

STRUCTURAL BASIS OF MEDICAL PRACTICE  
EXAMINATION 3

September 21, 2006

PART I. Answer in the space provided. (8 pts)

1. Identify the region. (0.5 pt)

a. Right Hypochondriac

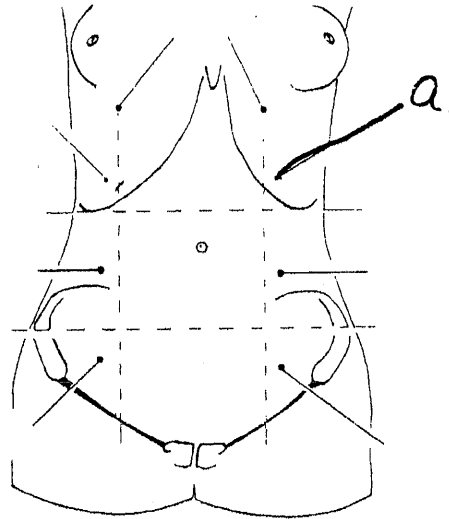


Figure 4.03. The nine abdominal regions.

2. Identify the structures. (1 pt)

a. Diaphragm  
b. Lateral femoral cutaneous nerve

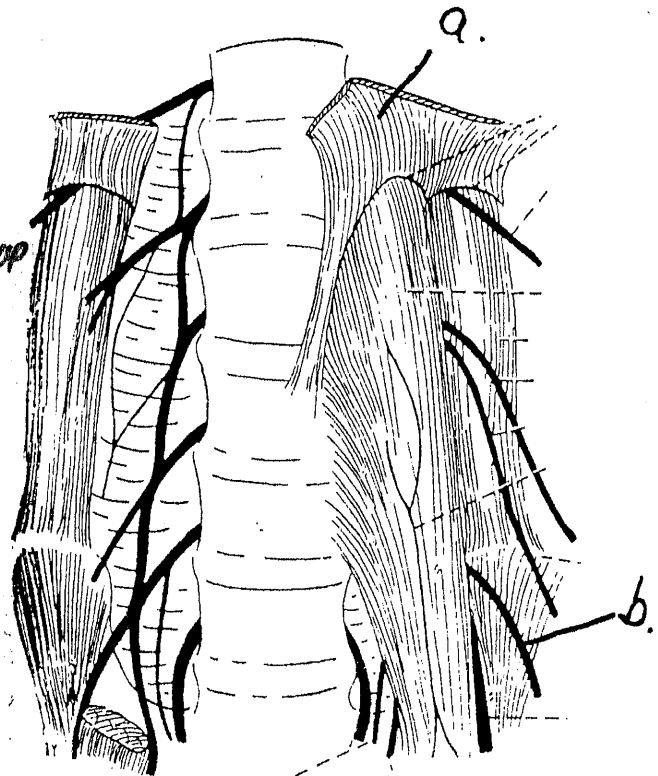


FIGURE 25-2.  
The lumbar plexus

3. Identify the structures. (1 pt)

- a. UDs (ductus) deferens
- b. Pampiniform plexus of veins

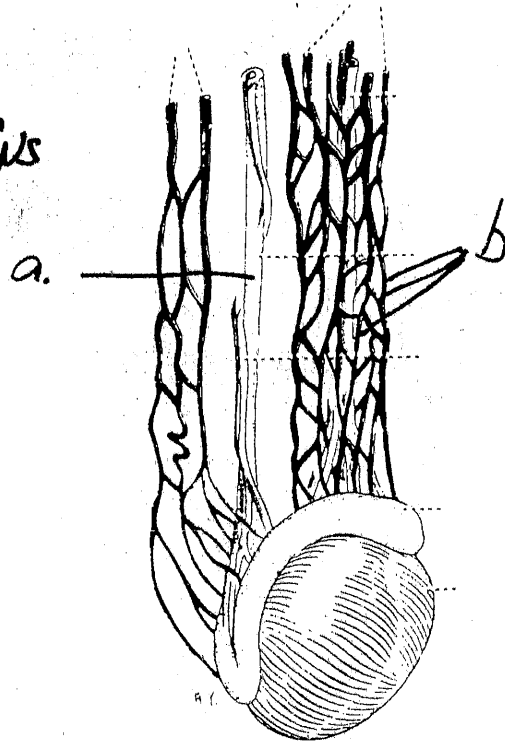
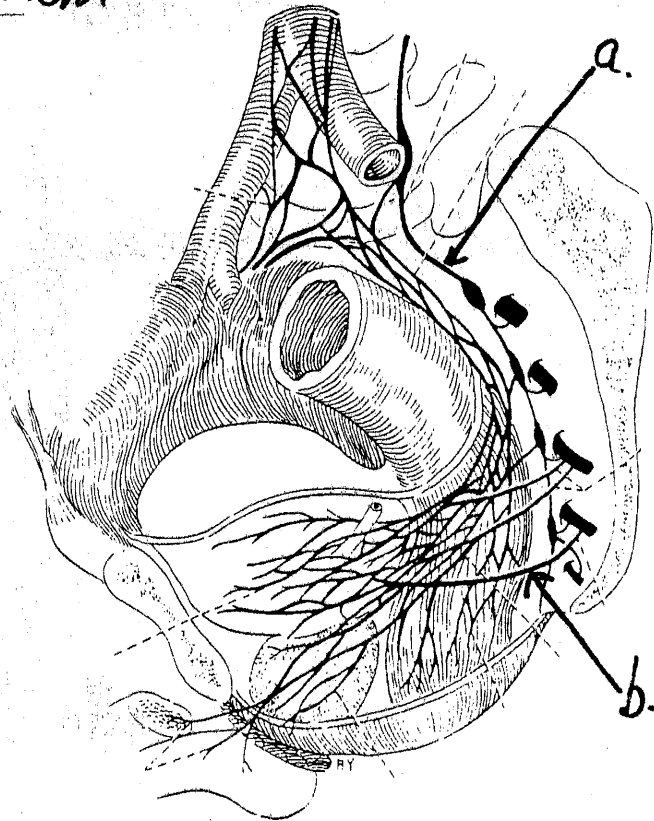


FIGURE 26-6.  
Blood supply of the testis.

4. Identify the structure. (1 pt)

- a. Sympathetic Trunk
- b. Pelvic Splanchnic Nerve



5. Identify the structures. (1 pt)

- a. Common Bile Duct
- b. Superior Mesenteric Artery

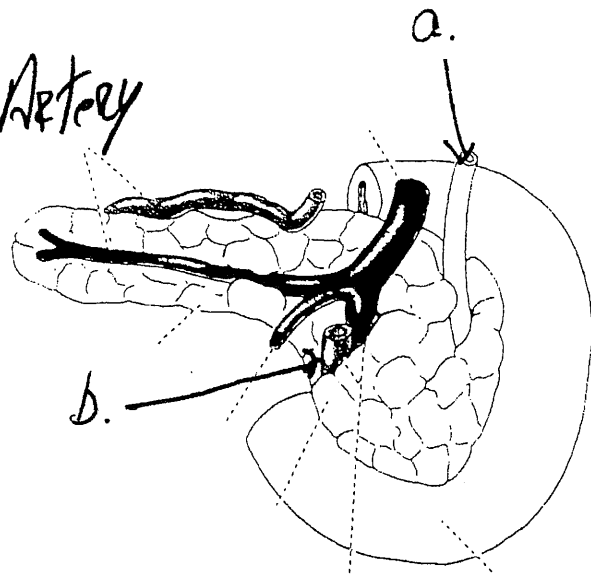


FIGURE 24-19.  
Posterior view of the pancreas.

6. Identify the structures. (1 pt)

- a. Dorsal/Ancro of Penis
- b. Deep Artery of Penis

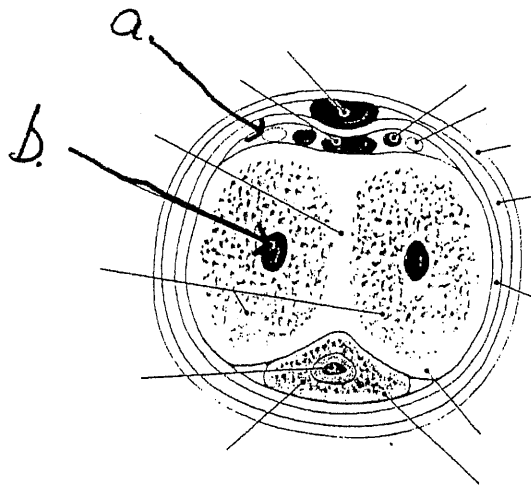


Figure 5.09. Transverse section through the body of the penis.

7. Identify the structure. (1 pt)

- a. Anococcygeal raphe
- b. Nervus terminalis

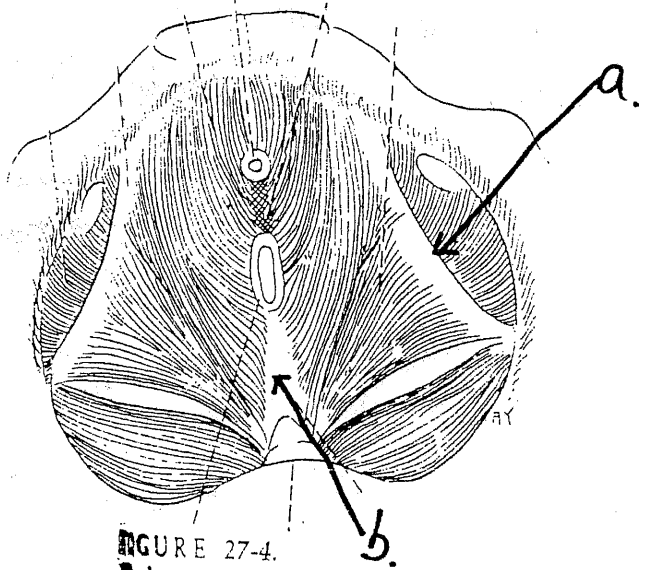


FIGURE 27-4.  
The levator ani from above.

8. Identify the structure. (1.5 pts)

- a. Perineal body (Central tendon)
- b. Inferior Rectal Vessels
- c. Deep Pteryx of Clitoris

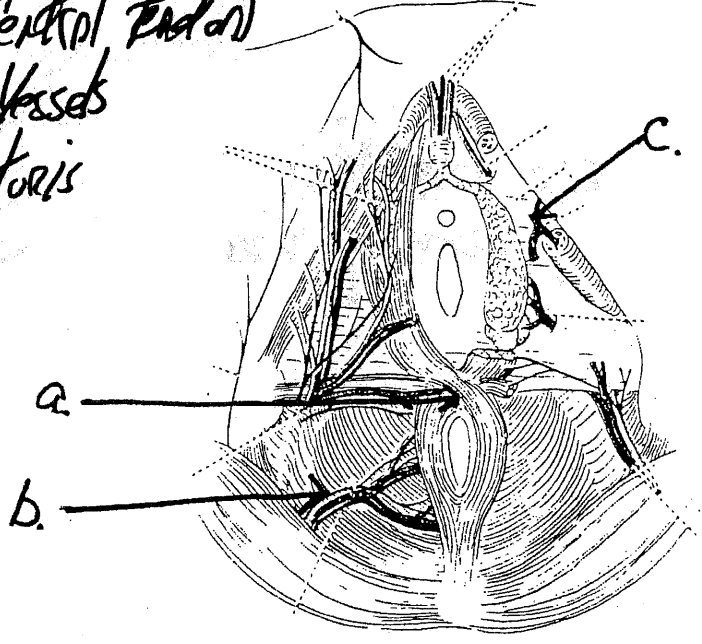


FIGURE 28-23.  
Nerves and vessels of the female perineum.

## Part II. Circle the correct answer. All, none, or some may apply. (26 pts)

1. With respect to the abdominal wall:

- a.  a. Nerves and vasculature of the anterior abdominal wall travel in the neurovascular plane, located between the external oblique and transversus abdominis muscles.
- b. The paraumbilical veins in the anterior abdominal wall drain, in part, to the superficial epigastric vein.
- c. Scarpa's fascia continues into the penis as Buck's fascia.
- d. The suspensory ligament is a specialization of tela subcutanea.
- e. The paraumbilical veins drain, in part, to the portal vein.
- f. The internal oblique muscle arises, in part, from the lateral two-thirds of the inguinal ligament.
- g. The umbilicus and the iliac crest are at the level of approximately L4.
- h. The pectineal ligament is derived from the inguinal and lacunar ligaments.

2. With respect to the abdominal vasculature:

- a. The portal vein is formed posterior to the neck of the pancreas.
- b. The inferior vena cava is formed by the junction of the two common iliac veins at about the level of L5.
- c. The ovarian arteries are branches of the anterior division of the internal iliac artery.
- d. The middle suprarenal arteries arise from the aorta at or superior to the origin of the renal artery.
- e. The left renal vein drains directly into the inferior vena cava.
- f. The renal arteries arise just inferior to the inferior mesenteric artery.
- g. The short gastric arteries are located in the gastrosplenic ligament.
- h. The anterior, but not the posterior, superior pancreaticoduodenal artery is intraperitoneal.

3. In the nervous system associated with the abdomen and pelvis:
- a. Transection of the spinal cord only through the dorsal root at S2-4 produces an "atonic" bladder.
  - b. The ischiocavernosus muscle is skeletal muscle innervated by perineal branches of the pudendal nerve.
  - c. The corpus spongiosum is innervated by somatic nerves associated with the pudendal nerve.
  - d. Helicine arteries are stimulated to vasodilate by the parasympathetic nervous system.
  - e. Parasympathetic (autonomic) nerves, derived from the pelvic splanchnic nerves, stimulate peristalsis in the sigmoid colon.
  - f. Sympathetic innervation of the duodenum is by way of the lumbar splanchnic nerves.
  - g. The sacral sympathetic trunk has white rami communicans.
  - h. The posterior scrotal/labial nerves are derived from the pudendal nerve.
4. With regard to the thoracic diaphragm
- a. The esophageal hiatus is formed by the left crus.
  - b. The thoracic duct ascends through the aortic hiatus.
  - c. The median arcuate ligament is derived from the right and left crus.
  - d. The vagal trunks pass from the thorax to the abdomen through the esophageal hiatus.
  - e. The foramen for the inferior vena cava lies at approximately the level of T10.
  - f. The sympathetic trunks descend deep (posterior) to the medial arcuate ligaments.
  - g. The azygous and hemiazygous veins pass through the aortic hiatus.
  - h. The lumbocostal trigone is a potential area of weakness just superior to the lateral arcuate ligament.
5. With respect to the fascia of the abdomen, pelvis, and perineum:
- a. The superior, but not the inferior, fascia of the urogenital diaphragm is considered parietal pelvic fascia.

- b. The arcus tendineus is a specialization of the obturator internus fascia.
  - c. The inferior surface of the thoracic diaphragm is associated with transversalis fascia.
  - d. The periprostatic fascia is a specialization of the parietal pelvic fascia.
  - e. The visceral pelvic fascia forms the renal fascia.
  - f. The Cardinal ligaments are specializations of the visceral pelvic fascia.
  - g. The pudendal canal is formed by parietal pelvic fascia.
  - h. The perirenal fat is derived from extraperitoneal connective tissue.
6. With regard to the abdomen, pelvis, and perineum:
- a. The sacrum is composed of 5 vertebrae.
  - b. The pelvic outlet is formed by the superior aspect of the pubic symphysis, the pelvic brim, and the sacral promontory.
  - c. In females, the greater (false) pelvis is shallower than in males.
  - d. The trigone of the bladder is formed by detrusor muscle.
  - e. The artery of the ductus (vas) deferens is derived from the inferior epigastric artery.
  - f. Venous drainage superior to the pectinate line is to the inferior rectal veins.
  - g. The prostatic sinus is located on the seminal colliculus.
  - h. The "puborectal sling" refers to the pubococcygeus muscle.
  - i. The caudate lobe and the left half of the quadrate lobe of the liver are part of the structural vascular distribution of blood vessels of the left lobe.
  - j. The umbilical arteries carry oxygenated blood to the fetus.
  - k. The superior mesenteric vessels arise superior to the 3rd part of the duodenum.
  - l. The duodenal cap does not contain plicae circulares.





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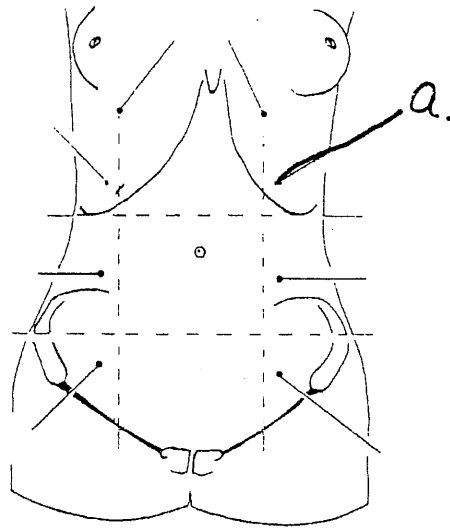


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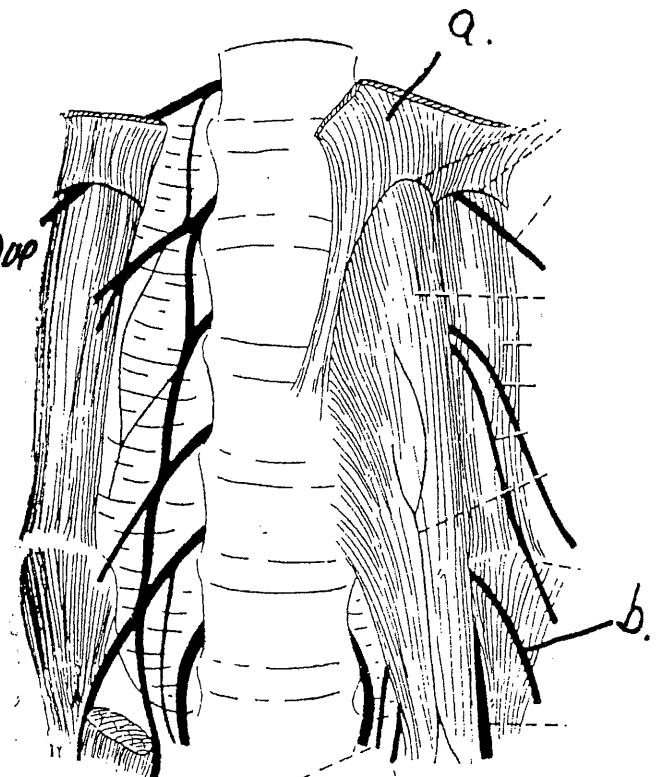


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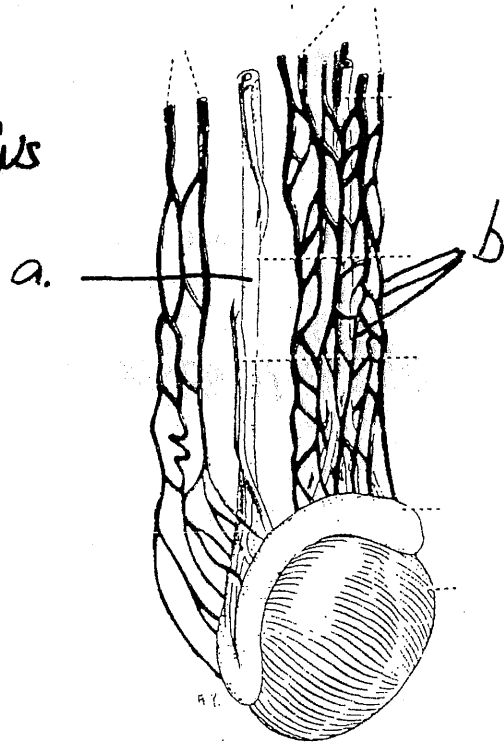
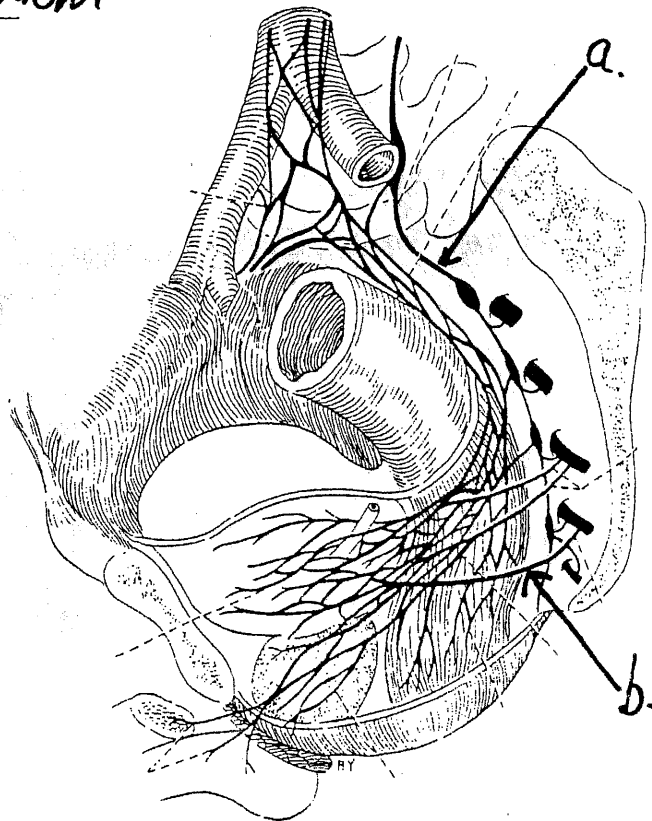


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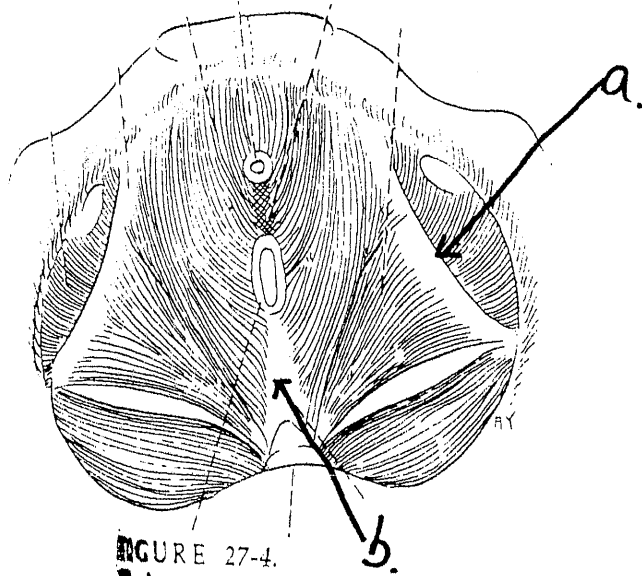


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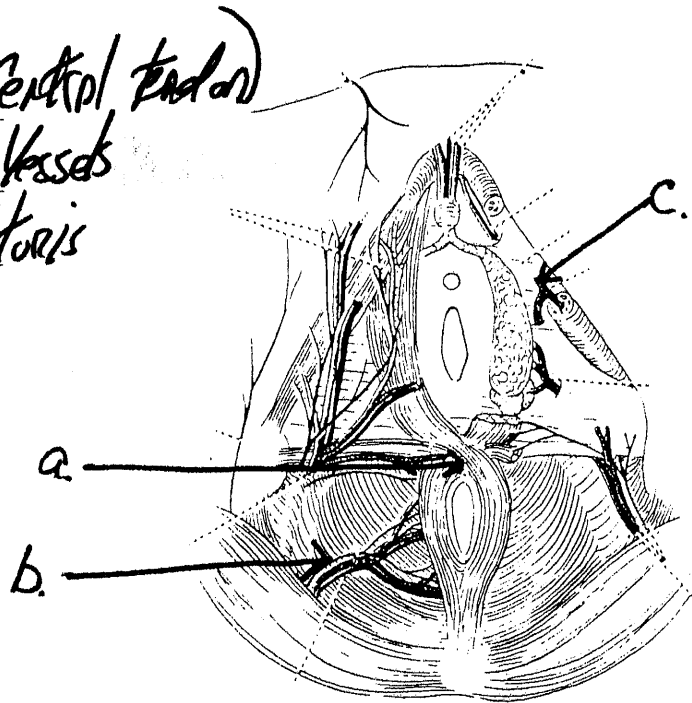


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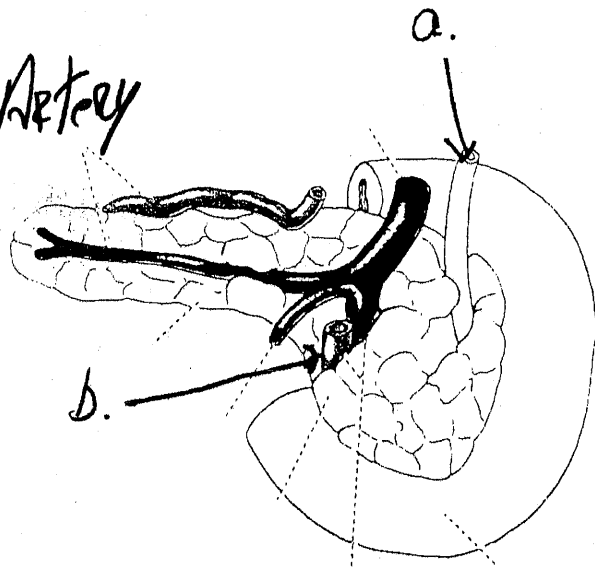


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Posterior view of the pancreas.

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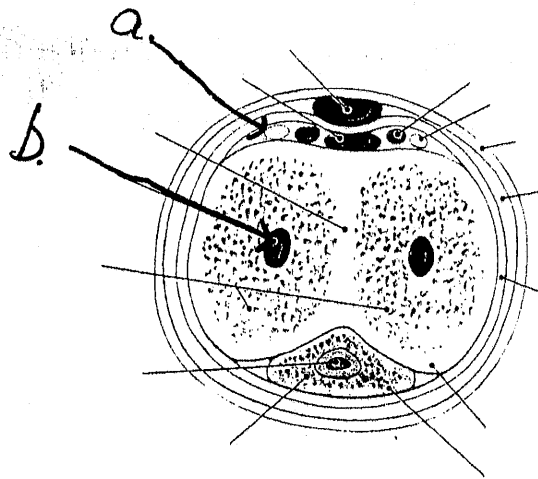


Figure 5.09. Transverse section through the body of the penis.

## Written Examination Part IV. (36 pts) - Essay: Abdomen, Pelvis, and Perineum (September 21, 2006)

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Ischiorectal Fossa

Left Kidney

Uterus, Uterine Tubes, and Ovary

Comments and Suggestions

**Note: This is an outline of topics to be covered. It is not the "answer key." It is an answer guide.**

### Ischiorectal Fossa

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**Discuss the boundaries and contents of the ischiorectal fossa, fascial specializations, vascularization, innervation, lymphatic drainage, the relationship of the ischiorectal fossa to the superficial and deep pouches, and provide an explanation of your observation that urine does not accumulate in the superficial pouch. (12 pts)**

- General
  - Wedge shaped area located between the ischial tuberosities and the anorectal canal and consisting of a posterior recess and an anterior superior recess.
- Boundaries of Anterior Superior Recess
  - Superior - inferior fascia of the pelvic diaphragm, most lateral and superior is arcus tendineus
  - Inferior - superior fascia of the urogenital diaphragm
  - Anterior - fusion of superior fascia urogenital diaphragm (transverse perineal ligament) with inferior fascia of pelvic diaphragm at the pubic bone
  - Posterior - open into the posterior recess of the ischiorectal fossa
  - Lateral - inferior - conjoint ramus, intermediate - obturator internus muscle
  - Medial - fusion of the inferior fascia of the pelvic diaphragm with superior fascia urogenital diaphragm at urogenital hiatus
- Boundaries of Posterior Recess
  - Superior - inferior fascia of the pelvic diaphragm
  - Inferior - medial: perianal skin, lateral: gluteus maximus
  - Anterior - superior to posterior free edge urogenital diaphragm: anterior superior recess of the ischiorectal fossa, inferior to posterior free edge of urogenital diaphragm: superficial perineal fascia (Dartos)
  - Posterior - gluteus maximus
  - Lateral - gluteus maximus
  - Medial - anal canal
- Fascial specializations
  - Arcus tendineus - thickening of obturator internus fascia, faces pelvic cavity on superior aspect and ischiorectal fossa on inferior aspect
  - Pudendal canal - thickened covering of obturator internus fascia over falciform edge along medial ischial tuberosity forms osseofibrous pudendal canal from lesser sciatic foramen to

the posterior free edge of the urogenital diaphragm at the conjoint ramus

- Contents and relationships
  - Loose areolar fat - accommodate distention
  - Anal canal
  - Pudendal nerve and branches - inferior rectal, perineal, posterior scrotal, dorsal nerve
  - Internal pudendal artery and branches - inferior rectal, perineal, posterior scrotal, dorsal artery, deep artery, artery to the bulb
- What fascial barriers prevent spread of infection into the superficial pouch
  - Infection does not spread from the ischioanal fossa into the superficial pouch because Scarpa's fascia attaches to the posterior free edge of the UG diaphragm. This attachment provides part of the anterior border of the ischioanal fossa at levels inferior to the posterior free edge of the urogenital diaphragm.
- What fascial barriers prevent spread of infection into the deep pouch
  - Infection does not spread from the ischioanal fossa into the deep pouch because the superior fascia of the urogenital diaphragm provides a fascial barrier between the anterior superior recess of the ischioanal fossa and the deep pouch.

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## Left Kidney

**Discuss the structure, innervation, vasculature, lymphatics, and relationships of the left kidney. (12 pts)**

- Structure
  - medial and lateral margins
  - hilum and renal sinus
  - fibrous capsule
  - cortex and medulla
  - pyramids and renal papilla
  - major and minor calyx
  - renal pelvis
  - extends through hilum to become ureter
- Position
  - paravertebral gutters
  - 11th thoracic to 3rd lumbar vertebra
- Relations to peritoneum and fascia
  - perirenal fat - into renal sinus
  - renal fascia - condensation of ECT, open inferiorly (support and spread of infection)
  - paranal fat - outside renal fascia, envelopes suprarenal gland and kidney
- Relations to surrounding viscera (left kidney)
  - superior - suprarenal gland
  - inferior - false pelvis
  - posterior - diaphragm, lumbocosto trigone, 11-12 ribs, quadratus lumborum, psoas major
  - posteromedial - medial and lateral arcuate ligaments, subcostal nerve, ilio-costal nerve
  - anteromedial - aorta

- anterior - suprarenal g., omental bursa, stomach and leinorenal lig., spleen, tail of pancreas, left colic flexure, intestine, descending colon
- Relations at the hilum
  - anterior to posterior - renal vein, renal artery, renal pelvis
- Sensory and motor innervation
  - preganglionic sympathetics - imlcc of T10-12, synapse in aorticorenal g.
  - postganglionic sympathetics - renal plexus
  - sensory - T10 - L1, follow renal plexus, referred pain
- vascular supply
  - left renal vein - crosses aorta in "nutcracker", anterior to renal artery,
  - left renal artery at level of L3,
- lymphatic drainage
  - lumbar nodes

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## Uterus, Uterine Tubes, and Ovary

Indicate your understanding of the uterus, uterine tubes, and ovary as to structure, orientation, relationships (anterior, posterior, superior, inferior, medial, lateral), support(s), and peritoneal associations, innervation (e.g., preganglionic, postganglionic, afferents, pawtways), vasculature, and lymphatics. (12 pts)

- Uterus
  - Structure
    - Pear shaped hollow organ - 8cm long, 5cm wide
    - myometrium and endometrium
    - cervix, body, fundus
    - external os, cervical canal, internal os, uterine cavity
  - Orientation
    - anteflexed and anteverted (lengthens posterior fornix vagina)
  - Support
    - intraperitoneal organ
    - Broad lig. - visceral lig (peritoneum)
      - lateral uterus to parietal peritoneum of lateral pelvic wall
    - fibrous lig's derived from endopelvic fascia
      - utereosacral, pubouteral, and lateral cervical (Cardinal) lig's.
    - round lig to lateral anterior pelvic brim - anterior lamina broad lig.
    - ovarian lig to posterior abdominal wall via suspensory lig. ovary
  - Relationships
    - anterior: bladder, vesicouterine pouch
    - posterior: rectum, rectouterine pouch
    - superior: false pelvis, abdominal cavity
    - inferior: vagina, posterior fornix, rectouterine pouch
    - lateral: broad lig, pelvic wall, ovary, uterine tube
  - vasculature and lymphatics,

- uterine a. at the cervix and ovarian a. at the fundus
      - ovarian v. to ivc on right and left renal v. on left
      - uterine venous complex into internal iliac vv.
    - fundus drains lymph to upper lumbar nodes along ovarian vessels
    - superior body near round ligament drains lymph to superficial inguinal nodes
    - cervix drains lymph toward internal iliac nodes
  - innervation
    - sympathetic by way of inferior hypogastric plexus to uterovaginal plexus along uterine a.
      - preganglionic in IMLCC lower thoracic and upper lumbar
      - postganglionic in microscopic ganglia of aortic and hypogastric plexuses
    - parasympathetic: unknown if present
    - sensory pain follow sympathetic pathways (eg. hypogastric nerves)
- Uterine Tube
  - Structure
    - shaped as a salpinx and about 10 cm long
    - connects uterine cavity to the peritoneal cavity
    - isthmus, ampulla, infundibulum, fimbriae
  - Orientation
    - courses laterally from fundus of uterus toward pelvic wall
    - intraperitoneal in superior free edge of broad lig.
    - cradles ovary as a posterior relation
  - Support
    - mesosalpinx - visceral lig (peritoneum) part of broad lig.
      - continuous with mesovarium
    - ovarian lig to posterior abdominal wall via suspensory lig. ovary
  - Relations
    - anterior: bladder, vesicouterine pouch
    - posterior: broad lig., rectum, rectouterine pouch, ovary
    - superior: false pelvis, abdominal cavity
    - inferior: broad lig., rectouterine pouch
    - lateral: broad lig, pelvic wall, ovary, ovarian fossa, uterine tube
    - medial: fundus and body of uterus
  - vasculature and lymphatics,
    - tubal a., uterine a. at the cervix and ovarian a. at the fundus
      - uterine venous complex to internal iliac vv
    - drains lymph to upper lumbar nodes along ovarian vessels
    - drains lymph to superficial inguinal nodes
    - drains lymph toward internal iliac nodes
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**Part II. Circle the correct answer. All, none, or some may apply. (26 pts)**

1. With respect to the abdominal wall:

- a. Nerves and vasculature of the anterior abdominal wall travel in the neurovascular plane, located between the external oblique and transversus abdominis muscles.
- b. The paraumbilical veins in the anterior abdominal wall drain, in part, to the superficial epigastric vein.
- c. Scarpa's fascia continues into the penis as Buck's fascia.
- d. The suspensory ligament is a specialization of tela subcutanea.
- e. The paraumbilical veins drain, in part, to the portal vein.
- f. The internal oblique muscle arises, in part, from the lateral two-thirds of the inguinal ligament.
- g. The umbilicus and the iliac crest are at the level of approximately L4.
- h. The pectineal ligament is derived from the inguinal and lacunar ligaments.

2. With respect to the abdominal vasculature:

- a. The portal vein is formed posterior to the neck of the pancreas.
- b. The inferior vena cava is formed by the junction of the two common iliac veins at about the level of L5.
- c. The ovarian arteries are branches of the anterior division of the internal iliac artery.
- d. The middle suprarenal arteries arise from the aorta at or superior to the origin of the renal artery.
- e. The left renal vein drains directly into the inferior vena cava.
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- g. The short gastric arteries are located in the gastrolial ligament.
- h. The anterior, but not the posterior, superior pancreaticoduodenal artery is intraperitoneal.

3. In the nervous system associated with the abdomen and pelvis:
- a. Transection of the spinal cord only through the dorsal root at S2-4 produces an "atonic" bladder.
  - b. The ischiocavernosus muscle is skeletal muscle innervated by perineal branches of the pudendal nerve.
  - c. The corpus spongiosum is innervated by somatic nerves associated with the pudendal nerve.
  - d. Helicine arteries are stimulated to vasodilate by the parasympathetic nervous system.
  - e. Parasympathetic (autonomic) nerves, derived from the pelvic splanchnic nerves, stimulate peristalsis in the sigmoid colon.
  - f. Sympathetic innervation of the duodenum is by way of the lumbar splanchnic nerves.
  - g. The sacral sympathetic trunk has white rami communicans.
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5. With respect to the fascia of the abdomen, pelvis, and perineum:
- a. The superior, but not the inferior, fascia of the urogenital diaphragm is considered parietal pelvic fascia.

- sympathetic by way of ovarian plexus
- parasympathetic: unknown if present
- sensory pain follow sympathetic pathways
- Ovary
  - structure and support
    - The ovary is roughly cylindrical about 3 cm long and 1 cm in diameter. The visceral peritoneum covering the ovary gives way to a specialized germinal epithelial cell layer. The egg is able to penetrate this layer and enter the peritoneal cavity.
    - The ovary is suspended from the posterior lamina of the broad ligament by the mesovarium -- a peritoneal ligament. Supporting the superior pole of the ovary to the pelvic brim is the suspensory ligament of the ovary. Supporting the inferior pole of the ovary to the lateral uterus is the ovarian ligament.
  - relationships
    - superior to the ovary is the pelvic brim and suspensory ligament
    - inferior to the ovary is the uterine wall and the ovarian ligament
    - anterior to the ovary is the broad ligament, uterine tube, and fimbria of uterine tube
    - posterior to the ovary is the rectum and pelvic floor
    - medial to the ovary is the pararectal fossa, rectouterine pouch, fundus of the uterus
    - lateral to the ovary is the ovarian fossa (internal iliac a. and ureter), psoas major muscle, and obturator n.
  - innervation (motor and sensory)
    - Parasympathetic preganglionic cell bodies are located in the central gray of the spinal cord (IMLCC) at levels S2-4. Preganglionic fibers enter the inferior hypogastric plexus by way of the pelvic splanchnic nerves. The inferior hypogastric plexus contributes a uterine plexus and then to the ovarian plexus. Postganglionic parasympathetic cell bodies are located in intrinsic ganglia of the ovary. The above pathway assumes that the uterovaginal plexus reaches the ovary. This is not known for certain. Parasympathetic preganglionic contributions from the vagus n. may also follow the ovarian plexus.
    - Sympathetic preganglionic cell bodies are located in the interomedial lateral cell column at cord levels T10 (and perhaps T11-12). Preganglionic fibers follow the lesser and least splanchnic nerves to aortic ganglia near (and including) the superior mesenteric ganglion and the aorticorenal ganglion. Postganglionic fibers from these ganglia enter the aortic plexus and extend along the ovarian artery as the ovarian plexus. Visceral afferent pathways follow the sympathetic pathways up to the T10 spinal level. Additional visceral pathways follow parasympathetic pathways back to the S3-4 spinal levels.
  - blood supply and lymphatics
    - The arterial supply is mostly from the ovarian arteries. These are paired arteries arising from the anterolateral surface of the aorta near the level of the third lumbar vertebra. The ovarian veins arise from the IVC on the right and the left renal vein on the left. Additional blood supply is by ascending branches of the uterine vessels (ovarian br.) that anastomose with the ovarian vascular supply. Lymph drainage is primarily along the embryological descent of the ovary. This includes upper lumbar

nodes in the vicinity of the renal arteries. Much of the vascular supply reaches the ovary through the suspensory ligament.

- Prolaps of Uterus
  - Weakening of the ligamentus support of the uterus leads to prolapse
    - most notably, the lateral cervical lig and important

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## Comments and Suggestions

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