بسم الله الرحمن الرحيم

ANATOMY

FINAL | Lecture 9

The Thigh-Inguinal Region

وَإِن تَتَوَلَّوْا يَسْتَبْدِلْ قَوْمًا غَيْرَكُمْ ثُمَّ لَا يَكُونُوا أَمْثَالَكُم

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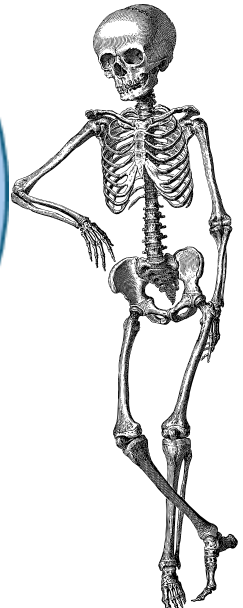
Written by: Abdulrahman Alsaadi
Osama Hamdan

Reviewed by: Bashar Khraisat



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QUIZ

The thigh –inguinal region

Inguinal Region

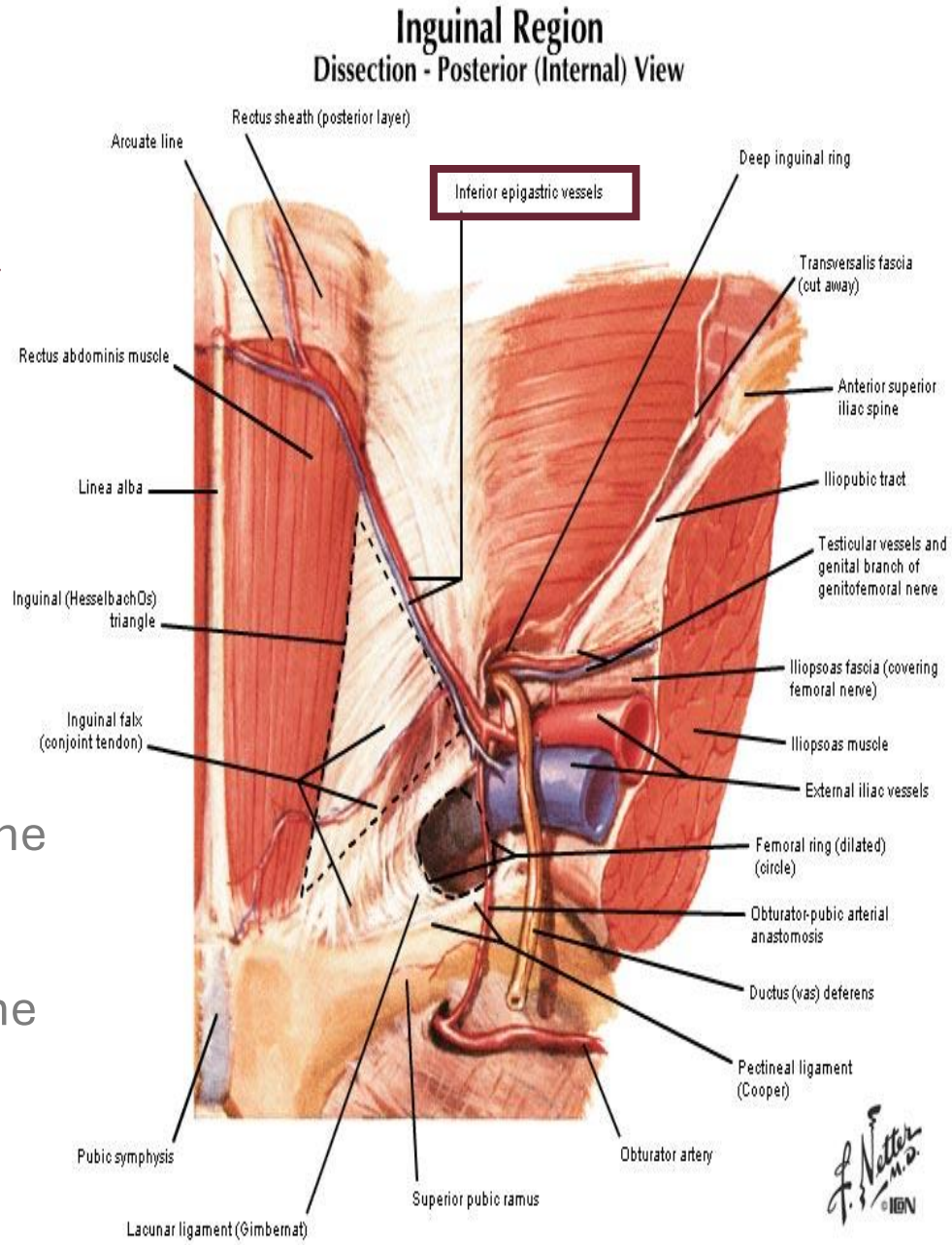
- The inguinal ligament lies beneath the skin fold in the groin and can be felt along its length.
- **Inguinal ligament is a folding of the aponeurosis of external oblique muscle**
- It is attached laterally to the anterior superior iliac spine and medially to the pubic tubercle.
- **At the level of inguinal ligament, external iliac vessels terminate and become femoral vessels .**

➢ **Branches from external iliac vessels**

1- inferior epigastric muscles

2- iliac vessels which go to anterior superior iliac spine

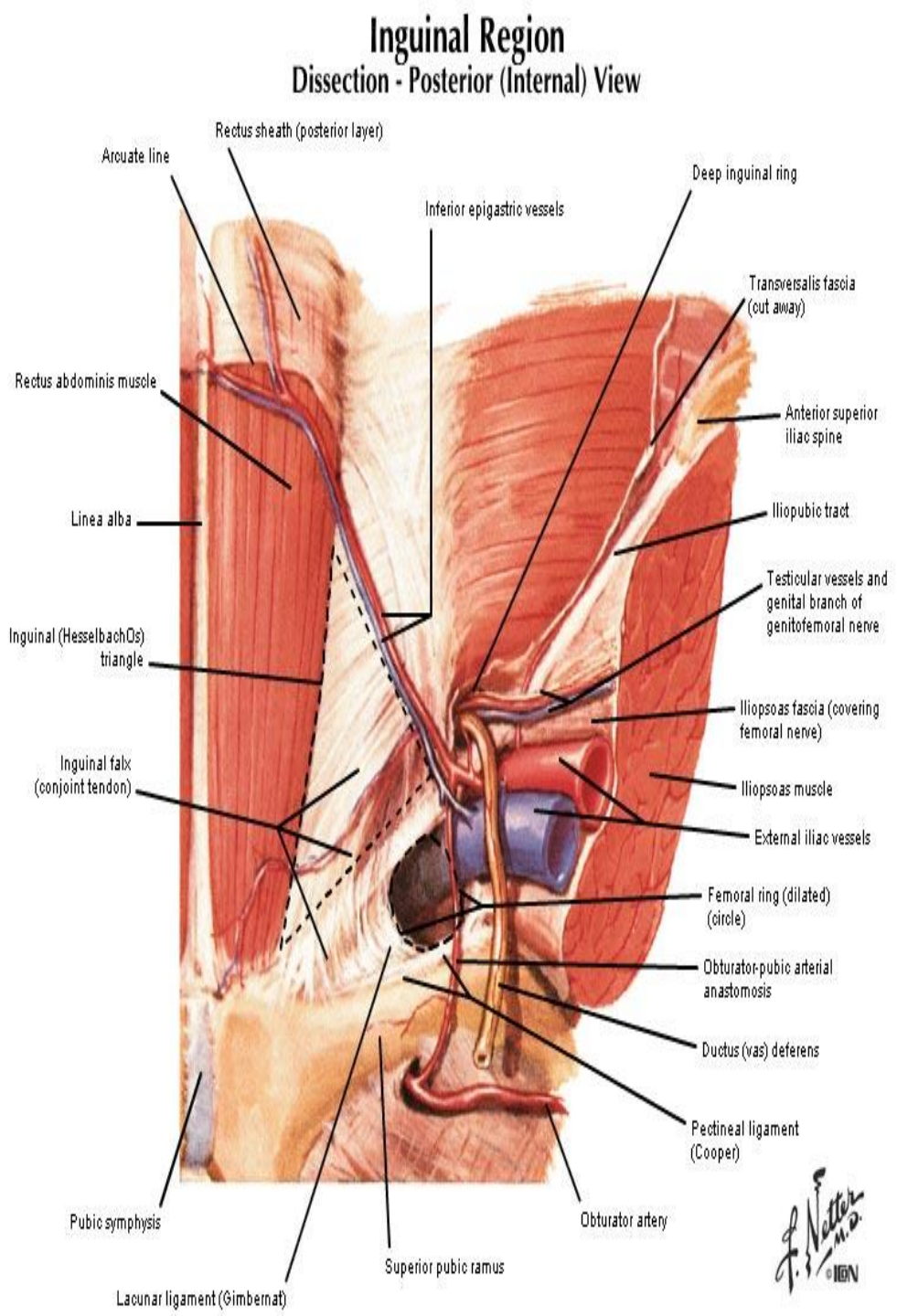
- The symphysis pubis is a cartilaginous joint that lies in the midline between the bodies of the pubic bones
- The upper margin of the symphysis pubis and the bodies of the pubic bones can be felt on palpation through the lower part of the anterior abdominal wall.
- The pubic tubercle can be felt on the upper border of the pubis



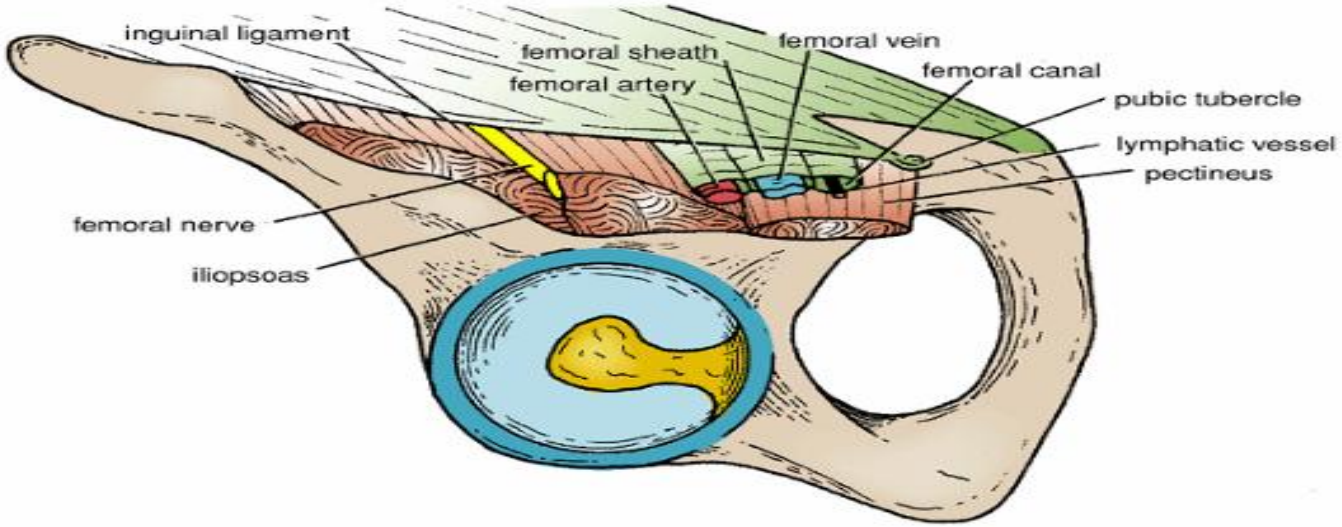
- Attached to it is the medial end of the inguinal ligament. The tubercle is easily palpated in the male by invaginating the scrotum with the examining finger.

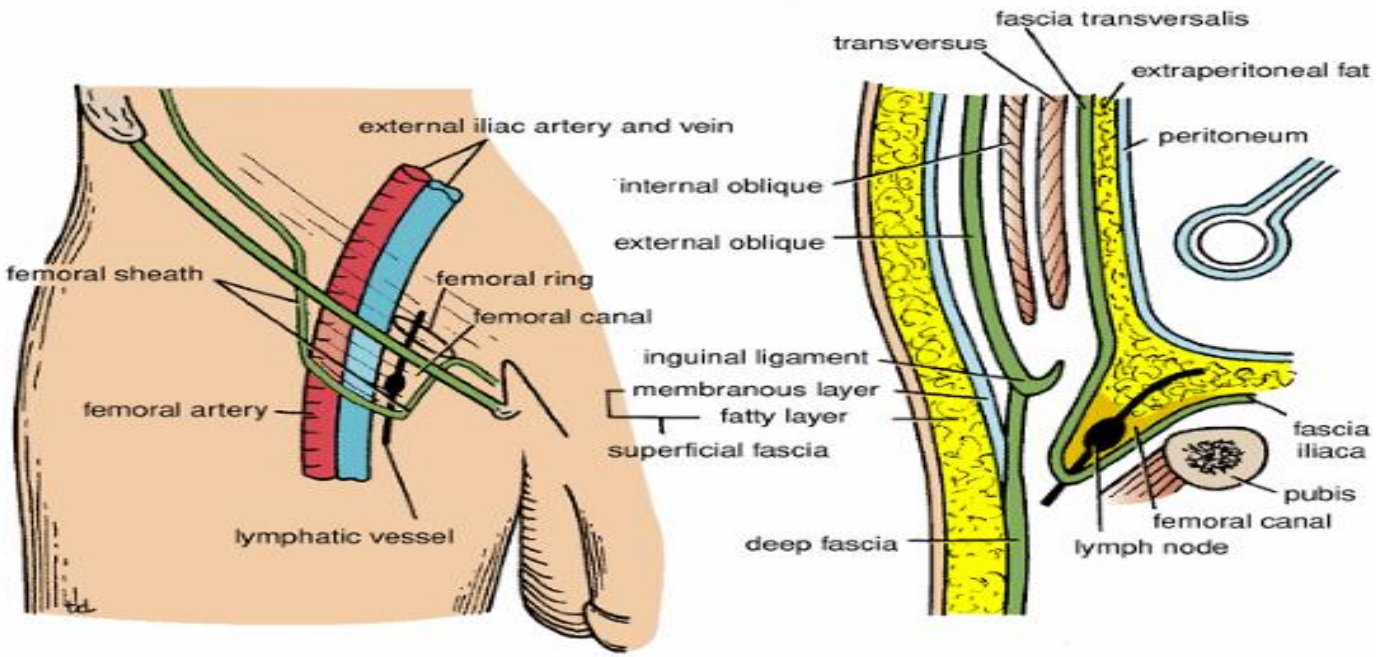
- In the female, it can be palpated through the lateral margin of the labium majus.

- The pubic crest is the ridge of bone on the upper surface of the body of the pubis, medial to the pubic tubercle

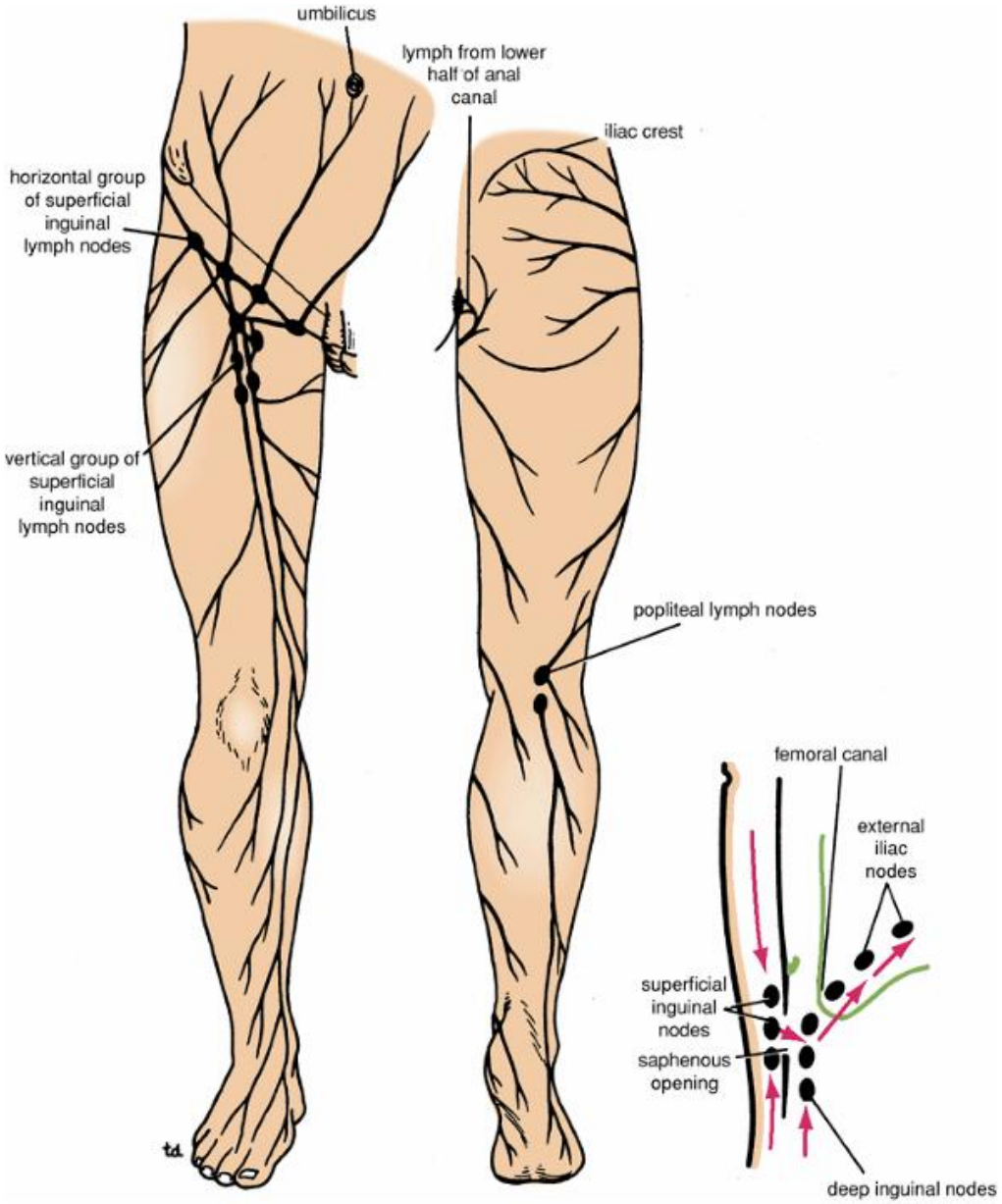


- Femoral sheath:
  Anteriorly from anterior abdominal wall from transversals fasci.
  Posteriorly from fascia iliaci, which lies anterior to iliacus muscle
- Femoral rings opens to abdominal wall (weak point)
- Causes of hernia :
  1- chronic constipation
  2- high pressure on abdominal wall
  3- In females, the **femoral ring is wider** and structurally **weaker** due to the broader pelvic anatomy.
- **F**emoral hernia is common in **F**emales despite lower prevalence in comparison to other hernias
- **Femoral nerve is outside femoral sheath but inside the femoral triangle (important)**





- **Inguinal Lymph Nodes**
- The inguinal lymph nodes are divided into **superficial and deep groups**.
- **(most important)** femoral inguinal lies in the femoral canal
- **Superficial Inguinal Lymph Nodes**
- The superficial nodes lie in the superficial fascia below the inguinal ligament and can be divided into a **horizontal and a vertical** group



Inguinal lymph nodes….cont

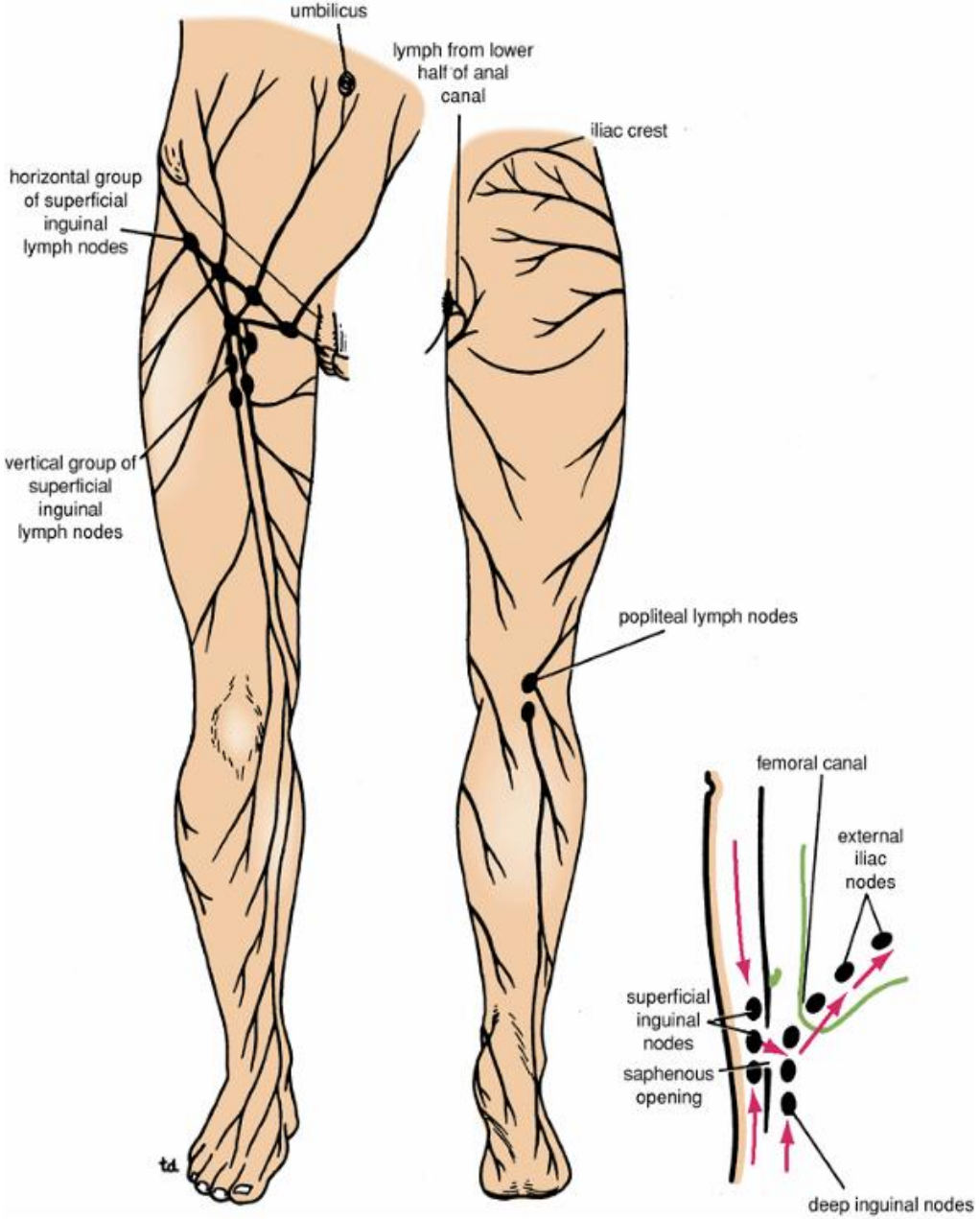
The horizontal group lies just below and parallel to the inguinal ligament

The medial members of the group receive superficial lymph vessels from:

- the anterior abdominal wall below the level of the umbilicus and from the perineum
- The lymph vessels from the urethra, the external genitalia of both sexes (but not the testes), and (some organs from the pelvis) the lower half of the anal canal are drained by this route.

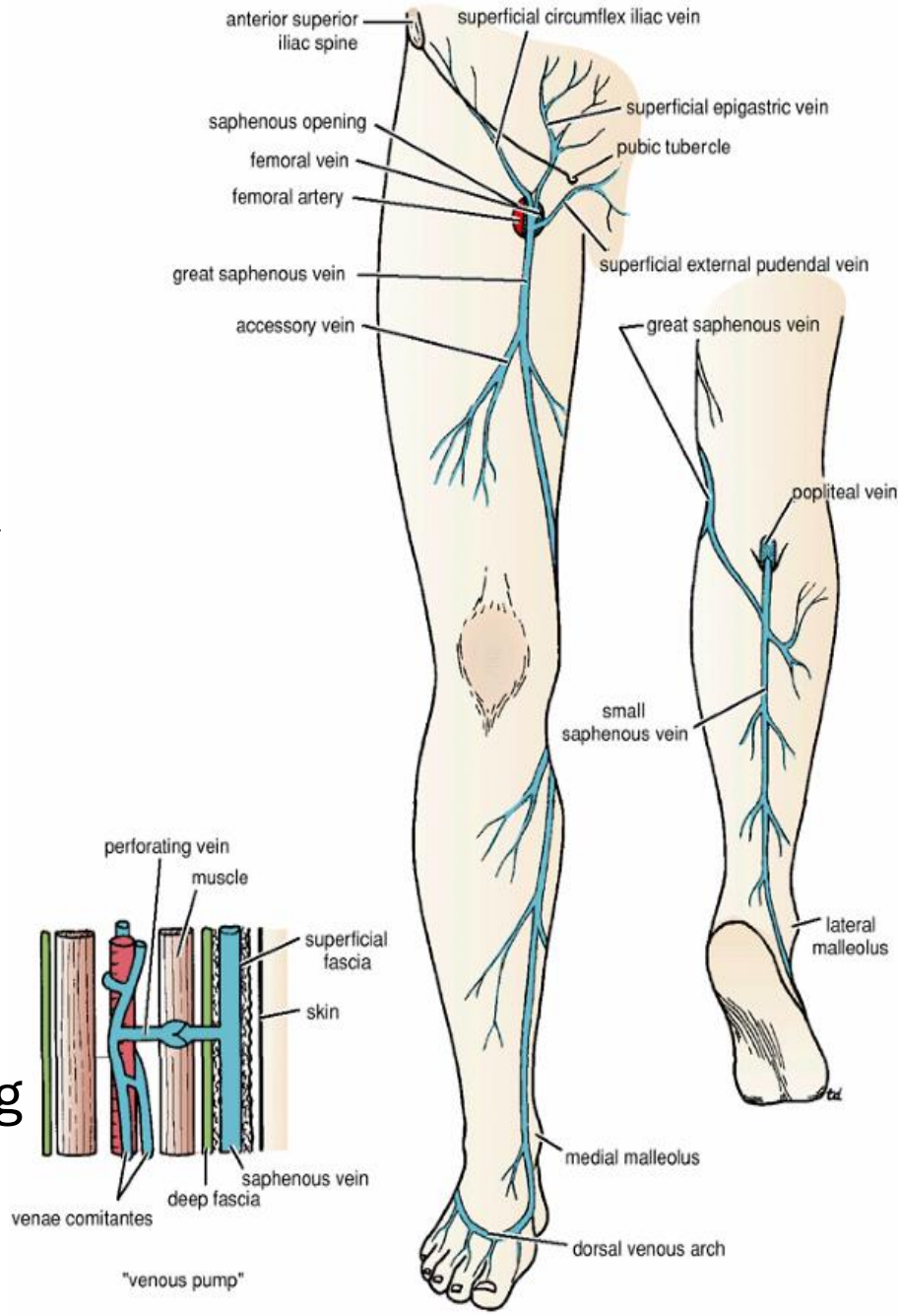
The lateral members of the group receive superficial lymph vessels from the back below the level of the iliac crests

- **Vertical and efferent lymph receives from the lower limb**
- **The vertical group** lies along the terminal part of the great saphenous vein and receives most of the superficial lymph vessels of the lower limb
- **The efferent lymph** vessels from the superficial inguinal nodes pass through the saphenous opening in the deep fascia and join the deep inguinal nodes.



Superficial Veins

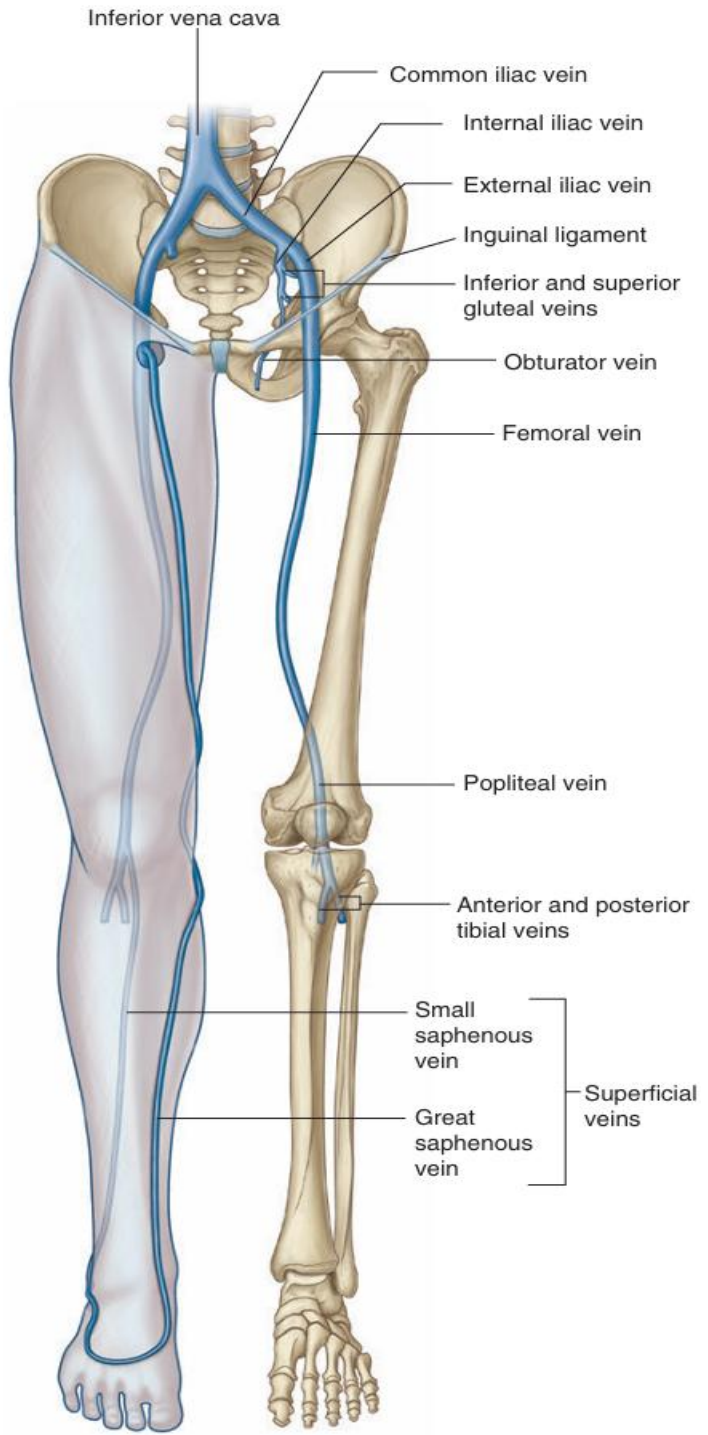
- The superficial veins of the leg are the great and small saphenous veins and their tributaries
- They are of great clinical importance.
- **The great saphenous vein** drains the medial end of the dorsal venous arch of the foot and passes upward directly in front of the medial malleolus
- It then ascends in company with the saphenous nerve in the superficial fascia over the medial side of the leg.
- The vein passes behind the knee and curves forward around the medial side of the thigh.
- It passes through the lower part of the saphenous opening in the deep fascia and joins the femoral vein about 1.5 in. (4 cm) below and lateral to the pubic tubercle



Veins Notes pt.1

Veins are generally characterized by **valves** that prevent blood regurgitation. There are **three types of veins**:

1. **Deep veins (venae comitantes)** – These accompany arteries, such as the anterior tibial, posterior tibial, and femoral arteries. Muscle contractions compress these veins, aiding blood return to the right atrium.
2. **Perforating veins** – These connect superficial and deep veins.
3. **Superficial veins** – Includes the **great saphenous vein** and **small saphenous vein**.



Veins Notes pt.2

Clinical Applications:

- **Dehydration & Cannulation Difficulty:**

  When a severely burned, dehydrated patient arrives in the emergency room, collapsed veins make cannulation challenging. In such cases, clinicians often access the **great saphenous vein** just **anterior to the medial malleolus**, as it remains palpable and superficial even in dehydration.

- **Anatomical Pathways:**

  The **small saphenous vein** runs **posterior to the lateral malleolus**, ascends along the posterior leg, pierces the deep fascia via perforators, and drains into the **popliteal vein,**
  A **connector vein** links the great and small saphenous veins (deep vein behind the knee).

- **Surgical Use:**

  The **great saphenous vein** is commonly harvested and extensively used in **cardiac surgery**, particularly in **coronary artery bypass grafting (CABG).**

- The great saphenous vein possesses numerous valves and is connected to the small saphenous vein by one or two branches that pass behind the knee.
- **Several perforating veins** connect the great saphenous vein with the deep veins along the medial side of the calf

❑Doctor didn't mention these two points above, but I think that they are important .

- At the saphenous opening in the deep fascia, the great saphenous vein usually receives three tributaries that are variable in size and arrangement :

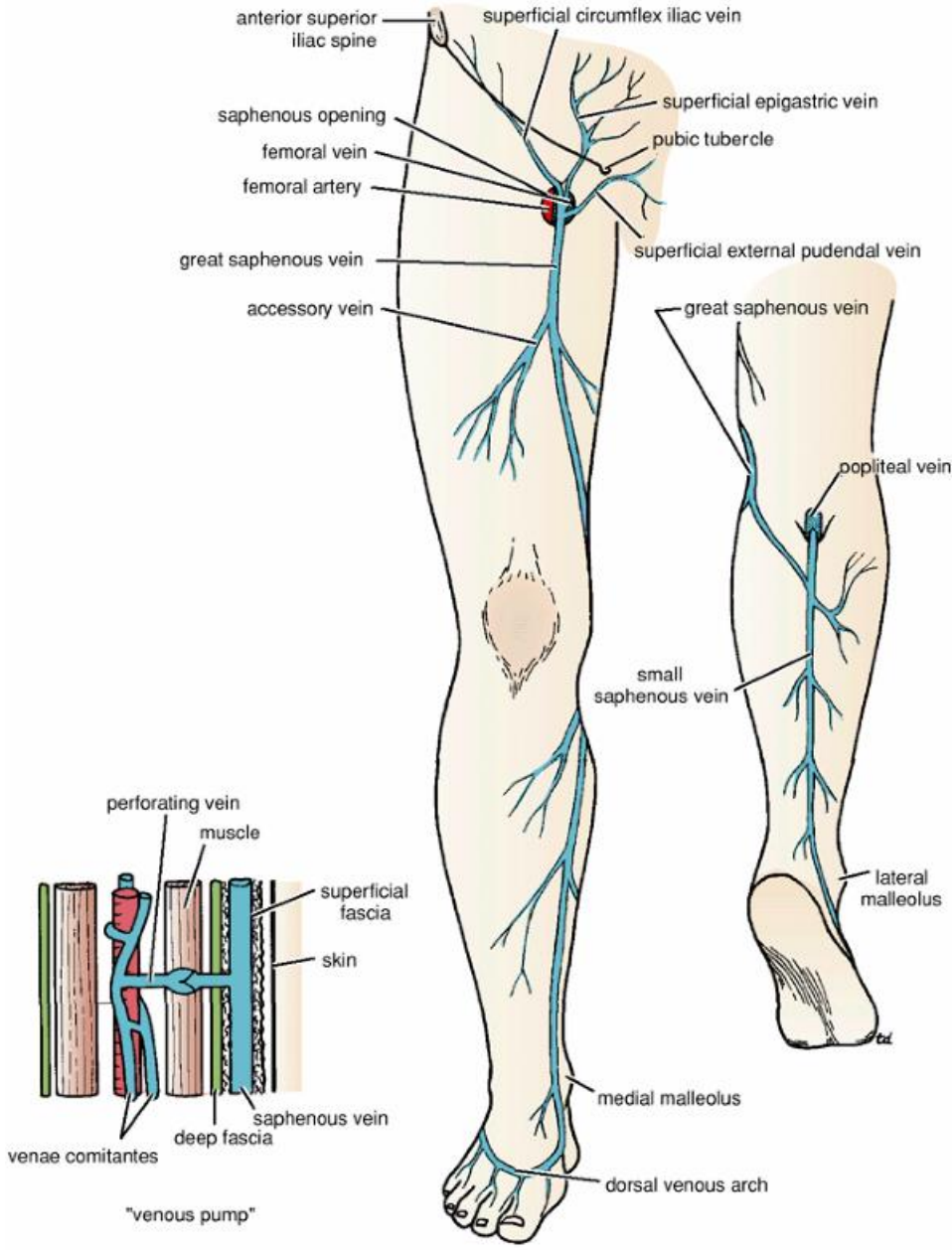
1- the superficial circumflex iliac vein

2- the superficial epigastric vein

3- the superficial external pudendal vein.

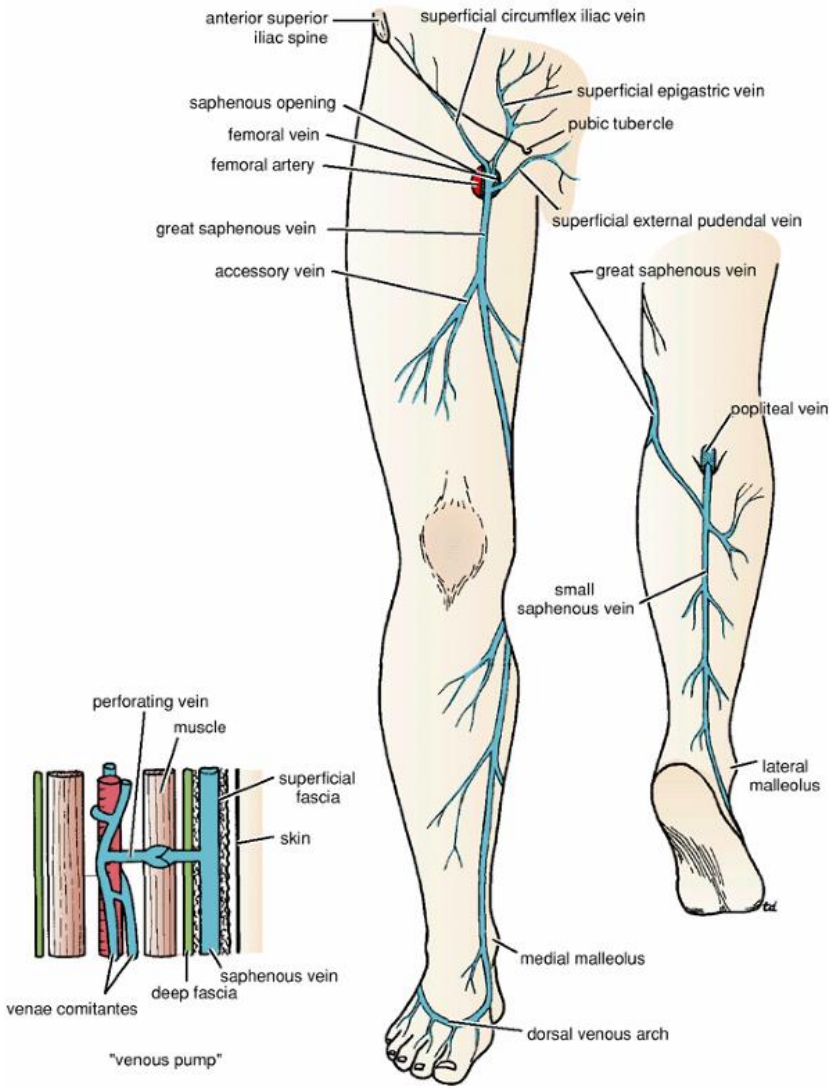
- These veins correspond with the three branches of the femoral artery found in this region.

- An additional vein, known as **the accessory vein**, usually joins the main vein about the middle of the thigh or higher up at the saphenous opening.



Saphenous opening

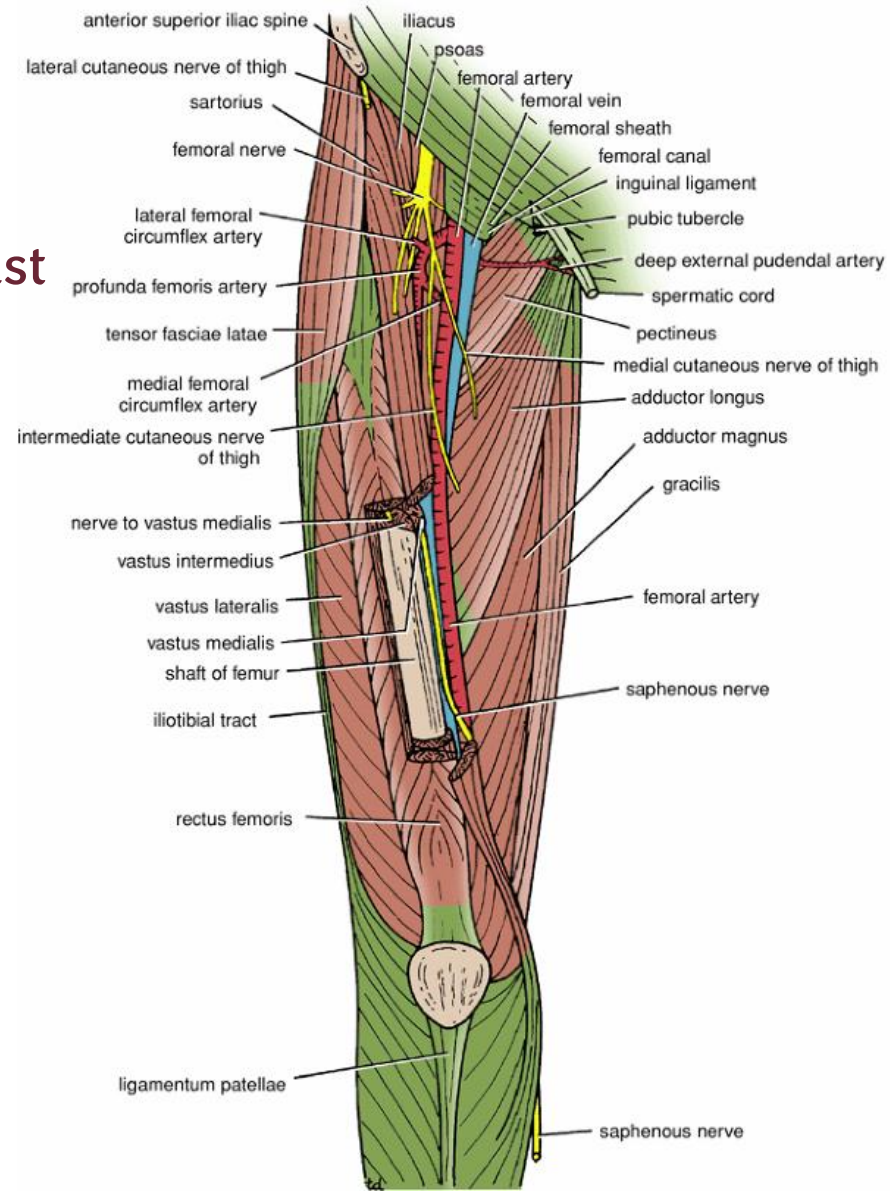
- Opening in deep fascia
- Oval in shape 1’inch long x1/2’ inch wide
- Its center 1.5 inch below and lateral to the pubic tubercle
- The upper , lateral and lower margine of the opening is sharp called falciform margine ,while the medial is smooth and formed by the fascia covering the pectineus muscle
- The fascia closing the saphenous opening is called **cribriform fascia** because it is pierced by **the great saphenous.v, suprficial inguinal arteries and lymph vessels & small saphenouse vein .**



- Sometimes, a catheter is inserted into the vein through the **saphenous opening** — it can be felt.
- The **femoral artery** can also be felt; its pulsation is located midway between the **anterior superior iliac spine** and the **symphysis pubis**.
- When they want to examine blocked arteries, the catheter is inserted through the **femoral artery**.
- It passes through the **femoral artery** → **external iliac** → **abdominal aorta** → **thoracic aorta** → **aortic arch** → until it reaches the **ascending aorta** coming from the **left ventricle**, where the contrast dye is injected to visualize the **coronary artery.**

Femoral Triangle

- The femoral triangle is a triangular depressed area
- situated in the upper part of the medial aspect of the thigh just below the inguinal ligament
- **Its boundaries are as follows:**
  - **Superiorly:** The inguinal ligament
  - **Laterally:** The sartorius muscle
  - **Medially**: The adductor longus muscle
  - **Its floor** is gutter shaped and formed from **lateral to medial:** iliopsoas (**I**liacus, **P**soas major) respectively, **P**ectineus, and **A**dductor longus. **IPPA**
  - **Its roof** is formed by the skin and fasciae of the thigh.
- **Base**: it is formed from the inguinal ligament
- **Apex**: it is the meeting point between sartorius and adductor longus



- ✓ **Continuing with the femoral triangle ,** Beneath the **sartorius** lies the **subsartorial canal** (also known as the **adductor canal**). It begins at the **apex of the femoral triangle** and ends in the **popliteal fossa** at the **adductor magnus opening** (also called the **adductor hiatus**).

- ✓ In the **femoral triangle**, the **artery** lies **lateral,** and the **vein** lies **medial**.
- ✓ At the **apex**, a **crossing** occurs, and the **artery** becomes **medial**, while the **vein** becomes **lateral**.

- **The femoral triangle contains :**

- the terminal part of the femoral nerve and its branches
- the femoral sheath
- the femoral artery and its branches
- the femoral vein and its tributaries
- the deep inguinal lymph nodes.

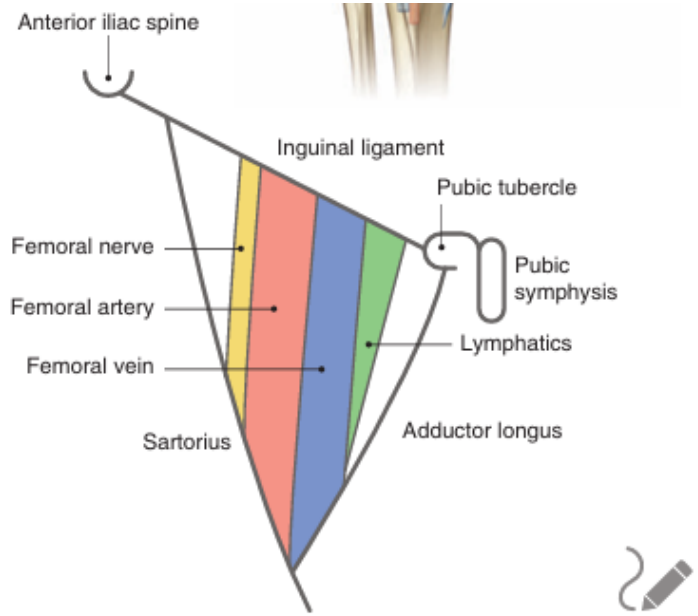
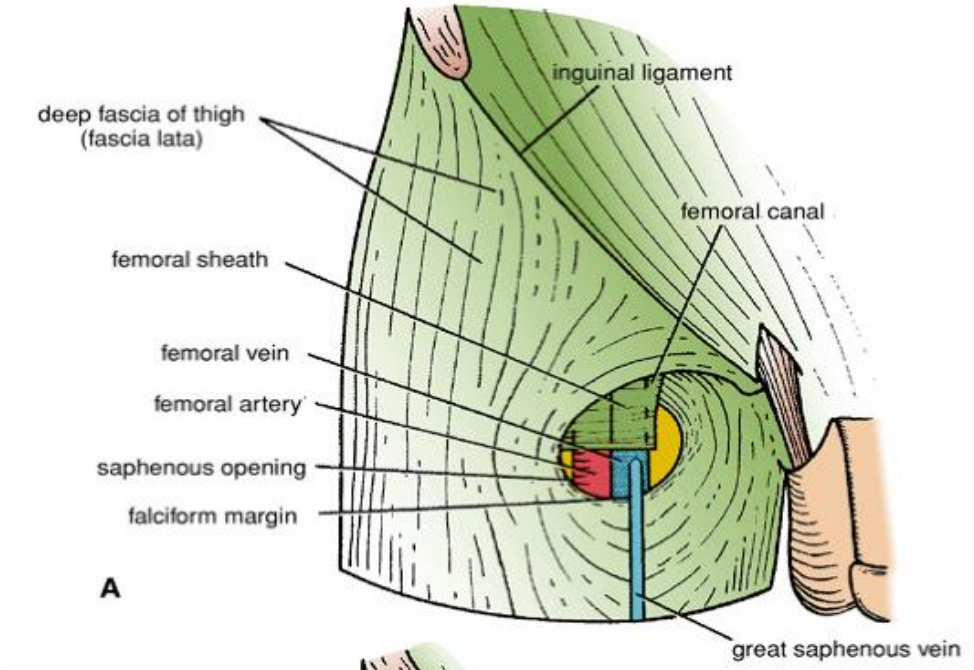
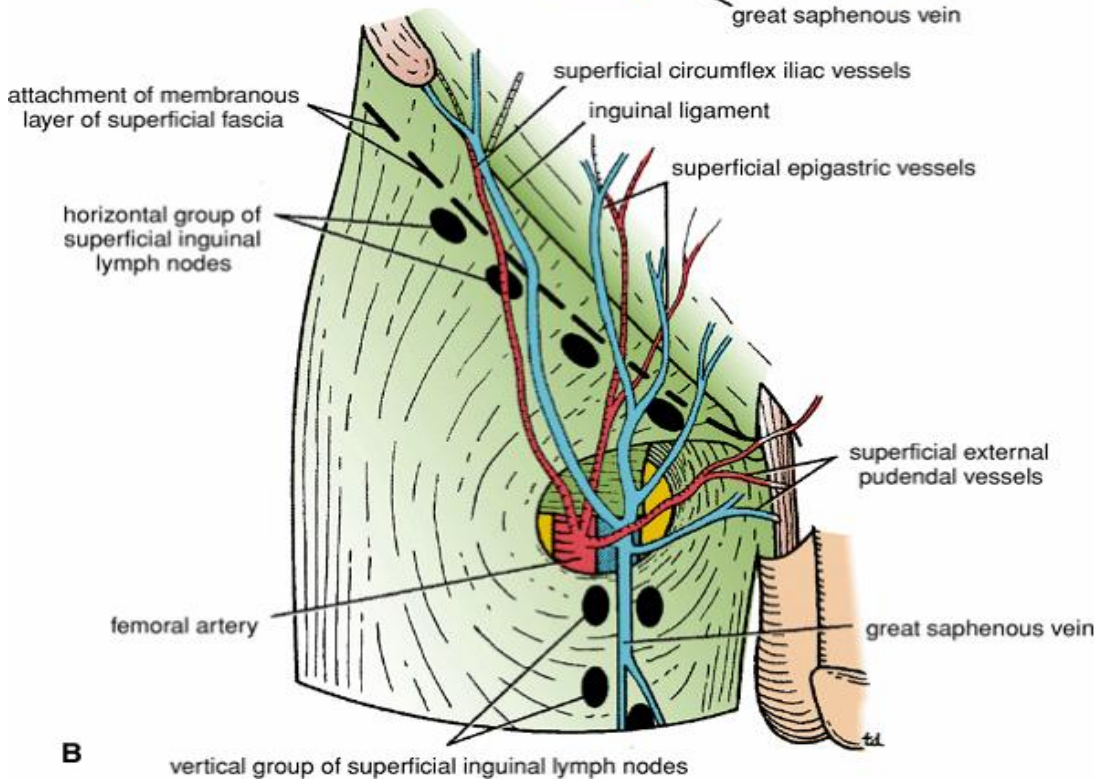


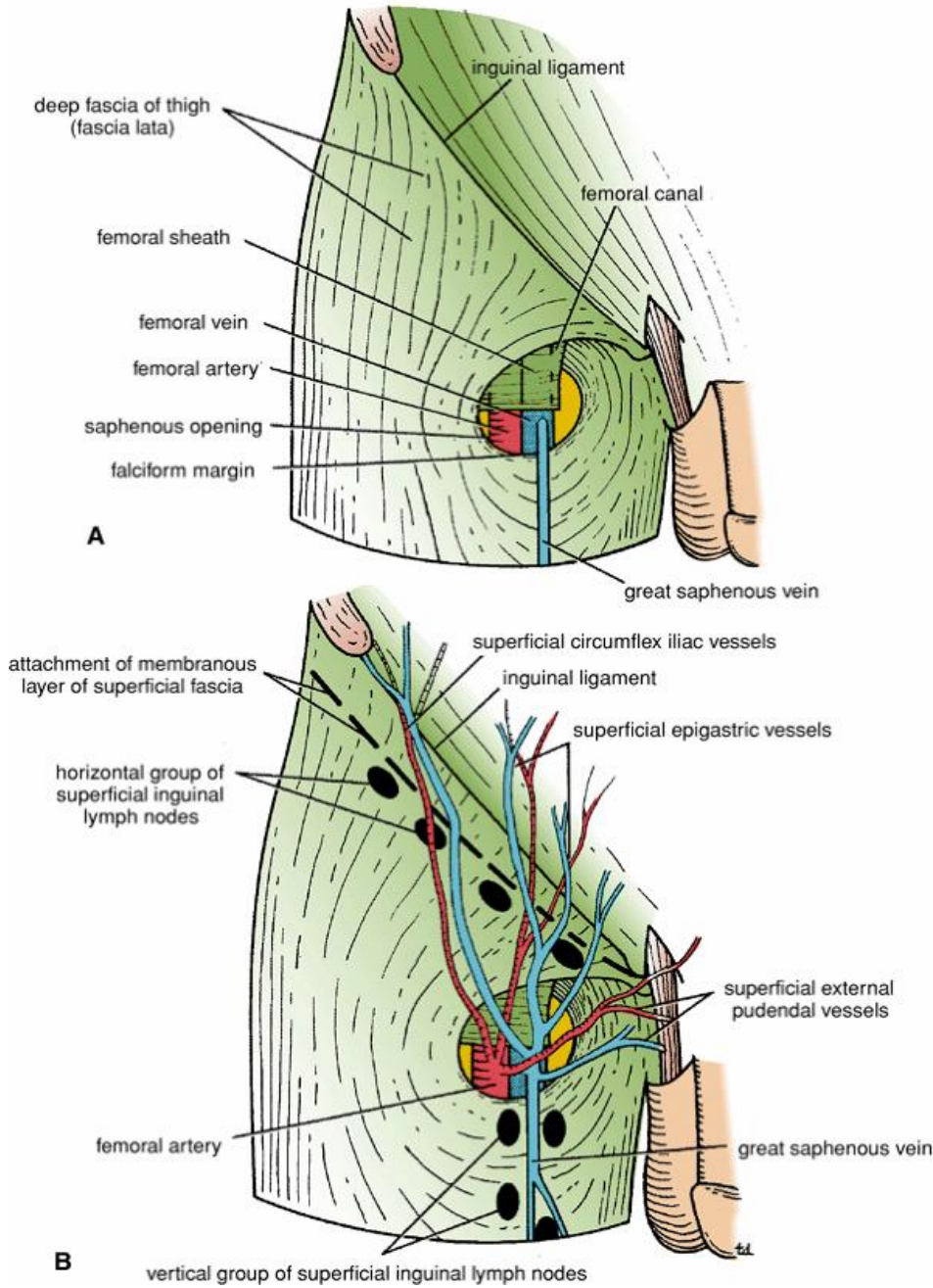
Fig. 6.43 Contents of the femoral triangle.





Femoral Sheath

- The femoral sheath (is a downward protrusion into the thigh of the fascial envelope lining the abdominal walls
- **Its anterior wall** is continuous above with the fascia transversalis
- **its posterior wall** with the fascia iliaca.
- The sheath surrounds the femoral vessels and lymphatics for about 1 in. (2.5 cm) below the inguinal ligament.
- **The femoral artery**, as it enters the thigh beneath the inguinal ligament, occupies the lateral compartment of the sheath.
- **The femoral vein,** as it leaves the thigh, lies on its medial side and is separated from it by a fibrous septum and occupies the intermediate compartment.
- **The lymph vessels,** as they leave the thigh, are separated from the vein by a fibrous septum and occupy the most medial compartment



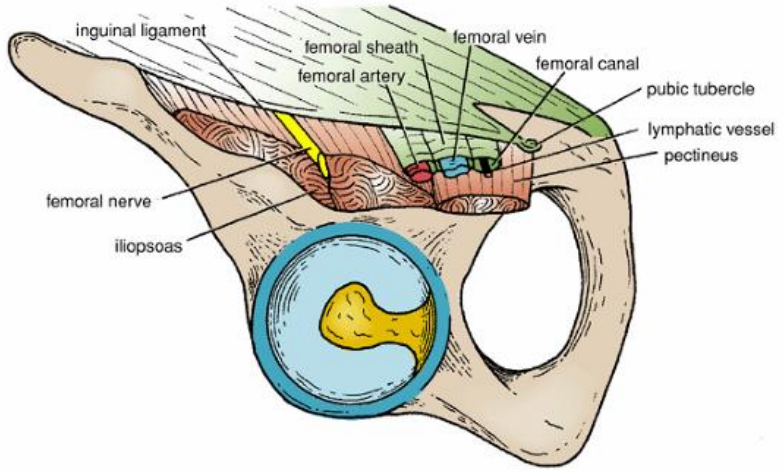
Femoral Sheath Compartments

Compartment	Contents	Clinical Relevance
Lateral	Femoral artery	Catheterization site
Intermediate	Femoral vein	Deep vein thrombosis risk
Medial	Lymphatics (femoral canal)	**Femoral hernia** site (weak area)

Remember: Femoral nerve is **outside** femoral sheath

The femoral canal

- It is the small medial compartment for the lymph vessels
- It is about 0.5 in. (1.3 cm) long , (the shortest one)
- its upper opening is called the femoral ring.

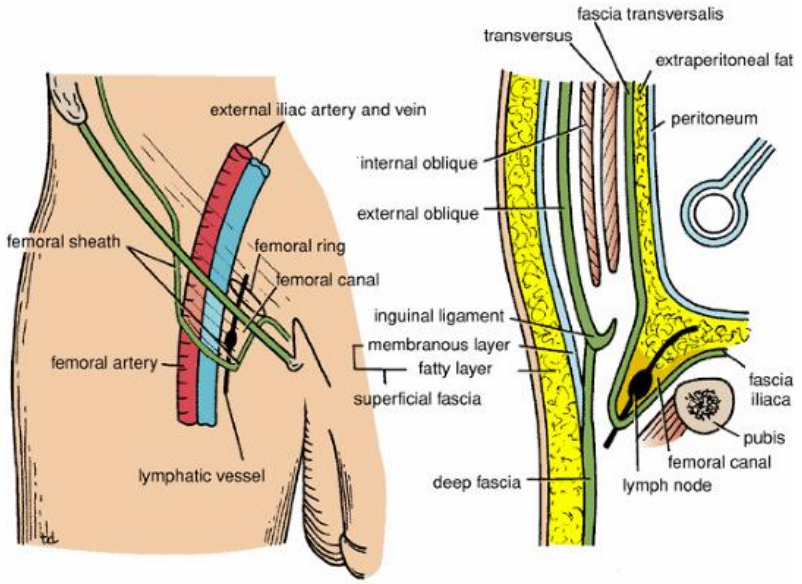


- The femoral canal contains :

1- fatty connective tissue

2- all the efferent lymph vessels from the deep inguinal lymph nodes

3- one of the deep inguinal lymph nodes.

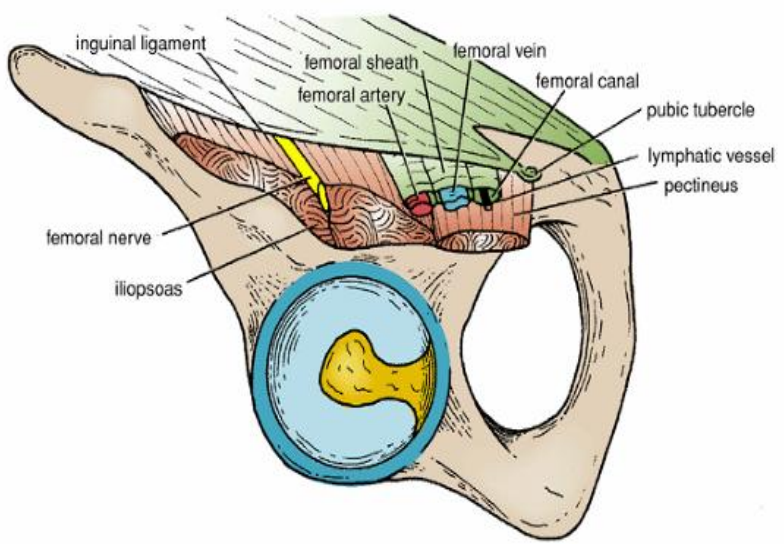


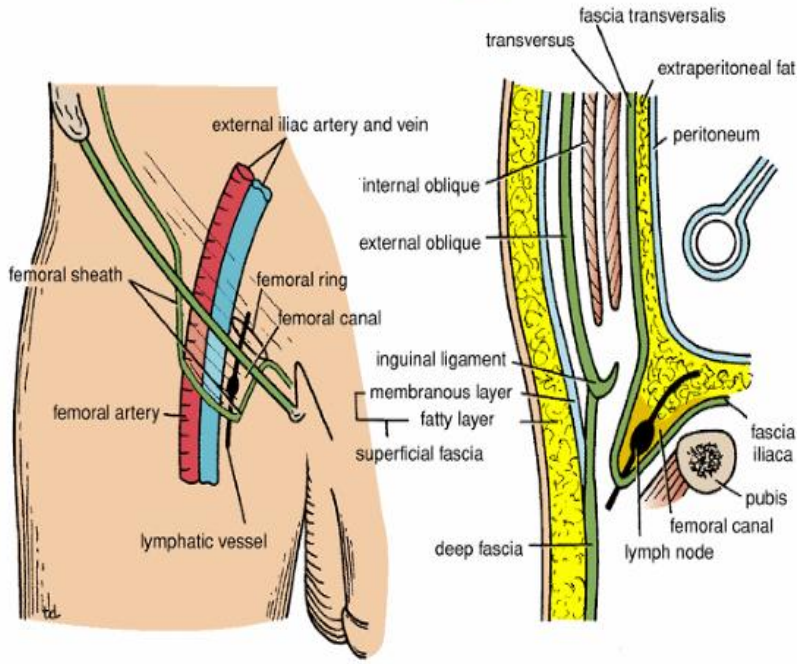
The femoral septum (separate between canal and vein)

- It is a condensation of extraperitoneal tissue, closes the ring.
- The disadvantage of canal is the femoral hernia

- **The femoral sheath** is adherent to the walls of the blood vessels
- inferiorly blends with the tunica adventitia of these vessels.

- There is a septum that divides femoral sheath into three compartments. The part of the femoral sheath that forms the medially located femoral canal **is not** adherent to the walls of the small lymph vessels; it is this site that forms a potentially weak area in the abdomen
- A protrusion of peritoneum could be forced down the femoral canal, pushing the femoral septum before it. Such a condition is known as a **femoral hernia** (firstly peritoneum and secondly small intestine or greater omentum).



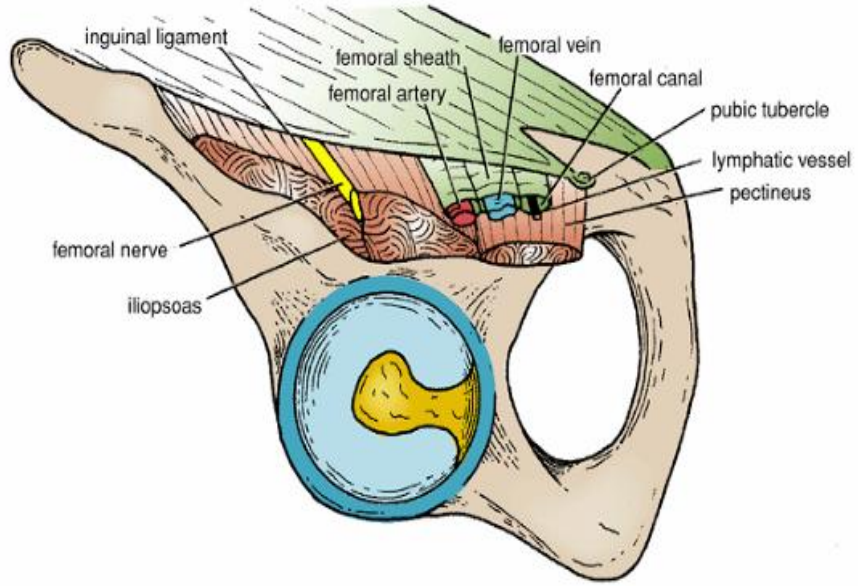


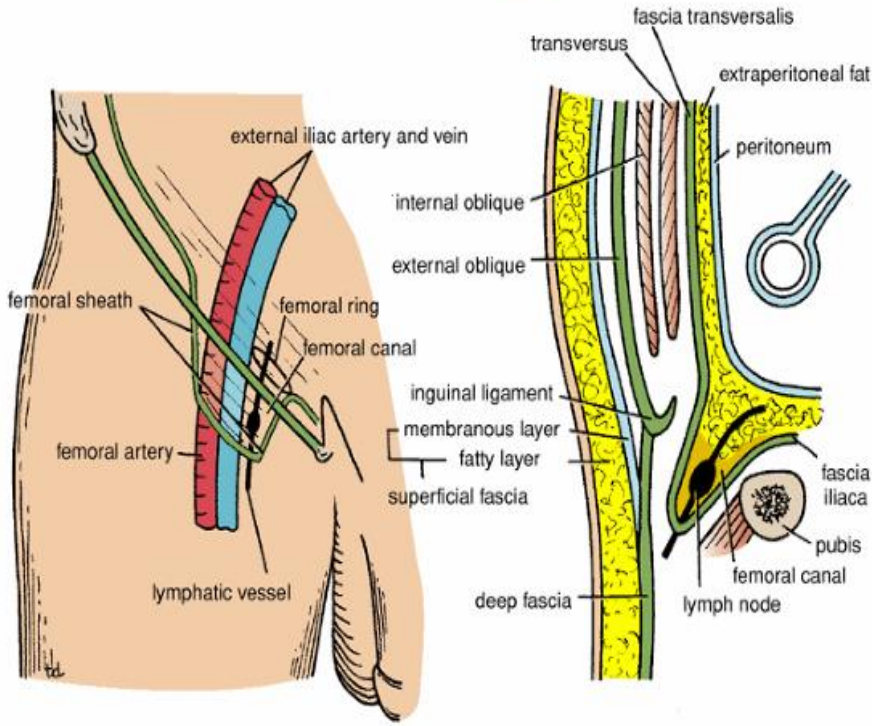
The femoral ring has the following important relations:

- **anteriorly,** the inguinal ligament
- **posteriorly,** the superior ramus of the pubis
- **medially,** the lacunar ligament
- **laterally,** the femoral vein.

- The lower end of the canal is normally **closed** by the adherence of its medial wall to the tunica adventitia of the femoral vein (**septum**).

- It lies close to the saphenous opening in the deep fascia of the thigh





- **Clinical Notes**
- **Femoral Sheath and Femoral Hernia**
- The hernial sac (peritoneum + abdominal structure) descends through the femoral canal within the femoral sheath.
- The femoral sheath is a prolongation downward into the thigh of the fascial lining of the abdomen.
- It surrounds the femoral vessels and lymphatic vessels for about 1 in. (2.5 cm) below the inguinal ligament

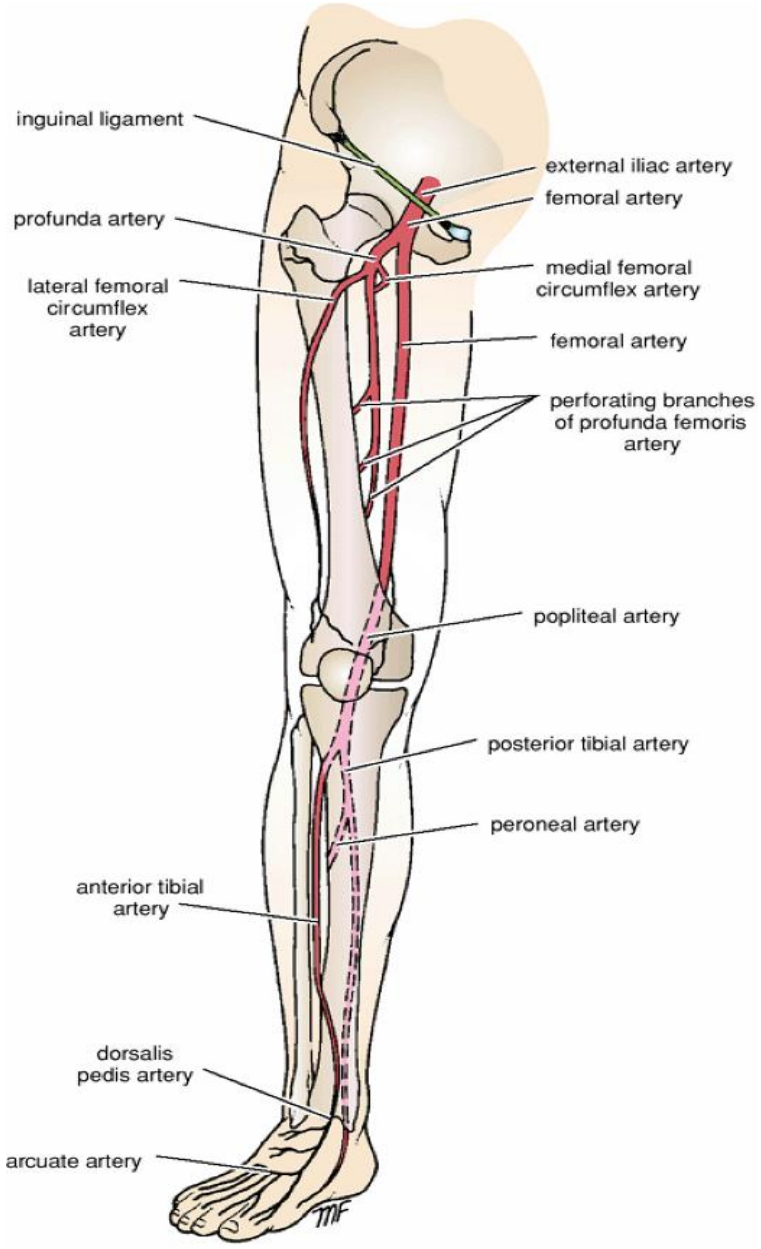
- A hernia is caused by the protrusion of **a viscus** (in the case of groin hernias, an intra abdominal organ) through a weakness in the containing wall.
- This weakness may be inherent, as in the case of

1. inguinal (direct, indirect. Will be discussed later in GI)
2. femoral
3. umbilical & paraumbilical hernias (para= around).

- On the other hand, the weakness may be caused by surgical incision through the muscles of the abdominal/thoracic wall. Hernias occurring through these are called **4. incisional hernias.**
- **Femoral hernias** occur just below **the inguinal ligament** when abdominal contents pass through a naturally occurring weakness called **the femoral canal**
- Femoral hernias are a relatively uncommon type, accounting for only 3% of all hernias.
- While femoral hernias can occur in both males and females, almost all of them develop in women because of the wider bone structure of the female pelvis.
- Femoral hernias are more common in adults than in children.
- Those that do occur in children are more likely to be associated with a connective tissue disorder or with conditions that increase intra-abdominal pressure.
- Seventy percent of pediatric cases of femoral hernias occur in infants under the age of one.

Femoral Artery

- The femoral artery enters the thigh from behind the inguinal ligament, as a continuation of the external iliac artery
- Here, it lies midway between the anterior superior iliac spine and the symphysis pubis.
- The femoral artery is the main arterial supply to the lower limb.
- **The femoral artery enters the subsartorial canal as it passes through the thigh,** it descends almost vertically toward the adductor tubercle of the femur and ends at the opening in the adductor magnus muscle by entering the popliteal space as the **popliteal artery.**



Femoral Artery

After entering the popliteal fossa, femoral artery becomes the popliteal artery. At the lower border of the popliteus muscle, it divides into:

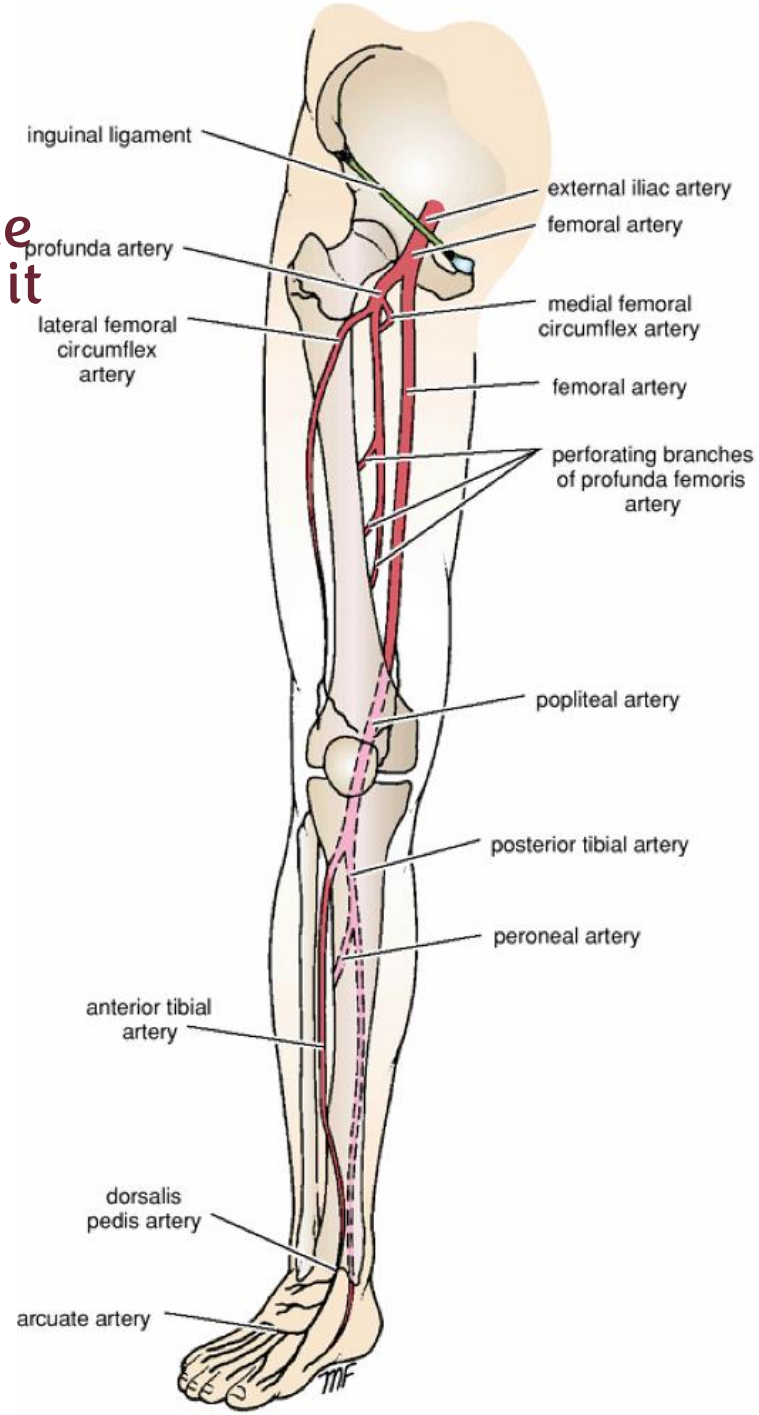
1. anterior tibial artery: supplies blood to the anterior compartment of the leg.
2. posterior tibial artery. supplies blood to the posterior compartment on the leg.

- Both arteries terminate on the foot.

Profounda artery

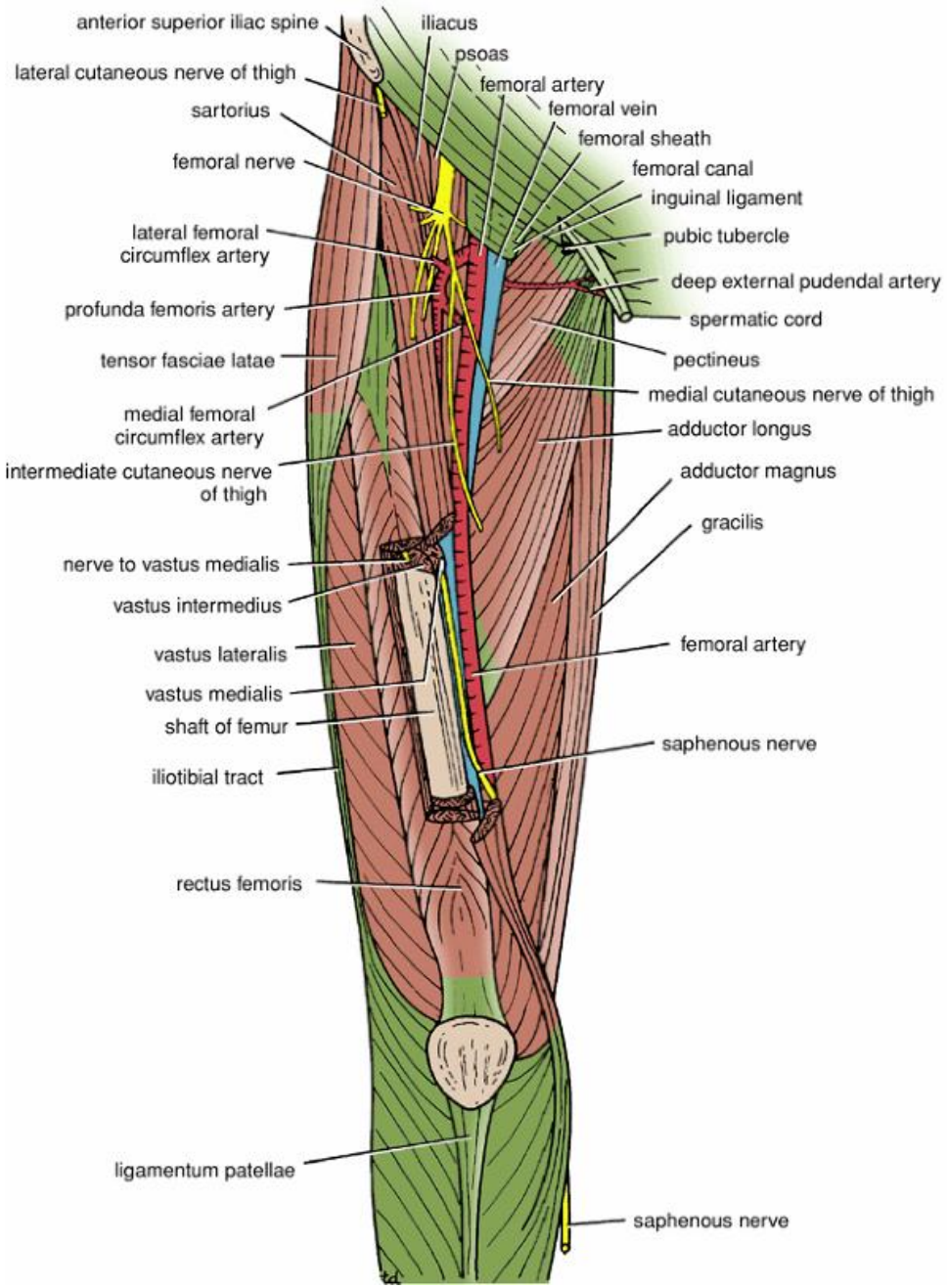
- profunda artery is a branch of the femoral artery, it supplies the medial and posterior compartment of the thigh through perforating branches.
- Branches of the Profunda femoris artery:

1. Lateral femoral circumflex artery
2. Medial femoral circumflex artery
3. Perforating arteries



Relations

- **Anteriorly:** In the upper part of its course, it is superficial and is covered by skin and fascia. In the lower part of its course, it passes behind the sartorius muscle
- **Posteriorly:** The artery lies on the psoas, which separates it from the hip joint, the pectineus, and the adductor longus
- The femoral vein intervenes between the artery and the adductor longus.
- **Medially:** It is related to the femoral vein in the upper part of its course
- **Laterally:** The femoral nerve and its branches

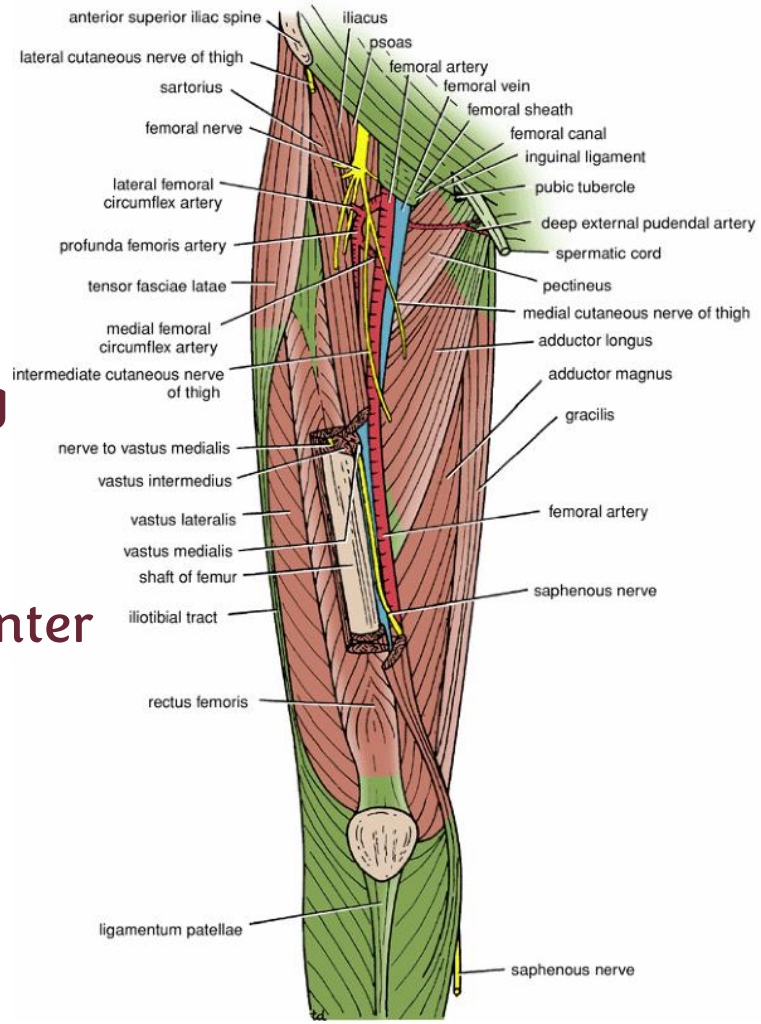


Relations in the Femoral Triangle and Subsartorial Canal

1. Crossing Pattern at the Femoral Triangle Apex

At the apex of the femoral triangle, the **femoral artery** and **femoral vein** undergo a positional change:

- Initially, the **femoral artery** lies *lateral* to the femoral vein.
- As they descend, the **artery moves anteriorly**, while the **vein shifts posteriorly**.
- This crossing is completed as they exit through the **adductor opening (hiatus)**.



2. Transition to the Subsartorial Canal

After passing the femoral triangle apex, the neurovascular structures enter the **subsartorial canal** (also called the **adductor canal** or **Hunter's canal**).

3. Key Structure: Saphenous Nerve

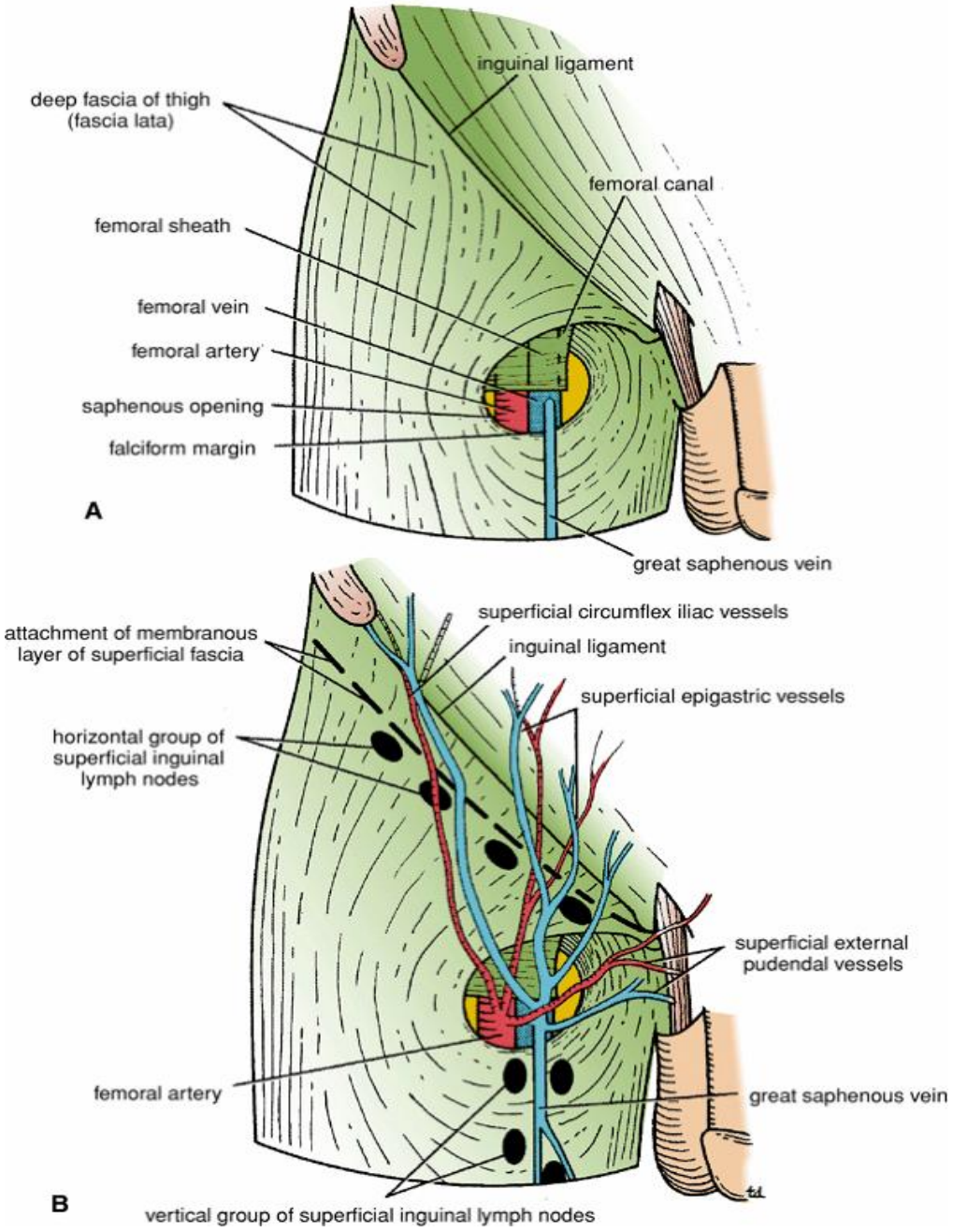
- The **saphenous nerve**, a branch of the femoral nerve, is the **most important sensory nerve** in the canal.
- It is the **only branch of the femoral nerve** that extends to the **foot**.
- **Function**: Provides **cutaneous innervation** to the **medial leg** and **medial foot**.

Branches of femoral artery

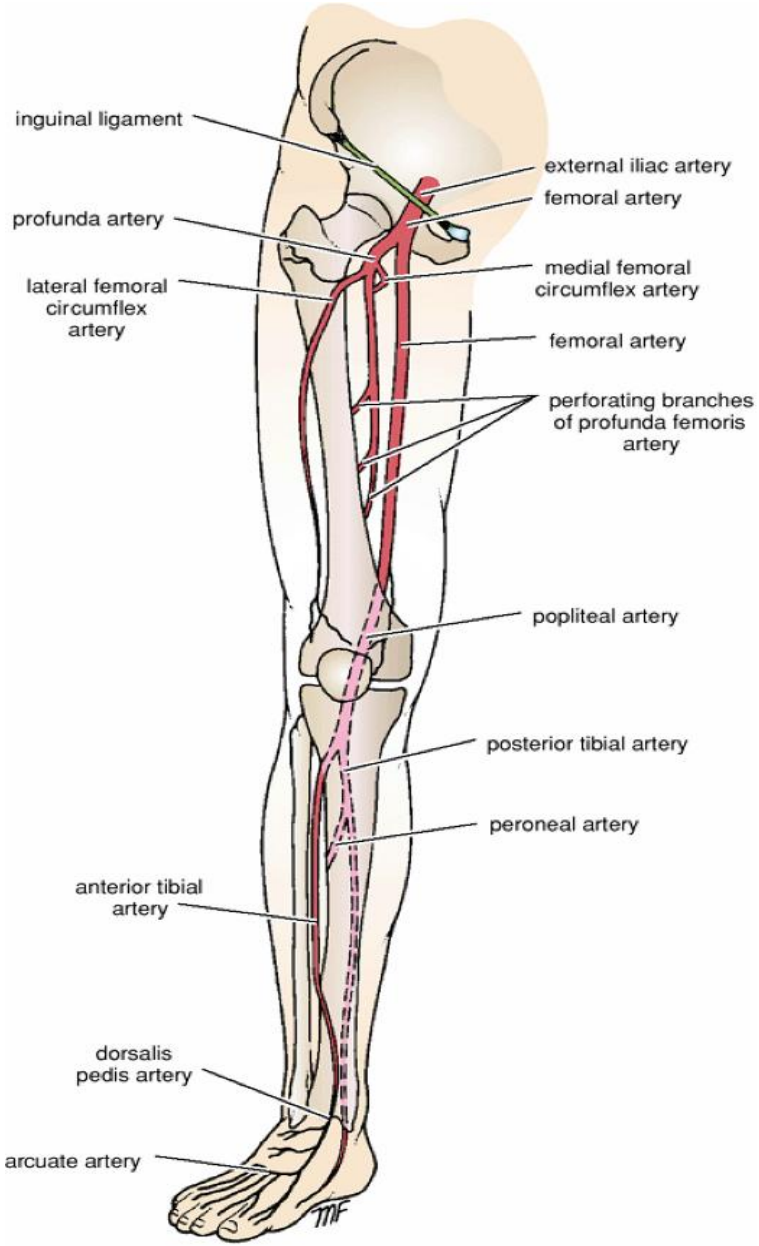
- **The superficial circumflex iliac artery** is a small branch that runs up to the region of the anterior superior iliac spine

- **The superficial epigastric artery** is a small branch that crosses the inguinal ligament and runs to the region of the umbilicus

- **The superficial external pudendal artery** is a small branch that runs medially to supply the skin of the scrotum (or labium majus).



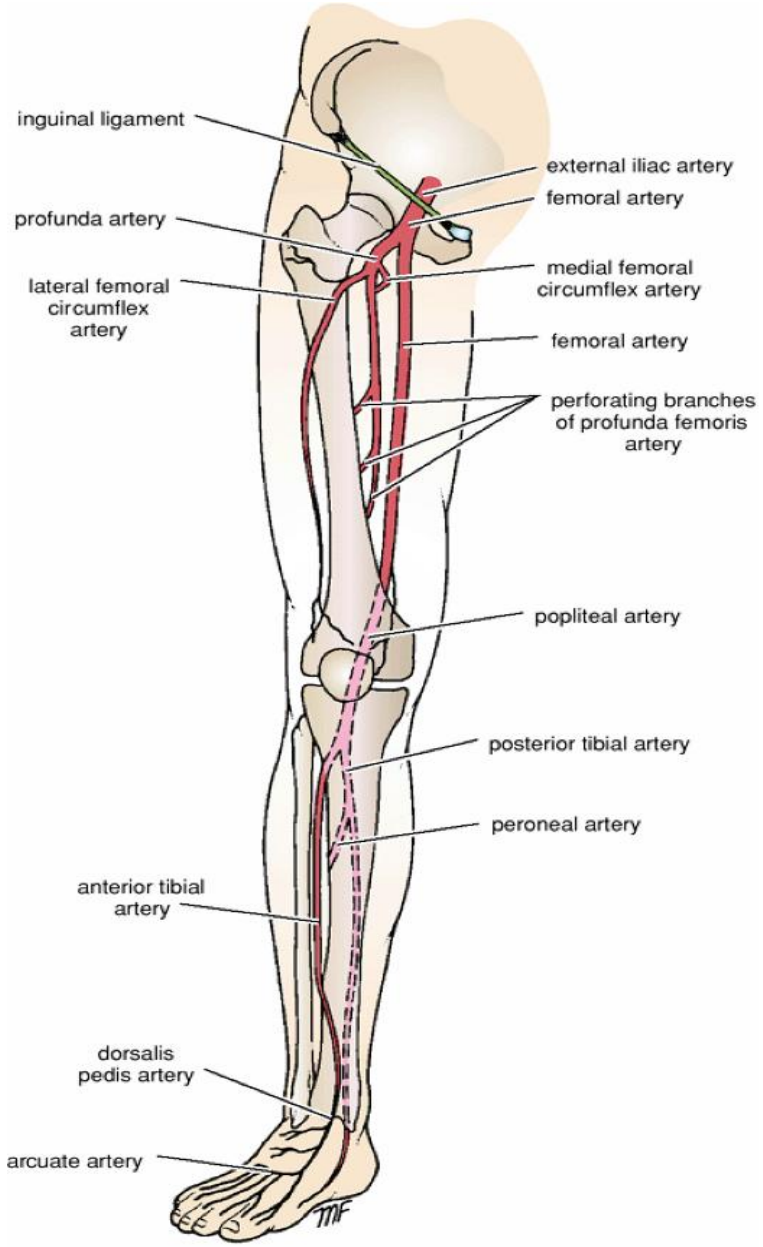
- **The deep external pudendal artery** runs medially and supplies the skin of the scrotum (or labium majus).



- **The profunda femoris artery** is a large and important branch
- arises from the lateral side of the femoral artery about 1.5 in. (4 cm) below the inguinal ligament
- It passes medially behind the femoral vessels and enters the medial fascial compartment of the thigh

- **It ends by becoming the fourth perforating artery.**

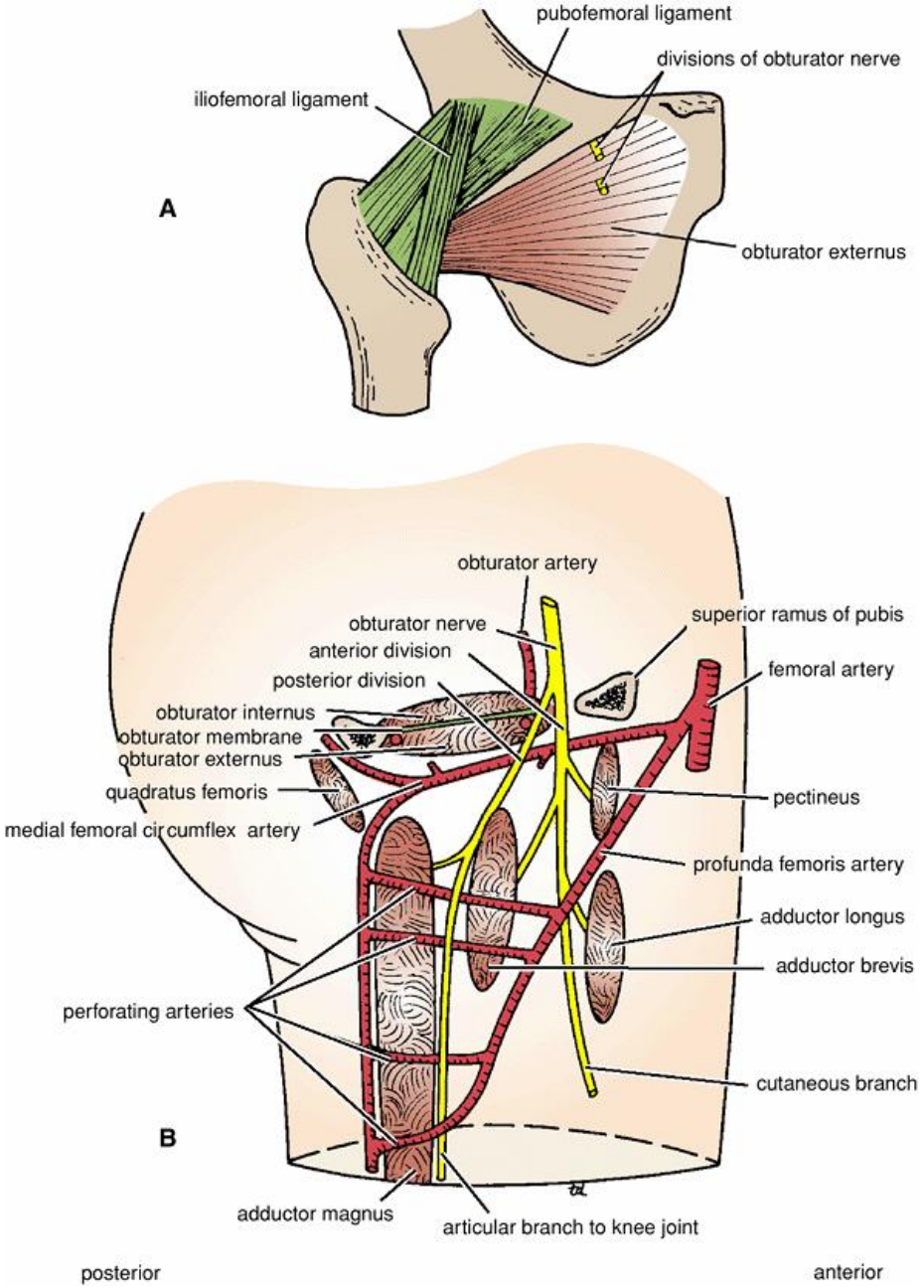
- At its origin, it gives off the medial and lateral femoral circumflex arteries, and during its course it gives off three perforating arteries .



Branches

- **Medial femoral circumflex artery**: This passes backward between the muscles that form the floor of the femoral triangle and gives off muscular **branches in the medial fascial compartment of the thigh ,It takes part in the formation of the cruciate anastomosis**.

- **Lateral femoral circumflex artery**: This passes laterally between the terminal branches of the femoral nerve
- It breaks up into branches that **supply the muscles of the region and takes part in the formation of the cruciate anastomosis.**
- **Another important anastomosis around the greater trochanter is called trochanteric anastomosis.**



Four perforating arteries:

- Three of these arise as branches of the profunda femoris artery
- the fourth perforating artery is the terminal part of the profunda artery
- The perforating arteries run backward, piercing the various muscle layers (adductor magnus) as they go to the posterior part.
- They supply the muscles and terminate by anastomosing with one another and with the inferior gluteal artery and the circumflex femoral arteries above and the muscular branches of the popliteal artery below.

➢ Popliteal Artery

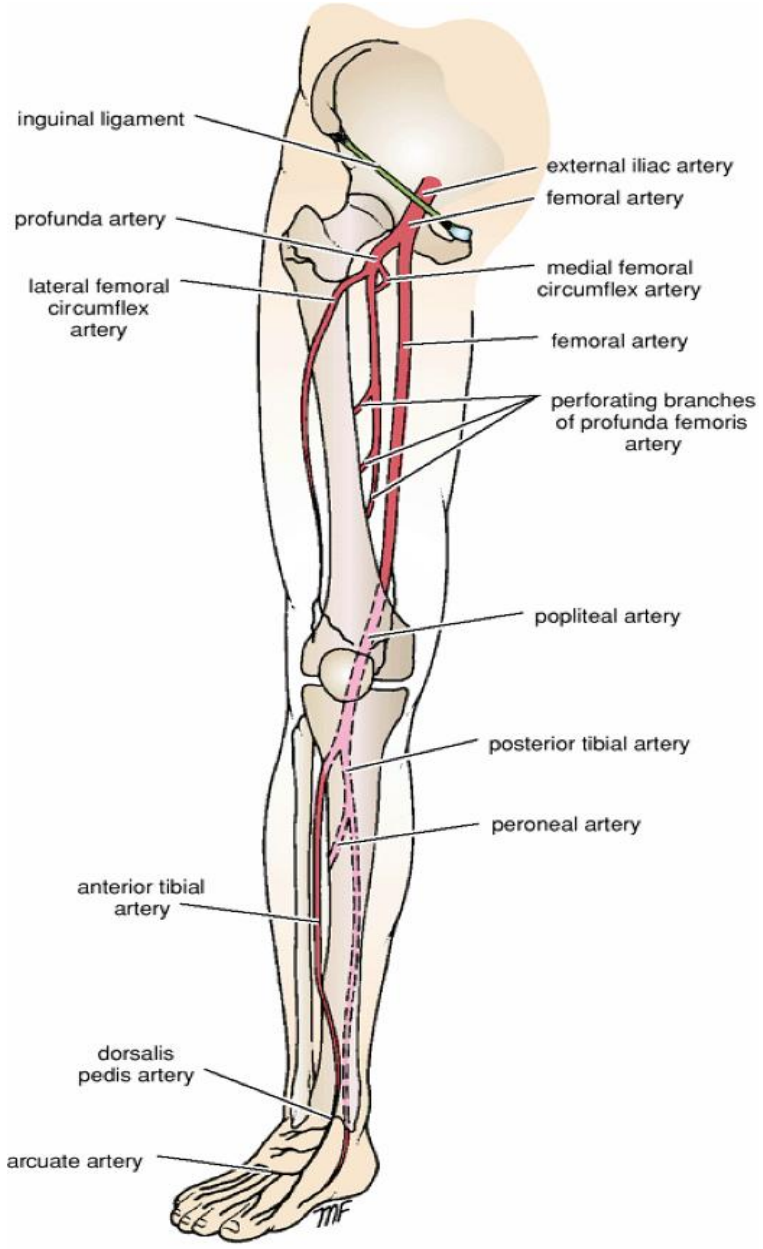
- The popliteal artery is deeply placed and enters the popliteal fossa through the opening in the adductor magnus, as a continuation of the femoral artery
- **Popliteal fossa contain popliteal artery, popliteal vein and genicular branches to the knee joint.**
- It ends at the level of the lower border of the popliteus muscle by dividing into anterior and posterior tibial arteries.

❖Relations

- **Anteriorly:** The popliteal surface of the femur, the knee joint, and the popliteus muscle
- **Posteriorly:** The popliteal vein and the tibial nerve, fascia, and skin

❖Branches

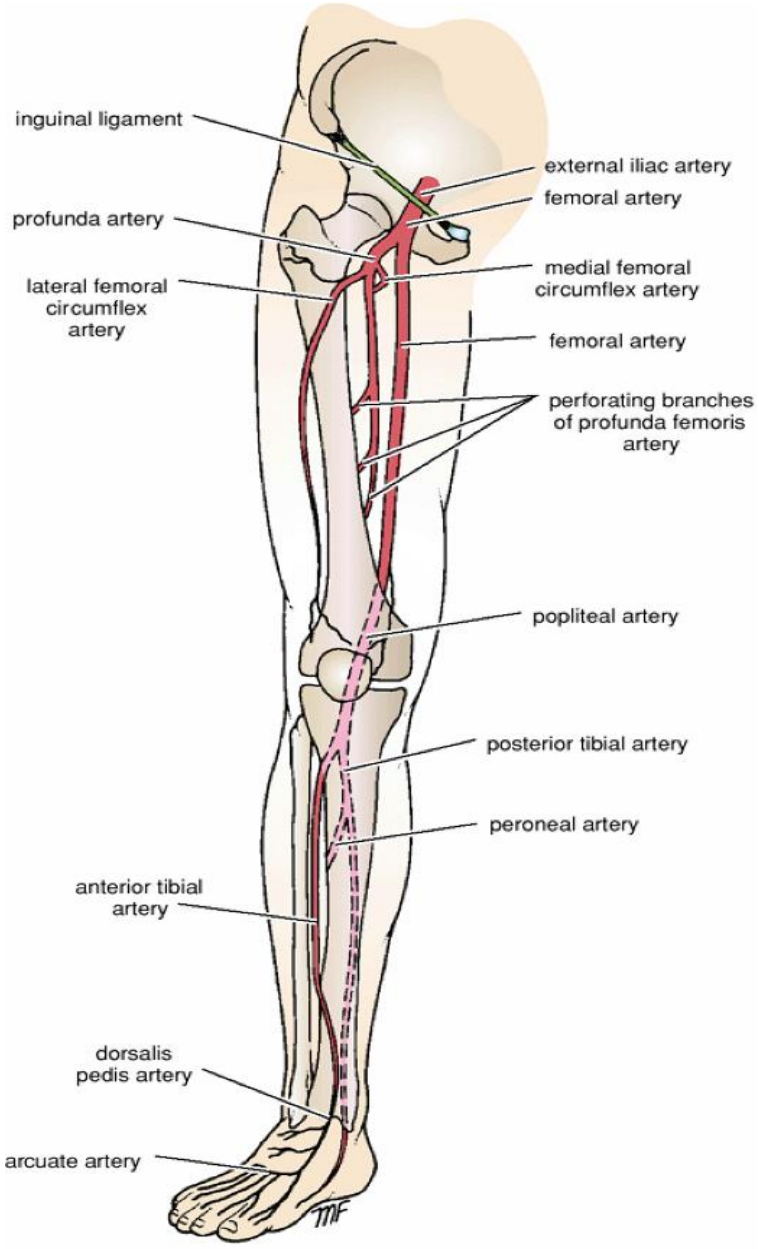
- The popliteal artery has muscular branches and articular branches to the knee.
- Ends as ant. & post. Tibial artery



Anterior Tibial Artery: **(it is the main blood supply to the anterior compartment of the leg)**

- The anterior tibial artery is the smaller of the terminal branches of the popliteal artery.
- It arises at the level of the lower border of the popliteus muscle and passes forward into the anterior compartment of the leg through an opening in the upper part of the interosseous membrane .

- It descends on the anterior surface of the interosseous membrane, accompanied by the deep peroneal nerve
- In the upper part of its course, it lies deep beneath the muscles of the compartment.
- In the lower part of its course, it lies superficial in front of the lower end of the tibia



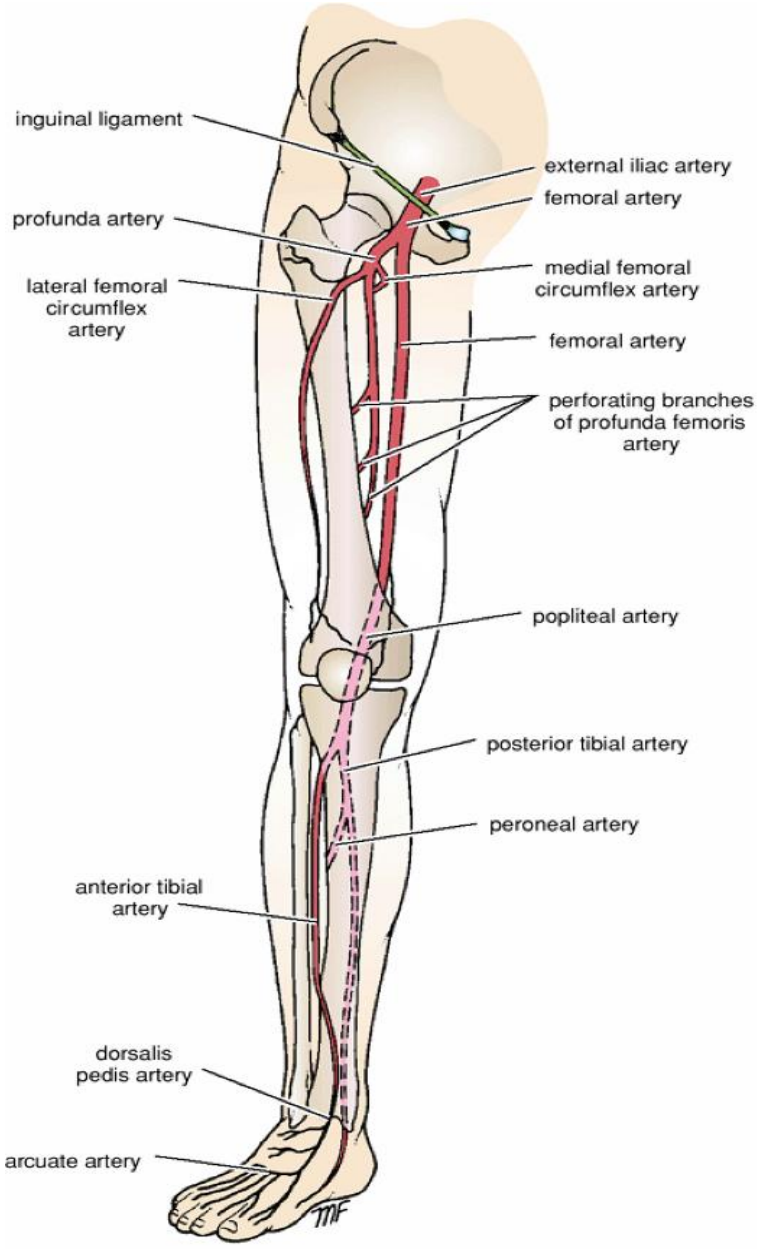
Anterior Tibial Artery

- Having passed behind the superior extensor retinaculum
- it has the tendon of the extensor hallucis longus on its medial side and the deep peroneal nerve and the tendons of extensor digitorum longus on its lateral side.
- It is here that its pulsations can easily be felt in the living subject.
- In front of the ankle joint, the artery becomes the dorsalis pedis artery, where it is easy to feel the pulsation
- If someone with diabetes has arteries that begin to constrict and their lower limb becomes cold due to reduced blood supply, we measure the pulsation from the dorsalis pedis artery proximal to the metatarsal of big toe
- The dorsalis pedis artery gives rise to **the arcuate artery** at the level of the **dorsum of the foot**.
- End as **Arcuate artery** gives **digital branches** for the toes.

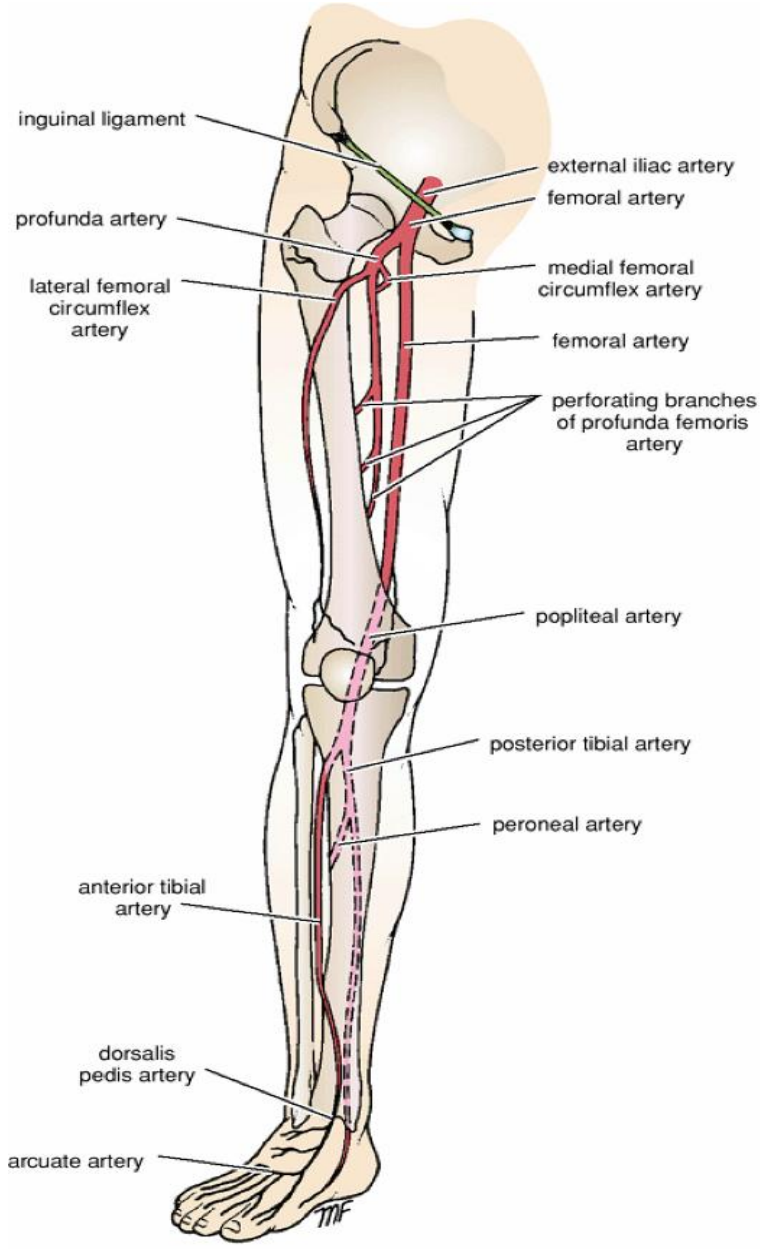
- **Branches of ant.tibial artery**
- Muscular branches to neighboring muscles
- Anastomotic branches that anastomose with branches of other arteries around the knee and ankle joints
- Venae comitantes of the anterior tibial artery join those of the posterior tibial artery in the popliteal fossa to vein

Posterior Tibial Artery

- The posterior tibial artery is one of the terminal branches of the popliteal artery
- It begins at the level of the lower border of the popliteus muscle and passes downward deep to the gastrocnemius and soleus and the deep transverse fascia of the leg .
- It lies on the posterior surface of the tibialis posterior muscle above and on the posterior surface of the tibia below.
- In the lower part of the leg the artery is covered only by skin and fascia.
- The artery passes **behind** the medial malleolus deep to the flexor **retinaculum and terminates by dividing into medial and lateral plantar arteries**



- **Branches of post.tibial artery**
- **Peroneal artery,** which is a large artery that arises close to the origin of the posterior tibial artery
- It divides into two branches: peroneal longus and peroneal brevis artery in the lateral side of the leg.
- It descends behind the fibula, either within the substance of the flexor hallucis longus muscle or posterior to it.
- The peroneal artery gives off numerous muscular branches and a nutrient artery to the fibula and ends by taking part in the anastomosis around the ankle joint.

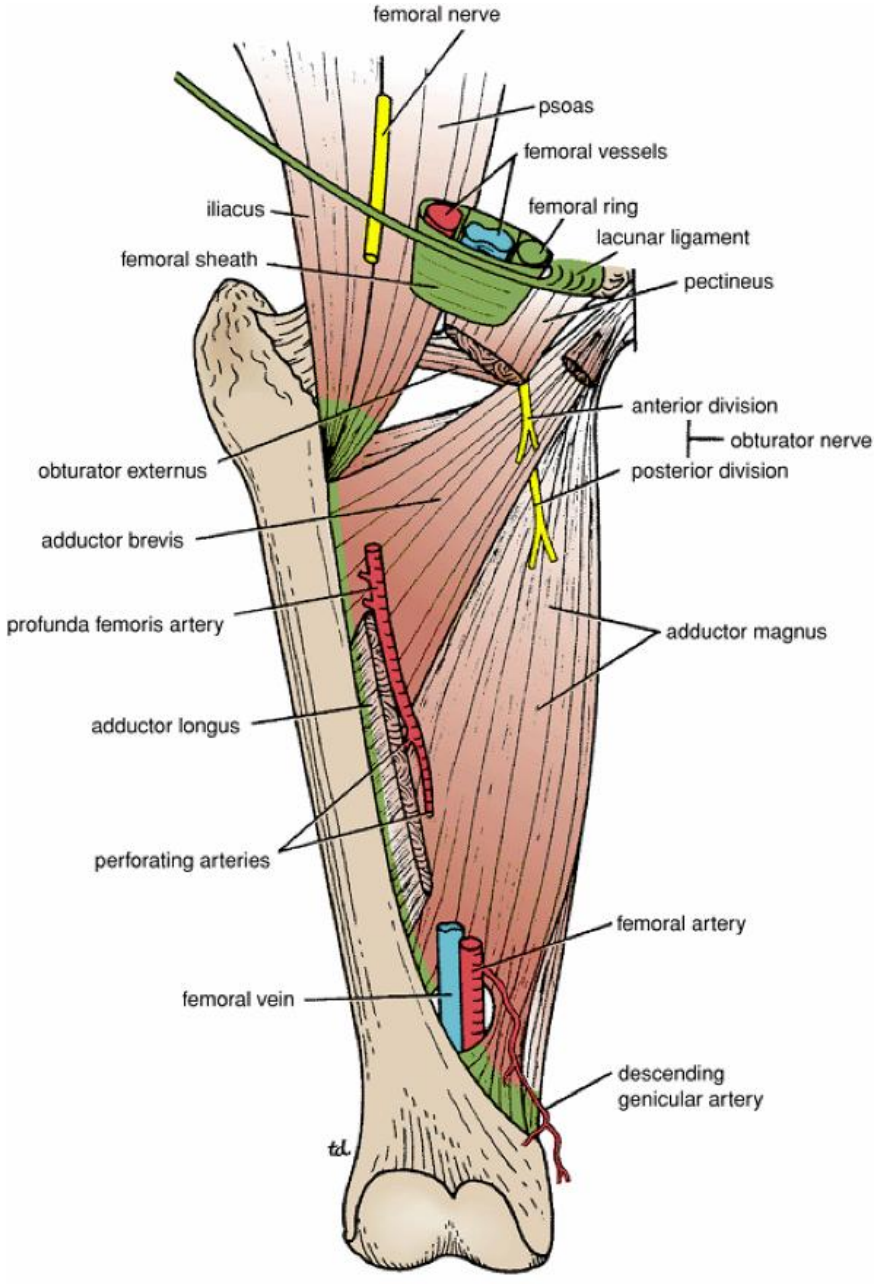


Post.Tibial artery.....cont

- **A perforating branch** pierces the interosseous membrane to reach the lower part of the front of the leg.
- **Muscular branches** are distributed to muscles in the posterior compartment of the leg.
- **Nutrient artery** to the tibia
- **Anastomotic branches**, which join other arteries around the ankle joint
- **Medial and lateral plantar arteries (end)**
- **Venae comitantes** of the posterior tibial artery join those of the anterior tibial artery in the popliteal fossa to form the popliteal vein.

Femoral Vein:

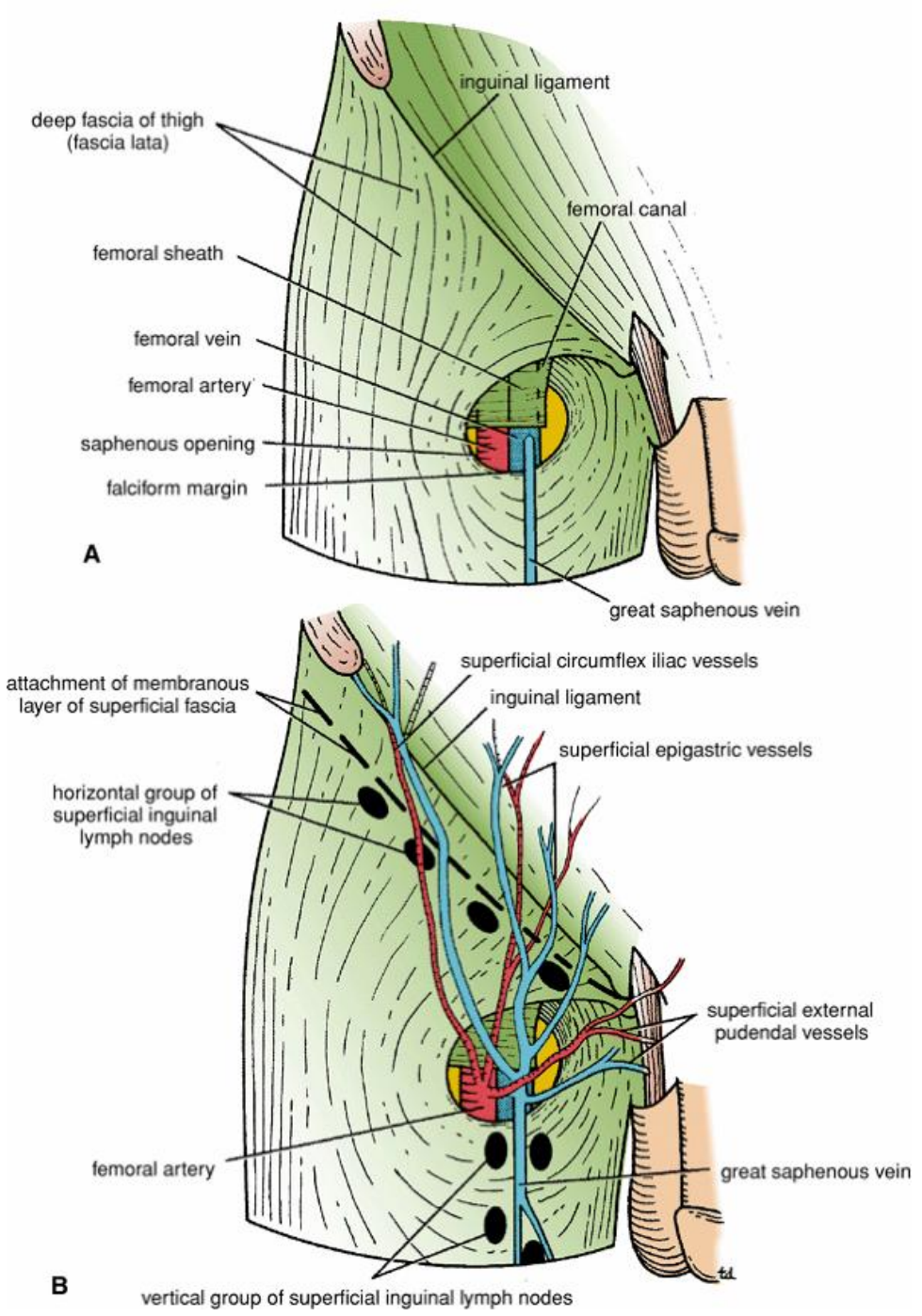
- The femoral vein enters the thigh by passing through the opening in the adductor magnus as a continuation of the popliteal vein
- Popliteal vein in the popliteal fossa receive blood from the short saphenous vein
- It ascends through the thigh, lying at first on the lateral side of the artery, then posterior to it, and finally on its medial side
- It leaves the thigh in the intermediate compartment of the femoral sheath and passes behind the inguinal ligament to become the external iliac vein.



Tributaries of femoral vein

- The tributaries of the femoral vein are:

- the great saphenous vein
- veins that correspond to the branches of the femoral artery
- The superficial circumflex iliac vein
- the superficial epigastric vein
- the external pudendal veins drain into the great saphenous vein.

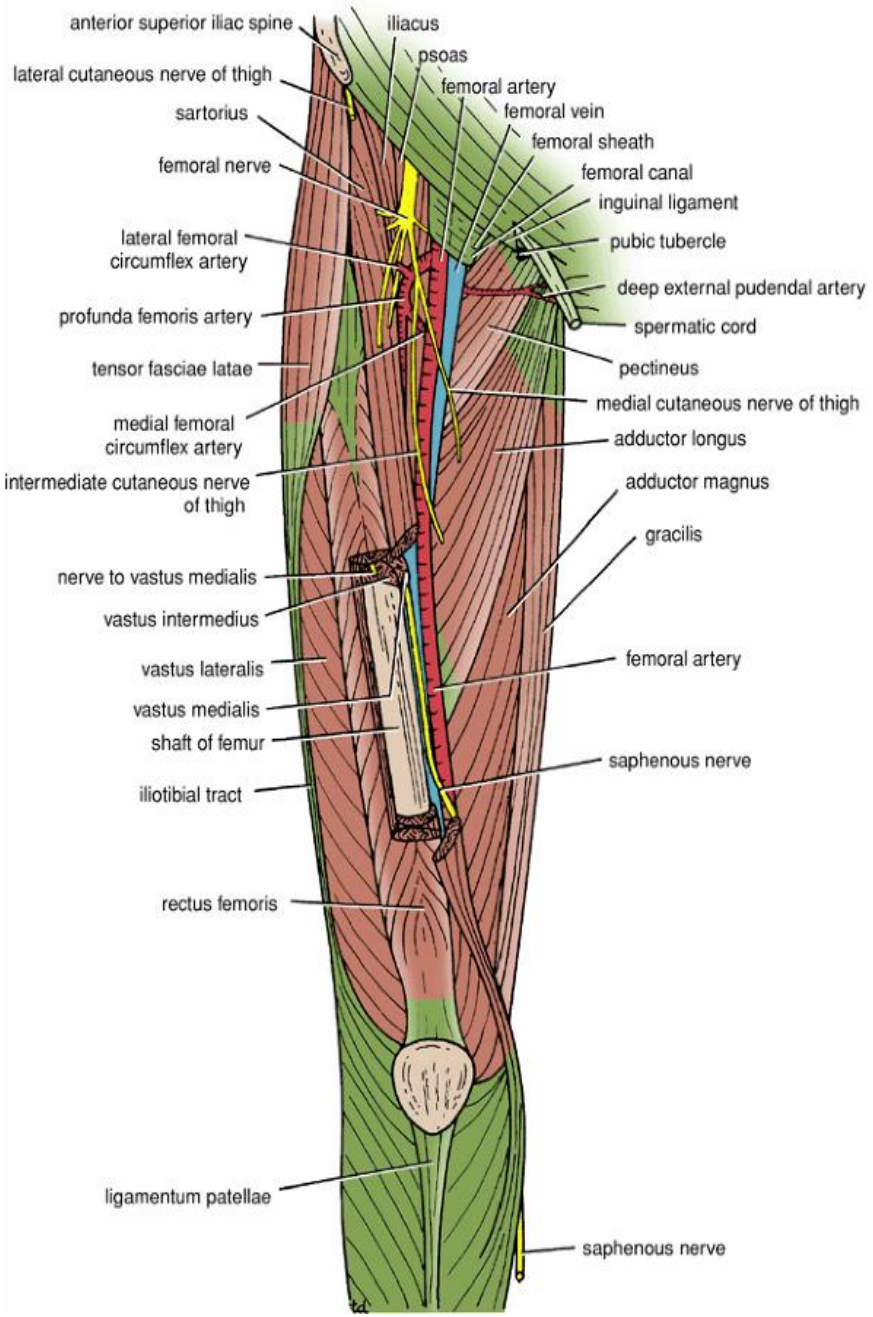


Clinical Notes

- **Femoral Vein Catheterization**
- Femoral vein catheterization is used when rapid access to a large vein is needed. The femoral vein has a constant relationship to the medial side of the femoral artery just below the inguinal ligament and is easily cannulated. However, because of the high incidence of thrombosis with the possibility of fatal pulmonary embolism, **before reaching the lung it can travel to the right atrium and the right ventricle and then to the lung,** the catheter should be removed once the patient is stabilized.
- **Anatomy of the Procedure**
- The skin of the thigh below the inguinal ligament is supplied by the genitofemoral nerve; this nerve is blocked with a local anesthetic.
- The femoral pulse is palpated midway between the anterior superior iliac spine and the symphysis pubis, and the femoral vein lies immediately medial to it.
- At a site about two fingerbreadths below the inguinal ligament, the needle is inserted into the femoral vein.

Femoral Nerve:

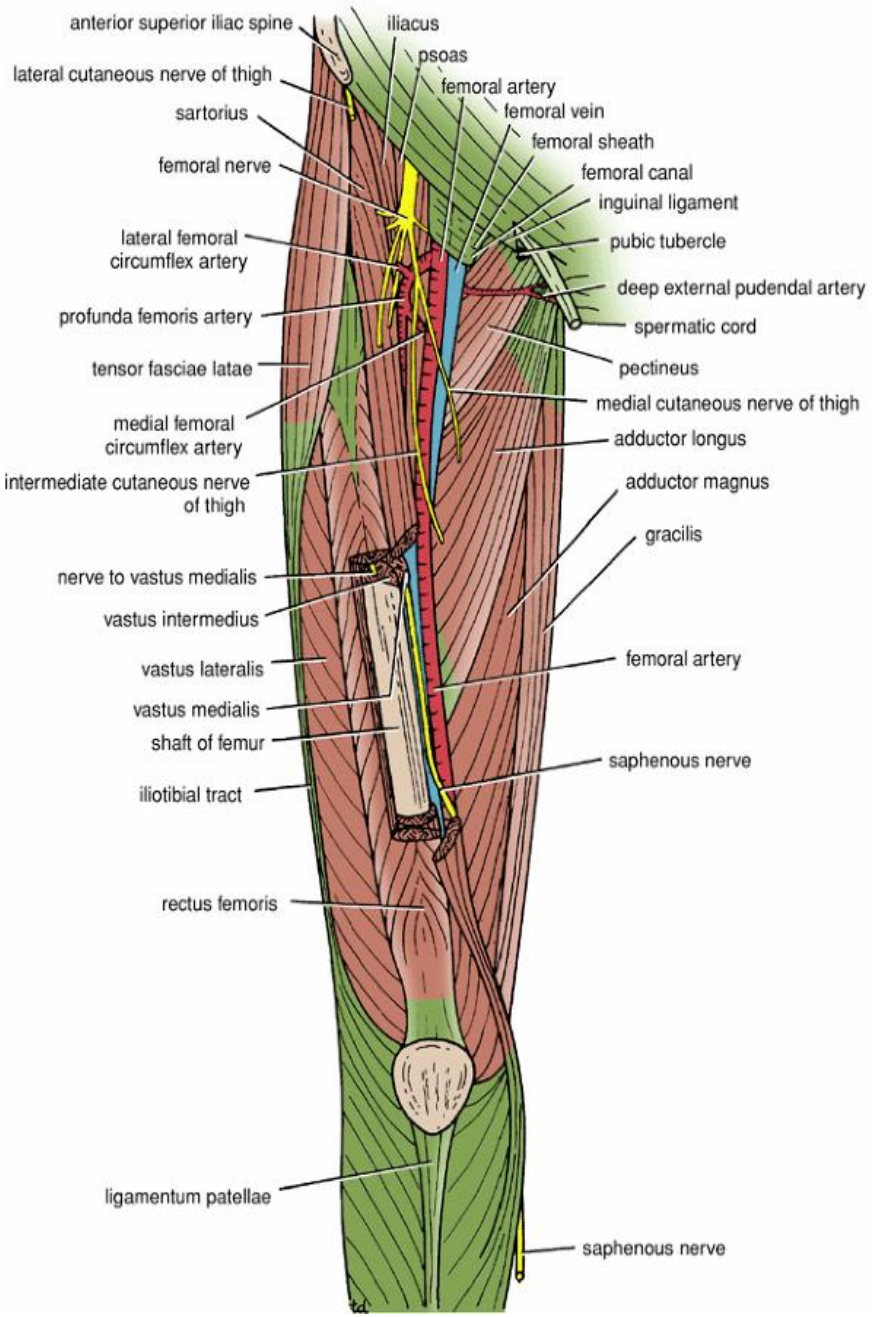
- The femoral nerve is the largest branch of the lumbar plexus (anterior primary rami of L2, 3, and 4 posterior division).
- It emerges from the lateral border of the psoas muscle within the abdomen and passes downward in the interval between the psoas and iliacus.
- It lies behind the fascia iliaca and enters the thigh lateral to the femoral artery and the femoral sheath, behind the inguinal ligament



- About 1.5 in. (4 cm) below the inguinal ligament, it terminates by dividing into anterior and posterior divisions.

- The femoral nerve supplies **all the muscles of the anterior compartment of the thigh**

- **Note that the femoral nerve does not enter the thigh within the femoral sheath.**



Branches of femoral nerve:

Anterior Division

- The anterior division gives off two cutaneous and two muscular branches.
- The cutaneous branches are the medial cutaneous nerve of the thigh
- the intermediate cutaneous nerves that supply the skin of the medial and anterior surfaces of the thigh, respectively
- The muscular branches supply the sartorius and the pectineus.

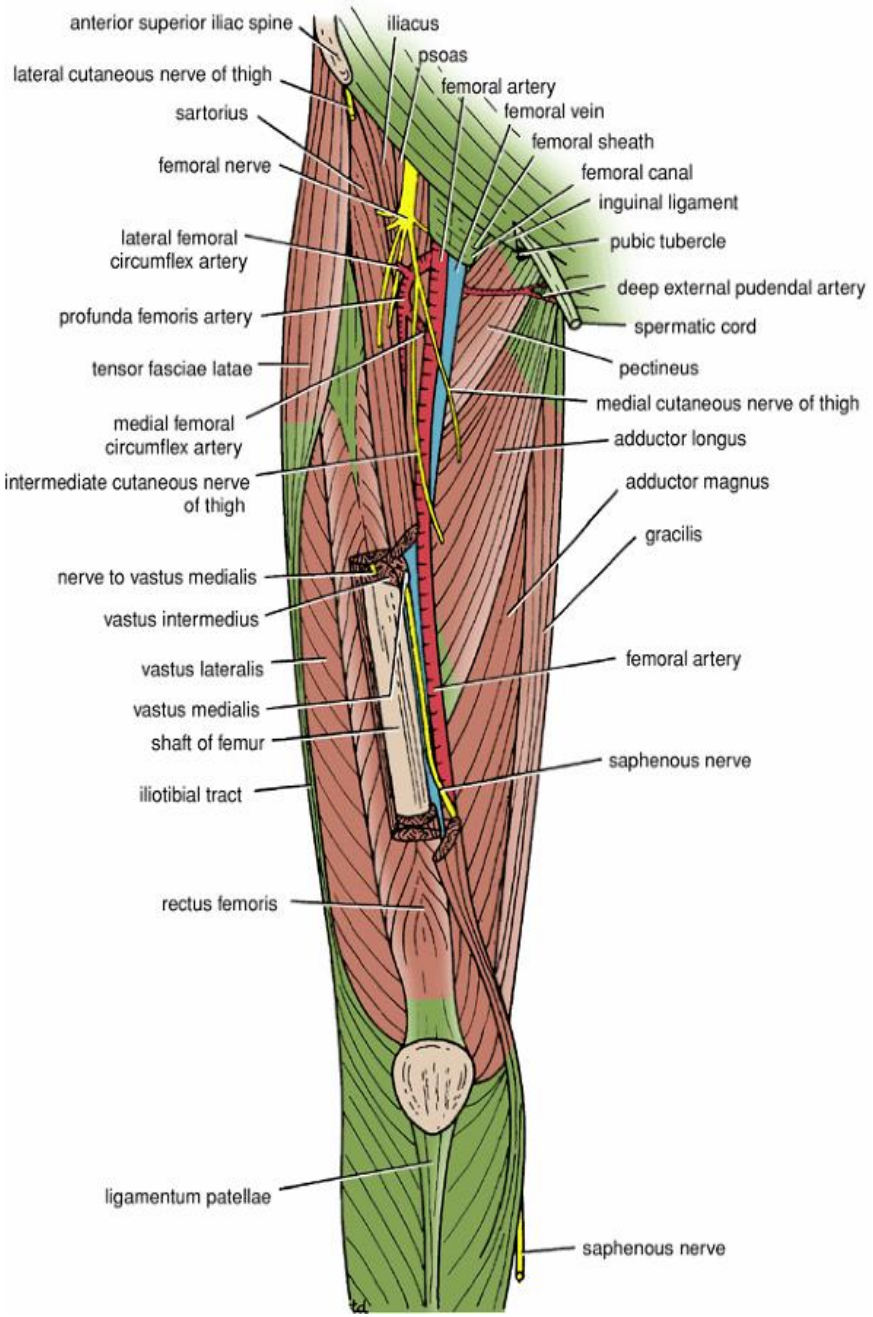
Posterior Division

- The posterior division gives off one cutaneous branch, the saphenous nerve
- muscular branches to the quadriceps muscle.

The saphenous nerve

- It runs downward and medially and crosses the femoral artery from its lateral to its medial side

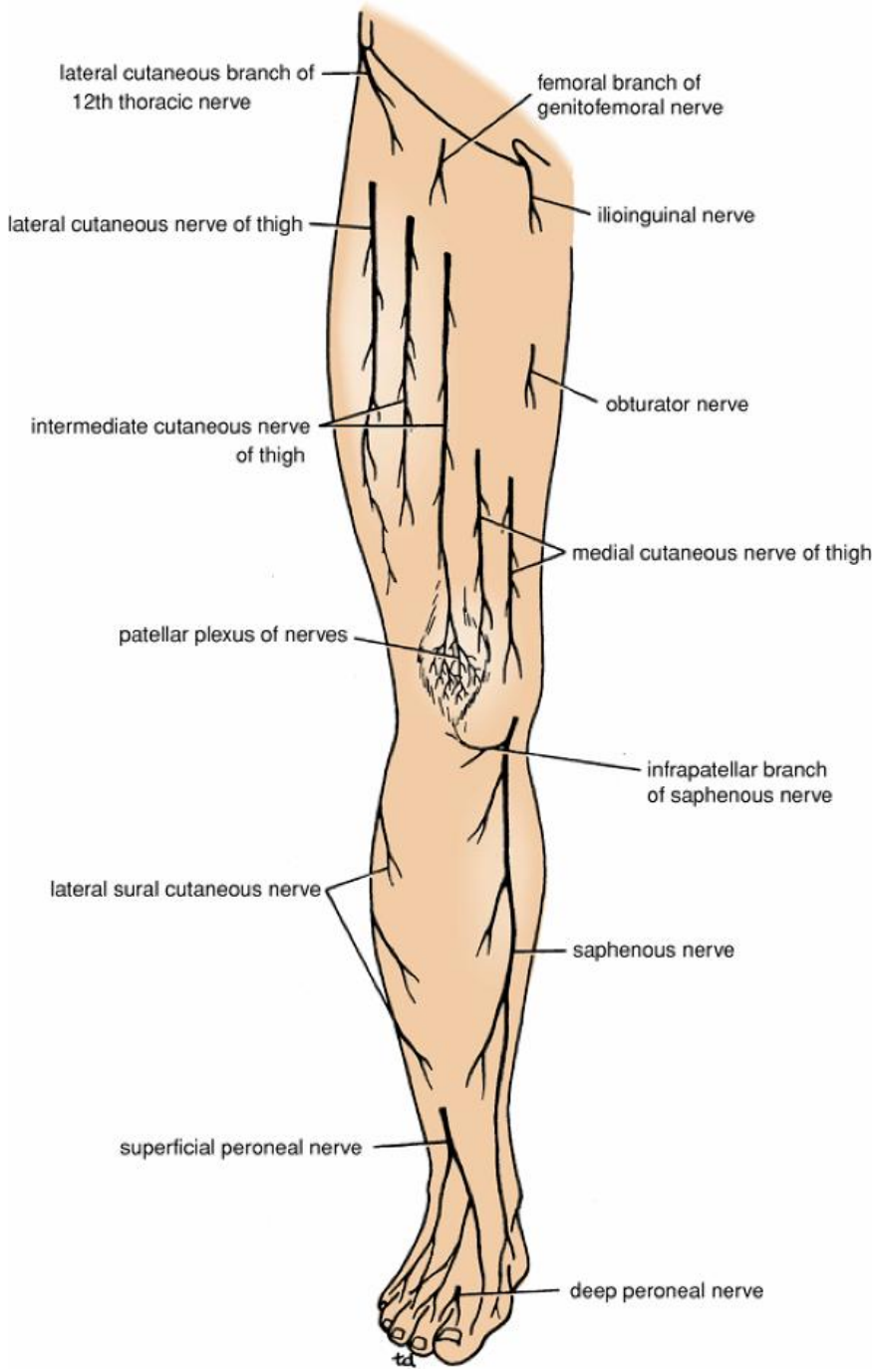
- It emerges on the medial side of the knee between the tendons of sartorius and gracilis



- It then runs down the medial side of the leg in company with the great saphenous vein.

- It passes in front of the medial malleolus and along the medial border of the foot, where it terminates in the region of the ball of the big toe.

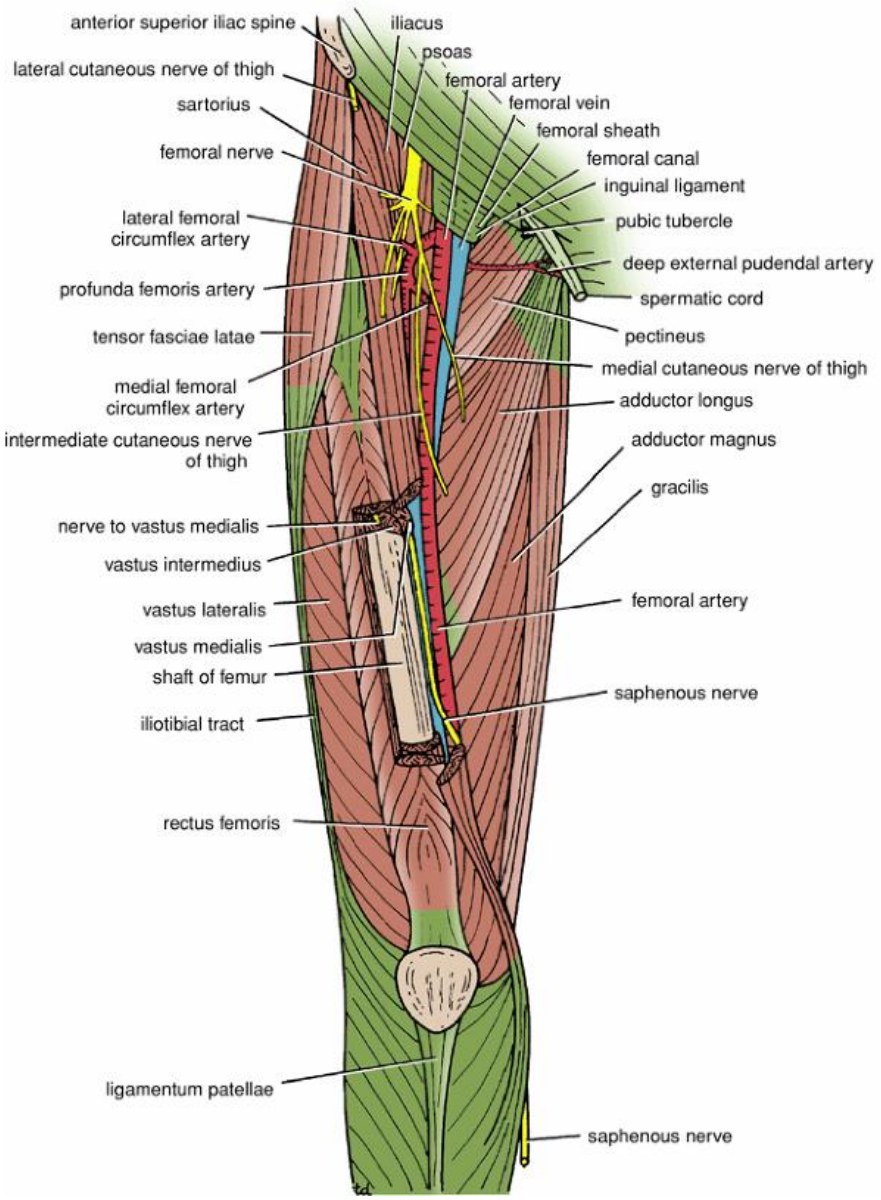
- **After The ball of the big toe Medial side of the big toe is supplied by Anterior tibial nerve**



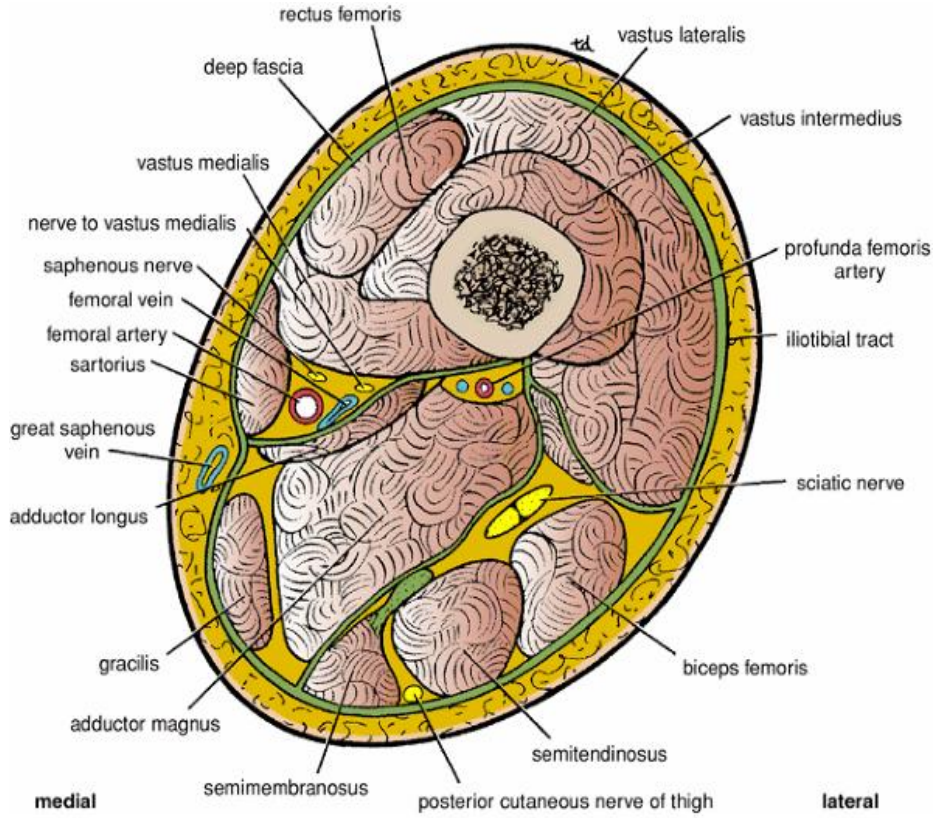
Adductor (Subsartorial) Canal

- The adductor canal is an intermuscular cleft situated on the medial aspect of the middle third of the thigh beneath the sartorius muscle

- It commences above at the apex of the femoral triangle and ends below at the opening in the adductor magnus



- In cross section it is triangular, having an anteromedial wall, a posterior wall, and a lateral wall.
- **The anteromedial** wall is formed by the sartorius muscle and fascia.
- **The posterior wall** is formed by the adductor longus and magnus.
- **The lateral wall** is formed by the vastus medialis



The adductor canal contains : **Important**

- the terminal part of the femoral artery
- the femoral vein
- the deep lymph vessels
- the saphenous nerve
- the nerve to the vastus medialis
- the terminal part of the obturator nerve (posterior division).

For any feedback, scan the code or click on it.

Corrections from previous versions:

Versions	Slide # and Place of Error	Before Correction	After Correction
V0 → V1	27	**Femoral artery** At the lower border of the popliteus muscle, it divides into	**Femoral artery** After entering the popliteal fossa, femoral artery becomes the popliteal artery. At the lower border.....
V1 → V2			

رسالة من الفريق العلمي:

دع المقاديرَ تجري في أعَنّتها
ولا تبيتنّ إلا خاليَ البالِ
ما بين غَمضةِ عَين وانتباهتها
يغيّر الله من حالٍ إلى حالِ