Solved Past Papers of Anatomy

1st Prof Part 2

For Quick Review

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Dedicated to
Abu Al Qasim Al-Zahrawi
(Albucaasis)
A Great Medieval Surgeon of Islamic World

Who First Time Invented Proper Surgical Instruments.
The First Surgeon To Describe An Ectopic Pregnancy,
The First Physician To Explain The Hereditary Nature of Haemophilia
Acknowledgements

One is not fit to live if he does not help other human beings. We came up with the idea of solving past papers first time in the history just to make things easy for you. We do believe that if we help others, God will help us, and surely He Will.

Solving past papers of Anatomy was in fact a very difficult and time taking task. We are much thankful to those students who participated in this project. We owe special thanks to Ahsan Sarwar, Ayesha Saleem, Iram Mahmood, Naila Hassan, Laraib Amjad, Mehak Ahmad, Warda Batool Ali and all other students who took interest and gave their time to this task. May Allah bless them all.

Wish You Best of Luck For Your Exams.

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**HISTOLOGY**

**Annual 2005**

Q1: Write the microscopic structure of ureter. Illustrate your answer with labeled diagram. [3, 2]

Ans:

**Microscopic structure of ureter:**

The wall of ureter is composed of three coats:

1. Mucosa  
2. Muscularis  
3. Adventitia

- **Mucosa:**
  
  The luminal surface of mucosa is lined by transitional epithelium. Beneath the epithelium is lamina proppria, composed of dense irregular fibroblastic connective tissue.

- **Muscularis:**
  
  Is thick and consist of smooth muscles. Inner layer of muscle in longitudinal direction outer in circular.

- **Adventitia:**
  
  Consist of loose connective tissue containing blood vessels, lymphatics and nerves.

**DIAGRAM:**

Fig 19.7

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Q2: Briefly describes the microscopic structure of pancreas and mention the function of different structural component of this organ. [3, 2]

Ans:

**Microscopic structure of pancreas:**

It is an endocrine and exocrine gland.

**EXOCRINE PANCREAS:**

- It is a serous gland.
- Secretory units consist of pancreatic acini made up of pyramidal serous cells.
- EM shows basally located nucleus with nucleoli. Basal region of cell stain basophilic, apical acidophilic. Also contain centroacinar cells.
- EM shows RER, Golgi apparatus.
- DUCT system: intercalated ducts, interlobular ducts, main duct
- Intercalated ducts contain low cuboidal cells.
- Interlobular ducts contain low columnar cells.
- Main duct contain stratified columnar epithelium.

**ENDOCRINE PANCREAS:**

- It consist of islets if Langerhans, 100-200um diameter, polyhedral cells, surrounded by connective tissue.
- H&E section: eosinophil with no cytoplasmic granules
- EM: A cells, B cells, D cells.

**Function of structural component:**

**EXOCRINE COMPONENT:**

- Synthesize and secretes digestive enzymes.

**ENDOCRINE COMPONENT:**
Secretes insulin, glucagon, and some other hormone release in blood.

Supply 2005

Q1: Describe briefly the microscopic structure of a mature Ovarian follicle. Illustrate your answer with labeled diagram.

Ans:
A mature ovarian follicle is a large cystic structure with 2.5 cm in diameter. It extends through the full breadth of ovarian cortex and produces a visible bulge on the surface of the ovary. As more and more fluid accumulates, the follicular cavity becomes very large. There is a decrease in the mitotic division of the granulose cells and, consequently, the stratum granulosum appears relatively thinner. The mature ovarian follicle releases its oocyte in the middle of the ovarian cycle. The process of release of the oocyte from the ovary is called ovulation.

Diagram: Pg. 267 fig 21-3

Q2: Name different types of cells found in the epithelium of the small intestinal mucosa and briefly describe the absorptive cells.

Ans:
SMALL INTESTINAL CELLS:
1. Enteroctyes
2. Goblet cells
3. Enteroendocrine cells
4. Paneth cells
5. M cells

ABSORPTIVE CELLS:
- Tall columnar cells, basally located oval nucleus.
- Apical surface contain microvilli which give striated appearance known as brush border, which facilitates the absorptive process.
- EM microvilli covered by glycocalyx coat.
- EM shows SER in apical and RER in basal portion, ribosomes and mitochondria, Golgi apparatus.
- Enteroctyes bound through junctional complexes.

Annual 2006

Q3: How many types of cells are found in the principal gastric glands? Briefly describe the microscopic structure of those cells which produce HCl.

Ans:
GASTRIC GLANDS:
It contains five types of cell:
1. Mucous neck cells
2. Parietal cells
3. Chief cells
4. Enteroendocrine cells
5. Stem cells

PARIETAL CELLS:
- The parietal cells secrete HCl
- Located in isthmus neck of fundic glands.
- Large round to pyramidal cells, centrally located rounded nucleus
- Contain Golgi apparatus, RER, mitochondria due to which stain eosinophilic.
- EM reveals presence of intracellular canaliculus which increases the surface area for HCl secretion.
- Microvilli project from plasma lemma into cavity of intracellular canaliculus.

Q4: What is the structure of a hepatic lobule? What type of cell line the hepatic sinusoids?

Ans:
Structure of hepatic lobule:
- Each lobule is polygonal prism like in shape
- Centrally it contain central vein through which plates of hepatocytes radiate
- LM shows lobules hexagonal and hepatocytes seen as cords
- At the angles of hepatic lobules portal areas are present
- Blood vessel
- Bile canaliculi
- Hepatic sinusoids

Two types of cells line the hepatic sinusoids:
1. Endothelial cells
2. Kupffer cells

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Q1. A: What is the microscopic structure of a respiratory bronchiole?  [3]

Ans:

RESPIRATORY BRONCHIOLE:
- Respiratory bronchiole is short branching tubes which arise from terminal bronchioles
- Wall is interrupted by alveoli
- Wall is lined by simple cuboidal epithelium
- Goblet cells and glands are absent
- Margins of alveolar opening, simple squamous epithelium
- Lined by smooth muscles and connective tissue.

B: Give the structural features and function of the great alveolar cells  [2]

Ans:

STRUCTURAL FEATURES:
- Cuboidal cells
- EM reveals microvilli on luminal surface, nucleus, organelle, cytoplasmic secretory granules titled as lamellar bodies.
- LM gives vacuolated appearance.

FUNCTIONS:
- They secrete oily material known as pulmonary surfactant and lines internal surface. It reduces the ST which facilitates breathing.
- They also serve as stem cells for alveolar epithelium.

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Q2. A: Draw and label a diagram of microscopic picture of the testis.  [3.5]

Ans: pg. 254 fig 20-1 b

B: Enumerate any three functions of sertoli cells.  [1.5]

Ans:
- Provide physical and nutritional support to developing germ cells.
- They establish blood testis barrier
- They carry out phagocytosis of excess cytoplasm that shed by spermatids.
Q1:
A: What structural arrangements are present in the mucosa of small intestine to increase the surface area? [1.5]
Ans:
Mucosa contains macroscopic and microscopic devices for increasing surface area:
1. Plicae circularis:
   Circular folds of mucosa
   Increase surface area of mucosa about 3 times
   Most pronounced in jejunum
   Absent in proximal duodenum and distal half of ileum
2. Villi:
   Finger like projections of mucosa
   Increase surface area by further 10 folds
   Cover entire surface of mucosa
3. Microvilli:
   They are small projections on enterocytes
   Increase surface area by factor of 20
4. Crypts of lieberkuhn:
   Invaginations of mucosa
   Increase surface area due to 0.4 mm deep invaginations
B: Name the cells found in the lining epithelium of small intestine and give the structural features of absorptive cells. [1.5, 2]
Ans:
SMALL INTESTINAL CELLS:
   1. Enteroctyes
   2. Goblet cells
   3. Enteroendocrine cells
   4. Paneth cells
   5. M cells
ABSORPTIVE CELLS:
   ➢ Tall columnar cells, basilycally located oval nucleus.
   ➢ Apical surface contain microvilli which give striated appearance known as brush border, which facilitates the absorptive process.
   ➢ EM microvilli covered by glycocalyx coat.
   ➢ EM shows SER in apical and RER in basal portion, ribosomes and mitochondria, Golgi apparatus.
   ➢ Enteroctyes bound through junctional complexes.

Q2: What are the various types of spermatogenic cells found in adult testis? [1.5]
Ans:
Spermatogonia:
   ➢ Located inside basal lamina of seminiferous epithelium, roughly spherical containing central nucleus
   ➢ Types: type A dark, type A pale, Type B
Primary Spermatocytes:
   ➢ Next to spermatogonia
   ➢ Large cell with vesicular nuclei
Secondary Spermatocytes:
   ➢ Smaller cells arise from primary spermatocytes
Spermatids:
Annual 2008

Q1: Enumerate four microscopic structural differences b/w beginning and end of esophagus in a tabular form. Explain its structural features regarding reflex esophagitis. Mention change in the epithelium of digestive tract as it is traced from stomach to anal canal.

[2, 1, 2]

Ans:
- Lamina propria consists of fine connective tissue while in upper and lower part it also contains mucus secreting simple branched tubular glands.
- In the upper third only contain skeletal muscle.
  In the middle both smooth and skeletal muscles present
  Only smooth muscles present in lower part.
- Adventitia is present in cervical and thoracic region
- Serosa is present in abdominal region

Reflux Esophagitis:
Epithelial injury, presence of neutrophil polymorphs in epithelium & lamina propria.

Epithelium From Stomach To Anal Canal:
1. STOMACH: simple columnar epithelium
2. Small intestine: simple columnar epithelium with 5 types of cells enterocytes, goblet cells, enter endocrines, paneth cells, M cells
3. COLON: epithelium consists of enterocytes and goblet cells.
4. RECTUM: simple columnar epithelium.
5. ANAL CANAL: above anal valve simple columnar

Below anal canal stratified squamous non keratinized epithelium.

Q2: Name the chromopils found in pars distalis of tabular form. Explain the tumors arising from this region.

[3, 2]

Ans:
Two types of chromopils:
1. Acidophils: stained reddish
2. Basophils: stained bluish
Tumors arising from this region are benign.
2/3rd produce hormone cause symptoms. These tumors produce excessive amount of growth hormone, prolactin, adrenocorticotropic, TSH.

Annual 2009

Q6: What is microscopic structure of optical (posterior) part of retina?

[1.5]

Ans:
Posterior or photosensitive part of retina is complex of structure containing more than 30 subtypes of neurons interconnecting. It has 10 layers
- Pigment epithelium
- Layer of rod and cones
- Ext. Limiting membrane
- Outer nuclear layer
- Outer plexiform layer
- Inner nuclear layer
- Inner plexiform layer
- Ganglion cell layer
- Optic nerve fiber layer
- Internal limiting membrane

Four cell groups are present:
- Photoreceptors [rods and cones]
- Direct conducting neurons [bipolar + ganglionic]
- Association Neurons [horizontal, amacrine, interplexiform]
- Supporting cells [Muller's, Neuroglia]

Q7:
A: Name the different types of alveolar cells with their functional histology. [3.5]
Ans:
- Type I alveolar cells: - thin squamous epithelial cells, line 95% of surface of alveoli, central flat nucleus, join by adjacent cell through occluding junctions, permit gaseous exchange b/w air and blood.
- Type II alveolar cells: - cuboidal cells, line 5% surface of alveoli, secrete surfactant which reduces surface tension.

B: What are the different components of blood air barrier. [1.5]
Ans:
Components:-
1. A thin layer of pulmonary surfactant.
2. A type I alveolar cell & its blood lamina
3. A capillary endothelial cells & its blood lamina.

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Annual 2010

Q1:
A: In a tabulated manner give the epithelial lining of various part of renal tubule. [3]
Ans:
PCT: - simple cuboidal epithelium
PST: - low cuboidal epithelium
Intermediate tubule: - simple squamous epithelium
DST: - cuboidal endothelium
DCT: - cuboidal epithelium
Collecting tubule: - cuboidal epithelium
Collecting duct: - simple columnar epithelium

B: Enumerate the components of juxtaglomerular apparatus. What is the functional significance of this apparatus? [1.5, 0.5]
Ans:
Components:-

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1. Macula densa of DCT.
2. Juxtaglomerular cells in the wall of afferent arteriole of glomerulus.
3. Extra glomerular cells b/w afferent and efferent arterioles.

**Functions:**
Play important role in regulation of blood pressure through rennin-angiotensin aldosterone system.

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**Annual 2011**

Q.1: Enlist the components of renal juxtaglomerular app mentioning histological features of each. Give the significance of this apparatus.  
\[ 1.5, 3, 0.5 \]

**Ans:**

**Components:**
1. Macula densa of DCT.
2. Juxtaglomerular cells in the wall of afferent arteriole of glomerulus.
3. Extra glomerular cells b/w afferent and efferent arterioles.

**Histological features:**
1. Macula densa: in this region simple cuboidal epithelium of DCT convert into tall columnar, Golgi app is sub nuclear.
2. Juxtaglomerular cells: contain modified smooth muscle cells, internal elastic lamina is absent.
3. Extra glomerular mesangial cells: resemble the intraglomerular mesangial cells which they are contiguous.

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**Supply 2012**

Q1. A: Draw & label a dig to show the histological structure of a seminiferous tubule. \[ 2 \]

**Ans:** Fig 20-1 B pg. 254 Laiq

B: Enumerate the secretory cells of islets of Langerhans, mentioning the products secreted by them. \[ 3 \]

**Ans:**
- A cells: glucagon
- B cells: insulin
- D cells: Somatostatin
- D1 cells: VIP
- PP cells: pancreatic polypeptide
Q3: What is indifferent gonad. How it develops into ovary? [2, 3]

Ans:
Development of the Gonads
The gonads (testes and ovaries) are derived from three source:
- Mesothelium (mesodermal epithelium) lining the posterior abdominal wall
- Underlying mesenchyme (embryonic connective tissue)
- Primordial germ cells

Indifferent Gonads
The initial stages of gonadal development occur during the fifth week when a thickened area of mesothelium develops on the medial side of the mesonephros. Proliferation of this epithelium and the underlying mesenchyme produces a bulge on the medial side of the mesonephros—the gonadal ridge. Fingerlike epithelial cords—the gonadal cords—soon grow into the underlying mesenchyme. The indifferent gonad now consists of an external cortex and an internal medulla.

In embryos with an XX sex chromosome complex, the cortex of the indifferent gonad differentiates into an ovary, and the medulla regresses.

Development of the Ovaries
Gonadal development occurs slowly in female embryos. The X chromosomes bear genes for ovarian development, and an autosomal gene also appears to play a role in ovarian organogenesis. The ovary is not identifiable histologically until approximately the 10th week. Gonadal cords do not become prominent, but they extend into the medulla and form a rudimentary rete ovarii. This structure and the gonadal cords normally degenerate and disappear. Cortical cords extend from the surface epithelium of the developing ovary into the underlying mesenchyme during the early fetal period. This epithelium is derived from the mesothelium. As the cortical cords increase in size, primordial germ cells are incorporated in them. At approximately 16 weeks, these cords begin to break up into isolated cell clusters—primordial follicles—each of which consists of an oogonium, derived from a primordial germ cell, surrounded by a single layer of flattened follicular cells derived from the surface epithelium. Active mitosis of oogonia occurs during fetal life producing primordial follicles.

No oogonia form postnatally. Although many oogonia degenerate before birth, the two million or so that remain enlarge to become primary oocytes before birth. After birth, the surface epithelium of the ovary flattens to a single layer of cells continuous with the mesothelium of the peritoneum at the hilum of the ovary. The surface epithelium of the ovary was once called the germinal epithelium, which was inappropriate because it is now well established that the germ cells differentiate from the primordial germ cells. The surface epithelium becomes separated from the follicles in the cortex by a thin fibrous capsule, the tunica albuginea. As the ovary separates from the regressing mesonephros, it is suspended by a mesentery—the mesovarium.

Q4: Enumerate derivatives of first and second pharyngeal arches. [2.5, 2.5]

Ans:
1st Arch Derivatives:
Skeletal elements
- From the cartilage of the 1st arch arises Incus & malleus

Muscles
- Muscles of mastication, mylohyoid & ant belly of digastric
- Tensor tympani
- Tensor veli palatini

Nerve supply

All right reserved.
Trigeminal (ophthalmic division doesn’t supply any pharyngeal arch)

2nd Arch Derivatives:

Skeletal elements

From the cartilage of the second arch arises Stapes, Temporal styloid process, Stylohyoid ligament and Lesser cornu of the hyoid bone.

Muscles

- Muscles of face
- Occipitofrontalis muscle
- Platysma
- Stylohyoid muscle
- Posterior belly of Digastric
- Stapedius muscle
- Auricular muscles

Nerve supply

- Facial nerve

Supply 2005

Q3: Describe briefly development of thyroid gland. Also mention the related congenital anomalies. [3, 2]

Ans:

Development of thyroid gland:

It is the 1st endocrine gland to be formed in embryo, approximately 24 days after fertilization from median endodermal thickening in the floor of primordial pharynx. This thickening soon forms a small outpouching - the thyroid primordium as the embryo & tongue grows developing thyroid descends in neck passing ventral to developing hyoid bone & laryngeal cartilages. For a short time thyroid gland is connected to tongue by a small opening thyroglossal duct. At first thyroid primordium is hollow, but it soon becomes a solid mass of cells & divide into right & left lobe that are connected by a isthmus of thyroid gland. This lies anterior to developing 2nd & 3rd tracheal rings.

By 7 week thyroid gland assume its final shape & located in its final position in neck. By this time thyroglossal duct has degenerated, the proximal opening of thyroglossal duct persist as a pit in the dorsum of tongue the foramen cecum.

The thyroid primordial consists of solid mass of endodermal cells. This cellular aggregation later breaks up into network of epithelia cords as it is invaded by surrounding vascular mesenchyme. By the 10th week cords divide into small cellular groups. A lumen formed in each cluster cell & cell becomes arranged in single layer around thyroid follicle. By 11 week colloid begins to appear in these follicles so thereby thyroid concentration can be demonstrated.

By 20 week thyroid stimulating hormone & thyroxin begins to increase & by 35 week it comes to adult level.

Developmental abnormalities:

Three major groups

1. Agenesis of thyroid gland, which is an important cause of neonatal hypothyroidism
2. Dysgenesis of the thyroid
3. Abnormalities due to persistence of the thyroglossal duct.

Furthermore most important are

- Thyroglossal Cyst
- The persistence of the thyroglossal duct.
Thyroglossal fistula
The partial degeneration of the thyroglossal duct

Q4: Describe briefly development of permanent kidney. Give the basis of horse shoe kidney. [4,1]

Ans:

Development of permanent kidney

Metanephroi-the primordia of permanent kidneys-begin to develop early in the fifth week and start to function approximately 4 weeks later. Urine formation continues throughout fetal life. Urine is excreted into the amniotic cavity and mixes with the amniotic fluid. A mature fetus swallows several hundred milliliters of amniotic fluid every day, which is absorbed by its intestines. The fetal waste products are transferred through the placental membrane into the maternal blood for elimination by the maternal kidneys. The permanent kidneys develop from two sources:

- The metanephric diverticulum (ureteric bud)
- The metaneprogenic blastema or metaneprogenic mass of mesenchyme

The metanephric diverticulum is an outgrowth from the mesonephric duct near its entrance into the cloaca, and the metaneprogenic blastema is derived from the caudal part of the nephrogenic cord. As it elongates, the metanephric diverticulum penetrates the metaneprogenic blastema—a mass of mesenchyme. The stalk of the metanephric diverticulum becomes the ureter, and the cranial portion of the diverticulum undergoes repetitive branching events, forming the branches which differentiate into the collecting tubules of the metanephros. The first four generations of tubules enlarge and become confluent to form the major calices, and the second four generations coalesce to form the minor calices. The end of each arched collecting tubule induces clusters of mesenchymal cells in the metaneprogenic blastema to form small metanephric vesicles. These vesicles elongate and become metanephric tubules. The proximal ends of these tubules are invaginated by glomeruli. The tubules differentiate into proximal and distal convoluted tubules, and the nephron loop (Henle loop), together with the glomerulus and its capsule, constitute a nephron. Each distal convoluted tubule contacts an arched collecting tubule, and the tubules become confluent. Between the 10th and 18th weeks of gestation, the number of glomeruli increases gradually and then increases rapidly until the 32nd week, when an upper limit is reached. The fetal kidneys are subdivided into lobes. The lobulation usually disappears during infancy as the nephrons increase and grow. At term, nephron formation is complete, with each kidney containing 400,000 to 2,000,000 nephrons. The increase in kidney size after birth results mainly from the elongation of the proximal convoluted tubules as well as an increase of interstitial tissue. Nephron formation is complete at birth except in premature infants. Although glomerular filtration begins at approximately the ninth fetal week, functional maturation of the kidneys and increasing rates of filtration occur after birth.

Horse Shoe Kidney:

In 0.2% population poles (usually inferior) of the kidney are fused. Kidney lies in pubic region, ant to inf lumbar vertebrae. Normal ascent of fused kidney is prevented because they are held down by the root of inf mesenteric artery.

It produces no symptoms because its collecting system & ureter develops normally. If urinary flow is impeded then symptoms of obstruction & infection are present.

7% people with turner syndrome have house shoe shaped kidney.

Q1: How diaphragm develops? What do you know about congenital diaphragmatic hernia? [3,2]

Ans:

Development of diaphragm

The diaphragm is a dome-shaped, musculotendinous partition that separates the thoracic and abdominal cavities. It is a composite structure that develops from four embryonic components
- Septum transversum
- Pleuroperitoneal membranes
- Dorsal mesentery of esophagus
- Muscular ingrowth from lateral body walls

The diaphragm is formed from a number of composite parts in the embryo. The most important is the septum transversum. Understanding the history of the formation of the diaphragm explains why the heart, lungs, liver, gut tube, neck and fascia all resonate strongly with the diaphragm. Clinical points that arise from the embryology are summarized at the end.

The septum transversum is a thick mass of cranial mesenchyme that gives rise to parts of the thoracic diaphragm and the anterior mesentery of the foregut in the adult. After its descent, discussed below, the septum transversum merges with mesoderm surrounding the esophagus, the growing pleura and peritoneum ('pleuroperitoneal folds') and the growing muscles of the abdominal wall.

The septum transversum originally arises as the most superior part of the mesenchyme on day 22. During head folding, due to the massive growth of the neural tube, it is folded underneath the developing heart at the level of the cervical vertebrae. At this stage the septum transversum picks up innervation from the adjacent ventral rami of spinal nerves C3, C4 and C5, thus forming the precursor of the phrenic nerve. During subsequent weeks the posterior of the embryo grows much faster than its anterior counterpart resulting in an “apparent descent” of the anteriorly located septum transversum. At week 8 it can be found at the level of the thoracic vertebrae. During the descent of the septum, the phrenic nerve is carried along and assumes its descending pathway. In the adult the whole diaphragm is innervated by the paired phrenic nerves; ‘C3,4,5 keep the diaphragm alive’.

During embryonic development of the thoracic diaphragm, myoblasts cells from the septum invade the other components of the diaphragm. They thus give rise to the motor and sensory innervation of the muscular diaphragm by the phrenic nerve.

The superior part of the septum transversum gives rise to the central tendon of the diaphragm and is the origin of the myoblasts that invade the pleuroperitoneal folds resulting in the formation of the muscular diaphragm.

Hernia of Diaphragm:

Posterolateral defect of the diaphragm is the only relatively common congenital anomaly of the diaphragm. This diaphragmatic defect occurs about once in 2200 newborn infants and is associated with congenital diaphragmatic hernia (CDH, herniation of abdominal contents into the thoracic cavity). Life-threatening breathing difficulties may be associated with CDH because of inhibition of development and inflation of lungs. The candidate region for CDH was reported to be chromosome 15q26. Moreover, fetal lung maturation may be delayed. CDH is the most common cause of pulmonary hypoplasia. Polyhydramnios (excess amniotic fluid) may also be present. CDH, usually unilateral, results from defective formation and/or fusion of the pleuroperitoneal membrane with the other three parts of the diaphragm. This results in a large opening in the posterolateral region of the diaphragm. As a result, the peritoneal and pleural cavities are continuous with one another along the posterior body wall. This congenital defect, sometimes referred to clinically as the foramen of Bochdalek, occurs on the left side in 85% to 90% of cases. The preponderance of left-sided defects may be related to the earlier closure of the right pleuroperitoneal opening. Prenatal diagnosis of CDH depends on ultrasound examination and magnetic resonance imaging of abdominal organs in the thorax.

Q2: How gland develops? Name the congenital anomalies related to this gland.  
Ans: 

[4,1]
Mammary glands Development

Mammary glands are a modified and highly specialized type of sweat glands. Mammary buds begin to develop during the sixth week as solid down growths of the epidermis into the underlying mesenchyme. These changes occur in response to an inductive influence from the mesenchyme. The mammary buds develop as down growths from thickened mammary crests, which are thickened strips of ectoderm extending from the axillary to the inguinal regions. The mammary crests (ridges) appear during the fourth week but normally persist in humans only in the pectoral area, where the breasts develop. Each primary bud soon gives rise to several secondary mammary buds that develop into lactiferous ducts and their branches. Canalization of these buds is induced by placental sex hormones entering the fetal circulation. This process continues until late gestation, and by term, 15 to 19 lactiferous ducts are formed. The fibrous connective tissue and fat of the mammary gland develop from the surrounding mesenchyme. During the late fetal period, the epidermis at the site of origin of the mammary gland becomes depressed, forming a shallow mammary pit. The nipples are poorly formed and depressed in newborn infants. Soon after birth, the nipples usually rise from the mammary pits because of proliferation of the surrounding connective tissue of the areola, the circular area of skin around the nipple. The smooth muscle fibers of the nipple and areola differentiate from surrounding mesenchymal cells. The rudimentary mammary glands of newborn males and females are identical and are often enlarged. Some secretion, often called “witch’s milk,” may be produced. These transitory changes are caused by maternal hormones passing through the placental membrane into the fetal circulation. The breasts of newborns contain lactiferous ducts but no alveoli. Before puberty, there is little branching of the ducts. In females, the breasts enlarge rapidly during puberty, mainly because of development of the mammary glands and the accumulation of the fibrous stroma and fat associated with them. Full development occurs at approximately 19 years. The lactiferous ducts of male breasts remain rudimentary throughout life.

Anomalies of Mammary Gland

- Gynecomastia
- Absence of Nipples (Athelia) or Breasts (Amastia)
- Aplasia of breast
- Supernumery breast

Annual 2007

Q3. a. Give the development of Stomach.

The distal part of the foregut is initially a simple tubular structure. Around the middle of the fourth week, a slight dilatation indicates the site of the primordium of the stomach. It first appears as a fusiform enlargement of the caudal or distal part of the foregut and is initially oriented in the median plane. The primordial stomach soon enlarges and broadens ventrodorsally. During the next 2 weeks, the dorsal border of the stomach grows faster than its ventral border; this demarcates the greater curvature of the stomach.

As the stomach enlarges and acquires its final shape, it slowly rotates 90 degrees in a clockwise direction (viewed from the cranial end) around its longitudinal axis. The effects of rotation on the stomach are:

The ventral border (lesser curvature) moves to the right and the dorsal border (greater curvature) moves to the left.

The original left side becomes the ventral surface and the original right side becomes the dorsal surface.

Before rotation, the cranial and caudal ends of the stomach are in the median plane. During rotation and growth of the stomach, its cranial region moves to the left and slightly inferiorly, and its caudal region moves to the right and superiorly.

After rotation, the stomach assumes its final position with its long axis almost transverse to the long axis of the body. The rotation and growth of the stomach explain why the left vagus nerve supplies the anterior wall of the adult stomach and the right vagus nerve innervates its posterior wall.
The stomach is suspended from the dorsal wall of the abdominal cavity by a dorsal mesentry-the primordial dorsal mesogastrium. This mesentry is originally in the median plane, but it is carried to the left during rotation of the stomach and formation of the omental bursa or lesser sac of peritoneum. The primordial ventral mesogastrium attaches to the stomach. The ventral mesogastrium also attaches the duodenum to the liver and the ventral abdominal wall.

B: What is congenital hypertrophic pyloric stenosis? [2]

Congenital hypertrophic pyloric stenosis:

Anomalies of the stomach are uncommon except for hypertrophic pyloric stenosis. This anomaly affects one in every 150 males and one in every 750 females. In infants with this anomaly, there is a marked muscular thickening of the pylorus, the distal sphincteric region of the stomach. The circular and, to a lesser degree, the longitudinal muscles in the pyloric region are hypertrophied. This results in severe stenosis of the pyloric canal and obstruction of the passage of food. As a result, the stomach becomes markedly distended, and the infant expels the stomach’s contents with considerable force ( projectile vomiting). Surgical relief of the pyloric obstruction (pyloromyotomy) is the usual treatment. The cause of congenital pyloric stenosis is unknown, but the high rate of concordance in monozygotic twins suggests that genetic factors may be involved.

Q4: Name the facial prominences. How these contribute to formation of face? [2, 3]

Ans:

- Frontonasal prominence (1)
- Maxillary prominence (2)
- Mandibular prominence (2)

Contribution:

Maxillary & mandibular prominences are derivatives of 1st pair of pharyngeal arches. The prominences are produces mainly by the expansion of neural crest populations that originate from mesencephalon & rostral rhombencephalic neural folds during 4th week. These cells are the major sources of connective tissue components including cartilage, bone, ligaments in facial & oral regions. The Frontonasal prominence surrounds ventrolateral part of forebrain, which gives rise to optic vesicle that forms eyes. The frontal part of FNP forms forehead, nasal part forms rostral boundary of stomodeum & nose. Maxillary prominences form lateral boundaries of stomodeum & mandibular prominences constitute caudal boundary of stomodeum.

Facial prominences are active centers of growth in underlying mesenchyme. This embryonic connective tissue is continuous from 1 prominence to other. Facial development occurs mainly between 4th & 8th week. By the end of embryonic period face has an unquestionably human appearance. Facial prominences develop during fetal period. The lower jaw & lower lip are 1st parts of the face to form. They result from merging of the medial ends of mandibular prominences in median plane.

By the end of 4th week bilateral over thickening of the surface ectoderm -nasal placodes- primordia of nasal epithelium have developed on the interolateral part of flat depression on each placode. Mesenchyme in the margins of placodes proliferates producing horseshoe hopped elevations, medial & lateral nasal prominences.as a result nasal placodes pits are primordial of anterior nares & nasal cavities, while lateral nasal prominences form the alae (sides) of nose.

Proliferation in mesenchyme in maxillary prominence cause them to enlarge & grow medially toward each other & nasal prominences this results in proliferation of medial nasal prominence towards median plane & lateral prominence is separated from maxillary prominence by a cleft called nasolacrimal groove.

Supply 2007
Q3: A New born child shows opacity of lens of eyes, what is anomaly & what is embryological basis of this anomaly? [5]

Ans:

- Its congenital cataracts
- In this condition, lens is opaque & frequently appears grayish white. Without treatment, blindness results. Many lens opacity are inherited, dominant transmission being more common than recessive or sex linked transmission. Some congenital cataracts are caused by teratogenic agents like rubella virus, that effect early development of lenses. Lenses are vulnerable to rubella virus b/w 4th & 7th weeks, when primary lens fibers are forming.
- Physical agents such as radiations can also damage lens & produce cataracts.
- Another cause of cataract is an enzymatic deficiency congenital glactosemia. These cataracts are not present at birth, but may appear as early as 2nd week after birth. Because of enzyme deficiency large amount of galactose from milk accumulate in infants’ blood & tissue causing injury to lens & resulting in cataract formation.

Q4:

A: Name the derivatives of 2nd pharyngeal arch. [2]

Ans:

2nd Arch Derivatives:

Skeletal elements

From the cartilage of the second arch arises Stapes, Temporal styloid process, Stylohyoid ligament and Lesser cornu of the hyoid bone.

Muscles

Muscles of face
- Occipitofrontalis muscle
- Platysma
- Stylohyoid muscle
- Posterior belly of Digastric
- Stapedius muscle
- Auricular muscles

Nerve supply

Facial nerve

B: what are causes of craniofacial anomaly? [1.5]

Ans:

- Combination of genes
  A child may receive a particular combination of genes from one or both parents, or there may be a mutation at the time of conception, which results in a craniofacial anomaly.

- Environmental
  Any specific drug or chemical exposure can cause a craniofacial anomaly. So, any prenatal exposure should be evaluated.

- Folic acid deficiency
  Folic acid is a B vitamin found in orange juice, fortified breakfast cereals, enriched grain products, and green,
leafy vegetables. Women who do not take sufficient folic acid during pregnancy, or have a diet lacking in folic acid, may have a higher risk of having a baby with certain congenital anomalies, including cleft lip and/or cleft palate.

C: Give the salient features of Pierre Robin Syndrome. [1.5]

Ans:

Pierre Robin syndrome (abbreviated to PRS), is a congenital condition of facial abnormalities in humans. PRS is a sequence, i.e. a chain of certain developmental malformations, one entailing the next. The 3 main features are cleft palate, micrognathia (a small jaw) and glossoptosis (airway obstruction caused by backwards displacement of the tongue base). A genetic cause to PRS was recently identified. Pierre Robin sequence may be caused by genetic anomalies at chromosomes 2, 11, or 17.

Q3: A pediatrician was called in labor room to examine revealed flattened abdomen & gut diagnosed which was confirmed on ultrasound machine.

A: Mention developmental defect in this case & reasons for signs & symptoms (flat abdomen, left sided gut sound, severe respiratory distress) [1, 3]

Ans:

Congenital diaphragmatic hernia is produced by the failure of the diaphragm to fuse properly during fetal development, allowing the abdominal organs to migrate up into the chest cavity. This result in the two primary problems underpinning congenital diaphragmatic hernias: pulmonary hypertension and pulmonary hypoplasia. This is compounded by dysfunction of the surfactant. Associated diseases, notably cardiac abnormalities, are frequent.

There are 3 basic types of hernia:
- Posterolateral Bochdalek's hernia
- Anterior Morgagni's hernia
- Hiatus hernia

B: Name the four sources of diaphragm. [1]

Ans:

- Septum transversum
- Pleuroperitoneal membranes
- Dorsal mesentery of esophagus
- Muscular ingrowth from lateral body walls

Q4: How neural tube is developed? Explain histogenesis leading to development of spinal cord. Mention the positional changes in the spinal cord till adult age.

Ans:

Neural tube development:

The central nervous system appears at the beginning of the 3rd week as a slipper shaped plate of Thickened ectoderm, the neural plate, in the mid-dorsal region in front of the primitive node. Its lateral edges soon elevate to form the neural folds.

With further development, the neural folds continue to elevate, approach each other in the midline and finally fuse, forming the NEURAL TUBE. Fusion begins in the cervical region and continues in cephalic and caudal directions. Once fusion is initiated, the open ends of the neural tube form the cranial and caudal neuropores that communicate with the overlying amniotic cavity. Closure of the cranial neuropore proceeds cranially from the initial closure site in the cervical region and from a site in the forebrain that forms later. This later site proceeds cranially,
to close the rostral most region of the neural tube and caudally to meet advancing closure. Finally the closure of the cranial neuropore at the 18 to 20-somite stage, closure of the caudal neuropore occurs approximately 3 days later. The cephalic end of neural tube shows three dilatations
   i)-Pros encephalon    ii)-Mesencephalon    iii)-Rhomb encephalon

Spinal Cord Development:
Neuroepithelial, mantle and Marginal Layers

The wall of a recently closed neural tube consists of neuroepithelial cells. These cells extend over the entire thickness of the wall and form a thick pseudo stratified epi. Junctional complexes at lumen connect them. During the neural groove stage and immediately after the closure of the tube, they divide rapidly, producing more and more neuroepithelial cells. Collectively, they constitute the Neuroepithelial layer.

Once the neural tube closes, neuroepithelial cells begin to give rise to another cell type characterized by a large round nucleus with pale nucleolus and a dark staining nucleolus. These are the primitive nerve cells. They form the mantle layer.

The outer most layer of the spinal cord, the marginal layer, contains nerve fibers emerging from neuroblasts or primitive nerve cells in the mantle layer. As a result of myelination of nerve fibers, this layer takes on a white appearance and therefore is called the white matter of the spinal cord.

Positional Changes:

In the 3rd month of development, the spinal cord extends the entire length of the embryo and spinal nerves pass through the intervertebral foramina at their level of origin. With increasing age, the vertebral column and dura lengthen more rapidly than the neural tube and the terminal end of the spinal cord gradually shifts to higher level. At birth, this end is at the level of third lumbar vertebrae. As a result of this disproportionate growth, spinal nerves run obliquely from their segment of origin in the spinal cord to the corresponding level of the vertebral column. The dura remains attached to vertebral column at the coccygeal level.

In the adult the dural sac and subarachnoid mater extend to S2. At the end of the cord, a threadlike extension of pia mater passes caudally, goes through the dura which provides a covering layer at S2 and extends to the first coccygeal vertebrae. This structure is called the filum terminale and it marks the tract of regression of spinal cord and provides support. Nerve fibers below spinal cord constitute the cauda equina. When CSF is trapped during a lumbar puncture, the needle is inserted at the lower lumbar level, avoiding the lower end of the cord.

Q8: Name different parts of aorta and give development of each part.  [0.75, 4.25]

Ans:

Ascending aorta, arch of aorta, descending aorta.

Development of different parts of aorta

During the early development of vascular system in 3rd week, blood islands appear bilaterally, parallel and close to the midline of the embryonic shield. These islands form a pair of longitudinal vessels, the DORSAL AORTA. During 4th and 5th weeks, the caudal portions of the dorsal aortas fuse to form a single lower thoracic? Abdominal aorta. Of the remaining the right regresses and the left becomes the primordial aorta. Truncus arteriosus which gives rise to ASCENDING AORTA originates from secondary heart field. During the 5th week right sup and left inf ridges appear in it which fuse to form the aorticopulmonary septum dividing the truncus into an aortic and pulmonary channel.

The proximal segment of arch of aorta is derived from aortic sac and part of it is derived from 4th aortic arch. Aortic arches give origin to further arteries:

- Maxillary arteries
- Hyoid and stapedial arteries
- Common carotid and first part of the internal carotid arteries
Q2: A five year old baby had Teratology of Fallot. Enlist the classic defects present in this condition, mentioning their embryological basis.

**Ans:**

**Tetralogy of Fallot**

This classic group of four cardiac defects consists of:

- Pulmonary stenosis (obstruction of right ventricular outflow)
- VSD
- Dextroposition of aorta (overriding or straddling aorta)
- Right ventricular hypertrophy. The pulmonary trunk is usually small, and there may be various degrees of pulmonary artery stenosis as well. Cyanosis is an obvious sign of the tetralogy but is not often present at birth. This anomaly results when division of the TA is so unequal that the pulmonary trunk has no lumen, or there is no orifice at the level of the pulmonary valve. Pulmonary atresia may or may not be associated with a VSD. Pulmonary atresia with VSD is an extreme form of tetralogy of Fallot. The entire right ventricular output is through the aorta. Pulmonary blood flow is dependent on a PDA (patent ductus arteriosus) or on bronchial collateral vessels. Initial treatment may require surgical placement of a temporary shunt, but in many cases, primary surgical repair is the treatment of choice in early infancy.

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**Annual 2011**

Q2: During an appendectomy, an inflamed fingerlike structure arising from ileum was observed.

A: Name structure, its location and embryological source. [0.5, 0.5, 01]

**Ans:**

**ILEAL DIVERTICULUM (LOCATION AND EMBRYOLOGICAL BASIS)**

- Ileal Diverticulum
  - An ileal diverticulum is the remnant of the proximal part of the omphaloenteric duct (yolk stalk).
  - It typically appears as a fingerlike pouch approximately 3 to 6 cm long that arises from the antimesenteric border of the ileum, 40 to 50 cm from the ileocecal junction.

B: Give axis, extent and changes of midgut loop within the umbilical cord. [0.5, 1, 1.5]

**Ans:**

While it is in the umbilical cord, the midgut loop rotates 90 degrees counterclockwise (looking from the ventral side) around the axis of the superior mesenteric artery. This brings the cranial limb (small intestine) of the midgut loop to the right and the caudal limb (large intestine) to the left. During rotation, the cranial limb elongates and forms intestinal loops (e.g., primordia of jejunum and ileum).

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**Supply 2012**

Q2: Give extent and axis of rotation of stomach. Give effect of this rotation on development and nerve supply of stomach. [01, 04]

**Ans:**

As the stomach enlarges and acquires its final shape, it slowly rotates 90 degrees in a clockwise direction (viewed from the cranial end) around its longitudinal axis. The effects of rotation on the stomach are:
- The ventral border (lesser curvature) moves to the right and the dorsal border (greater curvature) moves to the left.
- The original left side becomes the ventral surface and the original right side becomes the dorsal surface.
- Before rotation, the cranial and caudal ends of the stomach are in the median plane. During rotation and growth of the stomach, its cranial region moves to the left and slightly inferiorly, and its caudal region moves to the right and superiorly. After rotation, the stomach assumes its final position with its long axis almost transverse to the long axis of the body.
- The rotation and growth of the stomach explain why the left vagus nerve supplies the anterior wall of the adult stomach and the right vagus nerve innervates its posterior wall.
Q: Name the basal nuclei of brain. Give the connections of Globus Pallidus.

Ans:

i) Caudate nucleus  
ii) Globus Pallidus+Putamen  
iii) Claustrum  
iv) Amygdaloid nucleus  
v) Lentiform

Connections:

Efferents:

i) Thalamus: Mainly to the ventral anterior and ventro lent nuclei through thalamic fasciculi  
ii) Subthalamus: through subthalamic fasciculi  
iii) Red nucleus: Pallido rubral fibers  
iv) Substantia nigra: Pallido nigral fibers  
v) Midbrain: Pallido tegmental fibers  
vi) Hypothalamus: Not conclusively in man  
vii) Inferior olivary nucleus: Pallido olivary nucleus

Afferents:

i) Thalamus: Thalamopallidal fibers  
ii) Subthalamus: Through subthalamic fasciculus  
iii) Substantia nigra: Pallido nigral fibers  
iv) Striatum: Striopallidal fibers constitute the main afferents to the globus pallidus

Q: Name the cerebellar peduncles. Write a short note of superior cerebellar peduncle. List three clinical signs of cerebellar dysfunction.

Ans:

i) Superior cerebellar peduncle  
ii) Middle cerebellar peduncle  
iii) Inferior cerebellar peduncle

Superior Cerebellar Peduncle:

It connects the cerebellum with mid brain and consists mainly of efferent fibers. The two peduncles, one on each side, emerge from the upper part of ant cerebellar notch and ascend upwards and medially to disappear just below the inferior colliculi of midbrain. They are connected to each other by superior medullary velum and together they form the roof of 4th ventricle.

Efferents:

Ascending fibers:

i) Red nucleus of the brain  
ii) Ventral nucleus of thalamus

Descending fibers:

i) Inferior and accessory olivary nuclei  
ii) Reticular formation of pons and medulla

Afferent:

i) Anterior spinocerebellar  
ii) Tectocerebellar tracts

Cerebellar diseases:
i) Dysmetria and ataxia
ii) Dysdiadochokinesia
iii) Dysarthria and hypotonia

**Q: Name the parts of lateral ventricle?**

**Ans:**

i) Body
ii) Anterior Horn
iii) Posterior Horn
iv) Inferior Horn

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**Annual 2006 [1st Year]**

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**Q6: Trace visual fibres from retina to cortex.**

**Ans:**

**Optical Pathway:**

- 1. **Optic nerve** carrying visual signals from retina.
- 2. **Optic Chiasm**, where optic nerve fibers from nasal halves of retina cross to opposite side.
- 3. **Optic tract**. After crossing from nasal halves of retina to opposite side, optic nerve fibers **join fibers from opposite temporal retinas** and form **optic tract**.
- 4. Fibers of each optic tract synapse in **dorsal lateral geniculate nucleus** (in thalamus).
- 5. From **dL geniculate nucleus**, fibers known as **geniculo-calcarine fibers**, run through **optic radiation** (geniculo-calcarine tract) to **primary visual cortex** (in calcarine fissure area of middle occipital lobe).

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**Annual 2009 [3.5]**

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**Q10: Name arteries supplying Medulla Oblongata with their area of supply. What will be the effects of artery supplying lateral part?**

**Ans:**

The arteries of medulla oblongata are:

- Anterior spinal artery (branches from anterior spinal artery enter the substance of spinal cord and supply its anterior two-thirds)
- Posterior spinal arteries (branches also supply posterior one-third of spinal cord)
- Posterior inferior cerebellar artery (in addition to supplying medulla oblongata it supplies inferior surface of the vermis, the central nuclei of cerebellum and the undersurface of cerebellar hemisphere. It also supplies the choroid plexus of 4th ventricle)
- Basilar artery
  - As middle cerebral artery supplies most of the lateral part of cerebrum so, its occlusion leads to following signs and symptoms.
    1. Contralateral hemiparesis and hemisensory loss involving mainly the face and arm (when paracentral and post central gyri are involved)
    2. Aphasia (if left hemisphere is affected but rarely if right one is affected)
    3. Contralateral homonymous hemianopia (if optic radiation is damaged)
    4. Anosognosia if the right hemisphere is affected (rarely if the left hemisphere is affected)
A: Give the location and function of inferior colliculus? Give its connections in relation to the pathway associated with this colliculus?  
[0.5, 0.5, 02]

Ans:

The inferior colliculus consisting of large nucleus of gray matter lies beneath the corresponding surface elevation.

Function:

It forms part of the auditory pathway as it is a relay center receiving many of the terminal fibres of lateral lemniscus. The pathway then continues through the inferior brachium to the medial geniculate body.

Motor tracts associated with inferior colliculi are:
1. Corticospinal and corticobulbar tracts
2. Temporopontine
3. Fronto pontine
4. Medial longitudinal fasciculus

Sensory tracts associated with inferior colliculus:
1. Lateral, trigeminal, spinal and medial leminisci;
2. Decussation of superior cerebellar peduncles

B: Enlist the arteries supplying the cerebellum mentioning the sources from where they arise? [02]

Ans:

It is supplied by
1. Superior cerebellar artery branch of vertebro-basilar artery
2. Anterior inferior cerebellar artery branch of basilar artery
3. Posterior inferior cerebellar artery the largest branch of vertebro-basilar artery

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Q4: Enlist functional areas of cerebrum located in the frontal lobe mentioning their brodmann’s classification. Give the location and arterial supply of primary area concerned with voluntary motor control of the body?

[2.5, 01, 1.5]

Ans:

Functional Areas:

1. Primary motor area (brodmann no 4)
2. Secondary motor area (B.No 6)
3. Supplementary motor area
4. Frontal eye field (parts of brodmann area 6,8 and 9)
5. Motor speech area of broca (Brd. No 44 and 45)
6. Prefrontal cortex (Brd. No 9,10,11 and 12)

Location & Blood Supply:

➢ Primary motor area occupies the precentral gyrus extending over the superior border into the paracentral lobule.

➢ The part of primary motor area on the lateral surface is supplied by middle cerebral artery and the part on medial surface is supplied by anterior cerebral artery.

➢ Both are the branches of internal carotid artery.

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Annual 2011

Q3: Draw and label a transverse section of medulla oblongata at the level of decussation of medial leminisci. [5]

Ans: fig 5-11 page 201 of snell Neuro

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Q4:

A: Give the arteries supplying the superolateral surface of cerebrum mentioning their area of supply on this surface. Support your ans with the help of a diagram.  

[04]

Ans:
The cortical branches of the middle cerebral artery supply the entire lateral surface of the hemisphere, except for the narrow strip that is supplied by the anterior cerebral artery. This artery thus supplies all the motor area except for the ‘leg area’.

B: Give the location of taste areas in cerebral cortex mentioning its brodmann’s classification? [1]

Ans:
The taste area is situated at the lower end of the postcentral gyrus in the superior wall of the lateral sulcus and the adjoining area of the insula (Brodmann area 43). Ascending fibers from the nucleus solitaries probably ascend to the ventral posteromedial nucleus of the thalamus, where they synapse on neurons that send fibers to the cortex.

Q3: Draw and label diagram to show the floor of 4th ventricle? [5]

Ans: Fig 16-10 at page 455 of Snell Neuro

Q4:
A: Give the area of cerebrum supplied by cortical branches of ant cerebral artery. What sensorimotor deficit would most likely be produced in the event of occlusion of this artery? [02, 01]

Ans:
The cortical branches supply all the medial surface of the cerebral cortex as far as the parietooccipital sulcus. They also supply a strip of occipital sulcus about 1 inch (2.5 cm) wide on the adjoining lateral surface. The anterior cerebral artery thus supplies the “leg area” of the precentral gyrus.

1. Contralateral hemiparesis and hemisensory loss involving the leg and foot (paracentral lobule of cortex)
2. Inability to identify objects correctly, apathy and personality changes (frontal and parietal lobe)

Sensorimotor deficits:
   i) Contralateral hemiparesis and hemisensory loss involving the leg and foot
   ii) Inability to identify objects correctly, apathy and personality changes (frontal and parietal lobes)

B: Give the formation of great cerebral veins. How do they terminate? [01, 01]

Ans:
The deep middle cerebral vein drains the insula and is joined by the anterior cerebral and striate veins to form the basal vein. The basal vein ultimately joins the great cerebral vein which empties into the straight sinus. The veins at the anterior poles of the thalamus merge posterior to the pineal gland to form the Great Cerebral Vein.

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HEAD AND NECK

Annual 2005

Q5: Name the boundaries and contents of DIGASTRIC TRIANGLE. [2, 3]

Ans:

Digastric triangle lies in submandibular region. The boundaries of triangle are as follows:

Anteroinferiorly: ant. Belly of digastric
Posteroinferiorly: post. Belly of digastric and Stylohyoid
Superiorly: base of mandible and a line joining the angle of mandible to the mastoid process

Roof: roof is formed by:
1. Skin
2. Superficial fascia: (containing platysma, cervical branch of facial nerve, ascending branch of transverse cutaneous nerve of neck)
3. Deep fascia

Floor: Formed b mylohyoid muscle (anteriorly) and by the hypoglossus (posteriorly) and middle constrictor of Pharynx.

CONTENTS:

Ant. Part of triangle

➢ Structures superficial to mylohyoid are:
   (a) Superficial part of submandibular salivary gland, facial vein and sub mandibular lymph nodes, facial artery
   (b) Submental artery
   (c) Mylohyoid nerve and vessels

➢ Structures superficial to the hyoglossus:
   (a) Submandibular salivary gland
   (b) Intermediate tendon of digastric and Stylohyoid
   (c) Hypoglossal nerve

Post. Part of triangle

➢ Superficial structures:
   (a) Lower part of parotid gland
   (b) External carotid artery before it enters parotid gland

➢ Deep structures passing b/w external and internal carotid arteries are:
   (a) Styloglossus
   (b) Stylopharangeus
   (c) Glossopharyngeal nerve
   (d) Pharyngeal branch of vagus nerve
   (e) Styloid process
   (f) Part of parotid gland

➢ Deepest structures:
   (a) Internal carotid artery
   (b) Internal jugular vein
   (c) Vagus nerve
Q6: List the branches of first part of MAXILLARY ARTERY. Describe one that serve as main supply of dura matter. [2.5, 2.5]

Ans:
Branches of 1st part of maxillary artery are:
1. Deep auricular
2. Anterior tympanic
3. Middle meningeal
4. Accessory meningeal
5. Inferior alveolar
   “MIDDLE MENINGEAL ARTERY” serves as main supply of dura matter.
   It lays b/w lateral pterygoid and sphenomandibular ligament, then b/w two roots of auriculo temporal nerve enters d skull through foramen spinosum to reach middle cranial fossa. It divides into large frontal branch and a small parietal branch.

Q7: Name the intrinsic muscles of larynx. Give the attachments, nerve supply and action of cricothyroid. [2, 3]
Ans:
BD Chaurasia’s pg#242 (table16.1). Write names of intrinsic muscles of larynx and their attachments (table 16.2) their main action
NERVE SUPPLY:
“Recurrent laryngeal nerve” supplies post. Cricoarytenoid, lateral Cricothyroid, transverse and oblique arytenoid, aryepiglotticus, thyroarytenoid, thyroepiglotticus muscles. It supplies all intrinsic muscles except CRICOTHYROID which is supplied by “external laryngeal nerve”

Q5: Enumerate the movements of mandible and mention the muscles responsible for each movement. [2, 3]
Ans:
The movements of mandible and the muscles causing these movements are as follows:
1. Depression:
   • Mainly by lateral pterygoid
   • Digastric, geniohyoid and mylohyoid (help when mouth is opened wide or against resistance)
2. Elevation:
   • Masseter
   • Anterior vertical. Middle oblique fibres of temporalis
   • Medial pterygoid muscles of both sides
3. Protrusion:
   • Lateral and medial pterygoids
4. Retraction:
   • Posterior horizontal fibres of temporalis
5. Lateral / Side To Side Movements
   • Right lateral pterygoid right medial pterygoid (turn chin to left side) and vice versa.

Q6: Describe the extracranial part of facial nerve and name its branches. [3, 2]
Ans:
Extra cranial course of facial nerve:
- Facial nerve crosses the lateral side of base of styloid process.
- Enters posteromedial surface of parotid gland
- Runs forward through gland
- Crosses retromandibular vein and external carotid artery
- Behind the neck of mandible divide into five terminal branches which emerge along the ant. Border of parotid gland.

NAMES OF BRANCHES:
- Temporal
- Zygomatic
- Buccal
- Marginal mandibular
- Cervical

Q7: Describe the nerve supply of the tongue.
[5]
Ans:

Motor Supply:
All intrinsic and extrinsic muscle of tongue are supplied by hyoglossal nerve except palatoglossus.
Palatoglossus is supplied by the cranial root of accessory nerve through the pharyngeal plexus.

Sensory Supply:
General sensations: Lingual Nerve
Taste Sensations: Ant 2/3rd. choroa tympani , Post 1/3rd. Glossopharyngeal, Most Post part: Vagus [Internal Laryngeal]

Annual 2006

Q5: What are the relations of various surfaces of parotid gland? Name the structures which lie within the gland.
[3, 2]
Ans:

Relations:
Apex: Overlaps posterior belly of digastrics and carotid triangle. Cervical branch of facial nerve and two divisions of retro mandibular veins emerge through it.

Superior Surface:
- Cartilaginous part of external acoustic meatus.
- Posterior surface of temporomandibular joint.
- Superficial temporal vessels.
- Auriculotemporal nerve

Superficial Surface:
- Skin
- Superficial fascia with ant branches of great auricular nerve, the preauricular lymph nodes and posterior fibres of platysma and risorius.
- The parotid fascia
- Few parotid lymph nodes

Anteromedial Surface:
Q6: Name the ligaments of temporomandibular joints. Give the nerve supply of this joint. What muscles are responsible for its elevation? [2, 1, 2]

Ans:

LIGAMENTS:
1. Fibrous capsule
2. Lateral or temporomandibular ligament
3. Sphenomandibular ligament
4. Stylogobal bulbary ligament

NERVE SUPPLY:
- Auriculotemporal nerve
- Masseteric nerve

Muscles responsible for ELEVATION:
- Masseter
- Anterior vertical, Middle oblique fibres of temporalis
- Medial pterygoid muscles of both sides

Q7: What are the relations of various surfaces of the lobes of THYROID GLAND? What is the venous drainage and lymphatic drainage of this gland? [3, 1, 1]

Ans:

Relations:
- Apex is directed upward and slightly laterally upto attachment of sternothyroid to oblique line of thyroid cartilage.
- Base is on level with 4th or 5th tracheal ring.

Lateral/Superficial surface:
- a) Sternohyoid
- b) Sternothyroid
- c) Sup belly of omohyoid
- d) Ant border of sternocleidomastoid

Medial Surface
a) 2 tubes, trachea and esophagus  
b) 2 muscles, inferior constrictor and cricothyroid  
c) 2 nerves, external laryngeal and recurrent laryngeal

Posterolateral/Posterior Surface:  
Carotid sheath, overlaps common carotid artery.

Venous Drainage:  
By Superior, middle and inferior thyroid veins

Lymphatic drainage:  
Upper part: Prelaryngeal nodes/Upper deep cervical nodes.  
Lower part: Lower deep cervical/ pretracheal/ paratracheal.

Q8. A: Enumerate the cartilages, membranes and ligaments of larynx. [3]

AnS:

Cartilages:
Larynx contain 9 cartilages. 3 paired and 3 unpaired.

Unpaired cartilages:
1. Thyroid cartilage
2. Cricoid
3. Epiglottis

Paired cartilages:
1. Arytenoid
2. Corniculate
3. Cuneiform

Laryngeal Ligaments And Membranes:
Extrinsic:
1. Thyrohyoid membrane
2. Hyoepiglottic ligament
3. Cricotracheal ligament

Intrinsic:
1. Quadrate membrane
2. Conus elasticus

Q9: Give the origin, insertion, nerve supply of the muscles which abducts the vocal cords. [2]

AnS:

Muscle which abducts vocal cords is only "posterior cricoarytenoids".

Origin: Posterior surface of lamina of cricoids.

Insertion: Posterior aspect of muscular process of arytenoids.

Nerve Supply: Recurrent laryngeal nerve

Q10: EPISTRIXIS (bleeding from nose) is quite commonly observed. Discuss the anatomical basis of epistaxis with reference to arterial supply of nasal septum.

AnS:
Anterosuperior part by anterior ethmoidal artery.
Posterosuperior part by sphenopalatine artery.
Anteroinferior part by superior labial branch of facial artery.
Posterosuperior part by the greater palatine artery

Vestibule of nose contains anastomosis of branches of sphenopalatine, superior labial and anterior ethmoid artery so here is a large capillary network which is a site for nose bleeding.

Q8:
A: List the functional component of facial nerve. [2]

Ans:
Functional Components:
1. Special visceral or branchial efferent
2. General visceral efferent or parasympathetic
3. General visceral afferent
4. Special visceral afferent
5. General somatic afferent fibres

B: Name its branches [2]

Ans:
WITHIN FACIAL CANAL:
1. Greater petrosal nerve
2. Nerve to stapedius
3. Chorda tympani

AS FACIAL NERVE EXIT FROM STYLOMASTOID FORAMEN:
1. Post. Auricular
2. Digastric
3. Stylohyoid

TERMINAL BRANCHES WITHIN PAROTID GLAND:
1. Temporal
2. Zygomatic
3. Buccal
4. Marginal mandibular
5. Cervical

C: What type of fibers are carried in chorda tympani nerve? [1]

Ans:
It carries 2 types of fibers
(a) Preganglionic secretomotor fibres to submandibular ganglion for supply of the sub-mandibular and sublingual salivary glands.
(b) Taste fibres from the anterior 2/3 of the tongue except circumvallate papillae.

Q9:
A: What are the components of the bony part of the nasal septum? [1]

Ans:
Vomer and perpendicular plate of ethmoid. May include nasal spine of frontal bone, rostrum of sphenoid and nasal crests of nasal, maxillary and palatine bones.

B: Give the arterial supply of nasal septum. [2]

- Posteroinferior part by sphenopalatine artery.
- Anteroinferior part by superior labial branch of facial artery.
- Posterosuperior part by the greater palatine artery.

C: what is little’s area and its clinical importance? [2]

Kiesselbach’s plexus formed in anteroinferior part of nasal septum. Is a common site of bleeding from nose or epistaxis and is known as “little’s area”.

Ninety percent of nose bleeds (epistaxis) occur in Little’s area, as it is exposed to the drying effect of inspiratory current. Alternatively, it can be argued, since most nose bleeds are provoked by nose-picking, that this very vascular area of nasal mucosa is within reach of the probing finger.

Q8: Draw and label the cutaneous nerve supply of face and scalp. [0.33 * 15]

Ans:

BD pg# 54 (fig. 2.5) and pg# 60 (fig. 2.18) for further description of cutaneous nerve supply of face see pg# 98 of dissector of head and neck. Or go for d netter atlas.

Q9: Explain the location and the roots of the largest parasympathetic ganglion.  [1, 2, 2]

Ans:

PTERYGOPALATINE is the LARGEST parasympathetic ganglion, suspended by two roots of maxillary nerve.

Functionally it is related to 7th cranial nerve. It is called ganglion of “hay fever”

ROOTS:
The ganglion has sensory, sympathetic and secretomotor roots:
1. Sensory root is from “maxillary nerve”.
2. Sympathetic root is from “postganglionic plexus around internal carotid artery”
3. Secretomotor root is from “greater petrosal nerve” which arises from geniculate ganglion of 7th cranial nerve.
   These fibres relay in the ganglion.

Q3: A: Justify “Scalp wounds bleed profusely”, enlist arteries of scalp and their layer. [1, 3, 1]

Ans:

- Scalp wounds bleed profusely because the vessels are prevented from retracting by the fibrous fascia.
  Bleeding can be arrested by applying pressure against bone.
- Arteries supplying the scalp
  In front of auricle from before backward:
  o Supratrochlear
  o Supraorbital
  o Superficial temporal arteries (branch of external carotid)
  o First 2 branches of ophthalmic arteries (branch of internal carotid arteries).
  Behind the auricle from before backward:
Q4: What is the nerve supply of tongue? Correlate this nerve supply with development. [2.5, 2.5]

**Motor Supply:**
All intrinsic and extrinsic muscle of tongue are supplied by hyoglossal nerve except palatoglossus. Palatoglossus is supplied by the cranial root of accessory nerve through the pharyngeal plexus.

**Sensory Supply:**
General sensations: Lingual Nerve

**Taste Sensations:**
- Ant 2/3rd. chroda tympani, because this part develops from two lingual swellings and one tuberculum impar, which arise from the first branchial arch. Therefore it is supplied by lingual nerve and chorda tympani
- Post 1/3rd. Glossopharyngeal, as it develops from cranial large part of the hypobranchial eminence, i.e. From the third arch.
- Most Post part: Vagus [Internal Laryngeal], because it develops from fourth arch.

---

**Annual 2010**

Q8: A boy has upper airway obstruction. Tracheostomy was performed.
A: Name the structures needs care while procedure differing from adult. [02, 1.5]
Ans:
Care should be taken due to the fact that left brachiocephalic crosses posterior to manubrium in adults but in children they lie in the superior border of manubrium so less protected and prone to injury...it is also due to the fact that small size of neck leading to close proximity of structure more in children than adults...so chances of iatrogenic trauma is more.

B: Give extent and diameters of trachea in adults. [01, 0.5]
Ans:
The trachea or windpipe is a cartilaginous and membranous tube, extending from the lower part of the larynx (cricoid cartilage), on a level with the sixth cervical vertebra, to the upper border of the fifth thoracic vertebra, where it divides into the two bronchi. In short: C6-T5
- Diameter:
  - Male: 2 cm
  - Female: 1.5

---

Q9:
A: Give the location of palatine tonsil. Enumerate structures of palatine bed. [1.5, 01]
Ans:
Tonsillar sinus/ fossa b/w palatoglossal and palatophyrangeal arches.

**Tonsilar bed:**
From within outward
- Pharyngobasilar fascia
- Superior constrictor and palatopharyngeus muscles
- Buccopharyngeal fascia
B: Give arterial supply of tonsils. Which vessel commonly bleeds after tonsillectomy.  [1.5, 01]

Ans:
Arterial Supply:
- Tonsillar branch of facial artery (main source)
- ascending palatine (branch of facial artery)
- dorsal lingual (branch of lingual artery)
- ascending pharyngeal (branch of ex. Carotid)
- greater palatine (branch of maxillary artery)

Palatine vein (external palatine and paratonsillar vein) descents from palate into loose areolar tissue on lateral surface of capsule and crosses the tonsil b4 piercing wall of pharynx. The vein may get injured during tonsillectomy.

Q8: Give the formation of facial vein & how it communicates with cavernous sinus & give its clinical significance.  [1.5, 3.5]

Ans:
Facial vein is formed by the union of supra-troachlear and supraorbital veins that form anguler vein which descend on face as facial vein.

Communications:
Facial vein communicates with pterygoid plexus through deep facial vein through pterygoid plexus facial vein communicates with the cavernous sinus

Clinical:
Infection from the face can spread in retrograde direction ad cause thrombosis of the cavernous sinus
This is specially likely to occur in the presence of infection in the upper lip and in the lower part of nose this area is called as the dangerous area of face.

Q9:
A: Give the nerve supply of tongue.  [4]

Ans:
Motor Supply:
All intrinsic and extrinsic muscle of tongue are supplied by hypoglossal nerve except palatoglossus.
Palatoglossus is supplied by the cranial root of accessory nerve through the pharyngeal plexus.

Sensory Supply:
General sensations: Lingual Nerve
Taste Sensations:
- Ant 2/3rd:chorda tympani
- Post 1/3rd:Glossopharyngeal
- Most Post part: Vagus [Internal Laryngeal]

B: Which lymph node will enlarge if there is ulcer on anterior part of tongue?  [1]

Ans:
Submental lymph nodes
Supply 2012

Q8:
A: Name 3 fascial layers of deep cervical fascia. [1.5]
Ans:
- investing layer
- pretracheal layer
- prevertebral layer
- carotid sheath
- Buccopharyngeal fascia
- Pharyngobasilar fascia

B: Enumerate contents of carotid sheath. Give its superior and inferior communication with significance. [2, 1, 0.5]
Ans:
Contents of carotid sheath:
- common carotid art.
- internal carotid art.
- Internal jugular vein
- vagus nerve
- deep cervical lymph nodes
- sympathetic fibers
- carotid sinus nerve (rare)

- It Extending from the base of the skull to the root of the neck

Clinical Significance:
- It can be involved in any neck infection because it is made of those three layers: Investing, Pretracheal and Prevertebral Fascia.
- Infections tend to be localized within the cervical region (between hyoid and root of the neck) because the sheath is closely adherent to vessels.
- Infection usually arises from thrombosis of the internal jugular vein or from infection of those deep cervical lymph nodes that lie within the sheath.
- Thrombosis of the jugular vein from a deep infection of the neck is probably not due to direct infection of the carotid sheath, but rather to the fact that infectious material follows tributaries of the internal jugular vein to reach the sheath.
- Drug use (Heroin) usually use carotid route to obtain a fast high. A result can be abscess of the carotid sheath presenting in a patient who is groggy with a weak pulse (bradycardia) and low blood pressure due to the compression of the carotid sinus and irritation of the vagus nerve.

Q9: A female came with swelling of parotid gland. Pain was radiating from jaw to ear and forehead of same side.
A: Give reason for radiation and severity of pain. [02, 01]
Ans:
Pain is due to compression of temporal branch of facial nerve. As it supplies these regions.

B: Where does parotid duct opens within the buccal cavity? [02]
Ans:
The duct emerge from ant. Border of the gland runs forwards and slightly downward on the masseter. And then runs for a short distance b/w buccinators and oral mucosa and finally turns medially and open into the vestibule of mouth opposite the crown of upper 2nd molar teeth.

Prepared By:
Naila Hassan And Laraib Amjad
(Allama Iqbal Medical College)


Q9: How portal vein is formed. Name the tributaries and two clinically important sites of Porto-systemic anastomosis.

Ans:

**Portal vein:**

The portal vein is the main channel of the portal venous system. It is formed anterior to the IVC and posterior to the neck of the pancreas (close to the level of the L1 vertebra and the transpyloric plane) by the union of the superior mesenteric and splenic veins.

**Anastomosis:**

Anastomosis provide a collateral circulation in cases of obstruction in the liver or portal vein. Here, the portal tributaries are darker blue and systemic tributaries are lighter blue.

- Between the submucosal esophageal veins draining into either the azygos vein (systemic) or the left gastric vein (portal); when dilated these are esophageal varices.
- Between the inferior and middle rectal veins draining into the inferior vena cava (systemic) and the superior rectal vein, continuing as the inferior mesenteric vein (portal). The submucosal veins involved are normally dilated (varicose in appearance), even in newborns. When the mucosa containing them prolapses, they form hemorrhoids. (The varicose appearance of the veins and the occurrence of hemorrhoids are not typically related to portal hypertension, as is commonly stated.)
- Paraumbilical veins (portal) anastomosing with small epigastric veins of the anterior abdominal wall (systemic); this may produce the caput medusae.

Q10: Name ligaments of liver. Write a note on lesser omentum.

Ans:

**Ligaments of liver**

- Sup+inf coronary ligament.
- RT & Lt triangular ligament.
- Falciform ligament.
- Ligamentum venosum,
- Ligamentum teres

**Lesser omentum**

It’s a fold of peritoneum which extends from lesser curvature of stomach & the 1st 2 cm of duodenum to liver. (Hepatogastric + hepatoduodenal ligament)

**ATTACHMENTS:**

- Sup: liver
- INF: lesser curvature of stomach + duodenum

**Contents:**

- Hepatic artery proper, portal vein, bile duct. Lymph node + lymphatic, hepatic plexuses of nerves, RT +Lt gastric vessels, gastric nerves, lymph nodes
  - Behind its right free margin there is epiploic foramen through which lesser & greater sac communicates

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Q9: Describe the composition of anterior and posterior wall of rectus sheath. [5]

Ans:

ANT WALL:
It’s completely covered with fascia of muscles from end to end. It’s firmly adherent to tendinous intersections.

POST WALL:
It’s incomplete, deficient above the costal margin & below arcuate line & ends in arcuate line, its free from tendinous intersections.
At the level of ant sup iliac spine post wall has a free curved lower arcuate line, and in b/w costal margin + arcuate line) border called arcuate line, from here INF epigastric vessels enter rectus sheath.
(Draw the 3 diagrams of rectus sheath at level above the costal margin, below arcuate line, in b/w arcuate line &costal margins)

Q10: Describe the Urogenital diaphragm. Also mention its functional importance. [4, 1]

Urogenital diaphragm:
This is formed by deep perineal muscles (sphincter urethrae + deep transvers Perini muscles) which form a triangular sheath of voluntary muscles surrounding the membranous urethra and vagina. The sup and INF fascia (perineal membrane) of urogenital diaphragm. The ischiorectal fossa’s ant recess extends forward for a short distance above urogenital diaphragm.

Functional Importance:
It supports most of the pelvic and abdominal viscera and prevents them from herniation below.

Annual 2006

Q9: What are the relations of urinary bladder in female? What is arterial supply and lymphatic drainage? [3, 1, 1]

Ans:

Relations:
When empty, the adult urinary bladder is located in the lesser pelvis, lying partially superior to and partially posterior to the pubic bones. It is separated from these bones by the potential retropubic space (of Retzius) and lies mostly inferior to the peritoneum, resting on the pubic bones and pubic symphysis anteriorly and the pelvic floor posteriorly.

The bladder is relatively free within the extraperitoneal subcutaneous fatty tissue, except for its neck, which is held firmly by the lateral ligaments of bladder and the tendinous arch of the pelvic fasciae specially its anterior components, pubovesical ligament in females. The bladder bed is formed by the structures that directly contact it. On each side, the pubic bones and the fascia covering the levator ani and the superior obturator internus lie in contact with the inferolateral surfaces of the bladder. Only the superior surface is covered by peritoneum. Consequently, in females the fundus is directly related to the superior anterior wall of the vagina. The bladder is enveloped by a loose connective tissue visceral fascia. Posteriorly it has uterovesical pouch.

Arterial Supply: Sup vesical, inf vesical [uterine and vaginal in female], obturator, inf gluteal.


Q10: Briefly describe the course, relations, and branches of superior mesenteric artery. [1, 2, 2]
Ans:

Course:

Superior mesenteric artery is a large artery that originates from the front of the abdominal aorta opposite the first lumbar vertebra about a quarter of an inch below the celiac artery. It descends to the front of the third part of the duodenum, where it enters the mesentery; and then, in the root of the mesentery, it runs downward and to the right with a slight curve whose convexity is toward the left; and it terminates in the right iliac fossa, near the end of the ileum, by anastomosing with a branch of the ileo-colic artery.

Relations:

Throughout its course, the superior mesenteric artery is surrounded by the superior mesenteric plexus of sympathetic nerves, which originates from the lower part of the celiac plexus, and it is accompanied by its vein, which lies close along its right side. At its origin, it is behind the body of the pancreas, and is closely related to the two large veins that cross the front of the aorta from the left to right – namely, the splenic vein, which passes above its origin, and the left renal vein, which passes below it. As the artery begins its descent, it crosses in front of the left renal vein, and, after escaping from behind the body of the pancreas, it crosses in front of the uncinate process of the pancreas to reach the third part of the duodenum. Beyond that point, its posterior relations are the same as those of the root of the mesentery.

Branches:

- Jejunal and ileal branches
- Middle colic artery
- Inferior pancreatic-duodenal artery
- Right colic artery
- Ileo-colic artery
- Appendicular artery

---

Q6. A: What is spermatic cord?

Annual 2007

[0.5]

B: Enumerate structures present in spermatic cord.

[2.5]

C: What are the coverings of spermatic cord?

[02]

Ans:

A: A cordlike structure, consisting of the vas deferens and its accompanying arteries, veins, nerves, and lymphatic vessels, that passes from the abdominal cavity through the inguinal canal down into the scrotum to the back of the testicle.

B: Structures

- Ductus deferens or deferent duct
- Testicular artery
- Artery of the ductus deferens
- cremasteric artery
- Pampiniform venous plexus
- Testicular veins.
- Sympathetic nerve fibers on arteries and sympathetic and parasympathetic nerve fibers on the ductus deferens.
- Genital branch of the genitofemoral nerve.
- Lymphatic vessels
- Vestige of the processus vaginalis

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C: Coverings
- Internal spermatic fascia: derived from the transversalis fascia.
- Cremasteric fascia: derived from the fascia of both the superficial and the deep surfaces of the internal oblique muscle.
- External spermatic fascia: derived from the external oblique aponeurosis and its investing fascia.

Q7: Give the relations of rectum, its blood supply, what do you know about internal hemorrhoids? [2.5, 1.5, 1]

Ans:
Relations:
Peritoneum covers the anterior and lateral surfaces of the superior third of the rectum, only the anterior surface of the middle third, and no surface of the inferior third because it is subperitoneal. In males, the peritoneum reflects from the rectum to the posterior wall of the bladder, where it forms the floor of the rectovesical pouch. In females, the peritoneum reflects from the rectum to the posterior part of the fornix of the vagina, where it forms the floor of the rectouterine pouch. In both sexes, lateral reflections of peritoneum from the superior third of the rectum form pararectal fossae, which permit the rectum to distend as it fills with feces.

The rectum lies posteriorly against the inferior three sacral vertebrae and the coccyx, anococcygeal ligament, median sacral vessels, and inferior ends of the sympathetic trunks and sacral plexuses. In males, the rectum is related anteriorly to the funiculus of the urinary bladder, terminal parts of the ureters, ductus deferens, seminal glands, and prostate. The rectovesical septum lies between the fundus of the bladder and the ampulla of the rectum and is closely associated with the seminal glands and prostate. In females, the rectum is related anteriorly to the vagina and is separated from the posterior part of the fornix and the cervix by the rectouterine pouch. Inferior to this pouch, the weak rectovaginal septum separates the superior half of the posterior wall of the vagina from the rectum.

Blood Supply:
The superior rectal artery, the continuation of the inferior mesenteric artery, supplies the proximal part of the rectum. The right and left middle rectal arteries, usually arising from the inferior vesical arteries, supply the middle and inferior parts of the rectum. The inferior rectal arteries, arising from the internal pudendal arteries, supply the anorectal junction and anal canal. Anastomoses between these arteries provide potential collateral circulation.

Venous drainage is by superior, middle and inferior rectal veins and superficial and deep venous plexuses.

Internal Hemorrhoids:
Internal hemorrhoids are the pathological veins protruding into the anal canal due to trauma or rupture of mucosa above the pectinate line. These are painless.

Q6:
A: Give the boundaries of deep perineal pouch. [1.5]

Ans:
The deep perineal pouch (space) is bounded inferiorly by the perineal membrane, superiorly by the inferior fascia of the pelvic diaphragm, and laterally by the inferior portion of the obturator fascia (covering the obturator internus muscle). It includes the fat-filled anterior recesses of the ischioanal fossa. The superior boundary in the region of the urogenital hiatus is indistinct.

B: Name the contents of deep perineal pouch in males. [2]
- Part of the urethra, centrally.
- The inferior part of the external urethral sphincter muscle, above the center of the perineal membrane, surrounding the urethra.
- Anterior extensions of the ischioanal fat pads.
- Intermediate part of the urethra, the narrowest part of the male urethra.
- Deep transverse perineal muscles, immediately superior to the perineal membrane (on its superior surface), running transversely along its posterior aspect.
- Bulbourethral glands, embedded within the deep perineal musculature.
- Dorsal neurovascular structures of the penis.

C: What is anatomical basis of esophageal varices?  \[1.5\]
Ans:
There is a portosystemic anastomosis between the submucosal esophageal veins draining into either the azygos vein (systemic) and the left gastric vein (portal); when dilated these are esophageal varices.

Anastomoses provide a collateral circulation in cases of obstruction in the liver or portal vein. Here, the portal tributaries are darker blue and systemic tributaries are lighter blue. It occurs due to portal hypertension.

Q7:
A: Where portal vein is formed. Name the tributaries.  \[2.5\]
Ans:
**Portal vein:**
The portal vein is the main channel of the portal venous system. It is formed anterior to the IVC and posterior to the neck of the pancreas (close to the level of the L1 vertebra and the transpyloric plane) by the union of the superior mesenteric and splenic veins.

**Tributaries:**
- Superior and Inferior mesenteric veins, gastric veins, splenic veins, cystic veins.

B: Mention 3 important sites of portosystemic Anastomosis.  \[1\]
Ans:
Anastomosis provide a collateral circulation in cases of obstruction in the liver or portal vein. Here, the portal tributaries are darker blue and systemic tributaries are lighter blue.
- Between the submucosal esophageal veins draining into either the azygos vein (systemic) or the left gastric vein (portal); when dilated these are esophageal varices.
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C: What is the anatomical basis of esophageal varices?  \[1.5\]
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Annual 2008

Q6: Explain locations, afferents and efferents of major groups of pelvic lymph nodes.  [5]
Ans:
1. Location, afferents, efferents of major group of lymph nodes of pelvis:

*Internal iliac lymph nodes does not receive lymph from the ovary, testis, or superior half of the rectum; the
gonads drain to the Para aortic lymph nodes, while the superior half of the rectum drains to the pararectal
lymph nodes

<table>
<thead>
<tr>
<th>Locations</th>
<th>Afferents</th>
<th>Efferents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common iliac lymph nodes(4-6 in numbers)</td>
<td>External + internal iliac lymph nodes</td>
<td>Lateral aortic lymph nodes</td>
</tr>
<tr>
<td>External iliac lymph nodes (8-10 in numbers)</td>
<td>Inguinal, deep layer of infraumbilical part of abdominal wall, adductor region of thigh, glans penis, clitoris, membranous urethra, prostate, urinary bladder (fundus), cervix uteri, part of vagina</td>
<td>Common iliac lymph nodes</td>
</tr>
<tr>
<td>Internal iliac lymph nodes</td>
<td>Pelvic viscera, deeper part of perineum, gluteal region, back of thighs</td>
<td>Common iliac lymph nodes</td>
</tr>
</tbody>
</table>

Q: Mention location, distribution and segmental values of nerves lying on posterior abdominal wall. [5]

Ans:

<table>
<thead>
<tr>
<th>Nerve</th>
<th>Source</th>
<th>Innervation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subcostal</td>
<td>Ventral primary ramus of T12</td>
<td>Muscles of the abdominal wall</td>
</tr>
<tr>
<td>Lumbar nerve</td>
<td>Ventral primary rami of spinal nerves L1-L5</td>
<td>Numerous: see lumbar and sacral plexuses</td>
</tr>
<tr>
<td>Lumbosacral trunk</td>
<td>Part of the ventral primary ramus of L4 united with the ventral primary ramus of L5</td>
<td>Muscles of hip &amp; post thigh</td>
</tr>
<tr>
<td>Femoral nerve</td>
<td>Lumbar plexus (ventral primary rami of spinal nerves L2-L4)</td>
<td>Sartorius, rectus femoris, vastus lateralis, vastus intermedius, vastus medialis, pectineus</td>
</tr>
<tr>
<td>Femoral cutaneous lateral</td>
<td>Lumbar plexus (ventral primary rami of spinal nerves L2-L3)</td>
<td>Sympathetic motor innervation to skin</td>
</tr>
<tr>
<td>Genitofemoral nerve</td>
<td>Lumbar plexus (ventral primary rami of spinal nerves L1-L2)</td>
<td>Cremaster muscle</td>
</tr>
<tr>
<td>Obturator</td>
<td>Lumbar plexus (ventral</td>
<td>Muscles of the medial thigh: adductor longus m.,</td>
</tr>
</tbody>
</table>

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nerve | primary rami of spinal nerves L2-L4 | adductor brevis m. And adductor magnus m., gracilis m., obturator externus m.
---|---|---
**Lumbar splanchnic n.** | Lumbar sympathetic ganglia L1-L4 | Smooth muscle of vessels that supply the abdominal and pelvic viscera
**Pelvic splanchnic n.** | Ventral primary rami of spinal nerves S2-S4 (cell bodies are located in the lateral horn gray of the sacral spinal cord) | Smooth muscle and glands of the gut distal to the left colic flexure; smooth muscle and glands of all pelvic viscera
**Sacral pelvic nerve** | Sacral sympathetic ganglia | Vascular smooth muscle of the pelvic viscera

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**Annual 2009**

Q1: Define varicocele. Why incidence of left side varicocele is more than right side?  [1,4]
Ans:
**Definition:**
The vine like Pampiniform plexus might get dilated and tortuous producing a varicocele which is usually visible during straining and standing. It could result from defective valves in testicular vein or renal vein problems leading to distension of the plexus.

- INCIDENCE OF LEFT SIDED is more common because of the right angle at which the left testicular vein enters the left renal vein, whereas, right testicular vein enters the IVC at an acute angle. & because left testicular vein is longer than right and it’s also crossed by colon which may compress it when loaded.

Q2: A patient comes with fever and tenderness b/w anal canal and right ischial tuberosity.
A: Identify the space involved and give its boundaries.  [1, 2]
Ans:
The ischioanal fossae (formerly called ischiorectal fossae) on each side of the anal canal are large fascial-lined, wedge-shaped spaces between the skin of the anal region and the pelvic diaphragm. The apex of each fossa lies superiorly where the levator ani muscle arises from the obturator fascia. The two ischioanal fossae communicate by means of the deep postanal space over the anococcygeal ligament (body), a fibrous mass located between the anal canal and the tip of the coccyx.

- Each ischioanal fossa is bounded:
  - Laterally by the ischium and overlapping inferior part of the obturator internus, covered with obturator fascia.
  - Medially by the external anal sphincter, with a sloping superior medial wall or roof formed by the levator ani as it descends to blend with the sphincter; both structures surround the anal canal.
  - Posteriorly by the sacrotuberous ligament and gluteus maximus.
  - Anteriorly by the bodies of the pubic bones, inferior to the origin of the puborectalis. These parts of the fossae, extending into the UG triangle superior to the perineal membrane (and musculature on its superior surface), are known as the anterior recesses of the ischioanal fossae.

B: Enlist its Contents  [2]
It’s filled with fat and loose connective tissue, and contains pudendal canal. Inferior rectal artery and nerve. Inferior Anal nerves.

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Q5: During removal of gall bladder, surgeon stopped bleeding by putting his index finger into epiploic foramen and pressed the structure. Justify it. What is epiploic foramen, give its boundaries. [1, 1, 3]

Ans:
- Epiploic foramen contains hepatic artery proper, hepatic vein and bile duct. So by pressing these structures bleeding was stopped.
- Epiploic foramen is opening of lesser sac into greater sac behind the right free margin of lesser omentum.

Boundaries:
- Anteriorly: Right free margin of lesser omentum containing porta hepatis.
- Posteriorly: IVC, right suprarenal gland and T12 vertebra.
- Superiorly: Caudate process of liver.
- Inferiorly: First part of duodenum and horizontal part of hepatic artery.

Annual 2010

Q4: Give the embryological origin, arterial and nerve supply, venous drainage of anal canal above and below the pectinate line. Give reason for internal hemorrhoids being painless. [04, 01]

Ans:

<table>
<thead>
<tr>
<th>Anal canal below and above pectinate line.</th>
<th>Above</th>
<th>Below</th>
</tr>
</thead>
<tbody>
<tr>
<td>Embryo origin</td>
<td>Hind gut</td>
<td>Proctodeum</td>
</tr>
<tr>
<td>Nerve supply</td>
<td>Visceral motor and sensory</td>
<td>Somatic motor and sensory</td>
</tr>
<tr>
<td>Venous</td>
<td>Portal</td>
<td>Caval</td>
</tr>
<tr>
<td>Lymph</td>
<td>Internal iliac nodes</td>
<td>Super. inguinal nodes</td>
</tr>
<tr>
<td>Arteries</td>
<td>Inf mesenteric</td>
<td>Internal iliac</td>
</tr>
</tbody>
</table>

- Internal hemorrhoids are usually painless since the visceral nerves that are above the dentate line do not sense pain, only pressure. This area does not contain sensory nerve supply.

Q6:
A: Name the hernia entering inguinal canal at deep inguinal ring. Give its relation to inf. epigastric artery. [0.5, 1]

Ans:
- Direct Inguinal Hernia, It is lateral to inferior epigastric artery.

B: Enlist the structure forming the posterior wall and floor of inguinal canal. Give contents of canal in female. [1, 1.5, 1]

Ans:

<table>
<thead>
<tr>
<th>Boundary</th>
<th>Deep Ring/Lateral Third</th>
<th>Middle Third</th>
<th>Lateral Third/Superficial Ring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posterior wall</td>
<td>Transversalis fascia</td>
<td>Transversalis fascia</td>
<td>Inguinal falk (conjoint tendon) plus reflected inguinal ligament</td>
</tr>
<tr>
<td>Anterior wall</td>
<td>Internal oblique plus lateral crus of aponeurosis of</td>
<td>Aponeurosis of external oblique (lateral crus and)</td>
<td>Aponeurosis of external oblique (intercrural fibers)</td>
</tr>
<tr>
<td>Roof</td>
<td>Iliopubic tract</td>
<td>Transversalis fascia</td>
<td>Musculoaponeurotic arches of internal oblique and transverse abdominal</td>
</tr>
<tr>
<td>------------</td>
<td>-----------------</td>
<td>----------------------</td>
<td>-------------------------------------------------</td>
</tr>
</tbody>
</table>

**Contents:** The main occupant of the inguinal canal is the spermatic cord in males and the round ligament of the uterus in females. The inguinal canal also contains blood and lymphatic vessels and the ilioinguinal nerve in both sexes.

---

**Q5: A patient has prostatic cancer**

A: How can such enlargements be examined clinically, enumerate the lobes of prostate.  

**Ans:**

The prostate is examined for enlargement and tumors (focal masses or asymmetry) by digital rectal examination. The palpability of the prostate depends on the fullness of the bladder. A full bladder offers resistance, holding the gland in place and making it more readily palpable. The malignant prostate feels hard and often irregular.

Lobes of prostate:
- The isthmus of the prostate.
- The interposterior (posterior) lobe, it is readily palpable by digital rectal examination.
- The right and left (lateral) lobes on either side of the urethra form the major part of the prostate.
- The middle (median) lobe lies between the urethra and the ejaculatory ducts and is closely related to the neck of the bladder. Enlargement of the middle lobe is believed to be at least partially responsible for the formation of the nodule that may project into the internal urethral orifice.

B: Give various routes of metastasis in malignancy.  

**Ans:**

In advanced stages, cancer cells metastasize both via lymphatic routes (initially to the internal iliac and sacral lymph nodes and later to distant nodes) and via venous routes (by way of the internal vertebral venous plexus, to the vertebrae and brain).

---

**Q6: Name facial coverings of spermatic cord mentioning the source. Enlist contents of cord.**  

**Ans:**

Facial coverings of spermatic cord:
- Internal spermatic fascia: derived from the transversalis fascia.
- Cremasteric fascia: derived from the fascia of both the superficial and the deep surfaces of the internal oblique muscle.
- External spermatic fascia: derived from the external oblique aponeurosis and its investing fascia.

The constituents of the spermatic cord are the following:
- Ductus deferens or deferent duct: a muscular tube approximately 45 cm long that conveys sperms from the epididymis to the ejaculatory duct.
- Testicular artery: arising from the aorta and supplying the testis and epididymis.
• Artery of the ductus deferens: arising from the inferior vesical artery.
• Cremasteric artery: arising from the inferior epigastric artery.
• Pampiniform venous plexus: a network formed by up to 12 veins that converge superiorly as right or left testicular veins.
• Sympathetic nerve fibers on arteries and sympathetic and parasympathetic nerve fibers: on the ductus deferens.
• Genital branch of the genitofemoral nerve: supplying the cremaster muscle.
• Lymphatic vessels: draining the testis and closely associated structures and passing to the lumbar lymph nodes.
• Vestige of the processus vaginalis: may be seen as a fibrous thread in the anterior part of the spermatic cord extending between the abdominal peritoneum and the tunica vaginalis; it may not be detectable.

Q7: Give blood supply of abdominal part of ureter. Enlist site of ureteric obstruction by stones. Why its pain is referred to lumbar or inguinal region?  
[1.5, 1.5, 02]
Ans:
Blood Supply:
Arterial branches to the abdominal portion of the ureter arise consistently from the renal arteries, with less constant branches arising from the testicular or ovarian arteries, the abdominal aorta, and the common iliac arteries.

Ureteric constrictions:
The ureters are normally constricted to a variable degree in three places:
(1) at the junction of the ureters and renal pelvis.
(2) where the ureters cross the brim of the pelvic inlet.
(3) during their passage through the wall of the urinary bladder. These constricted areas are potential sites of obstruction by ureteric (kidney) stones.

Referred Pain:
The nerves of the abdominal part of the ureters derive from the renal, abdominal aortic, and superior hypogastric plexuses. Visceral afferent fibers conveying pain sensation (e.g., resulting from obstruction and consequent distension) follow the sympathetic fibers retrograde to spinal ganglia and cord segments T11-L2. Ureteric pain is usually referred to the ipsilateral lower quadrant of the anterior abdominal wall and especially to the groin.

Q5: A young man got pubic rami fractured. And a fluid was present in peritoneal cavity due to rupture of an organ.
A: Name the pelvic organ most likely rupture. Mention its peritoneal relations.  
[1, 1]
Ans:
➢ Fracture of pubic rami damages urinary bladder.
➢ Its upper surface is covered with peritoneum. Posteriorly it has utero-vesical pouch in females and rectovesical pouch in males. Laterally it has paravesical fossa of peritoneum.

B: What is pelvic girdle. Name weak areas of bony pelvis for fracture.  
[1.5, 1.5]
Ans:
Pelvic girdle:
In the mature individual, the pelvic girdle is formed by three bones:
• Right and left hip bones (coxa; pelvic bones): large, irregularly shaped bones, each of which develops from the fusion of three bones, the ilium, ischium, and pubis.
• Sacrum: formed by the fusion of five, originally separate, sacral vertebrae.
Weak areas of bony pelvis:
Weak areas of the pelvis, where fractures often occur, are the pubic rami, the acetabula (or the area immediately surrounding them), the region of the sacroiliac joints, and the alae of the ilium.

Q6: Give the nerve supply of abdominal peritoneum. Enumerate structures forming the boundaries of lesser sac. [02, 03]

Ans:
Nerve supply:
- Parietal peritoneum:
  - Its blood & nerve supply is same as of abdominal wall. Because its somatic innervation so its sensitive to pain. (Lower six thoracic/5 intercostal + subcostal nerve and 1st lumbar via its iliohypogastric & ilioinguinal branches)
- Visceral peritoneum:
  - Its blood & nerve supply is same as those of underlying viscera because its autonomic so visceral peritoneum evokes pain when viscera is stretched, ischemic or distended. (Parasympathetic via vagus + splanchnic nerves, sympathetic via sympathetic trunk + coeliac plexuses + ganglions)

Boundaries of lesser sac:
- Ant wall:
  - Caudate lobe of liver, lesser omentum, stomach
- Post wall:
  - Stomach bed
- Right border:
  - Floor of epiploic foramen, reflection of peritoneum to pancreas + duodenum (1st part post)
- Left border:
  - Gastrophrenic + gastroplenic + lienorenal ligament
- Upper border:
  - Diaphragm à esophagus (peritoneal reflection), fissure for ligamentum venosum
- Lower border:
  - Layers of greater omentum

Q7: Give the arterial supply of duodenum above the entry of bile duct. Give anatomical relations of 3rd part of duodenum. [01, 04]

Ans:
Blood Supply:
- As entry of bile duct in duodenum represents the junction of foregut & midgut so above the bile duct means 1st part of duodenum that is derived from foregut & its arterial
- Supply is from sup pancreaticoduodenal artery, branch of gastroduodenal) additionally from right gastric artery + supraduodenal artery (br of hepatic, retro duodenal (branch of gastroduodenal) & branches of right gastropiploic artery

Anatomical relations of 3rd part of duodenum:
- Peritoneal relations:
  - Its retroperitoneal, ant part is covered with peritoneum except in median plane where its crossed by sup mesenteric vessels.
Visceral relations:
- Ant: sup mesenteric vessels + root of mesentery
- Post: RT ureter, RT psoas major, RT gonadal vessels, IVC, Abdominal aorta
- Sup: head of pancreas with uncinate process
- Inf: coils of jejunum

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