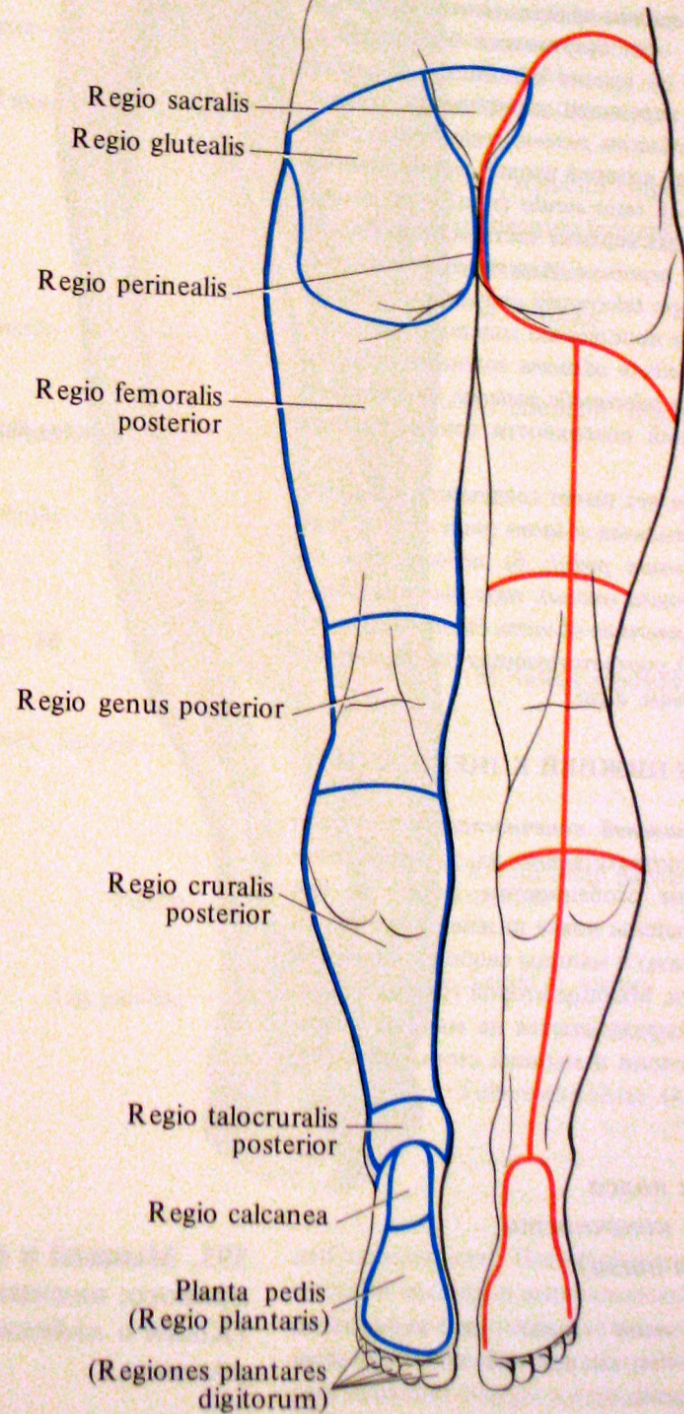
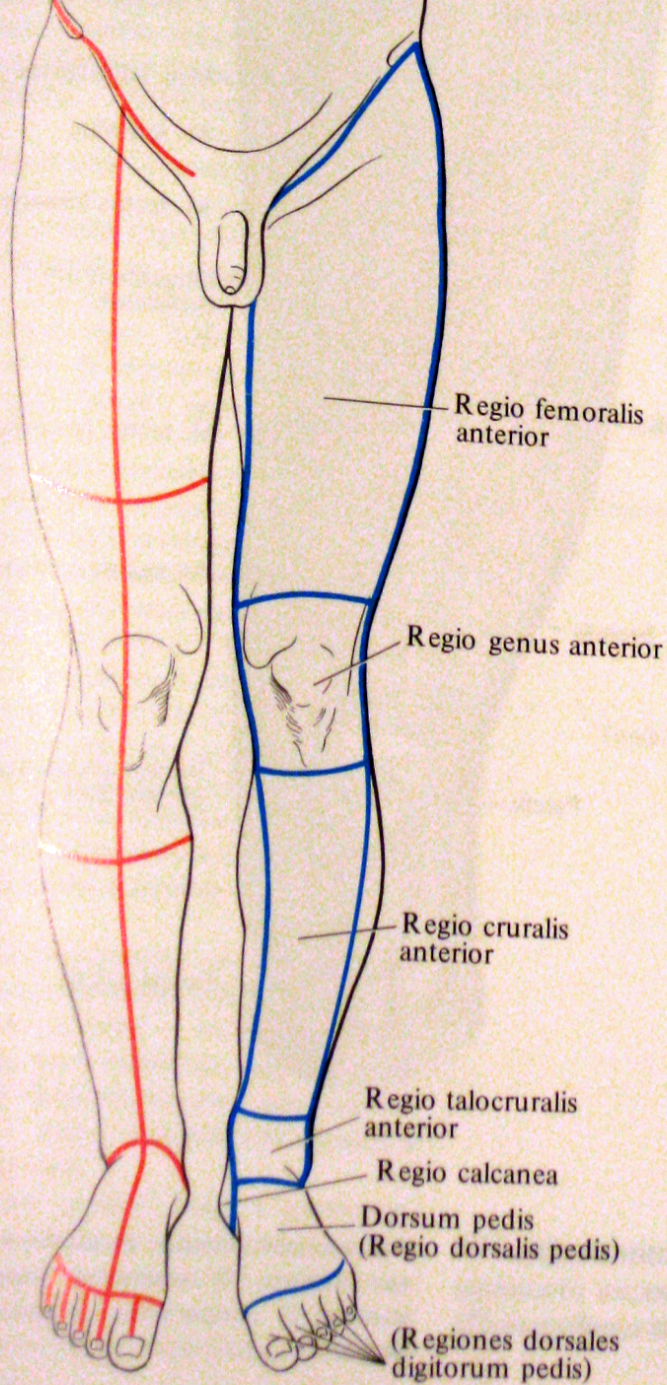


Clinical anatomy of the lower limb

professor Viorel Nacu



Landmarks of the lower limb

1. Regio glutealis

- **Crista iliaca**
- **Iliac Spina**
- **Trohanterul mare**
- **Plica glutealis**
- **Tuber ischiadicus**
- **Os sacrum**
- **2. anterior region of the thigh:**
- Anterior superior iliac spine.
- Pubic tubercle.
- Symphysis.
- Inguinal crease.
- Greater trochanter.
- Patella.
- Patellar ligament.
- Tendon of the quadriceps femoris.
- Condyles and epicondyles of the femur.
- **Iliopectineal Fossa.**

3. Genum

Patella

Ligamentum patella

Condyles and epicondyles of the tibia.

Tuberculum Jerdi

Tendo m. Biceps femuris

Tendo m. Semimembranosus et semitendinosus

Popliteal Fossa

4. The Leg

Caput fibula

The anterior surface of the tibia

The medial and lateral malleolas

Achile tendon

The Calcaneus

The base of the five metatarsal bone.

The metatarsal bones

Phalanges

Temporary haemostasis by manual compression of the vessels of the lower limb:

1 a. Femoralis on the middle of the inguinal fold by compressing to the pubic bone (between anterior superior spine and simphisis)

2. a. Poplitea by placing a roll in the popliteal fossa and calf maximal flexion.

The pulse could be palpated:

1. on femoral artery;

2.on popliteal artery;

3. posterior tibial artery in the medial malleolar canal (between tendon Achilles and medial malleola)

4. on a. Dorsalis pedis (projection line: proximally the middle between malleolas and first interdigital space).



The Anterior Region of the Thigh

- **Borders**
- Superior – inguinal fold.
- Medial – a line drawn from medial femoral epicondyle to pubic symphysis.
- Lateral – a line drawn from lateral femoral epicondyle to anterior superior iliac spine.
- Inferior – a circular line traced transversal two fingers above the patella.
-

Musculature, compartments, canals

-
- The Anterior Fascial Compartment of the Thigh Muscles:
 - - Tensor fasciae lata muscle.
 - - Sartorius muscle.
 - - Iliopsoas muscle.
 - - Pectineus muscle.
 - - Obturator externus muscle (posteriorly to the pectineus).
 - - Quadriceps femoris muscle (rectus femoris, vastus medialis, lateralis and intermedius).
-
- The Medial Fascial Compartment of the Thigh Muscles:
 - - Adductor brevis muscle (behind to the pectineus).
 - - Adductor longus muscle (medially to the pectineus).
 - - Adductor magnus muscle (behind the adductor brevis and longus).
 - - Gracilis muscle.

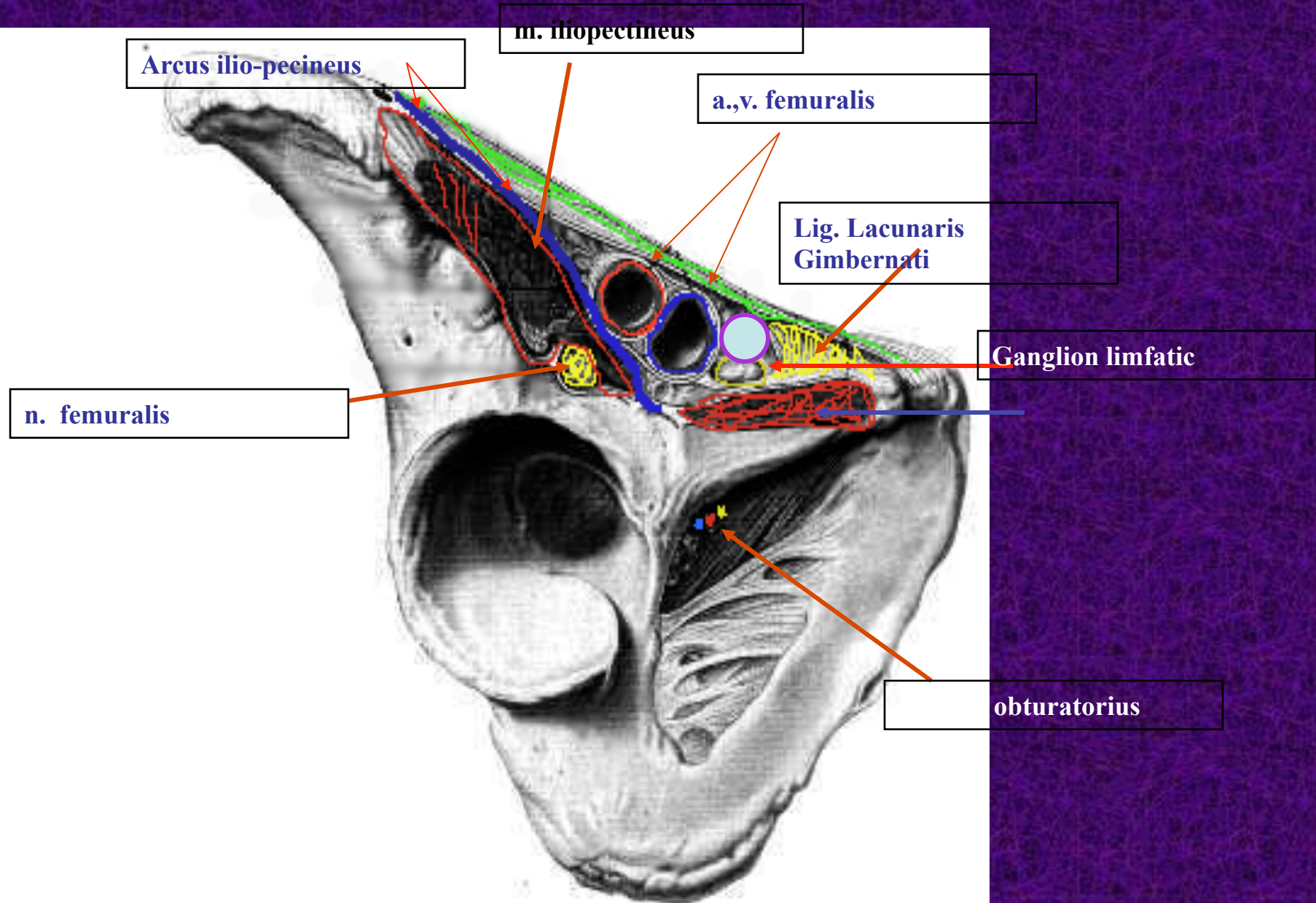
- Inguinal ligament – superiorly.
- Sartorius muscle – laterally.
- Adductor longus muscle – medially.
- Iliopsoas and pectineus muscles – at the bottom.

The Femoral (Scarp's) triangle

- - Inguinal ligament – superiorly.
- - Sartorius muscle – laterally.
- - Adductor longus muscle – medially.
- - Iliopsoas and pectineus muscles – at the bottom.

The Osteofascial lacunar compartments

- It is the area between inguinal ligament and pelvic bone parted/separated by iliopectineal ligament/arch in:
- Lacuna musculorum, contains m. iliopsoas, n. femoralis and n. cutaneus femoris lateralis.
- Lacuna vasorum, contains femoral artery, femoral vein, femoral branch of the genitofemoral nerve, and a lymph node.



Arcus ilio-pectineus

m. iliopectineus

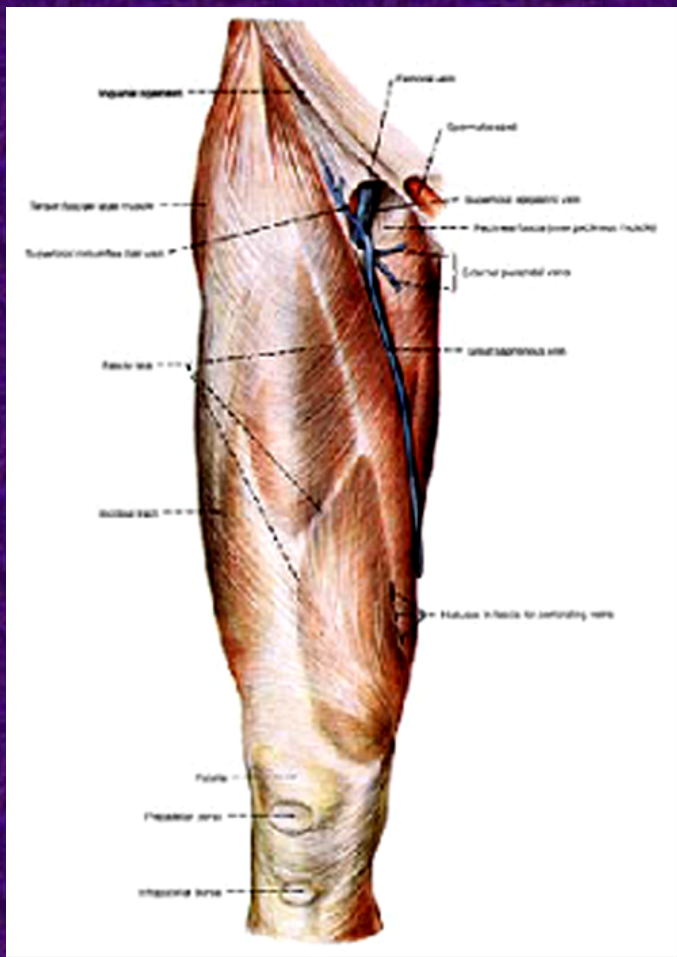
a.,v. femoralis

Lig. Lacunaris
Gimbernati

Ganglion limfatic

n. femoralis

obturatorius



Canalis femoralis (1-2 cm):

Annulus femoralis internus:

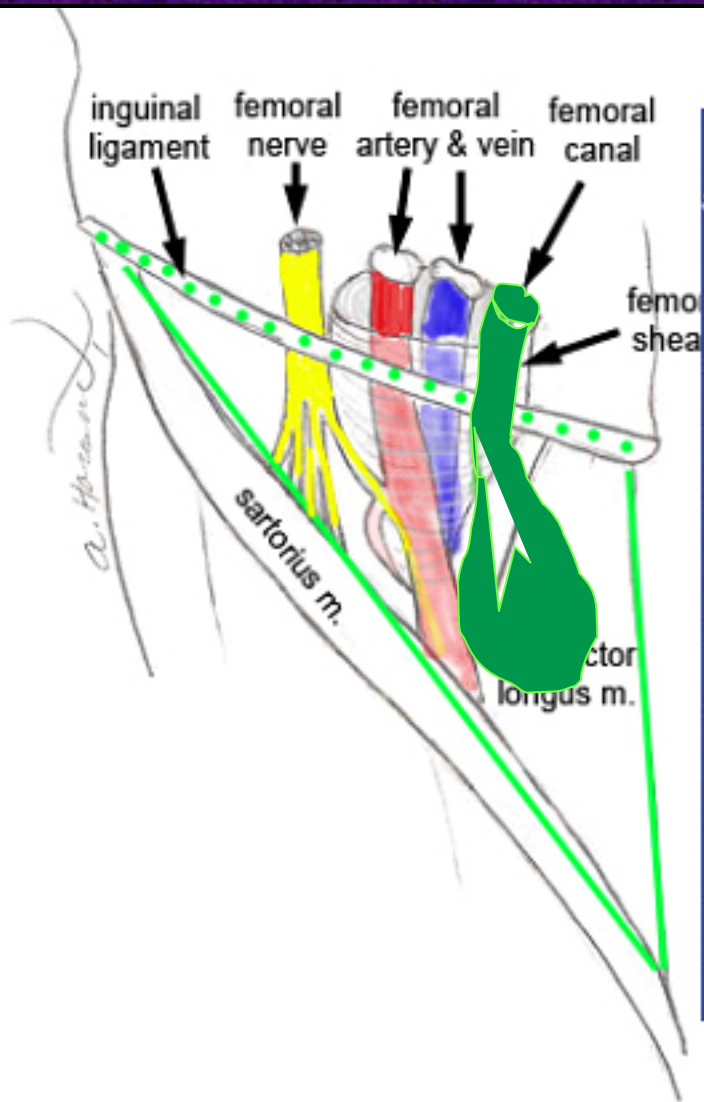
anteriorly lig. inguinale, medially lig. lacunare (Gimbernat's), posteriorly lig. pectineale (Cooperi's), laterally –v. femorale.

Annulus femoralis externus: margo falciforme cornus superior et inferior (fossa ovale or hiatus safenus)

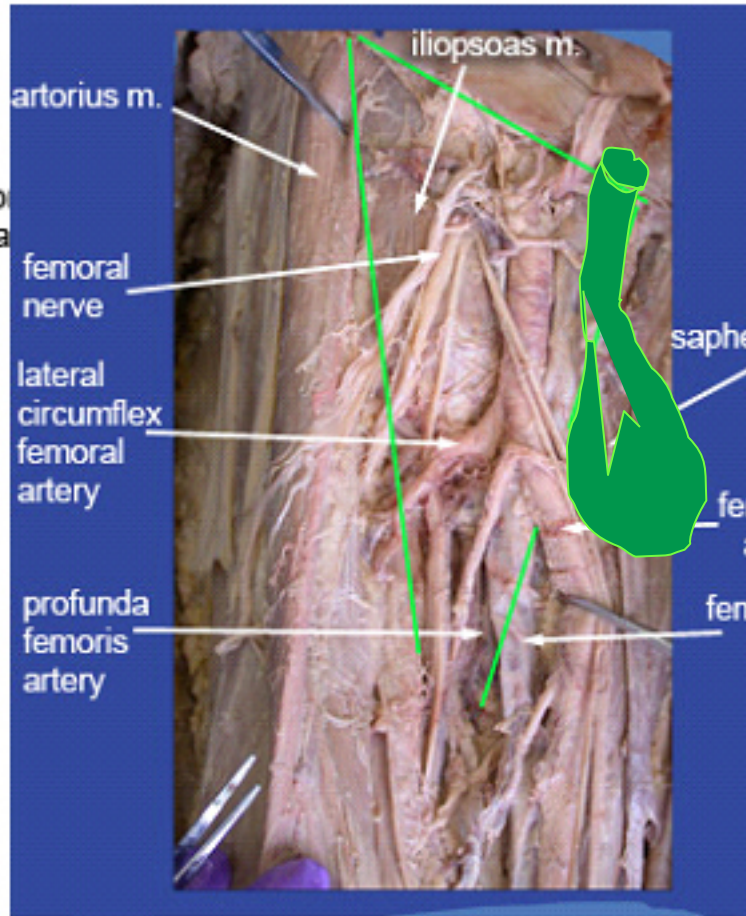
The walls: anteriorly - lig. Inguinale et cornus superior margo falciforme; posteriorly fascia iliopectinea; laterally v. femoralis.

Corona mortis: anteriorly a. epigastrica inferior; laterally v. femoralis; medially - a. obturatoria (25%)

- The sectioning of the aberrant obturator artery during the hernia repair procedure without preliminary clamping can give an invisible intrapelvic fatal hemorrhage. This artery arises from the inferior epigastric artery, crosses the deep femoral ring and passes around the neck of hernial sac. In the middle ages, the aberrant obturator artery was called “corona mortis” because of common cause of the death during the femoral herniotomy.



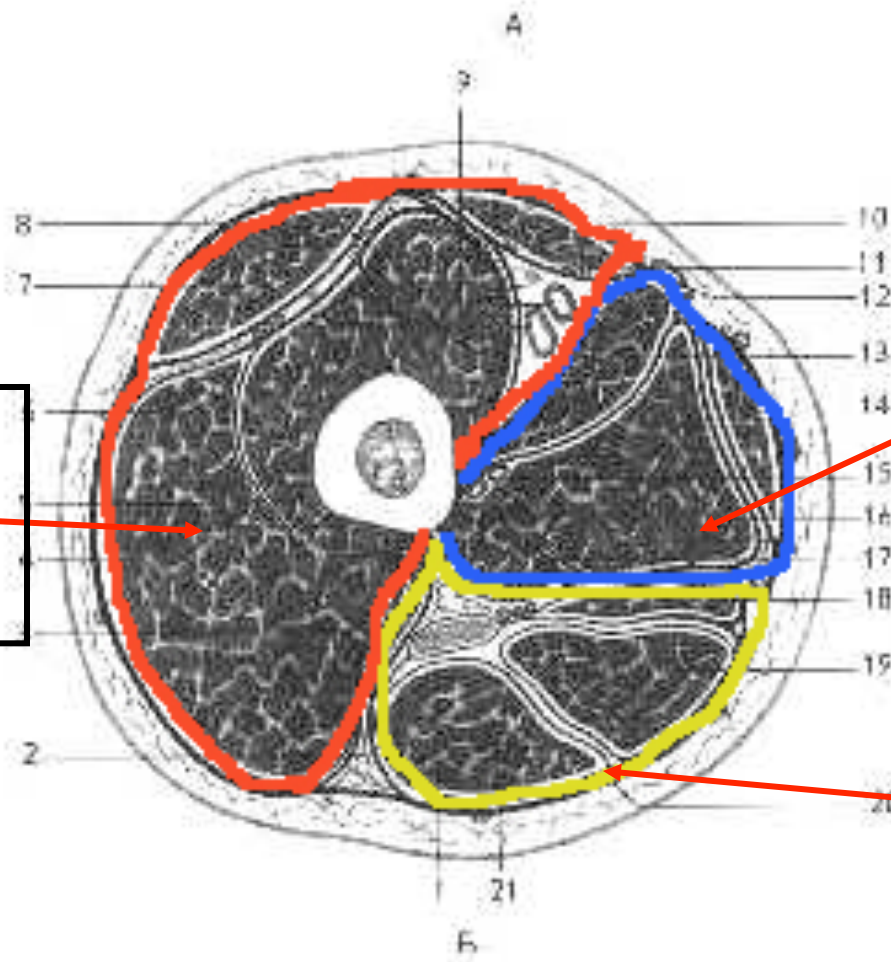
Femoral triangle



Deep femoral triangle

The Obturator canal,

- Located behind the m. pectineus at the anterior margin of the obturator foramen. It contains obturator neurovascular bundle.



Loja
anterioară
m. Extensori
ai gambei

Loja medială
m. adductori

Loja posterioară
m. Flexori ai gambei

Fascia lata make two fibrous septum the medial and lateral which divide the thigh in three loges: anterior, medial and posterior

The Adductor (Hunter's) subsartorial canal:

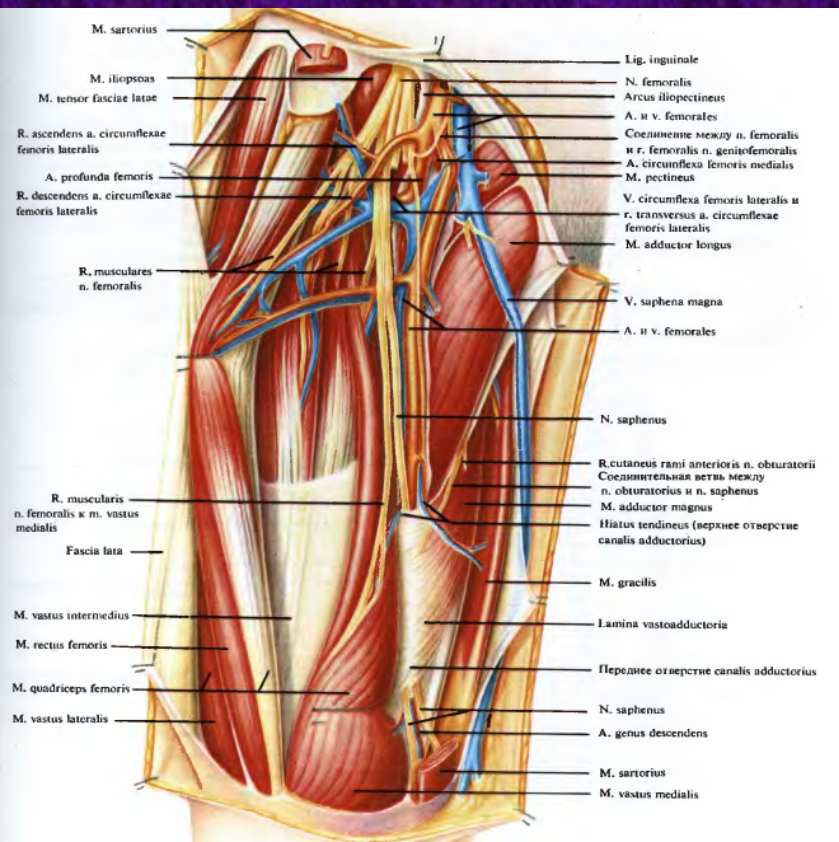
Walls –

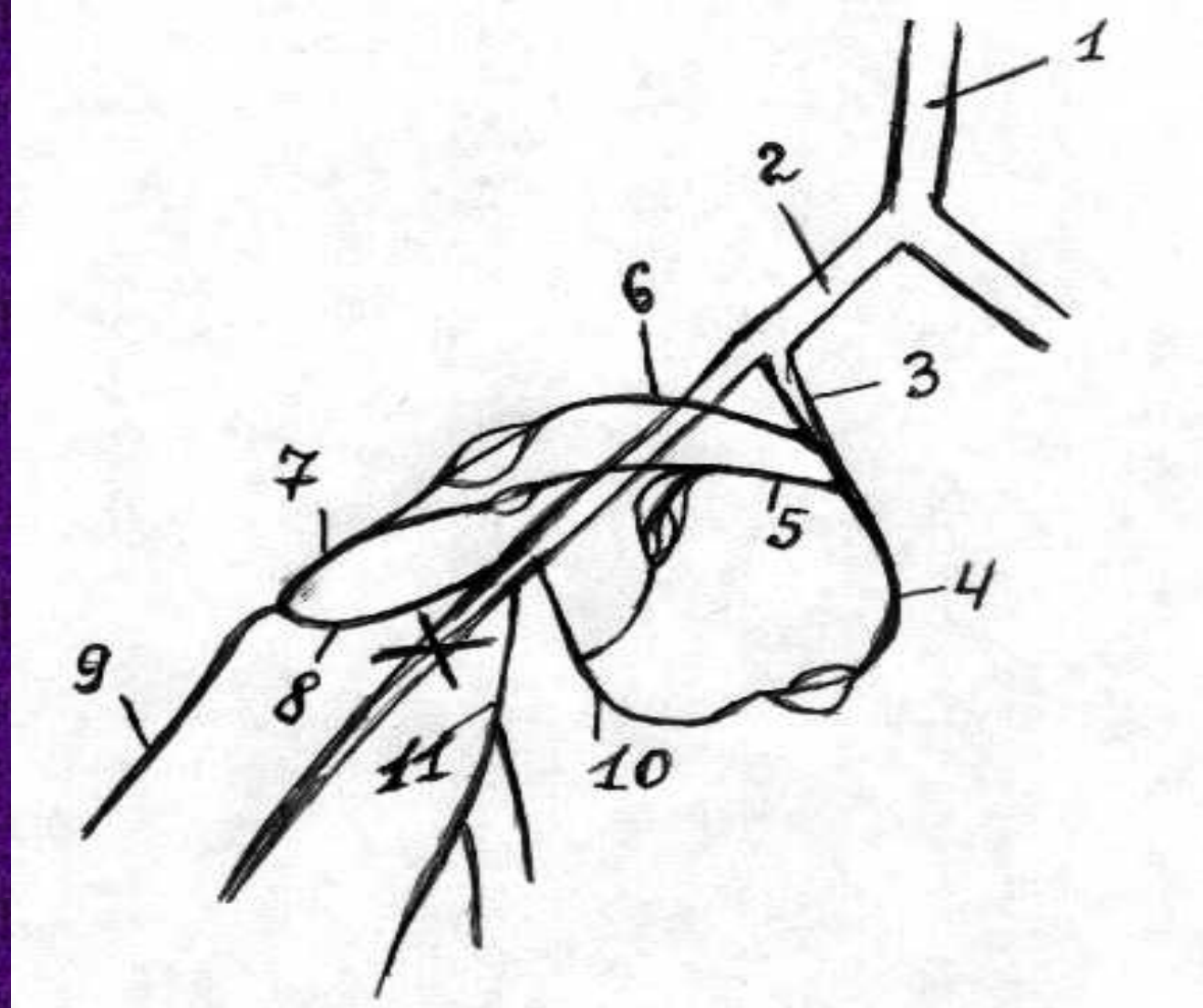
laterally - m. vastus medialis,
medially - m. adductor magnus
anteriorly the roof – lamina vastoadductoria.

Entrance – femoral artery and vein, and n. saphenus.

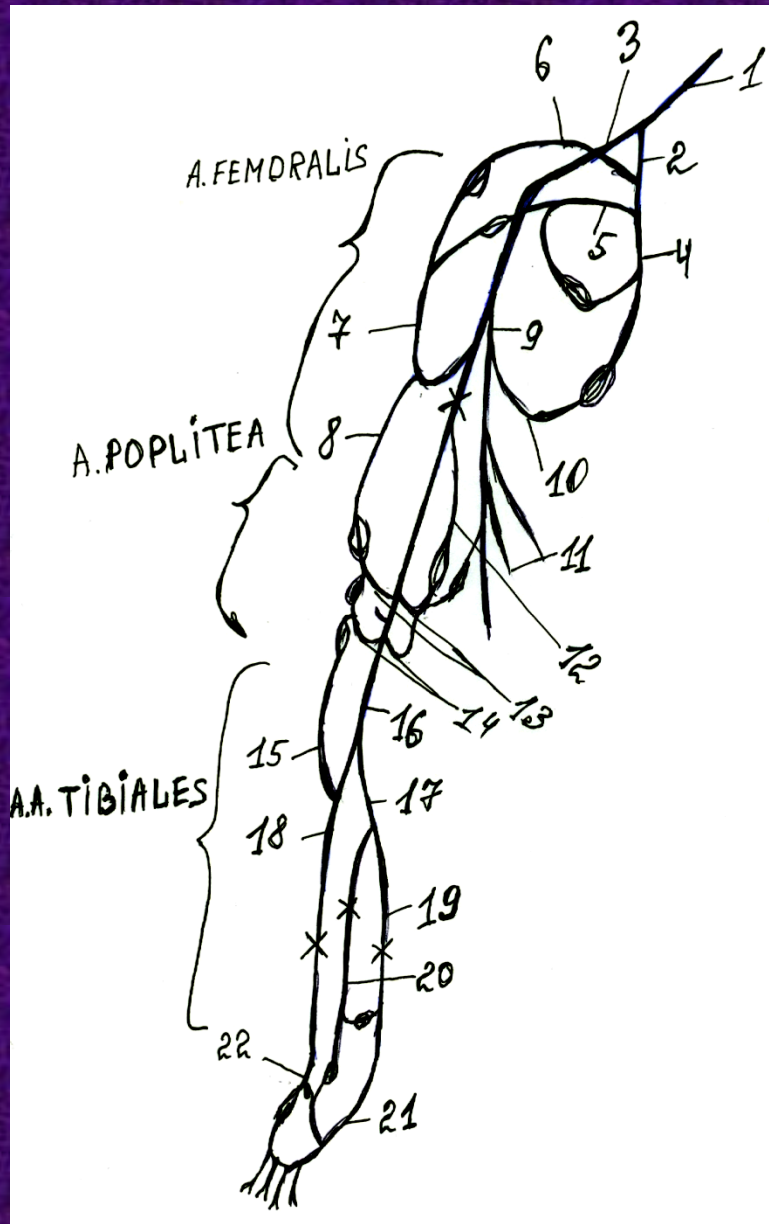
Anterior exit (vastoadductorial) – a. genu descendens and n. saphenus.

Posterior exit (hiatus adductorius) – femoral artery and vein.

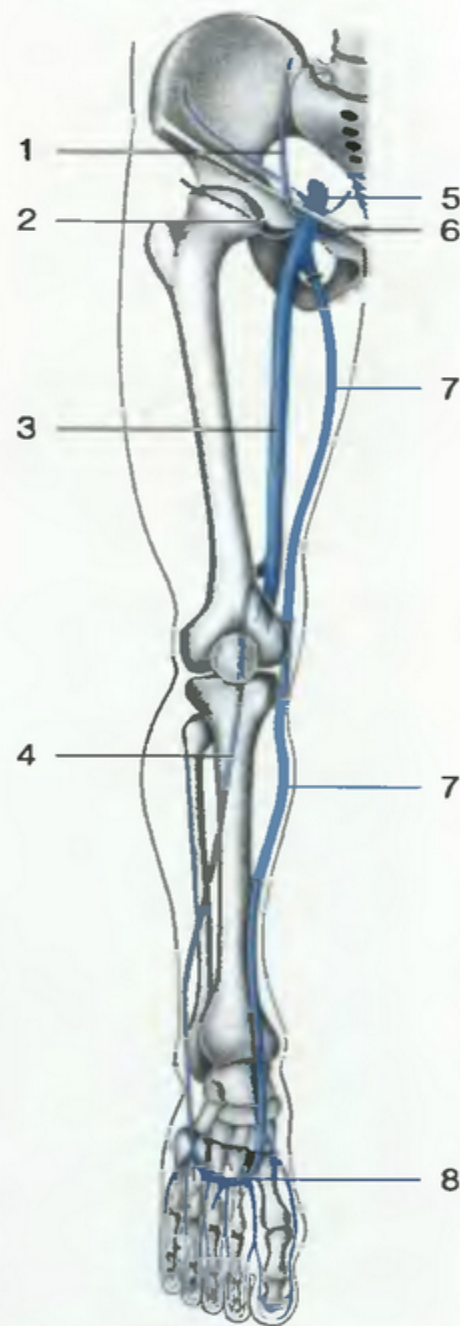
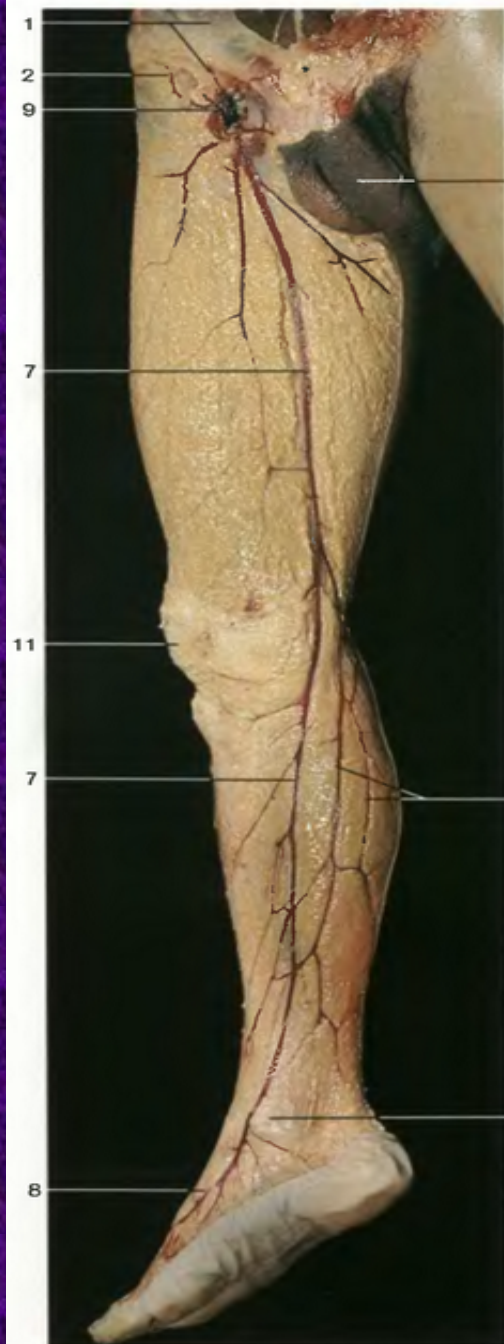




1. a. Femoralis; 2. a. Iliaca comunis; 3. a. Iliaca interna; 4. a. obturatoria; 5. a. glutea inferioris; 6. a. glutea superioris; 7. ramus ascendens a. circumflexa femoris lateralis; 8. a. circumflexa femoris lateralis; 9. ramus descendens a. circumflexa femoris lateralis; 10. a. circumflexa femoris medialis; 11. a. profunda femoris.



1. A. iliaca communis;
2. A. iliaca interna;
3. A. iliaca externa;
4. A. obturatoria;
5. A. glutea inferior;
6. a. glutea superior;
7. R. ascendens a. circumflexa femoris lateralis;
8. R. descendens a. circumflexa femoris lateralis;
9. A. profunda femoris;
10. A. circumflexa femoris medialis;
11. rr. Perforantes a. profunda femoris;
12. A. genus descendens;
13. Aa. Genus superior medialis et lateralis;
14. Aa. Genus inferior medialis et lateralis;
15. A. recurents tibialis anterior;
16. A. poplitea;
17. A. tibialis posterior;
18. A. tibialis anterior;
19. A. tibialis posterior;
20. A. tibialis anterior;
21. A. plantaris;
22. A dorsalis pedis.



- 1 V. epigastrica
superf.
- 2 V. circumflexa
ilium superf.
- 3 V. femoralis
- 4 V. saphena
parva
- 5 V. iliaca ext.
- 6 V. pudenda ext.
- 7 V. saphena
magna
- 8 Arcus venosus
dorsalis pedis
- 9 Ostium
v. femoralae
- 10 Anastomosis vv.
saphenae mag-
nae et parvae
- 11 Patella
- 12 Penis
- 13 Malleolus med.

The Gluteal Region (Buttock)

- **Borderlines**
- Superior – iliac crest.
- Medial – median line.
- Inferior – gluteal fold.
- Lateral – a line traced from anterior superior iliac spine to greater trochanter.

Layers

- Skin is thick.
- Subcutaneous fatty tissue. It is well developed, contains fibrous fascicles, and nn. clunium.
- Superficial fascia is less developed.
- Deep (gluteal) fascia covers gluteus maximus and gluteus medius muscles.
- Superficial muscles – gluteus maximus and gluteus medius, and fascial septa into them.
- Intrinsic lamina of the deep (gluteal) fascia covers inside surface of the gluteus maximus and gluteus medius muscles.
- Subgluteal space. It contains fatty connective tissue, vessels and nerves, outgoing through supra- and infrapiriform foraminae.
- Deep muscles:
 - - Gluteus minimus m. (under the gluteus medius).
 - - Piriformis m. (occupies the greater sciatic foramen).
 - - Gemelly superior m.
 - - Obturator internus m. (occupies the lesser sciatic foramen).
 - - Gemelly inferior m.
 - - Quadratus femoris m.

- Suprapiriform foramen. Through it passes the superior gluteal neurovascular bundle.
- Infrapiriform foramen. Through it passes (from the lateral site to medial site):
 - - Sciatic nerve (most lateral).
 - - Inferior gluteal artery and vein.
 - - Posterior femoral cutaneous nerve.
 - - Inferior gluteal nerve.
 - - Internal pudendal artery and vein.
 - - Pudendal nerve (most medial, at the margin of sacrum, on the sacrospinous ligament).

Piriformis syndrome

is a neuromuscular disorder that occurs when the sciatic nerve is compressed by the piriformis muscle causing pain, tingling and numbness in the buttocks and along the path of the sciatic nerve descending down the lower thigh and into the leg.

The syndrome may be due to anatomical variations in the muscle-nerve relationship, or from overuse or strain.

Posterior thigh region

Borders

- Superior – gluteal fold.
- Medial – a line drawn from medial femoral epicondyle to pubic symphysis.
- Lateral – a line drawn from lateral femoral epicondyle to anterior superior iliac spine.
- Inferior – a circular line traced transversal two fingers above the patella.

Layers

1. Skin.
2. Subcutaneous fatty tissue. It is well developed.
3. Superficial fascia. It is less developed.
4. Deep fascia (fascia lata) covers and forms sheath for muscles.
5. Muscles:
 - Biceps femoris m.
 - Semitendinosus m.
 - Semimembranosus m.

The sciatic nerve lies between the muscles:

- In the upper third it is covered by margin of gluteus maximus m., deep fascia and partly by long head of biceps femoris m.
- In the middle third it is covered by long head of biceps femoris m. and lies between short head of biceps femoris m. (laterally), semitendinosus m. and semimembranosus m. (medially), and adductor magnus m. (anteriorly).
- In the lower third it lies between biceps femoris muscle (laterally), semitendinosus and semimembranosus muscles (medially), and adductor magnus muscle (anteriorly).

Knee region

- **Borderlines**
- Superior – a circular line traced transversal two fingers above the patella.
- Medial – vertical line traced through the medial femoral epicondyl.
- Lateral – vertical line traced through the lateral femoral epicondyl.
- Inferior – a circular line traced on the level of the tibial tuberosity.

-

Layers (posterior knee region)

Skin of the popliteal fossa is thin and porous.

Subcutaneous fatty tissue is thin, contains small saphenous vein and its tributaries.

Superficial fascia is less developed.

Deep (popliteal) fascia covers popliteal space and forms a canal for small saphenous vein.

Popliteal space is diamond/rhomb-shaped and bounded by:

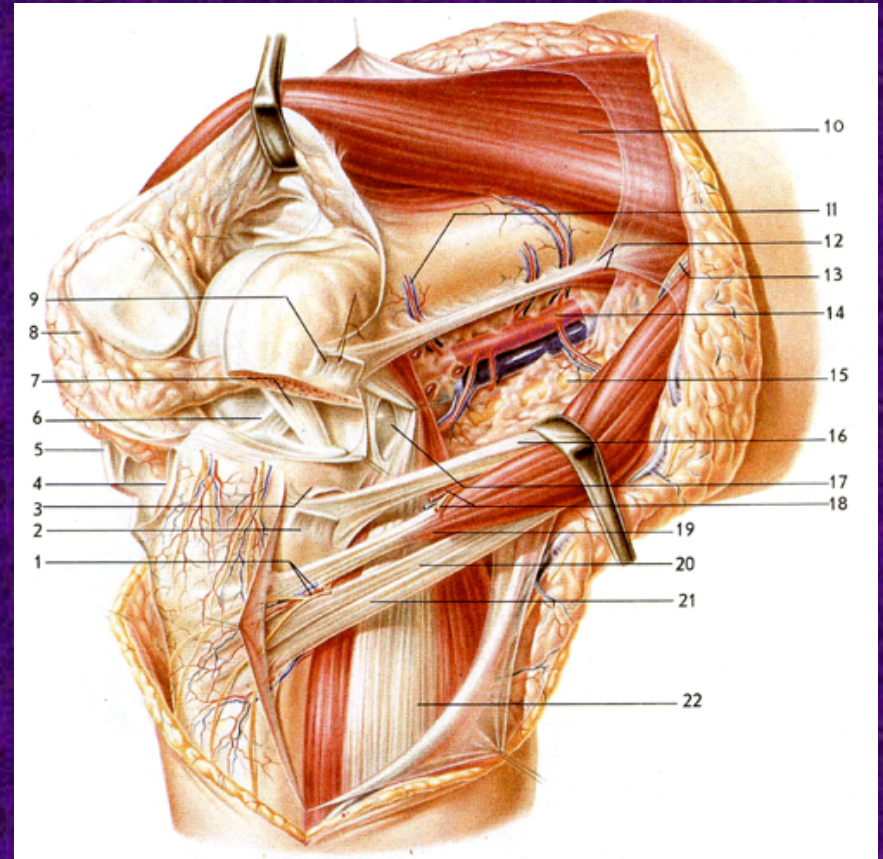
- Biceps femoris m. (superiorly-laterally).
- Semitendinosus and semimembranosus muscles (superiorly-medially).
- Lateral head of the gastrocnemius m. (inferiorly-laterally).
- Medial head of the gastrocnemius m. (inferiorly-medially).

Contents of the popliteal space:

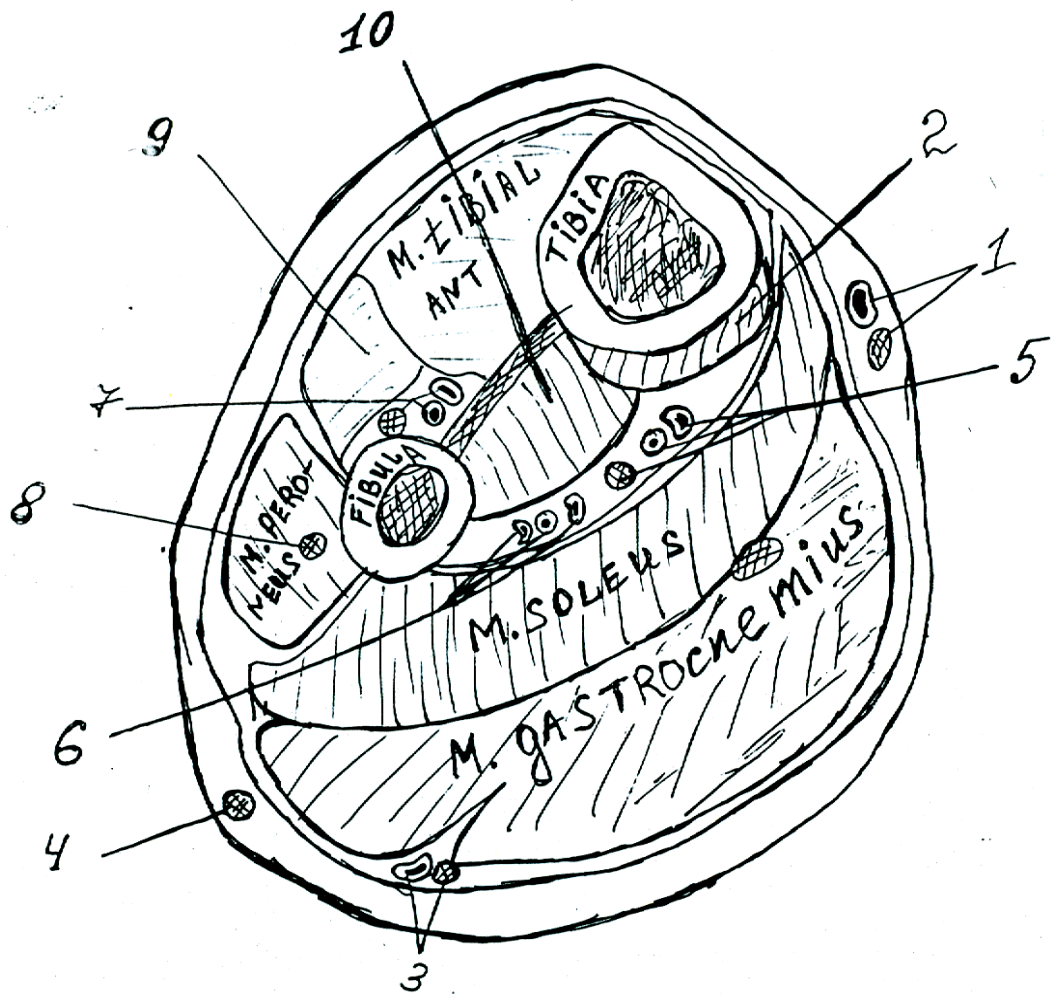
1. Fatty connective tissue.
 2. Lymph nodes.
 3. Sciatic nerve.
 4. Tibial nerve, as a continuation of the sciatic nerve it passes from the superior angle to inferior angle of the popliteal space, and is lying most superficially, close to the popliteal fascia.
 5. Popliteal vein lies medially and deeper to the tibial nerve.
 6. Popliteal artery lies medially and deeper to the popliteal vein, on the joint's capsule within so called Jobert's fossa (the medial angle of the popliteal space).
 7. Common peroneal nerve passes along the tendon of biceps femoris, posterior to the head of the fibula and laterally across the neck of the fibula in the superior musculoperoneal canal, dividing into the superficial and deep fibular nerves. Injury to the common fibular nerve results in foot drop (*pes equinus*).
6. Bottom of the popliteal space – the last layer.
- Popliteal plane of the femur.
 - Popliteal muscle.
 - Knee joint capsule with oblique popliteal ligament.

Jobert Fossa

- Anteriorly – m adductor magnus
- Posteriorly – mm. semimembranosus, semitendinosus et gracillis.
- superiorly m. sartorius;
- Inferiorly – medial condyl of the femur and the medial head of m. Gastrocnemius.



- **The Leg**
- **Borderlines**
- Superiorly – an imaginary circular line drawn transversal through the tibial tuberosity.
- Inferiorly – an imaginary circular line drawn transversal on the base of malleoli.
- **Layers**
- Skin (is thin).
- Subcutaneous fatty tissue contains the great and small saphenous vein and their tributaries.
- Superficial fascia is less developed.
- Deep fascia covers muscles and forms intermuscular septa, and retinaculum of tendons.
- Muscles and neurovascular fascicles by fascial compartments.
-



1. v. saphena magna et n. saphenus;
2. m. flexor digitorum longus;
3. v. saphena parva et n. cutaneus sura medialis;
4. n. cutaneus sura lateralis;
5. A. v. tibialis posterior et n. tibialis;
6. a. v. peronea;
7. A. v. tibialis anterior;
8. N. peroneus superficialis;
9. M. extensor digitorum longus;
10. M. tibialis posterior.

Fascial Compartments and Regions

The leg is divided, by intermuscular fascial septa and the interosseous membrane, into three fascial compartments and two regions (*regio cruris anterior and regio cruris posterior*).

The anterior crural region comprises the anterior and lateral fascial compartments. The posterior crural region comprises the posterior fascial compartment.

- **1. Anterior Crural Compartment** – the dorsiflexor extensor compartment contains:
 - Tibialis anterior muscle. It lies medially on tibia (shin-bone).
 - Extensor digitorum longus muscle+(fibularis tertius). It lies laterally on fibula (splint-bone).
 - Extensor hallucis longus muscle. It lies on the interosseous membrane.
 - Anterior tibial neurovascular fascicle – deep fibular nerve, anterior tibial artery and vein.
 -
- **2. Lateral Crural Compartment** comprises:
 - Fibular (peroneal) longus muscle.
 - Fibular (peroneal) brevis muscle.
 - Superior musculoperoneal canal with common fibular nerve.
 - Inferior musculoperoneal canal with peroneal artery and vein.

Posterior Crural Compartment

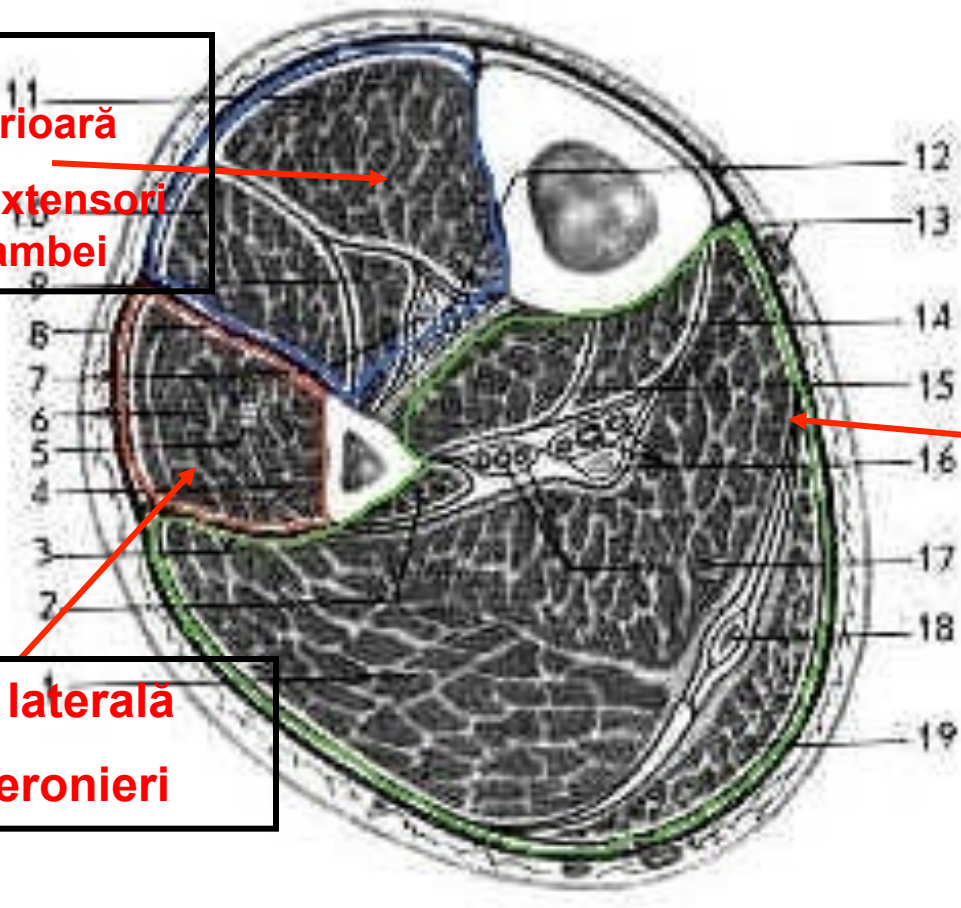
- the calf muscles compartment contains:
- Superficial group of muscles (*gastrocnemius*, *soleus*) – plantar flexors of the foot.
- Transverse intermuscular septum with posterior tibial neurovascular bundle into cruro-popliteal canal of Gruber which comprises tibial nerve, posterior tibial artery and vein.
- Deep group of muscles (*tibialis posterior*, *flexor digitorum longus*, *flexor hallucis longus*).
- Fibular (peroneal) artery and vein, passing into inferior musculoperoneal canal.

A

**Loja
anterioară**
m. Extensori
ai gambei

Loja posterioară
m. Flexori

Loja laterală
m. peronieri



Divisions of the talocrural (ankle) region

Anterior ankle division comprises:

- Extensor retinaculum.
- Tendon of anterior tibial muscle.
- Tendon of extensor digitorum muscle.
- Tendon of extensor hallucis longus muscle.
- Dorsal neurovascular bundle of the foot.

Medial malleolar division (canalis malleolaris) comprises:

- Flexor retinaculum.
- Tendon of tibial posterior muscle.
- Tendon of flexor digitorum muscle.
- Tendon of flexor hallucis longus muscle.
- Posterior tibial neurovascular bundle.
- Deltoid ligament.
- Sustentaculum tali.

- Lateral malleolar division contains:

- - Peroneal retinaculum
- - Tendon of peroneal longus muscle.
- - Tendon of peroneal brevis muscle.
- - Calcaneofibular ligament.

- Posterior ankle division contains:

- - Superficial calcanean bursa.
- - Calcanean (Achilles') tendon.
- - Deep calcanean bursa.
- - Subtendinous fatty-connective tissue.

The Foot

- **The foot is divided into three parts:**
- The hindfoot – talus and calcaneus (region of ankle joint, *articulatio talocruralis*).
- The midfoot – navicular, cuboid and cuneiforms bones.
- The forefoot – metatarsals and phalanges
- **Boundaries of the Hindfoot**
- Superiorly – an imaginary circular line drawn transversal on the base of malleoli.
- Anteriorly – a line traced on dorsal surface connecting the malleolar apexes.
- Inferiorly – a line traced on the plantar surface connecting the malleolar apexes.
-

The midfoot and forefoot (regio pedis) are divided into:

- Dorsal region of the foot or dorsum of the foot (dorsal foot).
- Plantar region of the foot or sole of the foot (plantar foot).

Layers of dorsal foot:

1. Skin.
2. Subcutaneous fatty tissue with venous network and superficial nerves.
3. Superficial fascia.
4. Deep fascia (forms extensor retinaculum).
5. Tendons, muscles and dorsal pedis neurovascular bundle.

Layers of plantar foot:

1. Skin (is thick).
2. Subcutaneous fatty tissue with 2-3 synovial bursae.
3. Superficial fascia.
4. Deep (proper) fascia and plantar aponeurosis.
5. Fascial compartments (medial, central and lateral):

Medial plantar compartment contains:

- Flexor hallucis brevis muscle.
- Tendon of flexor hallucis longus muscle.
- Abductor hallucis muscle.

Lateral plantar compartment contains:

- Abductor digiti minimi muscle.
- Flexor digiti minimi brevis muscle.

Central plantar compartment contains, by levels:

- Plantar aponeurosis.
- Flexor digitorum brevis muscle.

1st superficial

level

- Deep leaf of proper (deep) fascia.
- Quadratus plantae muscle.

- Tendons of flexor digitorum longus muscle.

2nd

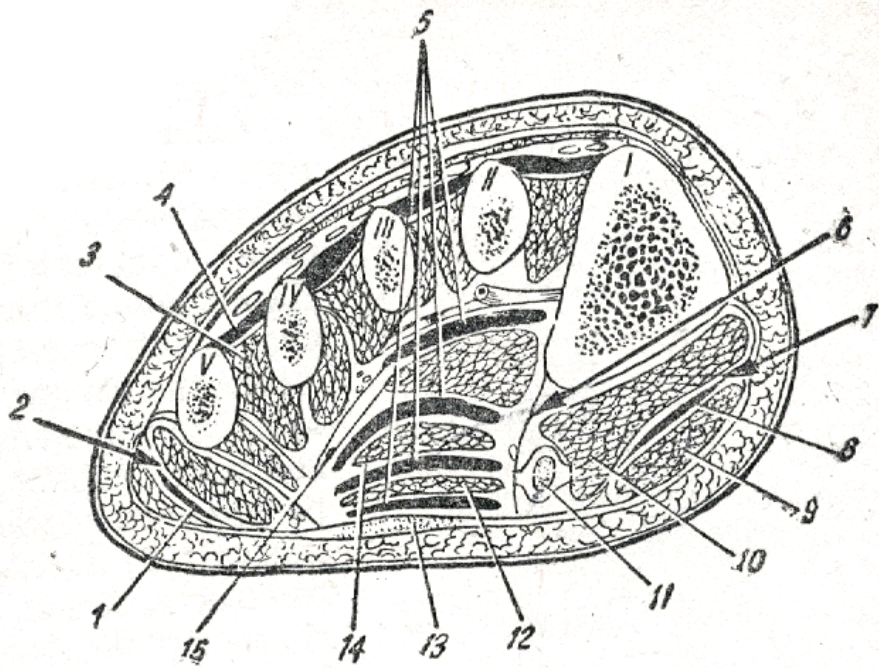
middle level

- Lumbrical muscle.
- Lateral and medial plantar neurovascular bundles.
- Long plantar ligament.
- Tendon of fibularis longus muscle.

3rd deep

level

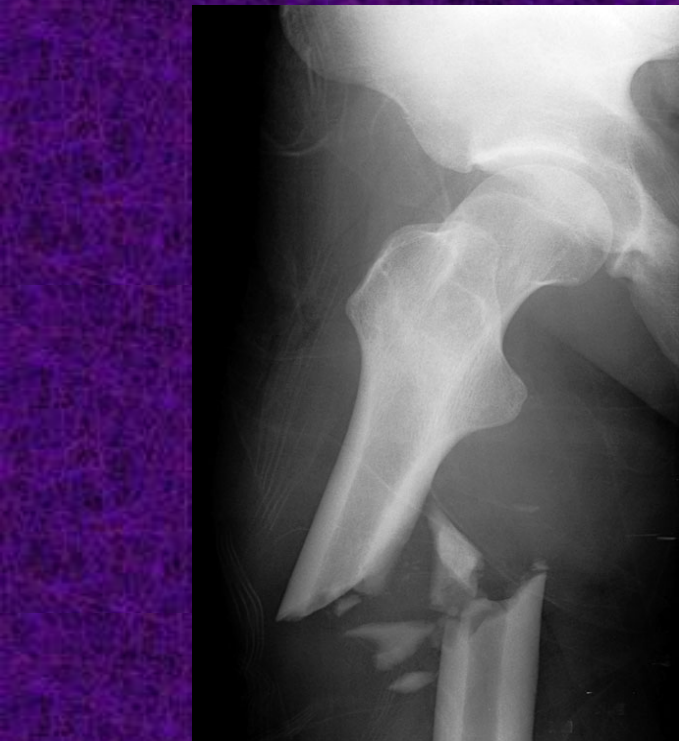
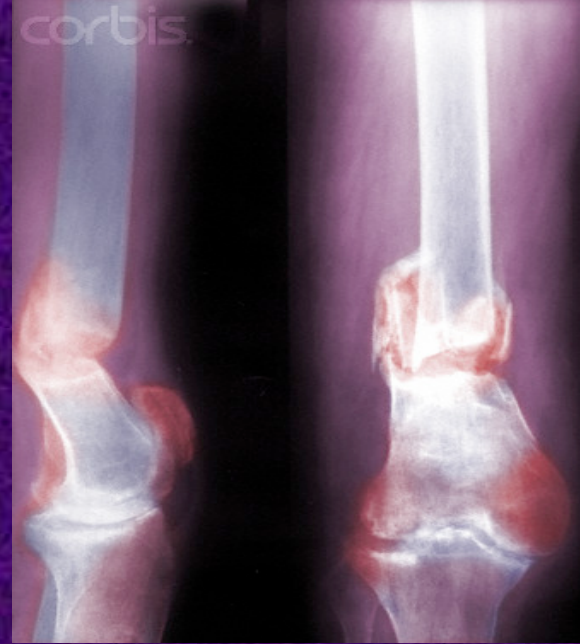
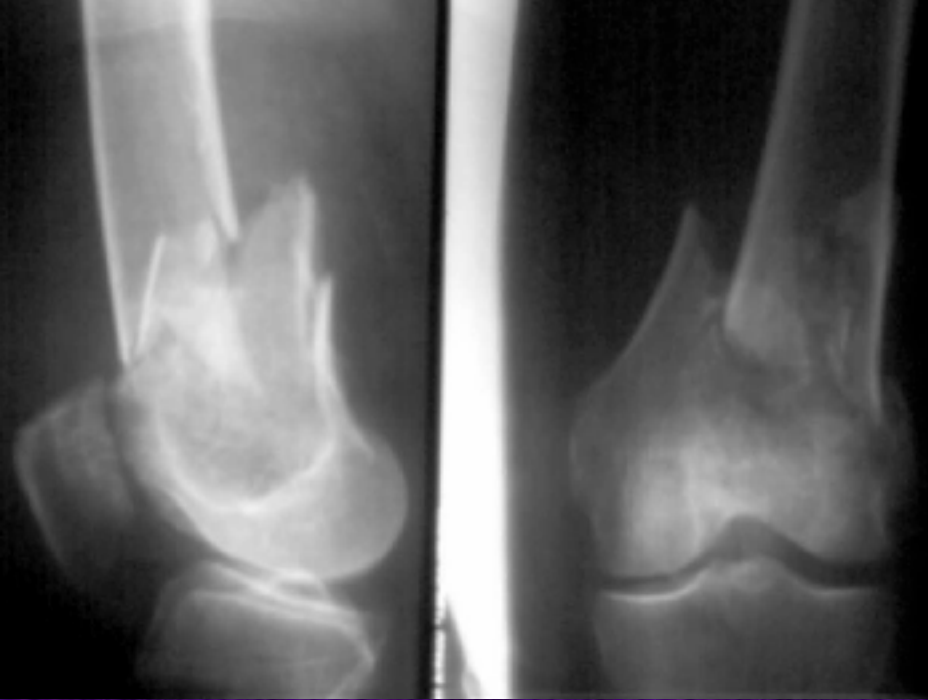
- Adductor hallucis muscle.
- Interosseous muscle.



1. Fat tissue space in to the lateral compartment;
2. m. ; 3. Muscului interoseus;
4. the dorsal subaponeurotic space of fat tissue;
5. The intermusculare space – the central compartment;
6. The medial fibrous septum;
7. M. 8. Fat tissue space in to the medial compartment;
9. Tendo m. abductor hallucis;
10. M. flexor hallucis brevis;
11. Tendo m. flexor hallucis longus;
12. M. flexor digitorum brevis;
13. aponeurosis plantaris;
14. M. quadrates plantae;
15. Caput obliquum m. adductor hallucis.

Disposition of the femur's fragments

- The general characteristic features for all fractures of the femur are next:
- 1. Shortening of the leg.
- 2. Twisting of the Roser-Nelaton's line (anterior superior iliac spine and sciatic tuberosity).
- 3. External rotation of the foot.
- In a fracture of the femoral neck the distal fragment is displaced upward resulting in shortening the lower extremity.
- In a fracture in upper third, the proximal fragment is abducted and flexed anteriorly by the iliopsoas and gluteals; the distal fragment is displaced upward and medially by adductors.
- A fracture of the midfemur, is associated with a little displacement. Muscle spasm produces an angled overriding of the fragments.
- In a supracondylar fracture, the distal fragment is displaced posteriorly by gastrocnemius spasm (this positioning jeopardizes popliteal structures); proximal fragment is displaced anteriorly and medially by adductors.



- Displacement of bone fragments in fractures of the femur:
Fractures: a) of the femoral neck - to the outer extremity rotated laterally
b) in the upper third, proximal femur fragment shifted to the medial side under the influence of the hip adductors, distal shifts in length.
c) in the lower third femur - distal fragment under the action of the m. Gastrocnemius is displaced posteriorly, and can result in damage to the popliteal neuro vascular bundle.

Surface Markings of the femoral artery

Femoral artery is indicated by the a line from the midpoint between the anterior superior iliac spine and the pubic symphysis to the femoral adductor tubercle.

Linia de proiecție a n. ischiadic

- de la mijlocul distanței dintre tuberozitatea ischiadica și trohanterul mare, până la mijlocul fosei poplitee.

—

Surface Markings of the popliteal artery

Popliteal artery is indicated by a line from the superior angle of the popliteal fossa to the middle of the back of the leg at the level of the tibial tuberosity.

Surface Markings of the a. tibialis posterior

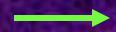
- Posterior tibial artery is indicated by a line on the back of the leg, from the level of the tibial tuberosity, downward to the midpoint between the medial malleolus and the heel.

a. Tibialis anterioris

- Anterior tibial artery is indicated by a midpoint between the tibial tuberosity and fibula to the midpoint between the two malleolis.

Proiecția a. dorsalis pedis

- Linia ce începe de la mijlocul distanței dintre maleole și se sfârșește în spațiul interdigital I.



**Thanks for your
attention !**