

STRUCTURAL BASIS OF MEDICAL PRACTICE

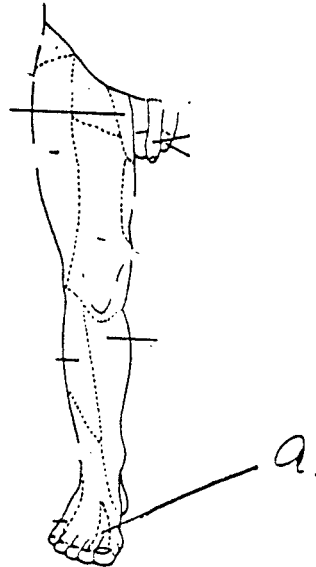
EXAMINATION I

September 5, 2003

PART I. Answer in the space provided. (6 pts)

1. Identify the innervation. (0.5 pt)

a. Deep Peroneal Nerve



2. Identify the structures. (1 pt)

a. Lamina

b. Pedicle

(Fig. 1.1, Grant's Dissector)

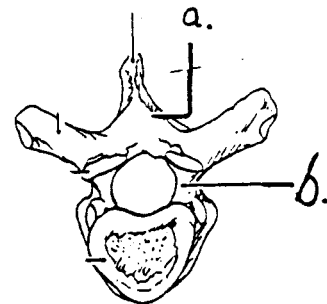
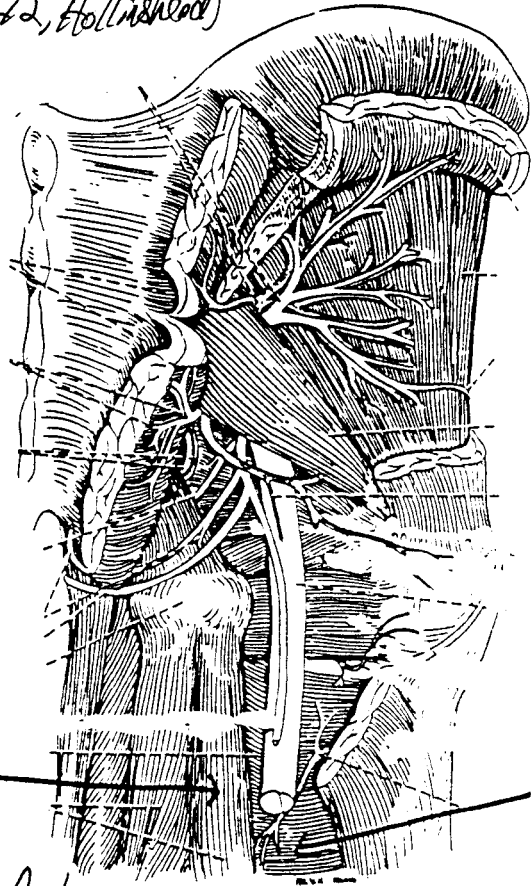


Figure 1. 1. Typical thoracic vertebra in lateral and superior view.

3. Identify the structures. (1 pt)

(Fig. 17-42, Hollishead)

- a. Biceps femoris (long head)
- b. Adductor Magnus



4. Identify the structures. (1 pt)

- a. Lateral Tibial Genicular Artery
- b. Circumflex Fibular Artery

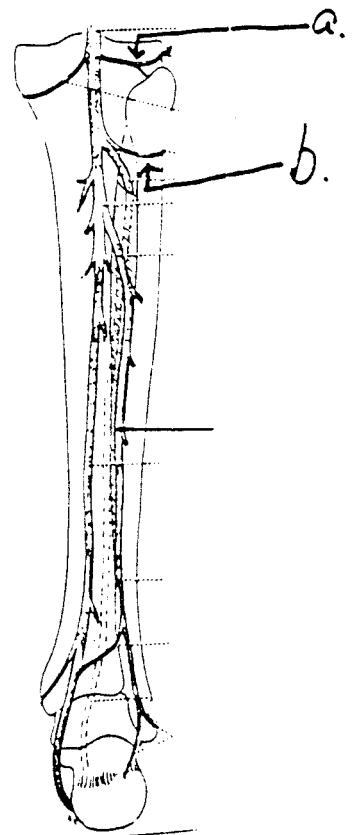
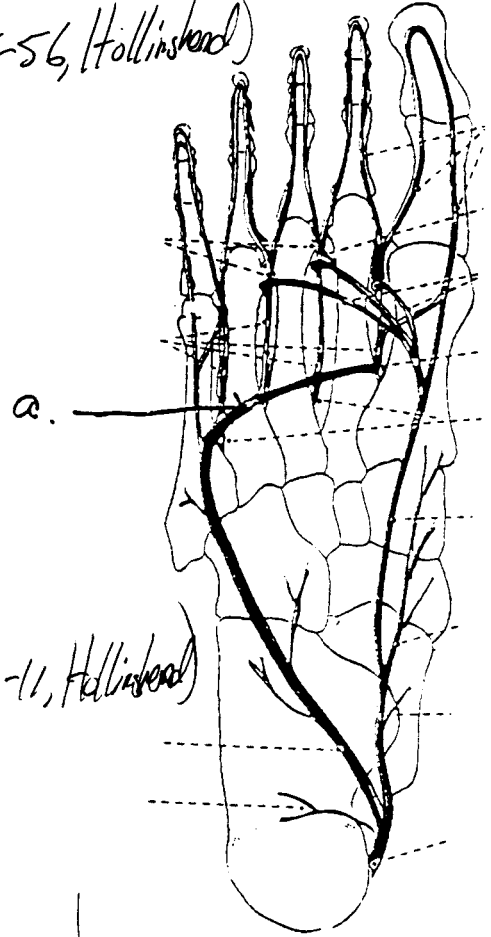


FIGURE 19-29.

5. Identify the structures. (0.5 pt) (Fig. 18-56, Hollinshead)

a. Plantar Arch



6. Identify the structures. (1 pt) (Fig. 22-11, Hollinshead)

a. Right Vagus Nerve

b. Right Pulmonary Vein

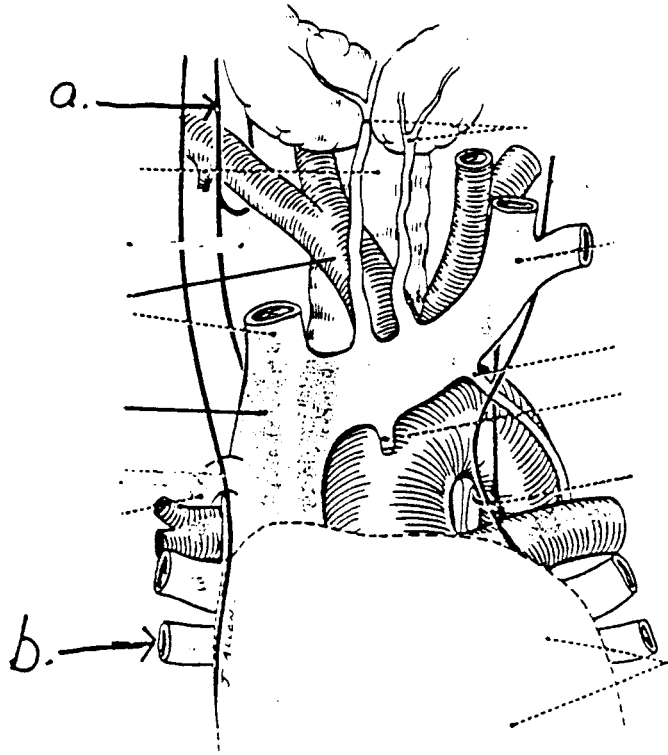


FIGURE 18-56.  
Diagram of the plantar arteries.

7. Identify the structures. (1 pt) (Fig. 18-10, Hollinshead)

- a. Rectus Femoris
- b. Biceps Femoris

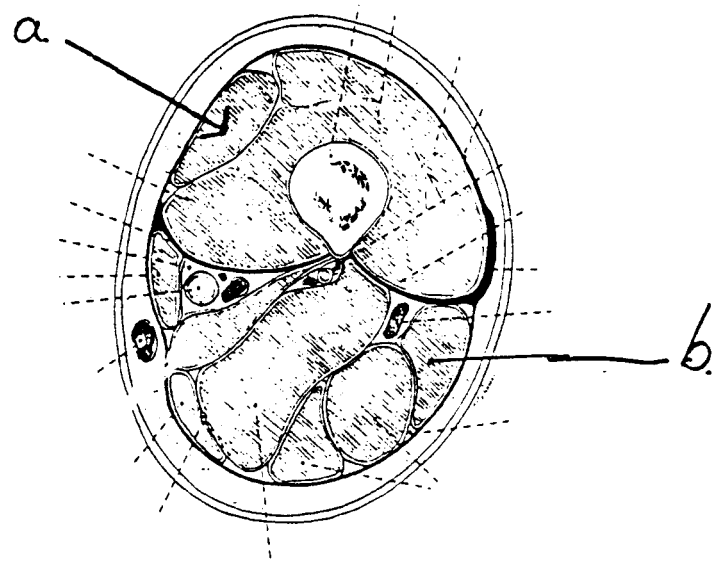


FIGURE 18-10.  
A transverse section through the middle third of the thigh, drawn to show schematically the division of the musculature into compartments and to illustrate the position of the main nerves and vessels. The thickness of the fascia lata, intermuscular septa, and iliotibial tract is exaggerated.

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

1. With respect to the nervous system:

- a. There are white rami at the level of T1-4.
- b. The somatic efferents of the femoral nerve consist of pre- and post-ganglionic neurons.
- c. The visceral layer of serous pericardium is innervated by the phrenic nerve.
- d. Post-ganglionic neurons of the sympathetic nervous system are generally quite long compared to pre-ganglionic neurons.
- e. The somatic afferent fibers have cell bodies in the ventral root ganglion.
- f. The diaphragm is an example of a skeletal muscle innervated by the somatic nervous system.
- g. Preganglionic fibers of the greater splanchnic nerve synapse in the sympathetic trunk.
- h. Sympathetic innervation to the heart dilates the coronary arteries.

2. With respect to the gluteal region:

- a. The superior and inferior gemelli originate from the ischial tuberosity.
- b. From the posterior perspective, the obturator externus muscle lies deep to the quadratus femoris.
- c. The superior and inferior gemelli, piriformis, and gluteus minimus are all innervated by the superior gluteal nerve.
- d. The internal pudendal artery exits the greater sciatic foramen on the superior border of the piriformis muscle and enters the lesser sciatic foramen on the inferior border of the piriformis muscle.
- e. The sciatic nerve courses through the greater sciatic foramen.
- f. A lesion (injury) of the left superior gluteal nerve will cause the pelvis to tilt to the right when the right limb is raised off the ground.

3. With regard to the subinguinal region:

- a. The femoral canal encloses the femoral sheath.
- b. The medial femoral circumflex artery passes posteriorly between the iliopsoas and pectineus muscles.
- c. The inferior gluteal artery contributes to the cruciate anastomosis.
- d. Femoral hernias lie inferior and lateral to the pubic tubercle.
- e. The deep femoral artery (profunda femoris) arises from the femoral artery within the femoral sheath.
- f. The superficial circumflex <sup>iliac</sup> artery, superficial epigastric artery, and external pudendal artery originate from the femoral artery.

4. With respect to the lungs and ventilation:

- a. The apex of the lung reaches to 1 inch inferior to the clavicle.
- b. The pulmonary ligament contains the pulmonary trunk.
- c. The surface projection of the horizontal fissure follows the 6th rib.
- d. The carina separates the openings of the two principal bronchi.
- e. A foreign body is more likely to lodge in the right bronchus.
- f. The surface projection of the inferior border of the lung is at the 6th rib in the midclavicular plane.

5. In regard to the thorax and lungs:

- a. The surface projection of the inferior aspect of the parietal pleura in the midclavicular plane is at the level of the 8th rib.
- b. The pericardial sac can be penetrated at the cardiac notch without entering the pleural cavity.
- c. The cavity between the lung tissue and visceral pleura contains pleural fluid.
- d. The lungs are innervated by branches of the phrenic nerve.
- e. The costal pleural is supplied by intercostal nerves.

f. Movement at the costovertebral and costotransverse joints of ribs 2-6 contribute to a change in movement in the transverse plane (termed the pump handle mechanism).

g. The pericardiophrenic artery and vein lie in the endothoracic fascia.

6. In the thorax:

a. The posterior intercostal arteries of the upper two intercostal spaces originate from the supreme intercostal artery that is derived from the costocervical branch of the subclavian artery.

b. At the 8th cartilage, the internal thoracic artery terminates in the musculophrenic and superior epigastric arteries.

c. The subcostal muscles are innervated by the autonomic nervous system.

d. There are 11 pair of intercostal spaces that contain innermost intercostal muscles.

e. The supreme (highest) intercostal vein drains into the brachiocephalic vein.

f. The anterior intercostal artery in the first intercostal space is derived from the brachiocephalic artery.

7. Contents of the superior mediastinum include:

a. Right bronchus.

b. Esophagus.

c. Arch of the aorta.

d. Right phrenic nerve.

e. Arch of the azygous vein.

f. Left phrenic nerve.

8. With respect to the lymphatics of the lower extremity and the thorax:

a. The deep inguinal lymph nodes are situated along the femoral vein deep to the fascia lata.

b. Bronchopulmonary lymph nodes are situated at hilum of the lung.

c. The bronchomediastinal lymph trunks are formed by the paratracheal nodes and parasternal lymphatics.

d. Tracheobronchial lymph nodes receive lymphatic drainage from the heart.

e. The upper lateral quadrant of the breast is drained by the parasternal (sternal, internal mammary) nodes.

9. With regard to the lower extremity:

a. The tibialis posterior is innervated by the peroneal nerve.

b. The flexor hallucis brevis is innervated by the lateral plantar nerve.

c. The peroneus tertius is innervated by the superficial branch of the common peroneal nerve.

d. The fibular (lateral) collateral ligament is extrasynovial but intracapsular.

e. The tibial (medial) collateral ligament is attached to the medial meniscus.

f. The superior peroneal retinaculum extends from the lateral malleolus to the calcaneus.



**Answer Key: Short Answers (Minimum answer required for full credit)**

**Hamstrings (4 pts)**

Criteria

1. Arise from the ischial tuberosity
2. Innervated by the tibial portion of the sciatic nerve
3. Insert on the leg/cross two joints (hip and knee)

Consist of the semimembranosus, semitendinosus and long head of the biceps femoris

Action: Extend hip, flex knee

**Muscular lacuna (3 pts)**

Region of femoral triangle/lies lateral to the vascular lacunae  
Contains the femoral nerve and iliopsoas muscle  
Iliopectineal arch separates vascular from muscular lacunae

**Subtalar joints (3 pts)**

Intertarsal joint between the articular surfaces of the talus and calcaneus  
Inversion/eversion takes place around the talus at both the subtalar joint and the transverse tarsal joints  
Strengthening ligaments/relation with spring ligament (posterior calcaneonavicular) attaches sustentaculum tali to navicular/floor of subtalar joint

**Popliteus muscle (4 pts)**

Intracapsular/extrasynovial

Arises from the lateral surface of the lateral condyle of the femur and passes inferiorly and medially to attach to the posterior surface of the tibia at the soleal line. "High lateral, low medial"

Innervation by the tibial nerve

Action:

Medial rotates tibia when leg off ground

Laterally rotates femur when leg on ground/"Unlocking mechanism"



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## Human Gross Anatomy - Answer Guide for Lower Limb and Thorax Essay Examination (36 pts)

September 05, 2003

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

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

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[ [Heart Valves and Coronary Flow](#) ] [ [Flexion and Extension of the Toes](#) ] [ [Femoral Triangle](#) ]

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1. **Discuss the structure and function (including blood flow to the coronary vessels) of the semilunar valves and the atrioventricular valves (12 pts)**
  - The valves of the heart direct blood flow in one direction
    - Between the atria and the ventricles are the atrioventricular valves
    - Between the ventricles and arterial trunks are the semilunar valves
    - Healthy valves permit little to no back flow
    - Integrated with the skeleton of the heart
    - Located in the ventricles (atrioventricular valves) and at the base of the arterial trunks (semilunar valves)
    - The atrioventricular valves and the semilunar valves are closed by the pressure (they are not closed by muscular contraction applied to the cusps)
    - IVC to rt atria to tricuspid to rt ventricle to pulmonary valve to pulmonary artery to lungs to pulmonary veins to left atria to bicuspid (mitral) valve to left ventricle to aortic valve to systemic circulation to coronary arteries during diastole
    - Atrioventricular valves close (lub) during systole whereas the semilunar valves close (dub) during diastole
  - Atrioventricular valve - Tricuspid
    - Between the right atria and the right ventricle
    - Three cusps open into the right ventricle
    - Three papillary muscles (extensions of trabeculae carne) - anterior, posterior, and septal
    - Cusps are stabilized by chorda tendeneae - fibrous cords between cusps and papillary muscles
    - Ventricular contraction raises pressure - blood pools on ventricular side of cusps causing the cusps to approximate each other and close the valve
    - Adjustments by the papillary muscles and chorda tendeneae provide support and prevent eversion of the cusps into the atria
    - Note - contraction of the papillary muscles, in the absence of ventricular contraction, open, not close, the atrioventricular valves

- Atrioventricular valve - Bicuspid (Mitral Valve)
    - Between the left atria and the left ventricle
    - Two cusps open into the left ventricle
    - Two papillary muscles - anterior and posterior
    - Resists extreme pressure generated by left ventricular contraction
  - Semilunar valve - aortic valve
    - Located at the base of the aortic trunk
    - Prevents reverse flow from the aorta to the left ventricle during diastole
    - Negative pressure of left ventricle and elastic recoil of systemic arteries move aortic blood toward the valve
    - Opened by blood flow during systole - cusps move toward aortic wall and block coronary ostia
    - Three cusps - no papillary muscles or chorda tendineae
    - Left and right coronary cusps and a non-coronary cusp
    - Nodule - weighted fibrous thickening at the midline of the free edge of each cusp aids in approximating the cusps and closing the valve
    - Aortic sinus - space between the wall of the aorta and each cusp
    - Valve closed by pressure - blood pools in the aortic sinuses during diastole and approximates the nodules
  - Semilunar valve - pulmonary valve
    - Located at base of pulmonary trunk
    - Prevents reverse flow from the pulmonary trunk to the right ventricle during diastole
    - Operation is the same as aortic valve except that there are not coronary cusps (no ostia in pulmonary trunk)
  - Blood flow to the coronary vessels
    - Coronary arteries are perfused during diastole when heart muscle is relaxed
    - During systole the coronary ostia are blocked by the open cusps of the aortic valve
    - During diastole blood pools in the aortic sinuses and closes the aortic valve.
    - Blood driven into the left and right aortic sinuses enters into the ostia of the coronary arteries.
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**2. Discuss the muscles and ligaments involved with flexion and extension of the digits of the foot, and relate this to function**

- Flexion of the digits, relative to extension, is more specific because of the independence of flexor tendons relative to extensor tendons
- The primary flexors of the toes include the flexor hallucis longus and brevis, the flexor digitorum longus and brevis, and flexor digiti minimi
  - Flexor Hallucis longus - inserts at base of distal phalanx of digit 1
    - flexes the IP joint plus the MP and ankle joint
    - Origin from posterior compartment of leg - interosseous membrane and fibula
    - crosses ankle inferior to sustentaculum tali and within flexor sheath
    - receives guidance from the sesamoid bones within the lateral and medial heads of the flexor digitorum brevis
  - Flexor hallucis brevis - inserts at base of proximal phalanx of digit 1
    - flexes the MP joint

- lateral and medial head each host a sesamoid bone near the head of the first metatarsal
- sesamoid bones provide a "groove" to guide the tendon of flexor hallucis longus toward the distal phalanx
- sesamoid bones provide site of attachment for the abductor hallucis and the adductor hallucis
- Flexor digitorum longus - inserts on the base of the distal phalanx of digits 2-4
  - flexes the distal IP joint plus the proximal IP, MP, and ankle
  - lumbricals arise from the lateral sides of the tendons - extend IP and flex MP
  - origin from the posterior compartment of the leg - tibia and interosseous membrane
  - crosses ankle superior to sustentaculum tali and within the flexor sheath
- Flexor digitorum brevis - inserts at the base of the middle phalanx of digits 2-4
  - flexes the proximal IP joint plus the MP joint
  - origin from the calcaneus - intrinsic to the foot
  - tendons are approximated to planter surface of flexor digitorum longus
  - tendon splits and inserts onto the sides of the base of the middle phalanx
  - the tendon of flexor digitorum longus passes through the split tendon without tethering to the flexor digitorum brevis
  - independent action at the distal and proximal IP joint is preserved relative to the extensors (extensor hood)
- Flexor digiti minimi - inserts at the base of the middle phalanx of digit 5
  - flexes the proximal IP joint plus the MP joint
  - intrinsic to the foot
- The primary extensors of the toes include extensor hallucis longus and brevis, and extensor digitorum longus and brevis
  - Extensor hallucis longus - inserts on the distal and proximal phalanges of digit 1
    - extends the IP joint plus the MP joint plus the ankle
    - origin from the anterior compartment of the leg - tibia and interosseous membrane
    - stabilized by the superior and inferior retinaculae
    - tendon receives a lateral attachment at the level of the head of the first metatarsal from extensor hallucis brevis
    - The tendons of extensor hallucis longus and brevis are tethered to each other and can not act independently.
  - Extensor hallucis brevis - inserts on the distal and proximal phalanges of digit 1 (via tendon of extensor hallucis longus)
    - extends the IP and MP joint
    - intrinsic to the dorsum of the foot
    - tendon attaches to lateral side of the tendon of extensor hallucis longus or to the proximal phalanx
    - origin is from the anterolateral aspect of the calcaneus
    - has been considered a named slip of extensor digitorum brevis
  - Extensor digitorum longus - inserts on the bases of the middle and distal phalanges of digits 2-5 by way of the extensor hood
    - extends the distal and proximal IP joints plus the MP and the ankle joints
    - origin from the anterior compartment of the leg - interosseous membrane and

- the fibula
  - stabilized by the superior and inferior extensor retinaculae
  - tendons receive lateral attachments from the extensor digitorum brevis on digits 2-4 at level of head of metatarsal
  - the combined tendons of the extensor digitorum longus and brevis contribute to the extensor hood
  - extensor hood has a center insertion on the proximal phalanx and sends two lateral bands to insert on the sides of the base of the distal phalanx
  - extensor hood also receives fibrous contributions from the lumbricals and the interossei
  - The extensor digitorum longus and brevis are tethered to each other by the extensor hood and can not act independently
  - Extensor digitorum brevis - inserts on the extensor hood and, thus, to the bases of the middle and distal phalanges of digits 2-4 (not 5)
    - extends the distal and proximal IP joints plus the MP
    - origin is from the anterolateral aspect of the calcaneus
    - tendons attach to the extensor at the lateral aspect of the extensor digitorum longus at the level of the head of the metatarsals
  - Additional comments
    - Mesotendons (vincula) derived from tendon sheaths provide vascular and nervous supply to the distal flexor tendons
    - It is the relative independence of the flexor tendons and the unique action of the lumbricals that permit greater specificity of flexion.
    - The deep and superficial transverse metatarsal ligaments stabilize the heads of the metatarsals and contribute to fine movement.
    - Collateral ligaments at the MP and IP joints stabilize flexion and extension.
- 

**3. Review the boundaries (6 in number) and contents (vasculature, nerves, lymphatics) of the femoral triangle. State the relationship of structures entering and leaving this region. (12 pts)**

1. superior boundary: Inguinal ligament spanning the anterior superior iliac spine and pubic tubercle (including a figure would help)
  - contents of the muscular and vascular lacunae enter the femoral triangle (discuss relations)
  - Vascular lacuna.
    - The vascular lacuna is located posterior to the inguinal ligament, medial to the iliopectineal arch, lateral to the lacunar ligament, and anterior to the pectineal fascia.
    - The contents include, from the lateral to medial, the femoral artery, the femoral vein, and the femoral canal.
    - These contents are contained within compartments of the femoral sheath. These compartments are separated by septa that run between the inguinal ligament and the pectineal fascia.
    - Femoral hernias occur in this region.
    - abdominal viscera may enter the femoral canal through the femoral ring.

- Muscular lacuna
  - posterior to inguinal ligament and lateral to iliopectineal arch
  - femoral nerve enters femoral triangle deep to iliacus fascia
  - lateral femoral cutaneous nerve enters femoral triangle lateral to femoral nerve and near anterior superior iliac spine
- 2. lateral boundary: sartorius
  - lateral femoral circumflex a/v exits laterally deep to sartorius and between rectus femoris and vasti
- 3. medial boundary: adductor longus
  - profunda femoral a/v exits posteromedial deep to super border of adductor longus and continues between adductor longus and adductor magnus
- 4. inferior boundary: adductor canal at the apex
  - Adductor canal.
    - At the apex of the femoral triangle is the beginning of the adductor canal.
    - The femoral artery and vein, and the saphenous nerve enter the adductor canal.
      - artery anterior to vein - note: this relation betrays relation of popliteal vessels
    - The adductor canal is bounded anteromedially by the sartorius muscle. Anterolaterally, it is bounded by the vastus medialis. Posteriorly it is bounded by adductor longus and adductor magnus.
    - nerve to vastus intermedius enters adductor canal
- 5. posterior boundary: iliopsoas, pectineus, and possibly parts of adductor brevis and adductor longus
  - the medial femoral circumflex a/v exits between iliopsoas and pectineus
  - the deep femoral artery exits between iliopsoas and adductor longus
- 6. anterior boundary: fascia lata and saphenous hiatus (show relations fig)
  - the contents of the cribriform fascia exit the femoral triangle at this location
  - superficial/external pudendal a/v
  - superficial epigastric a/v
  - superficial circumflex iliac a/v
  - the great saphenous vein
  - anterior femoral cutaneous nn pierce fascia lata anterior.

7. further discussion

- The saphenous hiatus
  - is a specialization of the fascia lata located in the anteromedial thigh just inferior to the inguinal ligament and superficial to the femoral sheath. The lateral margin overlies the femoral artery. The medial aspect overlies the femoral canal. Superiorly is the inguinal ligament. Approximately 2cm inferior to the inguinal ligament is the inferior cornu over which the great saphenous vein forms an arch as it leaves superficial fascia and enters the femoral vein. Notable tributaries of the great saphenous vein within the saphenous hiatus are the external pudendal vein coursing medially, the superficial epigastric vein coursing superiorly, and the superficial circumflex iliac vein coursing laterally and superiorly. Accompanying these veins are branches of the femoral artery. These vessels are piercing through the surrounding cribriform fascia. The distinct lateral margin of the saphenous hiatus is the falciform edge. There are superior and inferior borders referred