syndrome (pg 135)
  - Environmental
    - Heat stroke (pg 128)
    - Cold weather infertility
  - AI (artif. insemin.) assoc. infertility (pg 106)
  - Lameness (pg 155)
  - Malnutrition
Reproduction - Cow

Cyclic Irregularities (IM 246)

Common causes:
- Poor heat detection (pg 105)
- Intra-uterine therapy
- Endometritis (pg 111)
- Heat stress
- Cystic ovaries (pg 108)
- BVD (pg 121, 253)
- IBR (pg 118, 252)
- Leptospirosis (pg 121)
- Campylobacteriosis (pg 119)
- Trichomoniasis (pg 120)

Rare cause:
- BVD, IBR- infected semen

Repeat Breeding (IM 249)

Common causes:
- Erroneous heat detection (pg 105)
- Malnutrition (pg 265)
- Heat stress
- Erroneous AI timing (pg 106)
- Follicular cysts (pg 108)
- Leptospirosis (pg 121)
- Campylobacteriosis (pg 119)
- Trichomoniasis (pg 120)
- Inadequate uterine involution
- Endometritis (pg 111)

Uncommon causes:
- Urine pooling (pg 113)
- Ureaplasmosis (pg 123)
- Pneumovagina (pg 113)
- Uterine tumors (pg 113)
- Oviduct bursal adhesions (pg 109)
- Parovarian cyst
- Poor semen quality (pg 106)
- Inadequate number of bulls
- BVD (pg 121)
- IBR (pg 118)
- Brucellosis (pg 122)
- Anaplasmosis (pg 92)
- Bluetongue (pg 123)
- Phosphorus defc
- Fescue toxicity (pg 254)
- Zearalenone toxicity
- Selenium defc (pg 226)

Rare causes:
- Hydroaepinx (pg 109)
- Segmental aplasia (pg 113)
- Chromosomal abnormalities
- Ovarian tumors
- Johne's dz (pg 23)
- Oophoritis (pg 108)
- Tuberculosis
- Weaver syndrome (pg 135)
-Crooked canivx
- Salpingitis (pg 113)
- Fat necrosis (pg 50)
- Cobalt defc (pg 189)
- Molybdenum toxicity (pg 203)
- Iode defc
- Fluoride toxicity (pg 216)
- Brassica toxicity (pg 231)
- Copper defc (pg 203)
- Manganese defc (pg 146)
- Zinc defc (pg 189)
- Polybrominated biphenyl toxicity (pg 213)
- Phytoestrogen toxicity

Prolonging Gestation (IM 260)

- High environmental temp.
- BVD
- Fescue toxicity (pg 254)
- Autosomal recessive gene
- Holstein & Guernseys
- Hypothalomo-hypophyseal-adrenal axis disorders
- Fetal mummification (pg 107)
- Bluetongue (pg 123)
- Hydropic amni (pg 113)
- Akabane (exotic)

Retained Fetal Membranes (IM 266; DDX 117)

Common causes:
- Abortion (pg 116)
- Dystocia (pg 115)
- Induced parturition
- Hypocalcemia (pg 148)
- Stillbirth
- Abnormal gestation length
- Placentitis (bacterial or fungal)
- Multiple births (pg 107)

Uncommon causes:
- Uterine atony
- Uterine torsion (pg 112)
- Cesarean section (pg 114)
- Placentome injury, inflammation, edema or necrosis
- Entrapment of separated placenta
- Dropsy of fetal membranes (pg 113)
- Excessive wt. gain in dry period
- High milk production
- Incr. age
- Heat stress
- Late winter/early spring calving
- Vit A defc

Anestrus (IM 249)

Common causes:
- Pregnancy (pg 105)
- Erroneous heat detection (pg 105)
- Pyometra (pg 111)
- Postpartum period
- Nursing beef cows
- Luteal cysts (pg 106)
- Freemartinism (pg 107)
- Poor footing
- Heat stress
- Malnutrition (pg 265)

Uncommon causes:
- Macerated/mummified fetus (pg 107)
- Hydrometra
- Mucometra

Rare causes:
- Segmental aplasia (pg 113)
- Ovarian tumor

Anestrus (IM 249)

Common causes:
- Pregnancy (pg 105)
- Erroneous heat detection (pg 105)
- Malnutrition (pg 265)
- Heat stress
- Erroneous AI timing (pg 106)
- Follicular cysts (pg 108)
- Leptospirosis (pg 121)
- Campylobacteriosis (pg 119)
- Trichomoniasis (pg 120)
- Inadequate uterine involution
- Endometritis (pg 111)

Uncommon causes:
- Urine pooling (pg 113)
- Ureaplasmosis (pg 123)
- Pneumovagina (pg 113)
- Uterine tumors (pg 113)
- Oviduct bursal adhesions (pg 109)
- Parovarian cyst
- Poor semen quality (pg 106)
- Inadequate number of bulls
- BVD (pg 121)
- IBR (pg 118)
- Brucellosis (pg 122)
- Anaplasmosis (pg 92)
- Bluetongue (pg 123)
- Phosphorus defc
- Fescue toxicity (pg 254)
- Zearalenone toxicity
- Selenium defc (pg 226)

Rare causes:
- Hydroaepinx (pg 109)
- Segmental aplasia (pg 113)
- Chromosomal abnormalities
- Ovarian tumors
- Johne's dz (pg 23)
- Oophoritis (pg 108)
- Tuberculosis
- Weaver syndrome (pg 135)
- Crooked canivx
- Salpingitis (pg 113)
- Fat necrosis (pg 50)
- Cobalt defc (pg 189)
- Molybdenum toxicity (pg 203)
- Iode defc
- Fluoride toxicity (pg 216)
- Brassica toxicity (pg 231)
- Copper defc (pg 203)
- Manganese defc (pg 146)
- Zinc defc (pg 189)
- Polybrominated biphenyl toxicity (pg 213)
- Phytoestrogen toxicity
Abortion (IM 256; Br 469; DDX 20)

Common causes:
- Brucellosis (pg 122)
- IBR (pg 118)
- BVD-MD (pg 121)
- Trichomoniasis (pg 120)
- Leptospriosis (pg 121)
- Epizootic bovine abortion (pg 123)
- Maternal stress
- Campylobacteriosis (pg 119)
- Mycotic abortions (pg 120)

Uncommon causes:
- Tuberculosis (pg 70)
- Twinning (pg 107)
- Mycoplasma (pg 123)
- Salmonellosis (pg 119)
- Uterine torsion (pg 112)
- White muscle diz (pg 78)
- Q fever (pg 254)
- Umbilical cord abnormalities (pg 102)
- Placental abnormalities
- Fetal abnormalities
- Chromosomal abnormalities
- Malnutrition (pg 265)
- Bluetongue (pg 123)
- Anaplasmosis (pg 92)
- Hemophilus somnus (pg 258)
- Drug induced
- Manganese defc (pg 146)
- Vit A defc (pg 189)
- Salt toxicity (pg 205)
- Iodine defc

Rare causes:
- Johne's diz (pg 23)
- Liver flukes (pg 37)
- Bacillary hemoglobinuria
- Milk allergy (pg 188)
- Lice (pg 180)
- Ureaplasma (pg 123)
- Anthrax (pg 247)
- Yersinia pseudotuberculosis
- Copper defc (pg 189)

Toxic causes:
- Lead toxicity (pg 202)
- Ergotism (pg 237)
- Nitrate poisoning (pg 231)
- Phosphatic fertilizer toxicity (pg 215)
- Aflatoxicosis (pg 230)
- Chlorinated naphthalene (pg 213)
- Zearalenone (pg 241)
- Polybrominated biphenyl (pg 213)
- Locoweed (pg 236)
- Death camas (pg 239)
- Ryegrass (pg 237)
- Lathyrus
- Pine needles (pg 241)
- Broomweed (pg 220)

Uncommon causes:
- Tuberculosis (pg 70)
- Twinning (pg 107)
- Mycoplasma (pg 123)
- Salmonellosis (pg 119)
- Uterine torsion (pg 112)
- White muscle diz (pg 78)
- Q fever (pg 254)
- Umbilical cord abnormalities (pg 102)
- Placental abnormalities
- Fetal abnormalities
- Chromosomal abnormalities
- Malnutrition (pg 265)
- Bluetongue (pg 123)
- Anaplasmosis (pg 92)
- Hemophilus somnus (pg 258)
- Drug induced
- Manganese defc (pg 146)
- Vit A defc (pg 189)
- Salt toxicity (pg 205)
- Iodine defc

Dystocia (IM 263)

Common causes:
- Malpresentation (pg 115)
- Malposition (pg 115)
- Malposture (pg 115)
- Fetopelvic disproportion (pg 115)
- Twins (pg 157)
- Uterine torsion (pg 112)
- Lymphedema
- Cervix undilated
- Periparturient hypocalcemia

Rare causes:
- Rupture of prepubic tendon (pg 113)
- Prolonged gestation
- Uterine rupture (pg 113)
- Abd. inguinal hernias (pg 46)
- Fetal tumors
- Hereditary edema - Ayreshire calves
- Rectovaginal constriction - Jersey cattle
- Lipomatisis
- Polybrominated biphenyl toxicity (pg 213)
- Phytoestrogen toxicity

Uncommon causes:
- Triplets
- Hydrops of fetal membranes (pg 113)
- Retained fetus
- Mummification/maceration (pg 107)
- Empysematous fetus
- Hydrocephalus
- Ankylosis of extremities
- Congenital defects (monsters)
- Hydrops of fetal membranes
- Immature small females
- Preterm parturition
- Abortion (pg 118)
- Obesity
- Uterine inertia
- Vaginal prolapse (pg 116)
- Uterine, cervical, vaginal obstruction
- Pelvic fractures

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**Udder**

**Enlarged Mammary Glands**

Common causes:
- Mastitis (pg 192)
- Blind quarter
- Periparturient udder edema
- Trauma
- Abscess
- Pendulous udder

Uncommon causes:
- Photosensitization (pg 232)
- Sunburn (pg 184)
- Frostbite (pg 184)
- Eczema
- Urticaria (pg 188)
- Milk allergies (pg 188)
- Cowpox (pg 186)
- Pseudopox (pg 186)
- Bovine herpes mammillitis
- Foot & mouth diz (exotic) (pg 11)
- Tuberculosis (pg 70)
- Sarcoptic & psoroptic mange (pg 181)
- Papillomatosis, warts (pg 190)
- Furunculosis/abscess (pg 183)
- Staph. folliculitis (pg 183)
- Ovarian neoplasia
- Enzootic mycobacterial nodular-ulcerative mammillitis
- Cutaneous lipomatosis
- Primordial mammarian tissue swelling
- Neoplasia
- Zearalenone toxicity (pg 239)

**Udder Edema**

- Periparturient udder edema
- Obesity
- Excessively long dry period
- Anemia
- Excess dietary sodium, potassium
- Excessive dietary protein
- Overfeeding grain prepartum
- Hereditary
- Hypomagnesemia (chronic udder edema)
- Disruption of udder blood & lymph circulation

**Agalactia/Hypogalactia**

Common causes:
- Mammary aplasia, hypoplasia
- Abscess
- Mastitis (pg 192)

Uncommon causes:
- Trauma
- Neoplasia (lymphosarcoma, SCC)
- Salt toxicity (pg 205)
- Malnutrition (pg 266)
- Chapped teats/irritation
- Fescue syndrome (pg 254)
- Anemias (pg 82)
- Toxicities
- Papillomatosis (pg 190)
- Milk allergies (pg 188)
- Self suckling (pg 272)

**Precocious Mammary Gland Development**

- Abortion (pg 118)
- Pregnancy (pg 106)
- Suckling
- Ovarian tumors
- Ascending Infec. during pregnancy
- Zearalenone toxicity (pg 239)
- Spontaneous (prolactin secretion)
Decreased Weight Gain Growth (IM 181; 
GI 804; DDX 159)

Common causes:
• Malnutrition
• Parasites (pg 54)
  - Ostertagiasis (pg 55)
  - Flukes (pg 37)
  - GI worms (pg 55, 56)
  - Lungworm (pg 69)
  - Coccidiosis (pg 260)
  - Sarcotic mange (pg 181)
  - Lice (pg 180)
• Pneumonia (Pasteurella, Hemophilus) (pg 62)
• Viruses
  - BVD (pg 253)
  - Rotavirus (pg 18)
  - Coronavirus (pg 19)
  - IBR (pg 252)
  - Intussusception (pg 45)
  - Bluetongue (pg 10)
• Diarrhea
  - Undifferentiated
  - Salmonellosis (pg 20, 21)
  - Enterotoxigenic E. coli (pg 18)
• Deficiencies
  - Selenium defc (pg 89)
  - Copper defc (pg 89)
  - Cryptosporidiosis (pg 19)
  - Lameness (pg 155)

Uncommon causes:
• Deficiencies
  - Thiamine defc
  - Cobalt defc
  - Zinc defc
  - Vit A defc
• Viruses
  - Parvovirus
  - Adenovirus
• Bacteria
  - Johne’s dis (pg 23)
  - Pharyngeal abscess (pg 14)
  - Urachal/bladder abscess
  - Abomasal ulcers (pg 31)
• Peritonitis (pg 53)
• Parasites
  - Tick infestation
  - Giardiasis
  - Sarcocystosis
  - Miliaris
  - Eperythrozoonosis
  - Hydracephalus
  - Ricketts
  - Arthropneumosis
  - Ammonia toxicity
  - Goiter
  - Cardiac anomalies
  - Immune-mediated anemia
  - Neonatal isoerythrolysis

Rare causes: see IM 180

Weight Loss (IM 191; Br 122)

Common causes:
• Malnutrition/starvation
• Parasites (pg 54)
  - Ostertagiasis (pg 55)
  - Flukes (pg 37)
  - GI worms (pg 55, 56)
  - Lungworm (pg 69)
  - Lice (pg 180)
  - Coccidiosis
  - Sarcotic mange (pg 181)
  - Lice (pg 180)
  - Anaplasmosis (pg 85)
• Dental abnormalities (pg 7)

Toxic causes:
• Pyrrolizidine alkaloid (pg 232)
• Zinc toxicity (pg 215)
• Selenium toxicity (pg 226)
• Ergotism (pg 237)
• Iodine toxicity (pg 205)
• Fluorosis (pg 216)
• Herbicide toxicity
• Atlatoxicolysis (pg 233)
• Bracken fern (pg 84, 86)
• Oxalate toxicity (pg 224)
• Fescue toxicity (pg 254)

• Pneumonia (Pasteurella, Hemophilus) (pg 62)
• Viruses
  - BVD (pg 253)
  - Rotavirus (pg 18)
  - Coronavirus (pg 19)
  - IBR (pg 252)
  - Bluetongue (pg 10)
• Diarrhea
  - Undifferentiated
  - Salmonellosis (pg 20, 21)
  - Enterotoxigenic E. coli (pg 18)
• Deficiencies
  - Selenium defc (pg 89)
  - Copper defc (pg 89)
  - Cryptosporidiosis (pg 19)
• Lameness (pg 155)
  - Pedal osteomyelitis
  - Footrot (pg 159)
  - Septic arthritis (pg 172-3)
  - Sole abscess (pg 157)
• GI problems
  - Johne’s dis (pg 23)
  - Displaced abomasum (pg 38)
  - Hepatic abscess (pg 38)
  - Abomasal ulcer (pg 31)
  - Traumatic reticuloperitonitis (pg 38)
  - Vagal indigestion (pg 29)
  - Salmonellosis (pg 259)
  - Winter dysentery (pg 23)
  - Fat necrosis (pg 50)
  - Pharyngeal, retropharyngeal abscess (pg 14)

• Enterotoxigenic E. coli (pg 18)
• Intussusception (pg 45)
• Peritonitis (pg 53)
• Pasteurellosis, septicemia
• Leptospirosis (pg 257)
• Mastitis (pg 192)
• Cryptosporidiosis (pg 19)
• Ketosis (pg 33)
• Lameness (pg 155)
• Failure of passive transfer (neonates)
• Fescue toxicity (pg 254)
• Bovine leukosis

Uncommon, rare & toxic causes: see IM 190
**Musculoskeletal**

**Limb Pain** (IM 33)

Common causes:
- Foot rot (pg 159)
- Sole abscess (pg 157)
- Sole ulcer (pg 156)
- Degenerative arthritis (pg 170-2)
- Interdigital fibroma (pg 160)
- Laminitis (pg 163)
- Laceration
- Traumatic gonitis (pg 166)
- Hoof cracks (pg 158)

Less common causes:
- Septic arthritis (pg 172)
- Hip luxation (pg 166)
- Tenosynovitis (digit) (pg 168)
- Septic navicular bursitis
- Rupture of cranial cruciate (pg 167)
- Upward fixation of patella (pg 166)

Uncommon causes:
- Bicipital bursitis
- Fractures
- Neoplasia
- Nerve paralysis (pg 136)
- Toxins & plant poisonings
- Bone abscess
- Fescue foot (pg 254)
- Sacroiliac luxation

**Lameness/Stiffness** (IM 277)

Common causes:
- Sprain (pg 175)
- Bruised foot (pg 156)
- Puncture wounds (pg 157)
- Foot rot (pg 159)
- Infections of foot
- Granuloma of sole (pg 156)
- Corkscrew claw (pg 160)
- Underrun heel (pg 159)
- Hoof defects (pg 158)
- Overgrown feet
- Interdigital fibroma (pg 160)
- Interdigital dermatitis (pg 159)
- Laminitis (pg 163)
- Septic arthritis (pg 172)
- Contracted tendons (pg 168)
- Ligament rupture
- Arthrogryposis
- Fractures
- Osteomyelitis (pg 174)
- Muscle abscess
- Blackleg (pg 244)

Rare causes:
- Physeal injuries
- Hemimelia
- Salmonellosis (pg 259)
- Ulcerative lymphangitis
- BVD (pg 253)
- Dactylomegaly in shorthorn cattle
- Cloting factor deficits
- Neoplasia
- Melioidosis
- Sporadic bovine encephalomyelitis (pg 151)
- Phychomycosis
- Hyperparathyroidism

Toxins
- Copper defc (pg 89)
- Zinc defc (pg 89)
- Polyorominated biphenyl (PBB) (pg 2213)
- Acorn (oak) toxicity (pg 254)
- Locoweed toxicity (pg 152)
- Lupine alkaloid poisoning (pg 220)
- Hemlock poisoning (pg 238)
- Nicotine toxicity (pg 213)
- Calciosos (from poisonous plants)
- Fescue foot (ergot) (pg 254)
- Kaley-pea poisoning

**Spontaneous Fractures** (IM 275)

- Pathological fractures (pg 166-9)
- Infections
- Tumors
- Osteoporosis (pg 262)
- Osteomalacia (pg 262)
- Osteodystrophy (rickets) (pg 262)
- Lactation
- Advanced pregnancy
- Rapid growth
- Copper defc (pg 89)
- Phosphorus defc
- Protein defc
- Molybdenum excess (pg 89)
Postural Deformities

Common causes:
- Congenital
  - Contracted tendons (pg. 168)
  - Angular limb deformities
  - Crooked calf syndrome (Lupinosis)
  - Acorn calves (shortened long bones) (pg. 234)
  - Syndactyly (pg. 263)
  - Idiopathic deformities & abortion
  - Osteogenesis imperfecta (pg. 263)
  - Dactylomegaly - shorthorns
- Fractures (pg. 165)
- Luxation (pg. 164)
- 2nd contracted tendons (pg. 168)
- Severed tendons (pg. 168)
- Septic tenosynovitis (pg. 168)
- Ruptured gastrocnemius (pg. 168)
- Ruptured peroneus tertious (pg. 168)
- Septic arthritis w/ ankylosis (pg. 172)
- Arthritides (pg. 172-3)
- DJD (degenerative joint diz) (pg. 170)
- Physisitis (pg. 175)
- Osteomalacia (pg. 262)

Toxic causes:
- Osteomyelitis (pg. 174)
- Rickets (pg. 262)
- Hypertrophic osteopathy
- Muscle atrophy from denervation
- Infection of foot (pg. 159)
- Hyperparathyroidism
- Chronic laminitis (pg. 163)

Swellings of Limbs

Soft tissue
- Footrot (pg. 159)
- Fescue foot (pg. 159)
- Gangrene of foot (pg. 161)
- Interdigital fibroma (pg. 160)
- Interdigital papilloma
- Capped hock (pg. 164)
- Septic arthritis
- Mycoplasma arthritis
- Ruptured tendon (pg. 168)
- Chronic tendonitis (pg. 168)
- Tenosynovitis (pg. 168)
- Hygroma (pg. 165)
- Neoplasia
- Hematoma
- Abscess
- Granulomas
- Phycomycosis
- Habronemiasis
- Bee sting/snake bite (pg. 242)

Hard tissue
- DJD (pg. 170)
- Septic arthritis (pg. 172)
- Epiphysitis (pg. 175)
- Osteomyelitis (pg. 174)
- Sequestrum (pg. 174)
- Fracture (pg. 165-9)
- Osteosarcoma
- Tumor calcinosis
- Calcinosi circumscripta
- 2nd copper defc (molybdenosis) (pg. 89)
Paresis & Weakness (IM 285)

Common causes:
- Malnutrition (pg 266)
- Parturient paresis (pg 148)
- Nonparturient hypocalcemia
- Hypomagnesemic tetany (pg 146)
- Alert downer cow syndrome (pg 267)
- Toxic mastitis (pg 192)
- Ruminal lactic acidosis (pg 25)
- Abomasal ulcers (pg 31)
- Lt. displaced abomasum (pg 42)
- Vagal indigestion (pg 29)
- Ketosis (pg 33)
- Diarrhea in calves (pg 16)
- Colibacillosis (neonates) (pg 18)
- Salmonellosis (pg 20, 259)
- Cryptosporidiosis (pg 19)
- Parasitism (pg 55)
- Anaplasmosis (pg 92)
- Peritonitis (pg 53)
- Pneumonia (pg 62)
- Polioencephalomalacia (pg 140)
- Urolithiasis (pg 96)

Uncommon causes:
- Winter dysentery (pg 33)
- BVD (pg 22, 253)
- Johne’s diz (pg 23)
- Cecal torsion (pg 49)
- Rt. displaced abomasum (pg 40)
- Botulism (pg 145)
- Renal failure (pg 100)
- Postparturient hemoglobinuria (pg 88)
- Vit defc (pg 189)
- Trace mineral defc (pg 189)
- Water intoxication
- Snake bite (pg 242)
- Rabies (pg 144)
- Pseudorabies (pg 141)
- Focal symmetrical encephalomalacia
- CNS, spinal abscess (pg 134)
- Tick paralysis (pg 142)
- Vertebral, spinal abscess
- TEGA (pg 141)
- Blackleg (pg 244)

Malignant edema (pg 245)
- Listeriosis (pg 122)
- Black diz (pg 37)
- Ruptured uterus (pg 113)
- Neoplasia
- Lightening strike
- Gunshot
- Hemorrhage (pg 84)
- Hemolytic anemia
- Leptospirosis (pg 257)
- Anaplasmosis (pg 92)
- Onion, rape, kale (pg 89)
- Goiter (pg 223)
- Hypothermia
- Acute pulmonary edema

Rare cause:
- Sporadic bovine encephalomyelitis (pg 151)
- Piroplasmosis (rare) (pg 91)
- Other GI, Neurological, renal, cardiovascular or toxins

Paresis & Generalized Weakness (IM 283)

Fever/sepsis
- Toxicities
- Cardiovascular diz
- Neuromuscular diz
- Chronic inflammatory diz
- Anemia (pg 82)
- Electrolyte disorders
- Tumors
- Exhaustion
- Drug related
- Endocrine/metabolic disorders

Circling
DDx 38
- Listeriosis adult #1 (pg 143)
- Otitis media (calf) (pg 142)
- Encephalomalacia
- Encephalitis
- Brain abscess (pg 140)
- Brain neoplasia (pg 143)
- Pseudorabies (pg 141)
- Cervical vertebral osteomyelitis (pg 143)
- Brain trauma
- Sporadic encephalomyelitis (pg 151)
- East coast fever (exotic) (pg 261)
Blindness (DDX 28)
- Lead poisoning (calf > adult) (pg 152)
- Pinkeye (pg 178)
- Keratoconjunctivitis
- Brain edema
- Brain abscess (pg 140)
- Encephalomalacia, idiopathic
- Poisonings plants
- Salt poisoning (pg 205)
- Selenium (blind staggers) (pg 226)
- Encephalitis
- Inherited blindness
- Metaldehyde poisoning (pg 207)
- Idiopathic hepatitis (pg 34)
- Phenothiazine poisoning
- Malignant catarrhal fever (pg 10)
- Hydrocephalus (pg 143)
- Lupinosis (pg 220)
- Carbon tetrachloride (pg 217)
- Lightning strike
- Enterotoxemia (pg 250)
- Brain tumor (pg 143)
- Chediak-Higashi syndrome (pg 274)

Rare causes
- Haemophilus spp septicemia (pg 254)
- Listeriosis (pg 143)
- Meningitis (pg 151)
- Acidosis (pg 25)
- Mucosal diz, acute (pg 12)
- Tick paralysis (pg 142)
- Grain overload (pg 25)
- Brisket edema (pg 80)

Seizures - Neonate (IM 386, 389)
- Perinatal complications
  - Hypoxic-ischemic brain injury
  - Cerebral concussion
  - Intracranial hemorrhage
- Metabolic
  - Hypoglycemia
  - Hypernatremia
  - Hypokalemia
  - Hypomagnesemia
  - Metabolic acidosis
- Infectious
  - Generalized sepsis
  - Meningitis/encephalitis (pg 151)
  - Botulism (pg 145)
  - CNS parasite migration
- Drugs
  - Theophylline
  - Intracarotid injection
  - Ingestion or injection of toxins
  - Premature withdrawal of Anticonvulsants Rx
- Develop. malformations
  - Hypomyelogenesis
  - Hydrocephalus
  - Hydranencephaly (pg 143)
- Storage diz
  - Amino acid metabolism defects
  - Congenital myoclonus
- Liver failure (pg 34)
- Idiopathic epilepsy (pg 154)
- Heat stroke
- Rabies (pg 144)

Convolusions (BR-1b 213; Br 129; DDX 44)

Common causes:
- Lactation tetany (pg 146)
- Lead (calf) (pg 152)
- Brain neoplasm (pg 143)
- Acetonemia (pg 33)
- Tetanus (pg 145)
- Brain trauma/abscess/tumor (pg 140)
- Meningitis (pg 222)
- Encephalitis
- Alkalosis (pg 25)
- Toxemia
- Congenital conditions
  - Hydrocephalus, Doddler calf
- Hypomagnesemia (calf) (pg 146)
- Colibacillosis (calf) (pg 18)
- Polioencephalomalacia (pg 140)
- Rabies (pg 144)
- Electrocutition/lightening strike
- Ryegrass staggers (pg 237)
- Anthrax (pg 247)
- Epilepsy (pg 154)

Toxic causes:
- Strychnine (pg 215)
- Nicotine (pg 213)
- Red squill
- Carbon tetrachloride (pg 217)
- Chlorinated hydrocarbons (pg 207)
- Fluoride (pg 216)
- Mercury (pg 202)

Muscle spasm & myoclonus (IM 287)

Common causes:
- Hypomagnesemic tetany (pg 146)
- Grass tetany (pg 236)
- Hypocalcemia (pg 148)
- Tetanus (pg 145)

Uncommon causes:
- Meningitis (pg 161)
- Rabies (pg 144)
- Pseudorabies (pg 141)
- Nervous coccidiosis (pg 150)
- Hypoglycemia

Rare causes:
- Maple syrup urine diz in calves (pg 135)
- Hereditary neuralaxial edema - Herefords
- Hereditary paralysis - red Danish calves
- Congenital brain edema - Herefords
- Lethal spasms - Jersey & Hereford calves
- Ephemeral fever (exotic)

Toxic causes:
- Strychnine (pg 215)
- Chlorinated hydrocarbons (pg 207)
- Buckeye poisoning (pg 147)
- Cocklebur poisoning (pg 240)
Sudden Death

Differential Diagnosis

Weak/Depressed Neonates (IM 361)

Bacterial infections
- Joint & bone
- Pneumonia (pg 62)
- Enteritis (pg 18)
- Meningitis (pg 151)
- Septicemia
- Peritonitis (pg 53)

Congenital viral infection
- BVD (pg 253)
- IBR (pg 252)
- Parainfluenza (pg 65)
- Bluetongue (pg 10)
- Akbane virus

Prematurity
- Weak calf syndrome
- Placentalitis
- Intra-uterine growth retardation

Birth asphyxia
- Dystocia (pg 115)
- Premature placental separation
- Cesarean section (pg 114)
- Induced parturition

Birth trauma
- Fractured ribs, pneumothorax/hemothorax
- Brachial plexus injuries (pg 136)

Liver diz
- Hepatitis (pg 34)
- Severe hypoxic insult
- GI diz

GI ulceration (pg 31)
- Necrotizing enterocolitis

Metabolic derangements
- Hyponatremia
- Hypoglycemia
- Hypocalcemia (pg 184)
- Hypokalemia/hyperkalemia
- Acidosis (pg 25)
- Kidney diz (pg 100)
- Renal failure (pg 100)
- Uroperitoneum (pg 96)

Anemia
- Severe anemia (pg 82)
- Blood loss (pg 84)
- Isoerythrolysis (pg 91)

Brain diz
- Meningitis (pg 151)
- Trauma
- Hemorrhage (pg 84)
- Malformations
- Narcolepsy (pg 154)
- Ischemia/edema/necrosis

Spinal cord diz
- Vertebral malformation (pg 134)
- Vertebral abscess/osteomyelitis (pg 134)
- Vertebral fracture/trauma (pg 135)

Peripheral nerve/muscle diz
- Tetanus (pg 145)
- Congenital myopathy, polymyositis

Collagen-disorder
- White muscle diz (pg 78)
- Aminoglycosides neuro-muscular blockade? (pg 101)
- Neuropathy of spinal roots
- Disorders of metabolism
- Shaker calf syndrome
- GM-1 gangliosidosis
- Citrullinemia
- Maple syrup urine diz

Drugs & toxins
- Over sedation of neonate
- Transplacental anesthela or sedation

Staggers, Adult (DDX 139)

Nervous acetonemia (pg 33)
- Lactation tetany (pg 146)
- Ryegrass staggers (pg 237)
- Paspalum staggers (pg 237)
- Poisonous plant incoordination
- Hypocalcemia, nonparturient
- Transit tetany (pg 146)
- Milk allergies (pg 188)
- Phalaris staggers
- Brain neoplasms (pg 143)
- Organophosphates (pg 206)
- Cyanide poisoning (pg 222)
- Selenium toxicity (pg 236)
- Pseudorabies (pg 141)
- Brain edema
- Metaldehyde toxicity (pg 207)
- Urea toxicity (pg 204)
- Ethylene glycol toxicity (pg 209)
- Brain trauma

Calf Staggers (DDX 141)

Lead poisoning (pg 152)
- Ryegrass staggers (pg 237)
- Paspalum staggers (pg 237)
- Cerebellar hypoplasia (pg 143)
- IBR - CNS form (pg 154)
- Acorn calf (pg 234)
- Phalaris staggers
- Atlanta-occipital malformation (pg 134)
- Inherited congenital spasms
- Organophosphates (pg 206)
- Cyanide poisoning (pg 222)
- Selenium toxicity (pg 236)
- Pseudorabies (pg 141)
- Brain edema
- Metaldehyde toxicity (pg 207)
- Urea toxicity (pg 204)
- Ethylene glycol toxicity (pg 209)
- Brain trauma
Sudden Death (IM 291; Br 124; DDX 149)

Infectious & parasitic causes:
- Anthrax (pg 247)
- Salmonellosis (pg 259)
- Botulism (pg 145)
- Blackleg (pg 244)
- Black diz (pg 37)
- Red water (Cl. hemoyticum) (pg 90)
- Enterotoxemia (Cl. perfringens) (pg 253)
- Abscess rupture - liver (pg 36)
- Abscess rupture - pituitary
- Leptospirosis (pg 257)
- Septic metritis (pg 111)
- Pseudorabies (pg 141)
- Liver flukes (pg 37)
- Anaplasmosis (pg 92)
- TEME (pg 141)

Physical causes:
- Choke (pg 15)
- Bloat (pg 26)
- Abomasal bloat (calves)
- Ulcers, perforating or bleeding (pg 31)
- Reticuloperitonitis/pericarditis (pg 38)
- Gunshot
- Heatstroke
- Myocardial infarction
- Ruptured uterine artery
- Tracheal edema feeder cattle (pg 61)

Metabolic or nutritional causes:
- Hypocalcemia (pg 148)
- White muscle diz (Se defc) (pg 78)
- Grain overload (pg 26)

- Polioencephalomalacia (pg 140)
- Grass tetany (pg 146)
- Heart failure - molybdenosis (pg 89)

Toxic causes:
- Arsenic (pg 202)
- Botulism (pg 145)
- Salt toxicity (pg 205)
- Copper (pg 203)
- Lead toxicity (pg 162)
- Monensin (pg 203)
- Nicotine toxicity (pg 213)
- Organophosphates (pg 206)
- Carbamates (pg 206)
- Chlorinated hydrocarbons (pg 207)
- Gossypol (pg 229)
- Hydrogen sulfide gas (pg 210)
- Metaldehyde (pg 207)
- Selenium toxicity (pg 226)
- Urea (NPN) toxicity (pg 204)
- Nitrogen dioxide gas (pg 211)
- 4-Methyl-imadozole (bonkers syndrome)
- Crude oil (pg 213)
- Anticoagulants (pg 214)
- 4-aminopyridine (Avitrol)

Miscellaneous causes:
- Anaphylaxis (pg 251)
- Acute pulmonary edema & emphysema (pg 67)
- Sudden death syndrome (feeder cattle)
- Blood transfusion reactions
- Immune mediated hemolytic anemia (calves) (pg 92)

Toxic plants
- Blue green algae (pg 237)
- Larkspur (pg 235)
- Nightshades (pg 239)
- Death camus (pg 239)
- Lupine (pg 220)
Increased PCV (Erythrocytosis) (IM 478)

- Relative erythrocytosis
  - Dehydration
  - Endotoxic shock
    - Strangulation obstruction (pg 45)
    - Salmonellosis (pg 34, 42)
    - Septic metritis (pg 111)
    - Septic mastitis (pg 193)

- Absolute erythrocytosis
  - Common causes
    - Residence in high altitudes
    - Congenital cardiovascular diz (pg 76)
  - Less common cause
    - Hepatoma
    - Chronic hepatic diz (pg 34)
    - Hemangioblastoma (pg 84)

From Large Animal Internal Medicine, Smith pg 424 for uncommon causes

Anemia (IM 477; C3T 695, 696; DDX 24)

Common causes:
- Blood loss
  - Parasites (pg 55)
    - Intestinal (pg 55)
    - External (ticks & lice) (pg 180)
    - Abomasal ulcer (pg 31)
  - Moldy sweet clover toxicity (pg 229)

- Hemolysis
  - Anaplasmosis (pg 92)
  - Leptospirosis (pg 257)
  - Bacillary hemoglobinuria (pg 90)
  - Onion toxicosis (pg 89)
  - Brassica toxicity (pg 89)

- Inadequate RBC production
  - Liver abscess (pg 36)
  - Johne's diz (pg 23)
  - Chronic pneumonia (pg 62)
  - Chronic BVD (pg 253)
  - Chronic abscess
  - Lymphosarcoma (pg 268)

Uncommon causes:
- Blood loss
  - DIC (pg 85)
  - Severe pyelonephritis (pg 98)
  - Pulmonary abscess
  - Hemolysis
  - Immune mediated hemolytic anemia (pg 92)
  - Postparturient hemoglobinuria (pg 88)
  - Chronic copper toxicosis (pg 88)
  - Inadequate RBC production
    - Bracken fern toxicity (pg 86)
    - Radiation toxicosis
    - Chronic renal failure (pg 100)
Neutrophilia (Incr. PMNs)
(IM 484)
Common causes:
• Stress
• Corticosteroid administration
• Peritonitis (pg 53)
• Liver abscess (pg 34)
• Internal abscess
• Umbilical abscess (pg 46)
• Chronic mastitis (pg 111)
• Chronic pyelonephritis (pg 98)
• Septic arthritis (pg 172)
• Neonatal septicemia
• Enteritis (pg 16-23)

Uncommon causes:
• Toxins
• Autoimmune hemolytic anemia (pg 92)
• Bovine granulocytopathy syndrome

Monocytosis (Incr. Monocytes)
(IM 432)
Chronic bact. infections
• Granulomatous disease (pg 23)

Neutropenia (Decr. PMNs)
(IM 484)
Common causes:
• Septic metritis (pg 111)
• Gram neg. septicemia/endotoxemia
• Peritonitis - diffuse (pg 53)
- Rupture abomasal ulcer (pg 31)
- Ruptured uterus (pg 113)
• Septic mastitis (pg 194, 195)
• Acute pneumonia (pg 62)
• Fat cow syndrome (pg 32)
• Clostridial infec. (pg 250)
• Acute salmonellosis (pg 259)
• Bone marrow suppression - toxic

Uncommon causes:
• Bracken fern toxicity (pg 86)
• BVD (pg 253)
• Idiopathic aplastic anemia
• Trichloroethylene toxicity
• Radiation toxicity

Lymphocytosis (Incr. Lymphocytes)
(IM 486)
Lymphocytic leukemia
• Persistent lymphocytosis

Lymphopenia (Decr. Lymphocytes)
(IM 486)
Common causes:
• Stress
• Steroid injections
• Diffuse peritonitis (pg 53)
- Ruptured abomasal ulcer (pg 31)
• Acute pneumonia (pg 62)
• IBR (pg 252)
• Gram negative endotoxemia/septicemia (pg 258)

Uncommon causes:
• Immunodef. • BVD (pg 253)

Eosinophilia (Incr. Eosinophils)
(IM 486)
Uncommon causes:
• Migrating parasites
  - Lungworms (pg 69)
  - Flukes (pg 37)
  - Hypoderma (pg 182)
  - Ascarids (pg 56)
  - Trichostrongyles (pg 56)
• Toxoplasmosis
• Milk allergies
• Sarcocystosis (pg 261)
• Atypical Interstitial pneumonia (pg 67)
• Acute bovine pulmonary emphysema (pg 67)
**Hyperproteinemia** (IM 413)
- Panhyperproteinemia - dehydration
  - Common causes:
    - Ruminal acidosis (pg 25)
    - Peritonitis (pg 53)
    - Salmonellosis (pg 259)
    - Salt toxicity (pg 205)
    - Coccidiosis (pg 260)
    - Vagal indigestion (pg 29)
    - Abomasal torsion (pg 40)
    - Sepsis toxemia
      - Mastitis (pg 194-5)
      - Metritis (pg 111)
    - Diarrhea (pg 16-23)
    - Toxins

Uncommon causes:
- Rabies (pg 144)
- Lymphosarcoma (pg 268)
- Renal amyloidosis (pg 94)
- Pregnancy toxemia (pg 32)

**Hyperglobinemia**
Common causes: chronic inflam. diz
- Chronic pneumonia (pg 62)
- Lymphosarcoma (pg 268)
- Abdominal abscess
- Umbilical abscess (pg 46)
Less common causes:
- Parasitism (pg 55)
- Pregnancy (pg 106)

**Hypoproteinemia** (Decreased Protein) (IM 495)
- Hypoalbuminemia
  - Common causes:
    - Amyloidosis (pg 94)
    - Glomerulonephritis (pg 94)
    - Pyelonephritis (pg 98)
    - Johne's diz (pg 23)
    - Trichosarcoma infec. (pg 56)
    - Salmonellosis (pg 259)

Uncommon causes:
- Chronic liver failure (pg 34)
- Intestinal lymphosarcoma (pg 268)
- Intestinal lymphangiectasis

**Hypofibrinogenemia** (IM 496)
Acute inflammatory diz
- Acute mastitis (pg 192)
- Pneumonia (pg 62)
- Omphalophlebitis (pg 102)
- Pleuritis (pg 72)
- Traumatic reticuloperitonitis/pericarditis (pg 38)
Thrombocytopenia (Decr. Platelets) (IM 499)

Common causes:
- Bracken fern toxicity (pg 86)
- DIC (disseminated intravascular coagulation) (pg 85)
- Septic mastitis (pg 3192)
- Septic metritis (pg 111)
- DVD

Uncommon causes:
- Plasma cell myeloma
- Lymphosarcoma (pg 268)
- Gram neg. sepsis (pg 258)
- Salmonellosis (pg 259)
- Stachybotryotoxicosis
- Immune mediated thrombocytopenia

Elevated FDPs (Fibrin/Fibrinogen Degradation Products) (IM 502)

Common causes:
- DIC (Disseminated intravascular coagulation) (pg 140)
- Thrombophlebitis (pg 127)
- Severe inflammatory disorders
- Postoperative states
- IMTP (Immune-mediated thrombocytopenia) (pg 142)

Uncommon causes:
- Massive internal hemorrhage
- Primary hyperfibrinolysis

Prolonged PT (Prothrombin Time) (IM 500)

Common causes:
- Moldy sweet clover (pg 229)
- DIC (Disseminated intravascular coagulation) (pg 85)

Uncommon causes:
- Warfarin toxicity (pg 214)
- Aflatoxicosis (pg 233)
- Rubratoxicosis
- Pyrrolizidine alkaloid toxicosis (pg 232)
- Chronic hepatic fibrosis (pg 34)
- Bitterweed toxicity (pg 241)

Prolonged APTT (IM 501)

Common causes:
- Moldy sweet clover toxicity (pg 229)
- DIC (Disseminated intravascular coagulation) (pg 85)

Uncommon causes:
- Warfarin toxicosis (pg 214)
- Hepatotoxins
  - Pyrrolizidine alkaloids (pg 232)
  - Aflatoxins (pg 233)
  - Bitterweed (pg 241)
- Congenital defc factor XI

Reduced antithrombin III (IM 460)

Common causes:
- DIC (Disseminated intravascular coagulation) (pg 85)
- Renal amyloidosis (pg 64)
- Johne's diz (pg 23)

Less common causes:
- Starvation (pg 266)
- Venous thrombosis (pg 80)
- Hepatic failure (pg 34)
# Serum Enzyme Elevation

## DIFFERENTIAL DIAGNOSIS

### Serum Enzyme Elevation

(IM 461)

<table>
<thead>
<tr>
<th>Enzyme</th>
<th>Common Causes</th>
<th>Uncommon Causes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SDH</strong> (Sorbitol Dehydrogenase)</td>
<td>Acute liver failure (pg 34), Liver abscess (pg 36), Damaged bowel (Strangulation (pg 45), Acute toxic enteritis)</td>
<td>Chronic liver failure (pg 34), Acute &amp; severe anemia (pg 82), General anesthesia, Anorexia</td>
</tr>
<tr>
<td><strong>GGT</strong> (Gamma-Glutamyl Transferase)</td>
<td>Acute liver failure (pg 34), Chronic liver failure (pg 34), Pyrrolizidine alkaloid toxicity (pg 35), Aflatoxicosis (pg 233), Normal range in young</td>
<td>Fatty liver (pg 32), Cholangihepatitis (pg 35), Cholelithiasis (pg 35), Tying up (muscle damage), Malignant hyperthermia</td>
</tr>
<tr>
<td><strong>AP</strong> (Alkaline Phosphatase)</td>
<td>Liver disease (Acute liver failure (pg 34), Chronic liver failure (pg 34), Liver flukes (pg 37), Hemolysis (pg 53), Malignant edema (pg 245))</td>
<td>Nutritional myodegeneration (Se/Vit E defc (pg 78), Alert downer cow (pg 267), Sarcosporidiosis (pg 261), Purpura hemorrhagica (pg 140), IM injection, Fatty liver (pg 32), Cholangihepatitis (pg 35), Cholelithiasis (pg 35), Tying up (muscle damage), Malignant hyperthermia</td>
</tr>
<tr>
<td><strong>CPK</strong> (Creatine Phosphokinase)</td>
<td>Nutritional myodegeneration (Se/Vit E defc (pg 78), Alert downer cow (pg 267), Malignant edema (pg 245))</td>
<td>Sarcosporidiosis (pg 261), Cardiomyopathy (pg 277), IM injection, Tying up (muscle damage), Malignant hyperthermia</td>
</tr>
<tr>
<td><strong>LDH</strong> (Lactate Dehydrogenase)</td>
<td>Muscle disease, Nutritional myodegeneration (Se/Vit E defc (pg 78), Alert downer cow (pg 267), Malignant edema (pg 245), Liver disease (Acute liver failure (pg 34), Chronic liver failure (pg 34), Liver flukes (pg 37), Hemolysis (pg 53))</td>
<td>Acute cardiomyopathy (pg 77), Hemolytic anemia (pg 91), Sarcosporidiosis (pg 261), Purpura hemorrhagica (pg 140), IM injection, Fatty liver (pg 32), Cholangihepatitis (pg 35), Cholelithiasis (pg 35), Tying up (muscle damage), Malignant hyperthermia</td>
</tr>
<tr>
<td><strong>AST, GOT</strong> (Aspartate Aminotransferase)</td>
<td>Same as for LDH</td>
<td></td>
</tr>
</tbody>
</table>
**BUN (Blood Urea Nitrogen)**

**Common causes:**
- Liver failure (pg 34)
- Normally lower in neonates
- Low-protein diet

**Uncommon cause:**
- Anabolic steroids

---

**Serum Bilirubin**

**Common causes:**
- Hemolytic anemia (pg 82)
- Liver failure (pg 34)
- Systemic disease
- Fasting/anorexia

**Uncommon cause:**
- Chronic liver failure (pg 34)

---

**Indirect Bilirubin**

**Common causes:**
- Hemolytic anemia (pg 82)
- Liver failure (pg 34)
- Systemic disease
- Fasting/anorexia

**Uncommon cause:**
- Chronic liver failure (pg 34)

---

**Direct Bilirubin**

**Common causes:**
- Liver failure (pg 34)
- Neonatal isoerythrolysis (pg 91)

**Uncommon causes:**
- Hemolytic anemia (pg 82)
- Cholelithiasis (pg 35)
- Cholangiohepatitis (pg 35)

---

**Creatine**

**Common causes:**
- Prerenal azotemia
- Hypovolemia
- Congestive heart failure (pg 76)
- Reduced renal perfusion
- Dehydration
- Renal azotemia
- Acute renal failure (pg 100)
- Chronic renal failure (pg 100)
- Postrenal azotemia
- Urolithiasis (renal, ureteral, urethral calculi) (pg 96)
- Ruptured bladder (pg 96)

**Uncommon causes:**
- Neonatal isoerythrolysis (pg 91)
- Cholelithiasis (pg 35)
- Cholangiohepatitis (pg 35)

---

**Hypoglycemia**

**Common causes:**
- Pregnancy toxemia
- Anorexia in newborn
- Late endotoxic shock

**Uncommon cause:**
- Invitro glycolysis of RBCs

---

**Hyperglycemia**

**Common causes:**
- Excitement & stress
- Xylazine administration
- Glucocorticoid administration

**Uncommon causes:**
- Rapid dextrose administration
- Diabetes mellitus (pg 274)
Hyponatremia (↓ Na) (IM 450)
Common causes:
- Decreased fluid volume
  - Diarrhea (pg 16-23)
  - Blood loss (pg 82)
  - Excessive sweating
  - Fluid drainage
  - Pleural drainage
  - Sequestration of fluid in 3rd space
  - Ascites
  - Peritonitis (pg 53)
  - Ruptured bladder (pg 96)
  - Torsion or volvulus or gut
- Hyperglycemia
  - Excitement & stress, Steroid &/or xylazine admin.
  - Excessive 5% dextrose to renal diz patient

Uncommon causes:
- Water retention (normal circulatory volume)
  - Renal disease (pg 100)
  - Psychogenic polydipsia

Hypernatremia (↑ Na) (IM 450)
Common causes:
- Water loss
  - Water deprivation (pg 205)
- Sodium excess (water restriction/salt poisoning) (pg 205)

Uncommon causes:
- Water loss >> electrolyte loss
  - Diarrhea (pg 16-23)
  - Vomition
  - Burns
  - Intrinsic renal diz
  - Hypertonic saline or NaCO3 administration
  - Mineralocorticoid excess

Hypokalemia (↓ Potassium) (IM 451)
Common causes:
- Diarrhea (pg 16-23)
- Gut torsion/volvulus (pg 45)
- Peritonitis (pg 53)
- Metabolic alkalosis
- Dietary deficiencies
- Prolonged anorexia
- Vomition

Uncommon causes:
- Renal tubular acidosis
- Diuretics
- Postobstructive diuresis
- Excessive NaCO2 administration
- Excess catecholamines

Hyperkalemia (↑ potassium) (IM 451; DC 38)
Common causes
- Hypovolemia w/ renal shutdown
- Metabolic acidosis
- False hyperkalemia
  - In vitro hemolysis
  - Prolonged storage

Uncommon causes
- Renal disease (pg 100)
- Tissue necrosis
- Diabetes mellitus (pg 274)
Hypochloremia (↓ Cl) (IM 452)
Common causes:
- Diarrhea (pg 16-23)
- Blood loss (pg 84)
- Fluid drainage
- Peritonitis (pg 53)
- Ruptured bladder (pg 96)
- Ascites
- Gastric reflux
- Intestinal block
False hypochloremia:
- Hyperglycemia
- Hyperproteinemia
- Hyperlipidemia (pg 91)
Uncommon causes:
- Psychogenic polydipsia

Hypochloremia w/o hyponatremia
Common causes:
- Metabolic alkalosis
- Abomasal torsion (pg 40)
- Vagal indigestion w/ int. vomiting (pg 29)

Hyperchloremia (↑ Cl) (IM 452)
Common causes:
- Water deprivation (pg 205)
- Salt poisoning (pg 205)
Hyperchloremia w/o hypernatremia
Common causes:
- Hyperchloremic metabolic acidosis
- Renal tubular necrosis

Hypophosphatemia (↓ Phosphorus [P]) (IM 455)
Common causes:
- Parturient paresis (pg 148)
Uncommon causes:
- Postparturient hemoglobinuria
- Brassica toxicity
- Hyperparathyroidism
- Starvation

Hyperphosphatemia (↑ Phosphorus[P]) (IM 455)
Common causes:
- Acute renal failure (pg 100)
- Excessive phosphate intake
- Hi normal range in neonate
- Endurance exercise
Uncommon cause:
- Vit D toxicity

Hypomagnesemia (↓ Magnesium) (IM 455)
Common causes:
- Grass tetany (pg 146)
- Winter tetany (pg 146)
- Mg defc diet (milk only) (pg 146)
Uncommon causes:
- Acute toxemia of anorexic lactating dairy cows
- Hypoparathyroidism

Hypermagnesemia (↑ Magnesium) (IM 455)
No common cause
Uncommon causes:
- Epson salt overdose (orally or enema)
- Excessive IV Mg

Hypocalcemia (↓ Ca) (IM 454; BR-hb 541; BR 1426)
Common causes:
- Parturient paresis (milk fever) (pg 148)
- Grass tetany (pg 146)
- Fat necrosis (pg 50)
- Anorexia in lactating cattle
- Blister beetle toxicosis (pg 240)
- Acute renal failure (pg 100)
Uncommon causes: (full list IM 399)
- Acute toxemia of anorexic lactating dairy cows
- Hypoparathyroidism

Hypercalcemia (↑ Ca) (IM 454; 1470)
Common causes:
- Excessive, rapid IV calcium
Uncommon causes: (full list IM 400)
- Hypervitaminosis D
- Excessive supplementation
- Neoplasia parathyroid gland
- Hyperparathyroidism
Metabolic Acidosis (IM 457)
Common causes:
- Rumen overload
- Ketosis (pg 33)
- Pregnancy toxemia (pg 32)
- Acute diarrhea (pg 16-23)
- Abomasal torsion (pg 40)
- Strangulate bowel (pg 45)
- Peritonitis (pg 53)
- Ruptured bladder (pg 96)

Uncommon causes:
- Renal failure (pg 100)
- Renal tubular acidosis
- Ethylene glycol toxicity (pg 209)
- Salicylate toxicity
- Urea toxicity (pg 204)
- Methanol toxicity

Metabolic Alkalosis (IM 457)
Common causes:
- Abomasal sequestration of fluid
- Diuretic
- Chloride &/or potassium depletion

Uncommon cause:
- Vomiting

Respiratory Acidosis (IM 458)
Common causes:
- Obstruction of upper respiratory tract
- Laryngeal edema (pg 60)
- Pneumonia (pg 62)
- Pneumothorax (pg 73)
- Depression of resp. center of CNS
  - General anesthesia
  - Drugs (opiates, anesthetics & tranquilizers)
  - CNS disease

Respiratory Alkalosis (IM 458)
Common causes:
- Hypoxemia
  - Pulmonary disease
  - Severe anemia (pg 82)
  - Congestive heart failure (pg 125)
- Stimulation of CNS respiratory center
  - Neurologic disorders
  - Psychogenic hyperventilation
  - Septicemia
  - Transport, pain, fear, excitement
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### Abbreviations

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<td>a., aa.</td>
<td>artery (ies)</td>
</tr>
<tr>
<td>abd.</td>
<td>abdomen</td>
</tr>
<tr>
<td>abnorm.</td>
<td>abnormal</td>
</tr>
<tr>
<td>ABs</td>
<td>antibiotics</td>
</tr>
<tr>
<td>bact.</td>
<td>bacterial, bacteria</td>
</tr>
<tr>
<td>BID</td>
<td>twice/day</td>
</tr>
<tr>
<td>bilat.</td>
<td>bilateral</td>
</tr>
<tr>
<td>caud.</td>
<td>caudal</td>
</tr>
<tr>
<td>CCS</td>
<td>corticosteroids</td>
</tr>
<tr>
<td>CHO</td>
<td>carbohydrate</td>
</tr>
<tr>
<td>conc.</td>
<td>concentrate</td>
</tr>
<tr>
<td>cran.</td>
<td>cranial</td>
</tr>
<tr>
<td>CS</td>
<td>clinical signs</td>
</tr>
<tr>
<td>d(s)</td>
<td>day, days</td>
</tr>
<tr>
<td>decr.</td>
<td>decrease</td>
</tr>
<tr>
<td>DDx</td>
<td>differential dx</td>
</tr>
<tr>
<td>defc</td>
<td>deficiency</td>
</tr>
<tr>
<td>dist</td>
<td>distal</td>
</tr>
<tr>
<td>diz</td>
<td>disease</td>
</tr>
<tr>
<td>DJD</td>
<td>degen. joint diz.</td>
</tr>
<tr>
<td>dors.</td>
<td>dorsal</td>
</tr>
<tr>
<td>Dx</td>
<td>diagnosis</td>
</tr>
<tr>
<td>elev.</td>
<td>elevated</td>
</tr>
<tr>
<td>envlr.</td>
<td>environment</td>
</tr>
<tr>
<td>esp</td>
<td>especially</td>
</tr>
<tr>
<td>FB</td>
<td>foreign bodies</td>
</tr>
<tr>
<td>Feds</td>
<td>Federal agents</td>
</tr>
<tr>
<td>fx(s)</td>
<td>fracture (s)</td>
</tr>
<tr>
<td>gen</td>
<td>general</td>
</tr>
<tr>
<td>hi</td>
<td>high</td>
</tr>
<tr>
<td>hr(s)</td>
<td>hour (s)</td>
</tr>
<tr>
<td>HR</td>
<td>heart rate</td>
</tr>
<tr>
<td>Hx</td>
<td>history</td>
</tr>
<tr>
<td>incr.</td>
<td>increase</td>
</tr>
<tr>
<td>IM</td>
<td>intramuscular</td>
</tr>
<tr>
<td>IN</td>
<td>intranasal</td>
</tr>
<tr>
<td>infec.</td>
<td>infection (ous)</td>
</tr>
<tr>
<td>inflamm.</td>
<td>inflammation</td>
</tr>
<tr>
<td>IP</td>
<td>incubation period</td>
</tr>
<tr>
<td>IV</td>
<td>intravascular</td>
</tr>
<tr>
<td>lat.</td>
<td>lateral</td>
</tr>
<tr>
<td>lb</td>
<td>pound</td>
</tr>
<tr>
<td>lg</td>
<td>large</td>
</tr>
<tr>
<td>lig, ligg</td>
<td>ligament (s)</td>
</tr>
<tr>
<td>LMNs</td>
<td>lower motor neurons</td>
</tr>
<tr>
<td>ln, ln</td>
<td>lymph node(s)</td>
</tr>
<tr>
<td>lt.</td>
<td>left</td>
</tr>
<tr>
<td>m/</td>
<td>may</td>
</tr>
<tr>
<td>m/b</td>
<td>maybe</td>
</tr>
<tr>
<td>med.</td>
<td>medial</td>
</tr>
<tr>
<td>membr.</td>
<td>membrane</td>
</tr>
<tr>
<td>metab.</td>
<td>metabolic</td>
</tr>
<tr>
<td>min</td>
<td>minute</td>
</tr>
<tr>
<td>MLV</td>
<td>modified live virus</td>
</tr>
<tr>
<td>mo (s)</td>
<td>month, months</td>
</tr>
<tr>
<td>n, nn</td>
<td>nerve (s)</td>
</tr>
<tr>
<td>neg</td>
<td>negative</td>
</tr>
<tr>
<td>norm.</td>
<td>normal</td>
</tr>
<tr>
<td>PCV</td>
<td>packed cell volume</td>
</tr>
<tr>
<td>PM</td>
<td>postmortem</td>
</tr>
<tr>
<td>PMNs</td>
<td>neutrophils</td>
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<tr>
<td>pos.</td>
<td>positive</td>
</tr>
<tr>
<td>preg.</td>
<td>pregnancy</td>
</tr>
<tr>
<td>prblm.</td>
<td>problem</td>
</tr>
<tr>
<td>prox.</td>
<td>proximal</td>
</tr>
<tr>
<td>Px</td>
<td>prognosis</td>
</tr>
<tr>
<td>QID</td>
<td>four times/day</td>
</tr>
<tr>
<td>repro.</td>
<td>reproduction</td>
</tr>
<tr>
<td>resp.</td>
<td>respiratory</td>
</tr>
<tr>
<td>RR</td>
<td>respiratory rate</td>
</tr>
<tr>
<td>rt.</td>
<td>right</td>
</tr>
<tr>
<td>sm.</td>
<td>small</td>
</tr>
<tr>
<td>spec</td>
<td>spectrum</td>
</tr>
<tr>
<td>SQ</td>
<td>subcutaneous</td>
</tr>
<tr>
<td>supf.</td>
<td>superficial</td>
</tr>
<tr>
<td>Sx</td>
<td>surgery</td>
</tr>
<tr>
<td>thru.</td>
<td>through</td>
</tr>
<tr>
<td>TID</td>
<td>three times/day</td>
</tr>
<tr>
<td>TP</td>
<td>total protein</td>
</tr>
<tr>
<td>Tx</td>
<td>treatment</td>
</tr>
<tr>
<td>UMNss</td>
<td>upper motor neurons</td>
</tr>
<tr>
<td>usu.</td>
<td>usually</td>
</tr>
<tr>
<td>unilat.</td>
<td>unilateral</td>
</tr>
<tr>
<td>vac.</td>
<td>vaccination</td>
</tr>
<tr>
<td>ventr.</td>
<td>ventral</td>
</tr>
<tr>
<td>v, vv</td>
<td>vein (s)</td>
</tr>
<tr>
<td>w/</td>
<td>with</td>
</tr>
<tr>
<td>w/i</td>
<td>within</td>
</tr>
<tr>
<td>w/o</td>
<td>without</td>
</tr>
<tr>
<td>wk(s)</td>
<td>week, weeks</td>
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<tr>
<td>wt.</td>
<td>weight</td>
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<tr>
<td>yr(s)</td>
<td>year, years</td>
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<tr>
<td>$</td>
<td>expensive</td>
</tr>
<tr>
<td>#</td>
<td>number</td>
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</table>

Note: SQ is used instead of SC not to be "cute", but for ease of recognition.
### Clinical chemistry: normal range

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Normal Range</th>
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<tbody>
<tr>
<td>Total bilirubin</td>
<td>C-0.4 mg/dl</td>
</tr>
<tr>
<td>Direct reacting</td>
<td>0.04-0.4 mg/dl</td>
</tr>
<tr>
<td>Indirect reacting</td>
<td>0-0.5 mg/dl</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>60-140 mg/dl</td>
</tr>
<tr>
<td>Creatinine</td>
<td>0.7-2 mg/dl</td>
</tr>
<tr>
<td>Glucose</td>
<td>45-75 mg/dl</td>
</tr>
<tr>
<td>Fibrinogen</td>
<td>200-800 mg/dl</td>
</tr>
<tr>
<td>Protein</td>
<td>6.3-8.4 g/dl</td>
</tr>
<tr>
<td>Albumin</td>
<td>2.5-4.0 g/dl</td>
</tr>
<tr>
<td>Globulin</td>
<td>2.9-4.9 g/dl</td>
</tr>
<tr>
<td>A/G ratio</td>
<td>0.8-0.95</td>
</tr>
<tr>
<td>BUN (Urea nitrogen)</td>
<td>10-18 mg/dl</td>
</tr>
<tr>
<td>Enzyme</td>
<td></td>
</tr>
<tr>
<td>ALP (Alkaline phosphatase)</td>
<td>20-550 IU/L</td>
</tr>
<tr>
<td>AST, GOT (Aspartate aminotransferase)</td>
<td>40-140 IU/L</td>
</tr>
<tr>
<td>CPK (Creatine phosphokinase)</td>
<td>60-250 IU/L</td>
</tr>
<tr>
<td>GGT (Gamma-glutamyl transferase)</td>
<td>13-35 IU/L</td>
</tr>
<tr>
<td>LDH (Lactate dehydrogenase)</td>
<td>170-870 IU/L</td>
</tr>
<tr>
<td>SDH (Sorbitol dehydrogenase)</td>
<td>18-46 IU/L</td>
</tr>
<tr>
<td>Electrolyte</td>
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<tr>
<td>Sodium</td>
<td>132-152 mEq/L</td>
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<tr>
<td>Potassium</td>
<td>3.9-5.8 mEq/L</td>
</tr>
<tr>
<td>Chloride</td>
<td>97-111 mEq/L</td>
</tr>
<tr>
<td>Calcium</td>
<td>8.6-11.5 mg/dl</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>4.3-6.6 mg/dl</td>
</tr>
<tr>
<td>Magnesium</td>
<td>1.6-2.9 mg/dl</td>
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### Normal values for RBCs & WBCs

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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<tbody>
<tr>
<td>PCV (%) (hematocrit)</td>
<td>24-46%</td>
</tr>
<tr>
<td>RBCs (Erythrocytes)</td>
<td>5-10 x 10⁶/μl</td>
</tr>
<tr>
<td>Hgb (Hemoglobin)</td>
<td>8-15 g/dl</td>
</tr>
<tr>
<td>MCV (mean corpuscular vol.)</td>
<td>40-60 μL</td>
</tr>
<tr>
<td>MCH (mean corpuscular Hgb)</td>
<td>11 - 17 pg</td>
</tr>
<tr>
<td>MCHC (mean corpuscular Hgb conc.)</td>
<td>28-34 g/dl</td>
</tr>
<tr>
<td>Reticulocytes</td>
<td>0 %</td>
</tr>
<tr>
<td>Thrombocytes</td>
<td>100,000-800,000</td>
</tr>
<tr>
<td>PMNs (Neutrophils)</td>
<td>15-45%</td>
</tr>
<tr>
<td>Bands</td>
<td>0-2%</td>
</tr>
<tr>
<td>Lymphocytes</td>
<td>45-75%</td>
</tr>
<tr>
<td>Monocytes</td>
<td>2-7%</td>
</tr>
<tr>
<td>Eosinophils</td>
<td>2-20%</td>
</tr>
<tr>
<td>Basophils</td>
<td>0-2%</td>
</tr>
<tr>
<td>Neutrophil:lymphocyte (N/L) ratio</td>
<td>0.3-0.6</td>
</tr>
</tbody>
</table>

### Acid-Base (venous blood)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>7.31-7.53</td>
</tr>
<tr>
<td>PCO₂ (mm Hg)</td>
<td>35-44</td>
</tr>
<tr>
<td>HCO₃⁻ (bicarbonate)</td>
<td>17-29</td>
</tr>
<tr>
<td>Total CO₂</td>
<td>20-32</td>
</tr>
</tbody>
</table>

### Rectal temperature

<table>
<thead>
<tr>
<th>Species</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beef</td>
<td>101°F (38.3°C)</td>
</tr>
<tr>
<td>Dairy</td>
<td>101.5°F (38.6°C)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart rate (HR)</td>
<td>60-70 beats/min</td>
</tr>
<tr>
<td>Resp. rate (RR)</td>
<td>30 breaths/min</td>
</tr>
<tr>
<td>Urine volume</td>
<td>17-45 ml/kg BW/d</td>
</tr>
</tbody>
</table>