

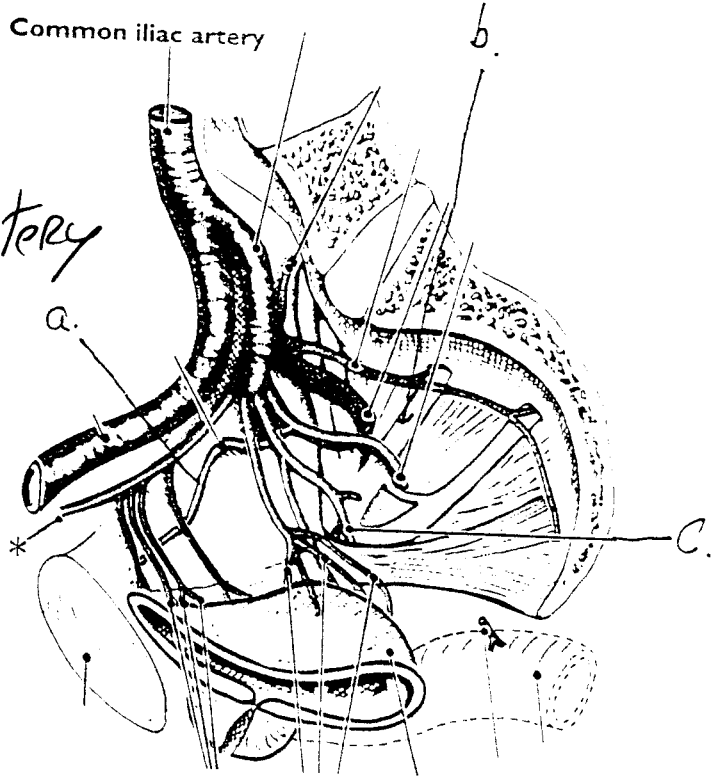
STRUCTURAL BASIS OF MEDICAL PRACTICE
EXAMINATION 3

September 25, 2003

PART I. Answer in the space provided. (5 pts)

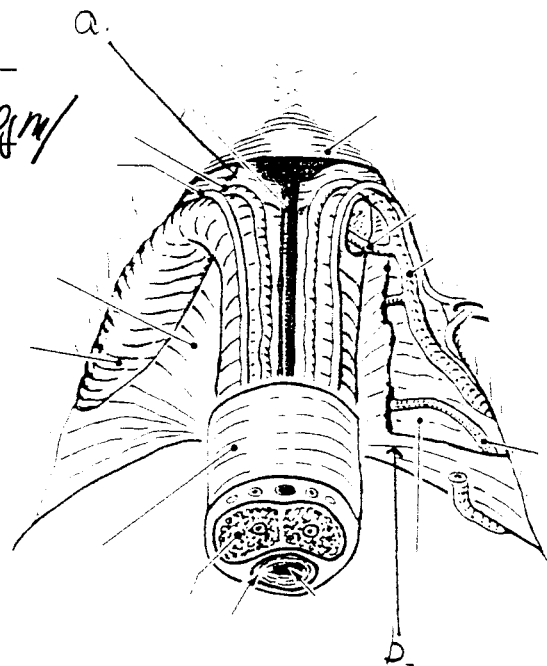
1. Identify the structures. (1.5 pts)

- a. Obturator Artery
- b. 1st Sacral Nerve
- c. Internal Pudendal Artery



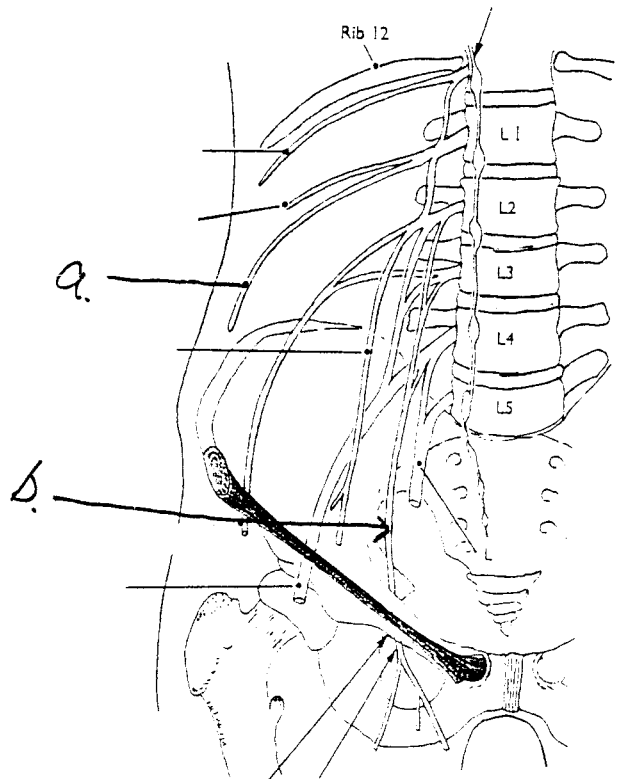
2. Identify the structures. (1 pt)

- a. Transverse Perineal Ligament
- b. Inferior Fascia of U.G. Diaphragm / Perineal Membrane



3. Identify the structures. (1 pt)

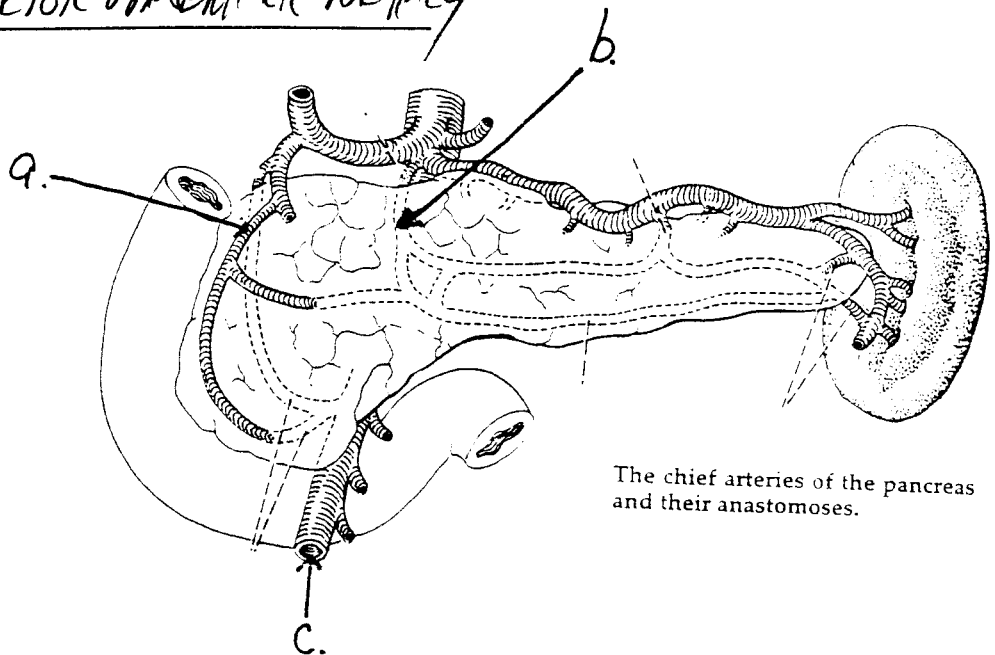
- a. Ilioinguinal Nerve
 b. Obturator Nerve



Lumbar plexus of nerves.

4. Identify the structures. (1.5 pts)

- a. Ant. Sup. Pancreatico-duodenal Artery
 b. Dorsal Pancreatic Artery
 c. Superior Mesenteric Artery



The chief arteries of the pancreas and their anastomoses.

Part II. Circle the correct answer. All, none, or some may apply. (28 pts)

1. With regard to the abdominal wall:
- a. The suspensory ligament ^{of the penis} is a condensation of the deep (investing) fascia.
- b. The external oblique muscle arises, in part, from the lateral two-thirds of the inguinal ligament.
- c. The transversus abdominis muscle arises, in part from the lateral one-third of the inguinal ligament.
- d. Tendinous insertions extend from the rectus abdominis muscle to the anterior rectus sheath.
- e. The internal oblique muscle is covered on its deep aspect by the transversalis fascia.
- f. Intercostal nerves 6-12 continue contribute to part of the innervation of the anterior abdominal wall musculature.
2. With respect to the inguinal region:
- a. A direct inguinal hernia that descends into the scrotum will be located in the testicular coelom and surrounded by the tunica vaginalis.
- b. The genital branch of the genitofemoral nerve innervates the cremaster muscle.
- c. Extraperitoneal connective tissue surrounds the spermatic cord.
- d. The parietal layer of the tunica vaginalis is also termed the tunica albuginea.
- e. The posterior scrotum is innervated by posterior scrotal nerves that arise from the perineal nerve, a branch of the pudendal nerve.
- f. The vas deferens contains smooth muscle innervated by somatic nerves.
- g. Venous drainage of the right testis is drained into the pampiniform plexus which forms the testicular vein that drains into the inferior vena cava.
- h. A direct inguinal hernia lies medial to the median umbilical ligament.
- i. Indirect inguinal hernias protrude superior and medial to the pubic tubercle.
- j. The deep inguinal ring is the site of a prolongation of the transversalis fascia into the inguinal canal.

3. With regard to lymphatic drainage of the abdomen, pelvis, and perineum:
- a. Cancer of the head of the pancreas may involve the celiac, superior mesenteric, and upper lumbar lymph nodes.
 - b. The intestinal lymph trunk terminates in the cisterna chyli.
 - c. The lumbar lymph nodes receive drainage from the pelvic viscera.
 - d. The right colic flexure has dual lymphatic drainage: along the middle colic and left colic arteries.
 - e. The lymphatic drainage of the rectum goes to the superior rectal lymphatic vessels and then to the superior mesenteric nodes.
 - f. The lesser curvature of the stomach has lymphatic drainage to the left and right gastric nodes
4. With respect to the abdomen:
- a. The head of the pancreas, as well as the uncinata process of the pancreas, are intraperitoneal structures.
 - b. Vasa recta of the ileum are shorter than those of the jejunum.
 - c. Haustra are found on the large, but not the small, intestine.
 - d. The short gastric arteries travel through the lienorenal ligament.
 - e. The proper hepatic artery is located in the hepatogastric ligament of the lesser omentum.
 - f. According to internal morphology (e.g., vasculature), the quadrate lobe and part of the caudate lobe belong to the left lobe of the liver.
 - g. The 3rd part of the duodenum courses horizontally at the level of L3.
 - h. The testicular arteries arise inferior to the renal arteries.
 - i. In the 5th embryonic week, the gastrointestinal tract herniates into the umbilicus and undergoes a 90 degree clockwise rotation.
 - j. The dorsal surface of the stomach becomes the greater curvature as a result of the clockwise rotation occurring during development.

- k. In portal hypertension, blood flow between the portal and inferior vena may occur at the left gastric vein and esophageal vein, resulting in esophageal varicosities.

5. With regard to the kidneys:

- a. The renal fascia is derived from the transversalis fascia.
- b. The renal pyramids are extensions of the cortex into the medulla of the kidney.
- c. The uvula is the location of the termination of the ureters into the trigone of the bladder.
- d. The left renal artery lies posterior to the left renal vein.
- e. The renal sinus contains perirenal fat.
- f. In general, the kidneys extend from T12 to L3, although the right kidney is somewhat lower than the left kidney.

6. With respect to the thoracic diaphragm:

- a. The left crus of the diaphragm contributes to the formation of the esophageal hiatus.
- b. The thoracic duct in the abdomen enters the thorax at the level of T12.
- c. The medial lumbocostal arch (ligament) is formed by the juncture of the right and left crura.
- d. The vagal trunks pass from thorax to the abdomen through the esophageal hiatus.
- e. A weakness in the diaphragm superior to the lateral lumbocostal arch (ligament) is termed the lumbocostal trigone.

7. In regard to the nervous system of the abdomen, pelvis, and perineum:

- a. The detrusor muscle of the bladder is skeletal muscle and the trigone muscle of the bladder is smooth muscle.
- b. Transection of the spinal cord above S2-4 allows for an "automatic cord bladder".
- c. The levator ani is skeletal muscle innervated by the autonomic nervous system.
- d. During defecation, the "puborectal sling" is relaxed.

- e. "Nervi erigentes" refers to the pelvic splanchnic nerves.
- f. The pelvic splanchnic nerves are pre-ganglionic nerve fibers.
- g. The lumbar splanchnic nerves are post-ganglionic nerve fibers.

8. With respect to fascial planes in the abdomen, pelvis, and perineum:

- a. Parietal pelvic fascia forms the periprostatic fascia.
- b. The Cardinal ligaments are derived from the visceral pelvic fascia.
- c. The superior fascia of the pelvic diaphragm is a condensation of the visceral pelvic fascia.
- d. The retropubic space contains visceral pelvic fascia.
- e. The transversalis fascia in the abdomen is the parietal pelvic fascia of the pelvis.



Human Gross Anatomy - Answer Guide for Pelvis, Abdomen, and Perineum Essay Examination (36 pts)

September 05, 2003

(The following is a guide to answering the questions and is not the "answer.")

[[SBMP](#)] [[Lab Key](#)] [[Short Ans Key](#)] [[Essay Guide](#)] [[Lab Results](#)] [[Written Results](#)] [[Cumulative Results](#)]

[[Transverse Colon](#)] [[Uterus, Uterine Tube, and Ovary](#)] [[Boundaries of Scarpa's fascia](#)]

1. Discuss the anatomy of the transverse colon. Include structure, support, relationships, innervation, vasculature, and lymphatics. (12 pts)

- **General comments:** The transverse colon is an intraperitoneal segment of the large bowel. It spans from the right colic flexure to the left colic flexure. Surgical access to the lesser sac is provided by the gastrocolic ligament. The transverse colon divides the greater sac into supracolic and infracolic compartments.
- **Structure -**
 - Layers - from inner to outer
 - mucosa (columnar epithelium) - no villi in large intestine
 - submucosa (vascular and submucosal nerve plexuses) - padding between mucosa and muscular layer
 - tunica muscularis - inner circular and outer longitudinal smooth muscle, myenteric plexus, peristalsis
 - mesothelium and connective tissue
 - serosa - visceral peritoneum covers the transverse colon except at the attachment of transverse mesocolon
 - teniae coli - 3 longitudinal bands of smooth muscle
 - haustra coli - sacculations caused by the teniae coli being shorter than the gut tube
 - appendices epiploicae - fat appendages hanging from the teniae
 - caliber is generally larger than the small intestine
- **support -**
 - Right
 - superior aspect of retroperitoneal ascending colon, cradled by right lobe of liver
 - right hepatocolic ligament
 - Middle
 - transverse mesocolon attaches to posterior abdominal wall crossing right kidney, duodenum, IVC, aorta, pancreas, left kidney
 - gastrocolic ligament provides anchoring to the stomach
 - Left
 - phrenicocolic ligament
- **relationships -**
 - Right - level of L2
 - Superior - liver, gallbladder, descending duodenum
 - Inferior - coils of jejunum and ileum

- Anterior - costal margin, diaphragm, liver
 - Posterior - diaphragm, right kidney, inferior vena cava, pancreas, quadratus lumborum
 - Lateral left -
 - Lateral right - liver, right paracolic gutter, hepatorenal recess
 - Middle - level of L1-2
 - Superior - stomach, gastrocolic ligament, liver, lesser sac
 - Inferior - coils of jejunum and ileum
 - Anterior - greater omentum, costal margin, diaphragm, falciform ligament
 - Posterior - pancreas (head, body, and tail), horizontal duodenum, aorta, superior mesenteric artery, intestinal mesentery
 - Lateral left - left colic flexure (see below)
 - Lateral right - right colic flexure (see above)
 - Left - level of T12-L1
 - Superior - spleen, diaphragm
 - Inferior - jejunum, descending colon, left paracolic gutter
 - Anterior - diaphragm
 - Posterior - diaphragm, left kidney, quadratus lumborum
 - Lateral left - phrenicocolic ligament, superior aspect of left paracolic gutter
 - Lateral right -
- **innervation** -
 - Right Side
 - Parasympathetic
 - Preganglionic
 - vagus nerves
 - preganglionic pathway - vagus nerves, superior mesenteric ganglion (no synapse), superior mesenteric plexus, right and middle colic arteries
 - Postganglionic
 - enteric ganglia at the target
 - cell bodies in submucosal layer - postganglionic fibers contribute to submucous plexus, enteric plexus
 - Sympathetic
 - Preganglionic
 - cell bodies within intermediolateral cell column (IMLCC) of T10-11
 - preganglion fiber path - ventral root to spinal nerve, to ventral ramus, white ramus communican, thoracic sympathetic trunk, thoracic splanchnic nerves, lesser splanchnic nerve
 - Postganglionic
 - cell bodies in the superior mesenteric ganglion
 - postganglionic fiber pathway - superior mesenteric plexus, right colic artery, middle colic artery, enteric plexus
 - Visceral Afferent
 - High threshold (pain)
 - follow sympathetic preganglionic and sympathetic postganglionic pathways
 - Low threshold (homeostatic)
 - follow the vagus nerves
 - Left Side
 - Parasympathetic
 - Preganglionic
 - pelvic splanchnics
 - preganglionic pathway - IMLCC S2-4, pelvic splanchnics, inferior hypogastric plexus, left hypogastric nerve, sigmoid mesocolon, retroperitoneal along medial margin of descending colon, left transverse mesocolon

- Postganglionic
 - enteric ganglia at the target
 - cell bodies in submucosal layer - postganglionic fibers contribute to submucous plexus, enteric plexus
 - Sympathetic
 - Preganglionic
 - cell bodies within intermediolateral cell column (IMLCC) of L1-3
 - preganglion fiber path - ventral root to spinal nerve, to ventral ramus, white ramus communican, lumbar sympathetic trunk, lumbar splanchnic nerves, aoric plexus, inferior mesenteric ganglia (synapse here)
 - Postganglionic
 - cell bodies in the inferior mesenteric ganglia
 - postganglionic fiber pathway - inferior mesenteric plexus, left colic artery, enteric plexus
 - Visceral Afferent
 - High threshold (pain)
 - follow sympathetic preganglionic and sympathetic postganglionic pathways
 - Low threshold (homeostatic)
 - follow parasympathetic preganglionic pathway (see parasympathetic preganglionic pathway)
- **vasculature** - provided by the arteriovenous supply of midgut and hindgut, venous drainage is into portal system
 - Right
 - right colic artery/vein from superior mesenteric artery/vein
 - retroperitoneal up to right colic flexure
 - contributes to marginal artery/vein
 - Middle
 - middle colic artery/vein from superior mesenteric artery/vein
 - travels through to transverse mesocolon
 - contributes to marginal artery/vein
 - Left
 - left colic artery/vein from inferior mesenteric artery/vein
 - retroperitoneal up to left colic flexure
 - contributes to marginal artery/vein
- **lymphatics** - intestinal nodes to central nodes (superior and inferior mesenteric nodes) to intestinal lymph trunks to cysterna chyli
 - Right
 - paracolic nodes to superior mesenteric nodes
 - Middle
 - paracolic nodes to superior mesenteric nodes
 - Left
 - paracolic nodes to inferior mesenteric nodes

2. **Provide a comprehensive review of the uterus, uterine tubes, and ovary. Include structure, support, relationships, vasculature, innervation, lymphatic drainage, and function. (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 derived from endopelvic fascia
 - uterosacral, pubouteral, and lateral cervical (Cardinal) lig.
 - round lig to lateral anterior pelvic brim - anterior lamina broad lig.
 - ovarian lig to posterior abdominal wall via suspensory lig. ovary
 - Relations
 - 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
- 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
 - 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 ligamentous support of the uterus leads to prolapse
 - most notably, the lateral cervical lig and important

3. **Discuss the boundaries of Scarpa's fascia and its derivatives with respect to the containment of urine. Specify the fascial layers associated with the accumulation of urine. Discuss whether urine will be found in the ischiorectal fossa. (12 pts)**

- **General comments:** Scarpa's fascia is membranous tela subcutanea. This fascia is capable of holding sutures and defines a potential space between it and deep fascia. This space can be invaded by infection or the extravasation of urine. The tear in the inferior fascia of the urogenital diaphragm transmits urine from the deep pouch to the superficial perineal pouch. The intact superior fascia of the urogenital diaphragm together with the intact superficial perineal fascia will prevent urine from entering the ischiorectal fossa. The accumulation of urine is restricted by the boundaries of Scarpa's (membranous) fascia.
- **Anterior abdominal wall** - between Scarpa's fascia and deep fascia of external oblique
 - superior: Scarpa's fascia attaches to deep fascia in finger like projections at level of umbilicus
 - inferior medial: open passage to scrotum
 - inferior lateral: passage to thigh
 - lateral: near mid-axillary line at the thoracolumbar fascia
 - medial: along the linea alba, fundiform ligament
 - anterior: Scarpa's fascia
 - posterior: deep fascia of external oblique
- **Thigh** - between Scarpa's fascia and fascia lata
 - Inferior: 2 cm below inguinal ligament
 - superior: open
 - lateral: iliotibial tract
 - medial: pubic ramus
 - anterior: Scarpa's fascia
 - posterior: fascia lata
- **Scrotum** - between Darto's tunic (Scarpa's derivative) and external spermatic fascia (deep fascia)
 - superficial: Darto's tunic
 - deep: external spermatic fascia
- **Penis** - between Colle's fascia (Scarpa's derivative) and Bucks fascia (deep fascia)
 - extends distally toward base of, but not including, the glans
 - superficial: Colle's fascia
 - deep: Buck's fascia
- **Urogenital triangle** - within superficial pouch between superficial perineal fascia (derivative of Scarpa's fascia) and perineal membrane (deep fascia)
 - superior: perineal membrane (inferior fascia of the urogenital diaphragm)
 - inferior: superficial perineal fascia
 - anterior: open into scrotum
 - posterior: posterior free edge of urogenital diaphragm, superficial perineal fascia

- lateral: conjoint rami
- medial: not restricted

Extravasation into the ischiorectal fossa? - NO

- limited by superior fascia of UG diaphragm
- limited by superficial perineal fascia (attached to posterior free edge of UG diaphragm and conjoint rami)

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