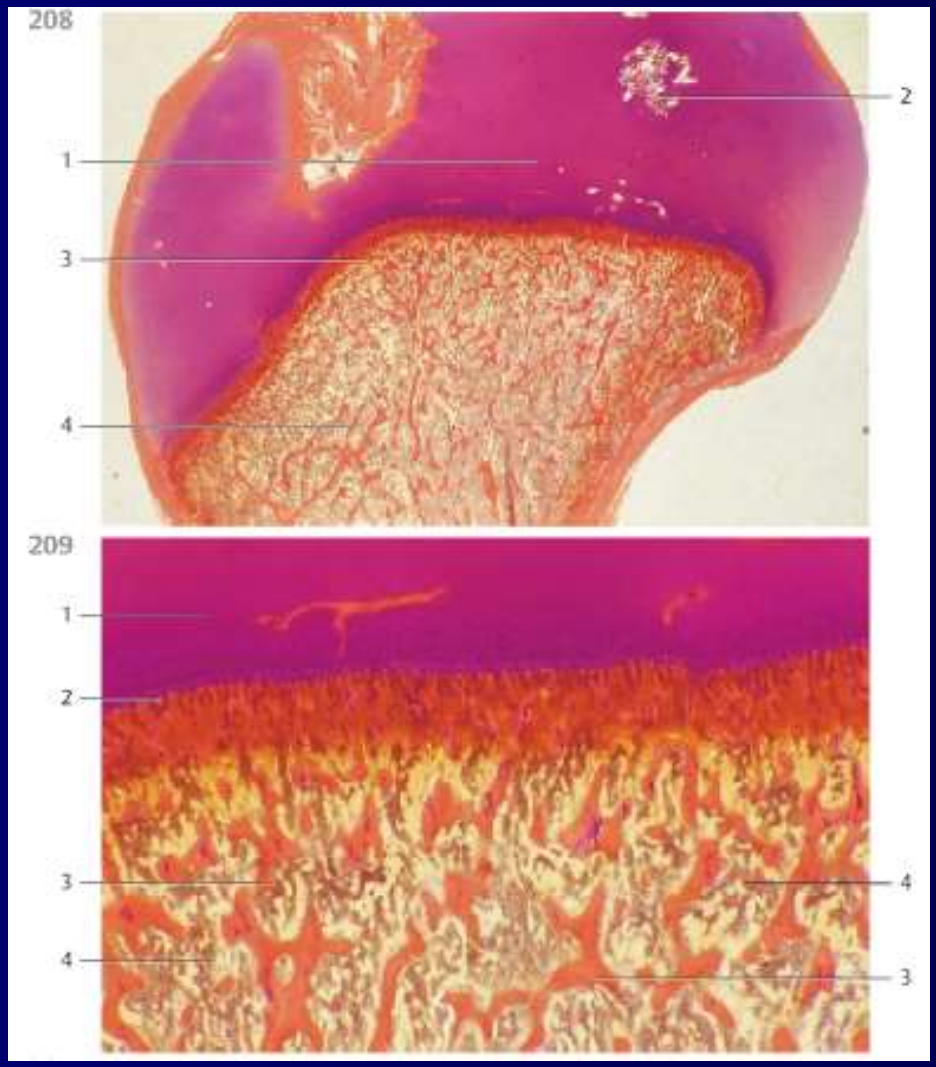
Anatomy of limbs with clinical aspects

- Pavel Šnajdr

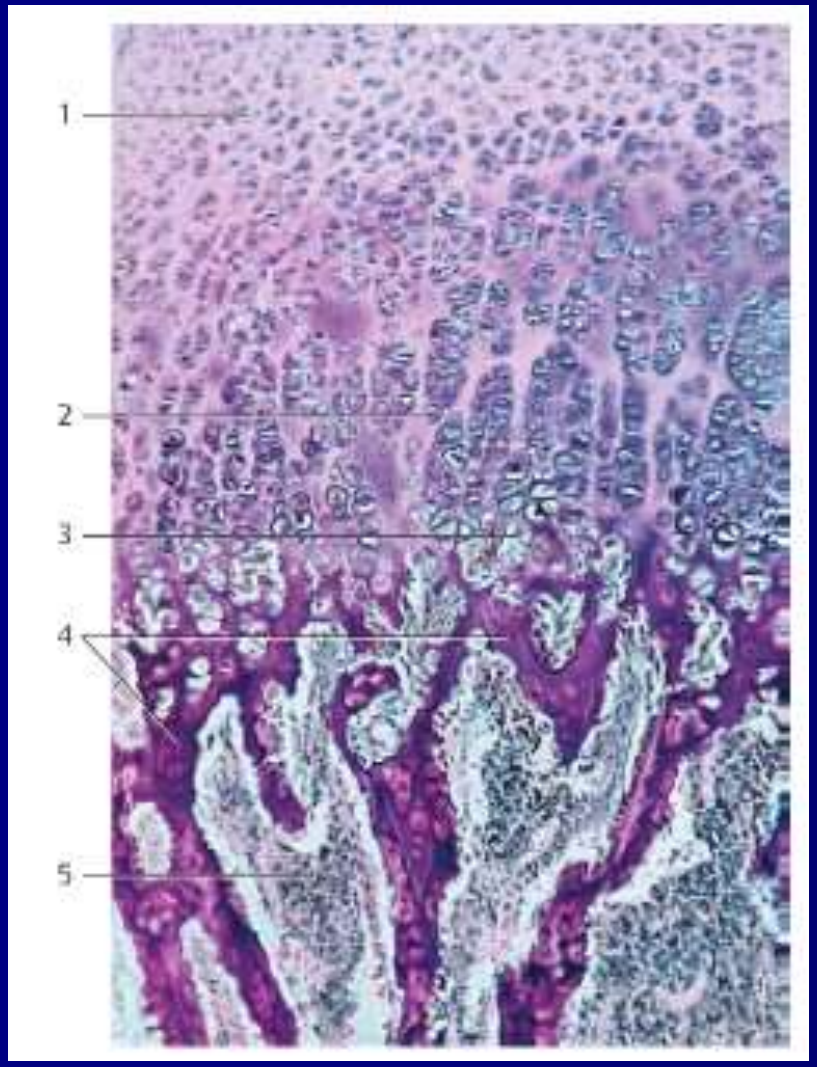
Bone development (osteogenesis)

- A) membranous (desmogenic)
- B) chondral (chondrogenic)



proximal humerus of a newborn

Growth plate

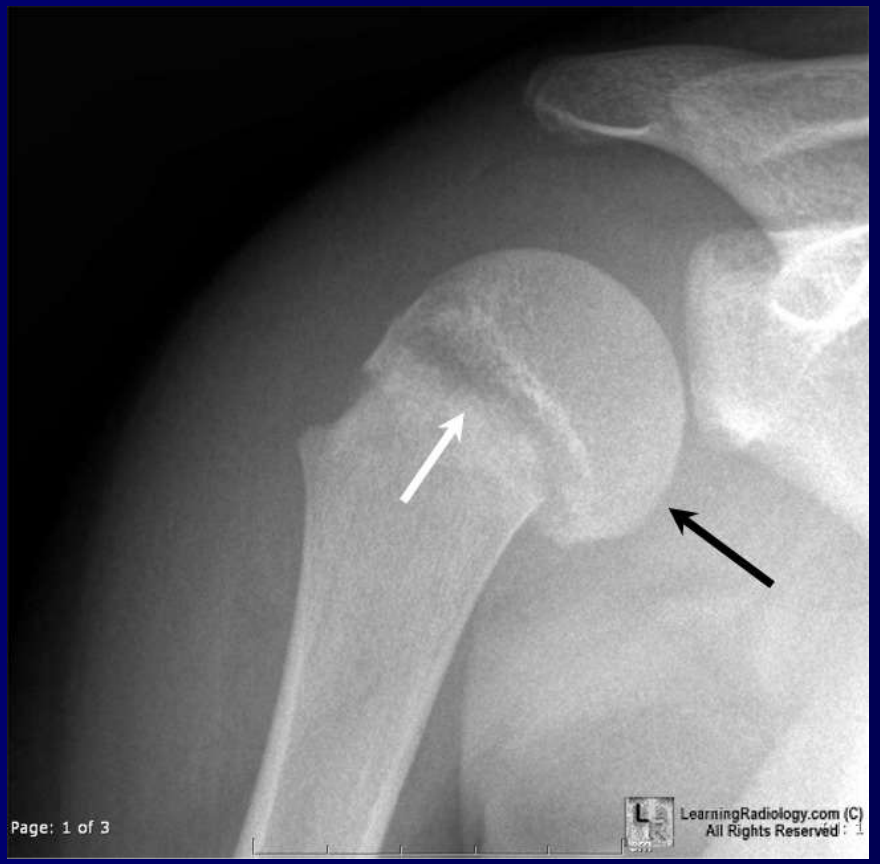


tibia

1 Epiphyseal cartilage (resting zone)
2 Column cartilage (zone) -proliferating cells
3 Distended hypertrophied cartilage cells - finally degraded by chondroclasts (zone of maturation, resorption, primary calcification)
4 Primary spongiosa lamellae
5 Medullary cavity,bone marrow

Clinical case

•8 years ols boy with shoulder pain after fall onto an oustretched arm



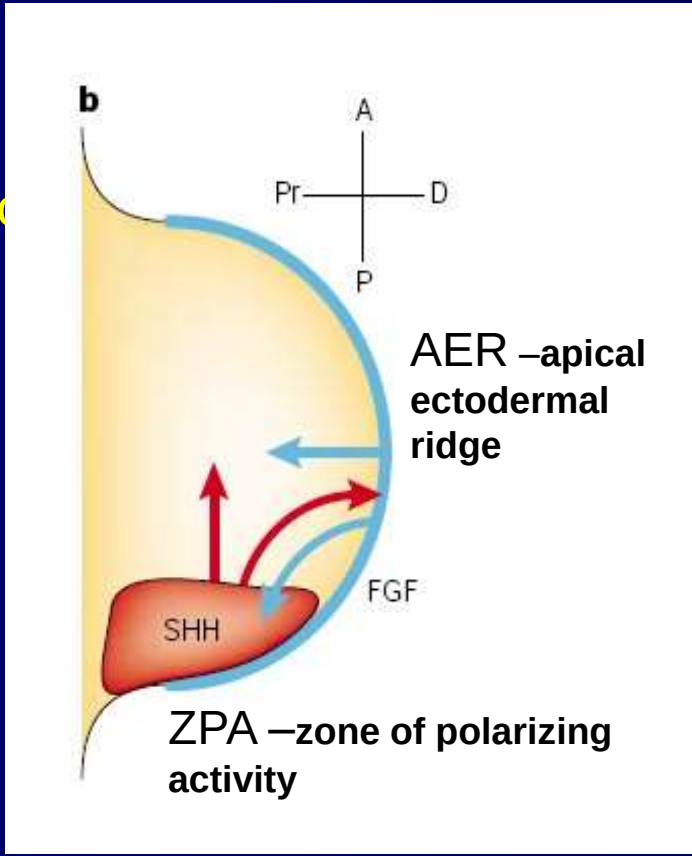
epiphyseal (growth) plate fracture

<u>complication</u>: retardation x acceleration of growth

epiphysis is displaced medially and proximally (black arrow)
frct. line through epiphyseal plate (white arrow).

Limb development

1) specification of the limb fields
2) induction of the early limb bud
3) specification of forelimb and hindlimb
4) generating the limb
    a)P-D axis (AER + progress z
    b)A-P axis (ZPA)
    c)D-V axis
    d)coordinating three axis



Congenital limb defects - 10% congenital defects

isolated x syndromes

in 2008 in Czech Republic :

154 cases of polydactyly,

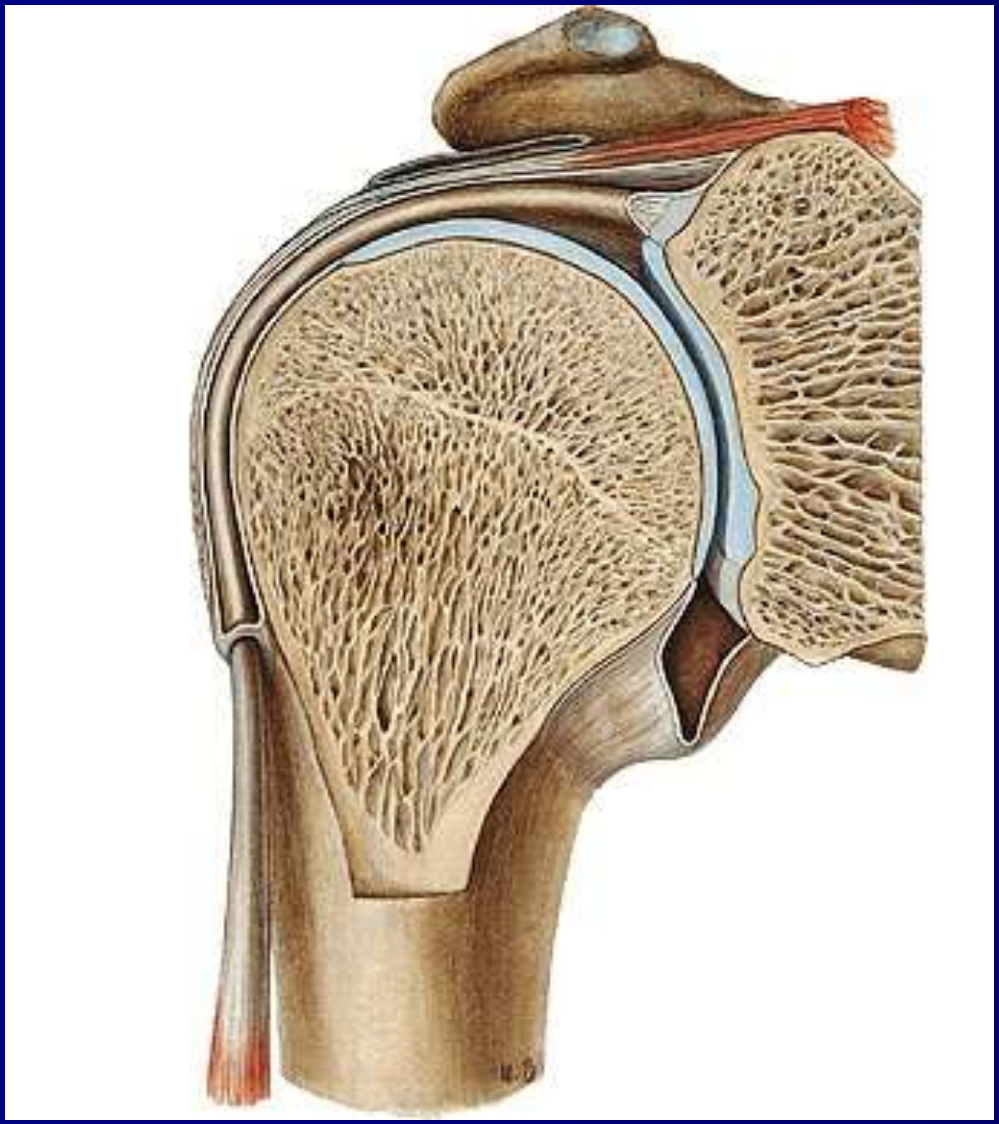
142 cases of syndactyly

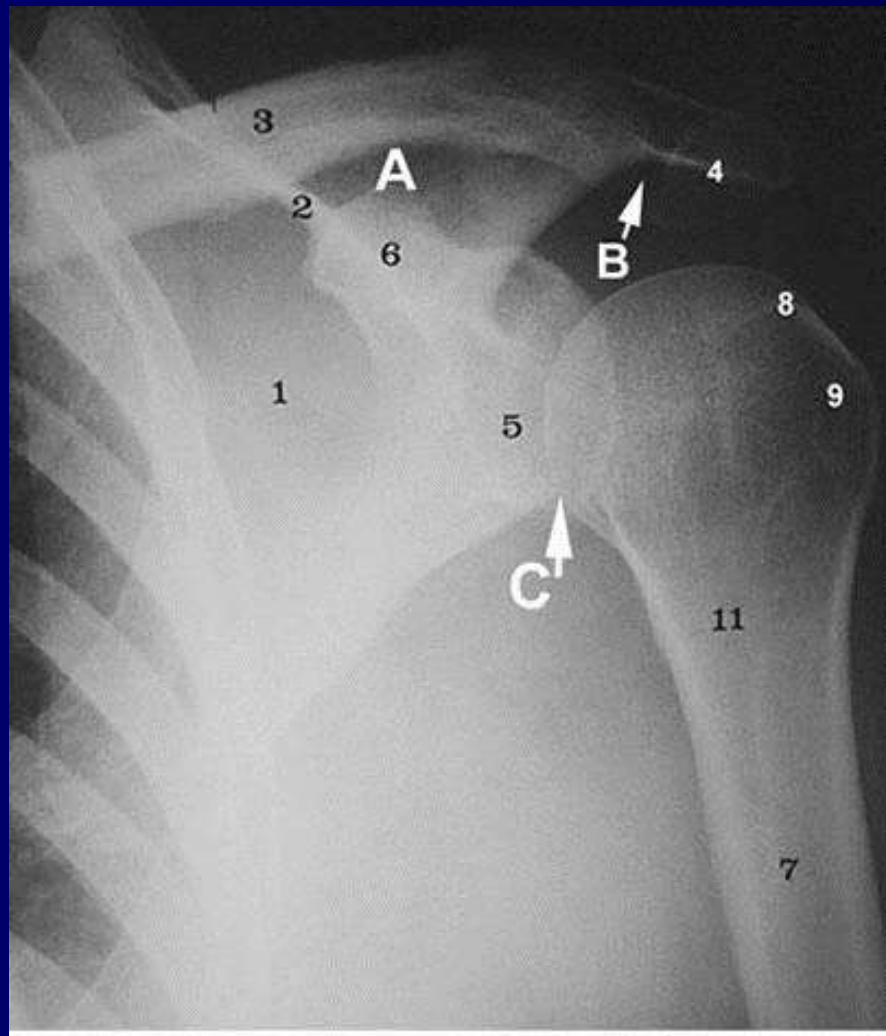
41 cases of complete or partial absence of the limb

20% genetic factors

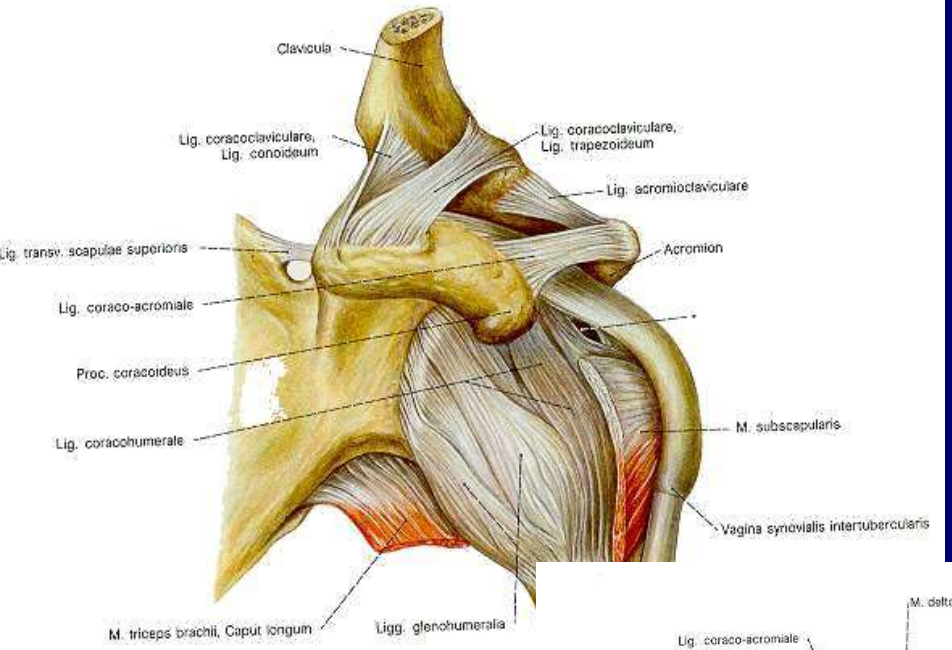
10% exclusively external/environmental factors

70% ??



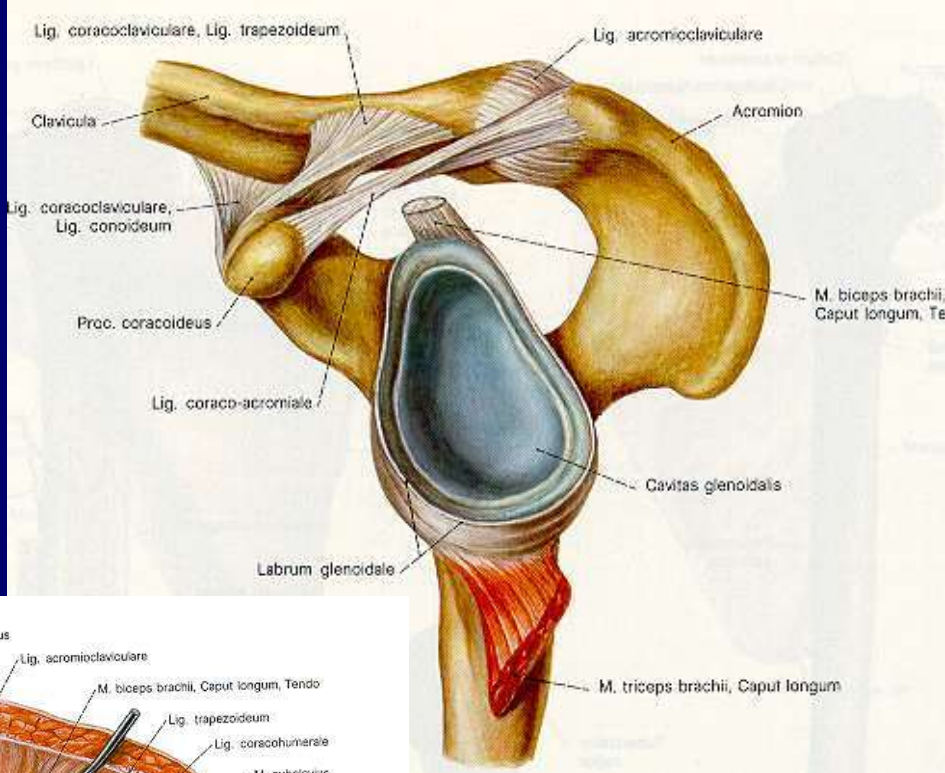


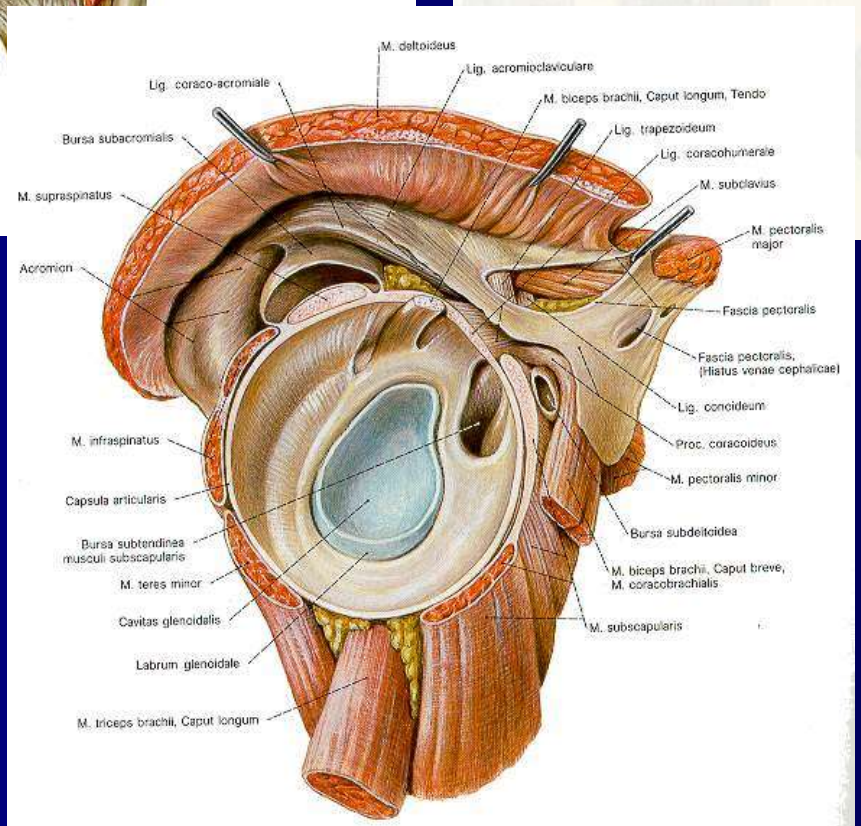
1 scapula 2 scapular spine 3 clavicle
4 acromion process 5 glenoid fossa
6 coracoid process 7 humerus
8 anatomical neck of humerus
9 greater tuberosity
10 lesser tuberosity
11 surgical neck of humerus
A coracoclavicular joint
B acromioclavicular joint
C glenohumeral joint

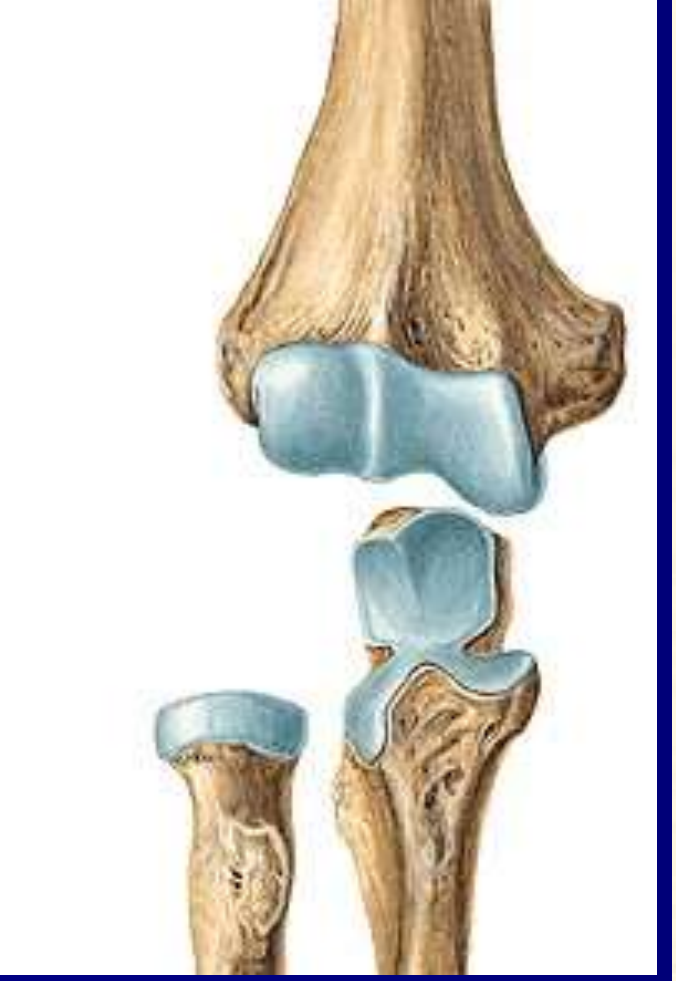


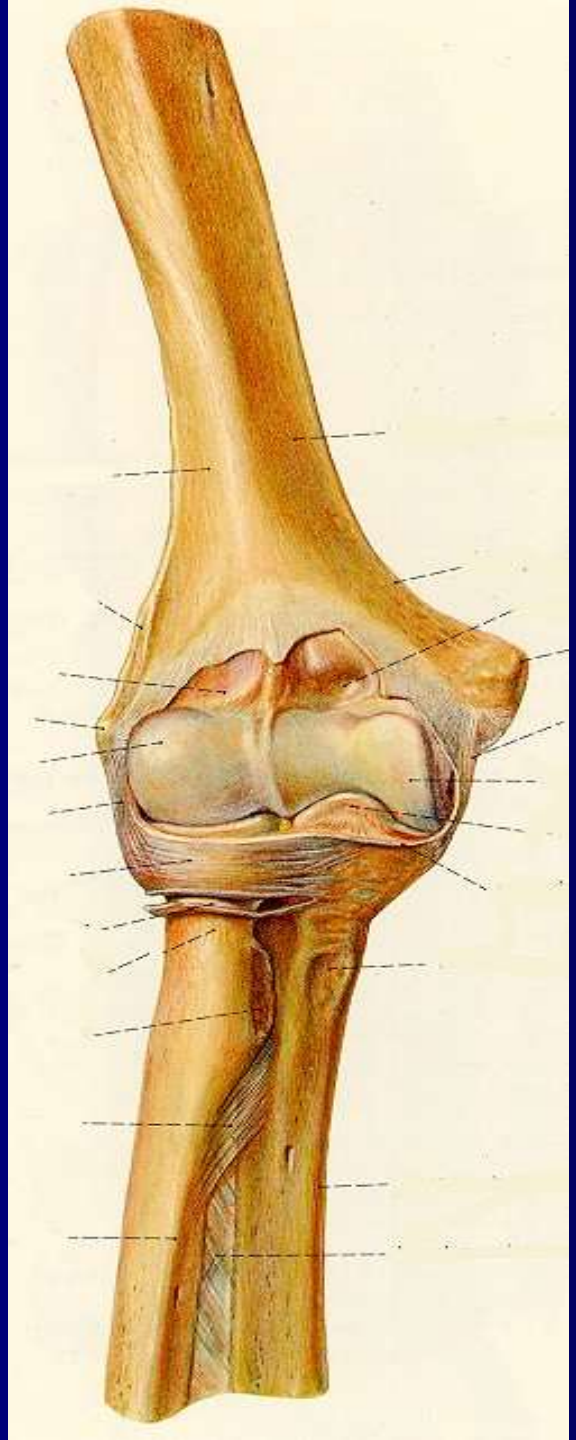
44. Left articulatio (capitis) humeri and articulatio
ioclavicularis. Anterior view.

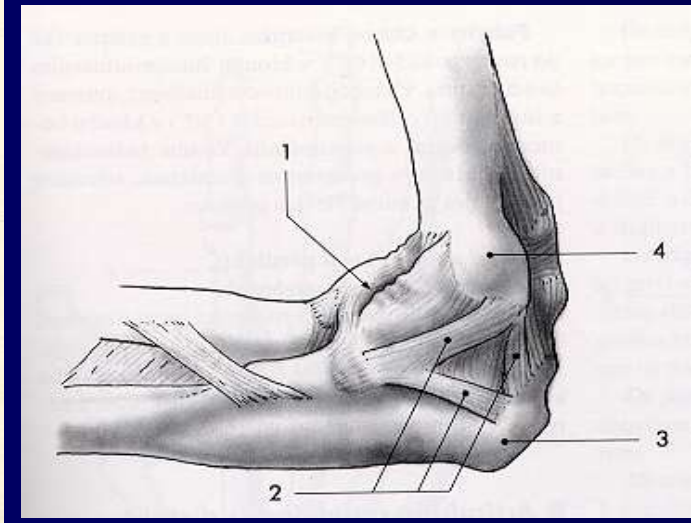
ning into bursa subacromialis







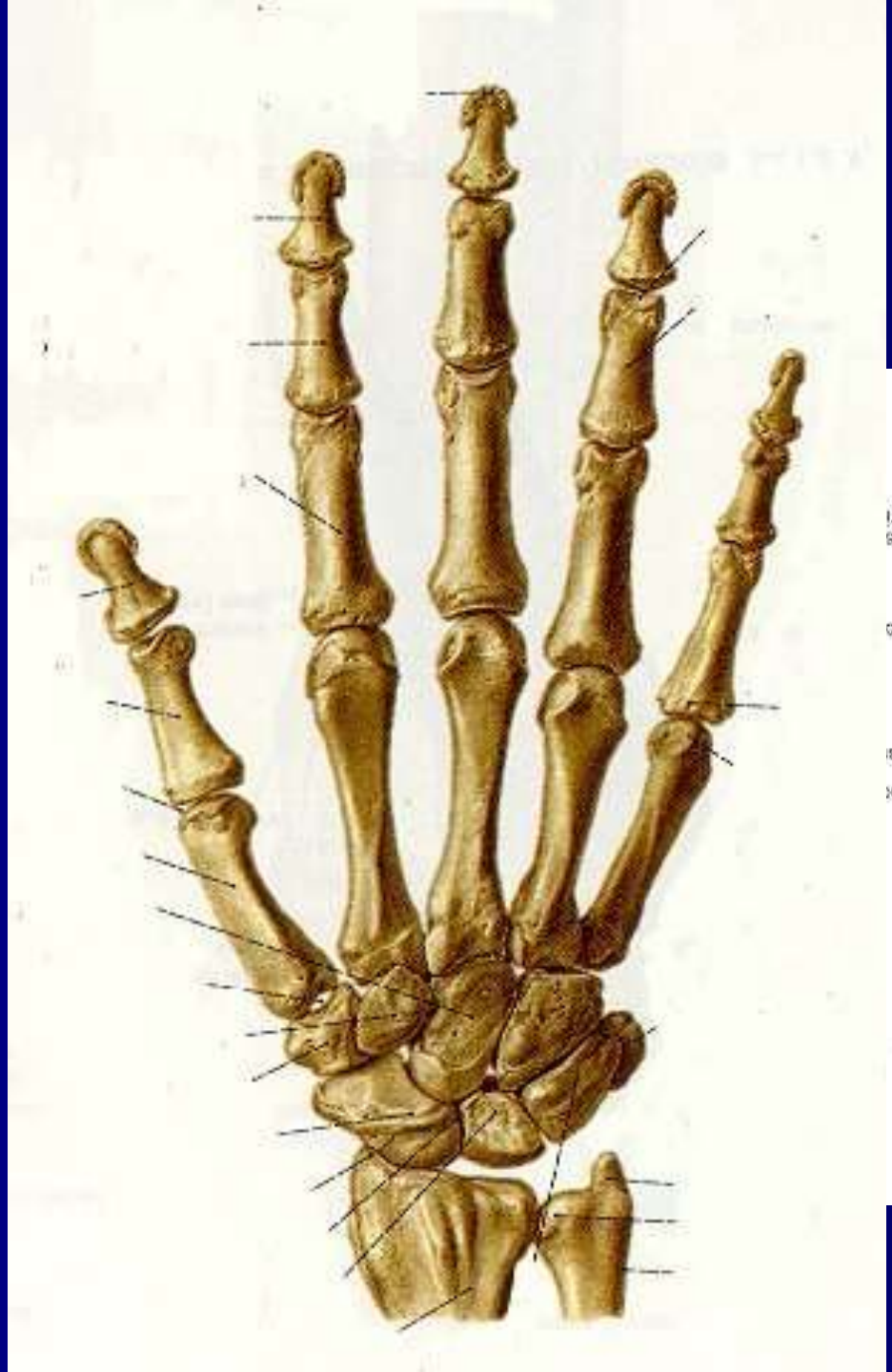


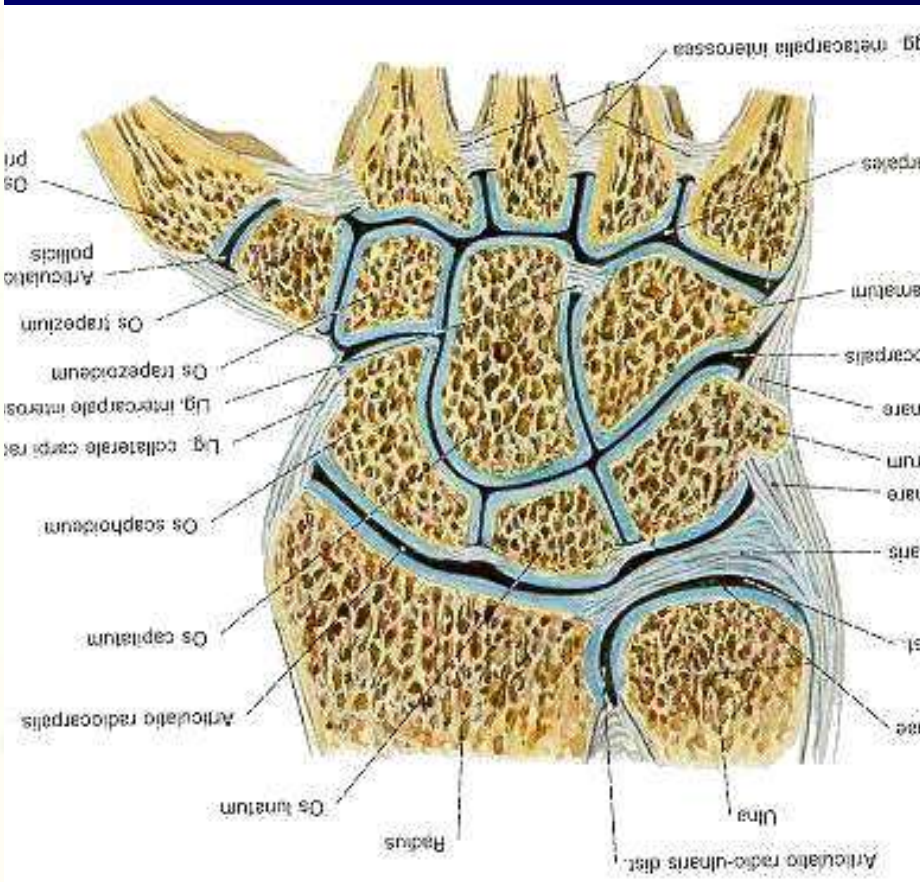

1
2
3
4

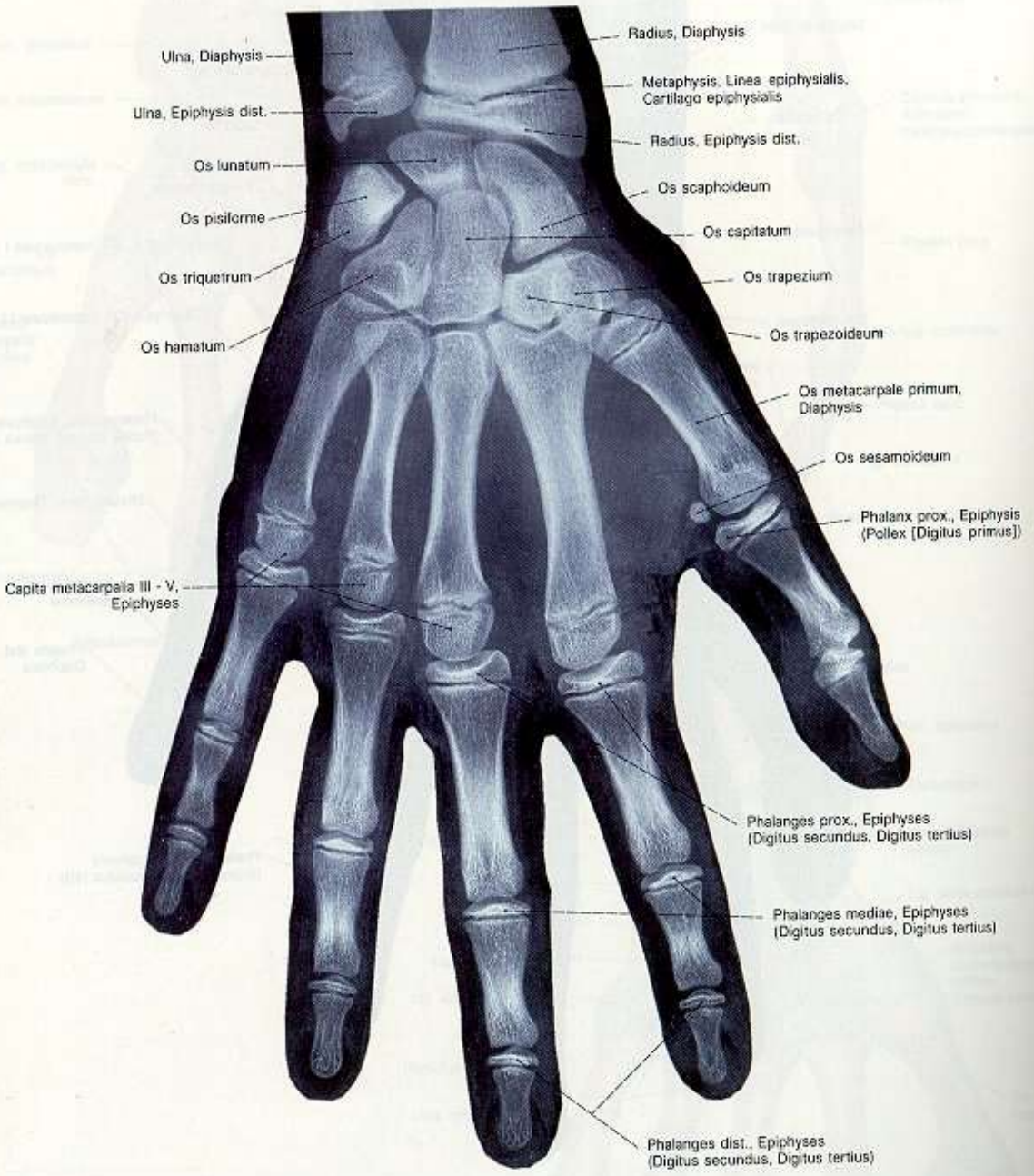

Capsula articularis
Epicondylus lat.
Lig. collaterale radiale
Lig. annulare [anulare] radii
Olecranon
Radius
Ulna

Abraham Colles
(1773-1843)

frct. radii dist + frct. processus styloidei ulnae

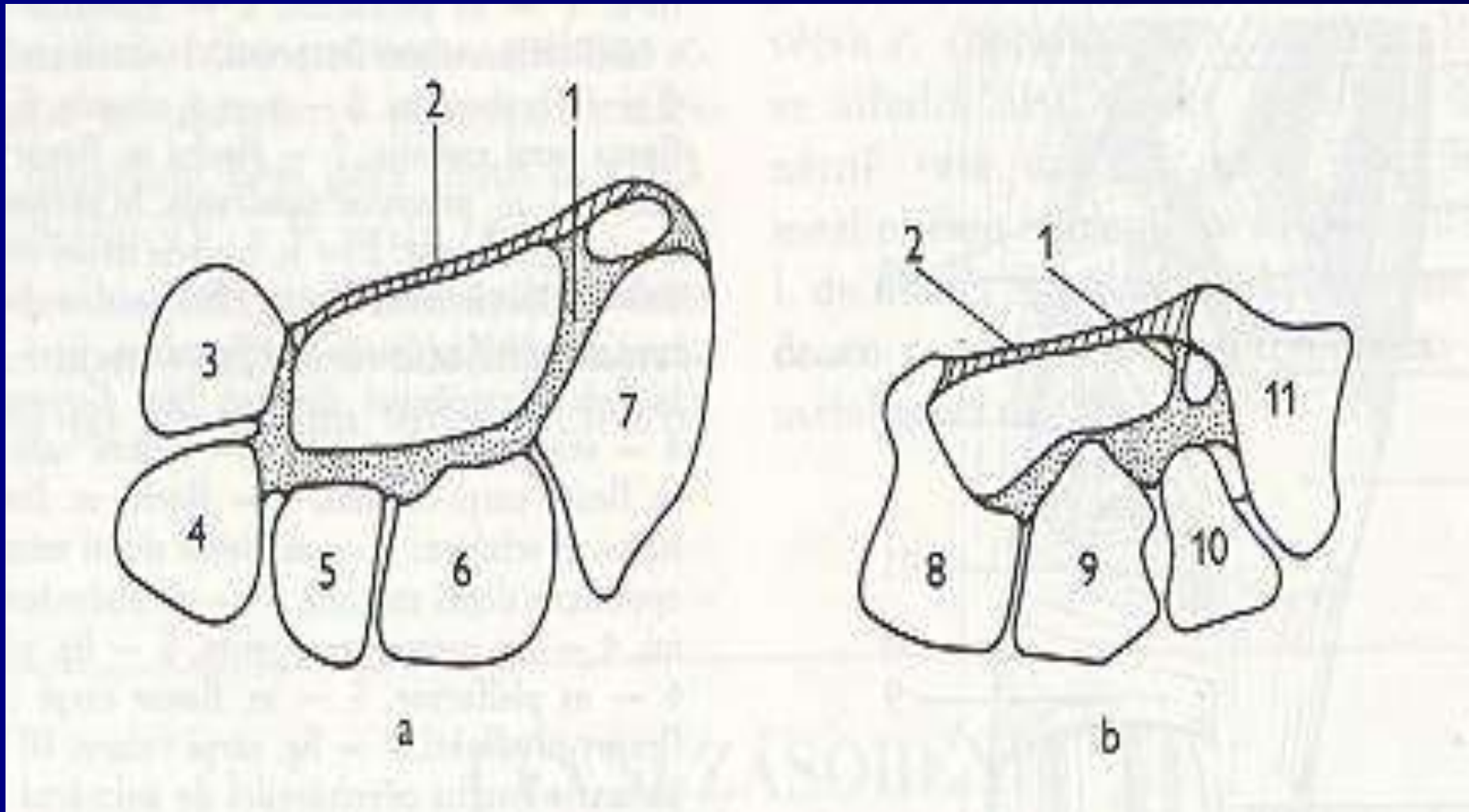


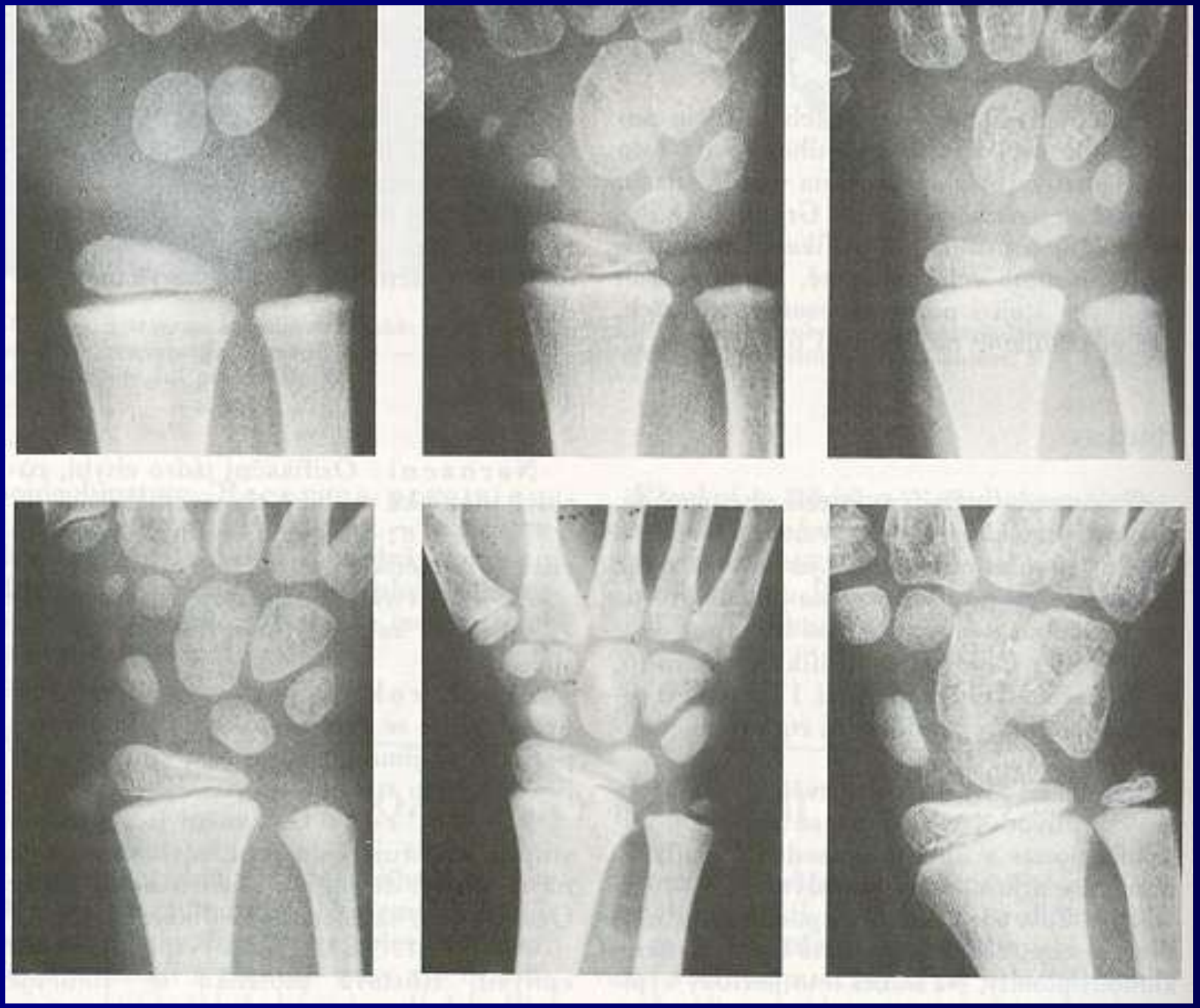

Articulatio radio-ulnaris dist.
Radius
Ulna
Os lunatum
Articulatio radiocarpalis
Os capitatum
Os scaphoideum
Lig. collaterale carpi ra
Lig. intercarpale interos
Os trapezoideum
Os trapezium
Articulatio
pollicis
Os
pi
Lig. metacarpalia interossea


Ulna, Diaphysis
Ulna, Epiphysis dist.
Os lunatum
Os pisiforme
Os triquetrum
Os hamatum
Radius, Diaphysis
Metaphysis, Linea epiphysialis, Cartilago epiphysialis
Radius, Epiphysis dist.
Os scaphoideum
Os capitatum
Os trapezium
Os trapezoideum
Os metacarpale primum, Diaphysis
Os sesamoideum
Phalanx prox., Epiphysis (Pollex [Digitus primus])
Capita metacarpalia III - V, Epiphyses
Phalanges prox., Epiphyses (Digitus secundus, Digitus tertius)
Phalanges mediae, Epiphyses (Digitus secundus, Digitus tertius)
Phalanges dist., Epiphyses (Digitus secundus, Digitus tertius)

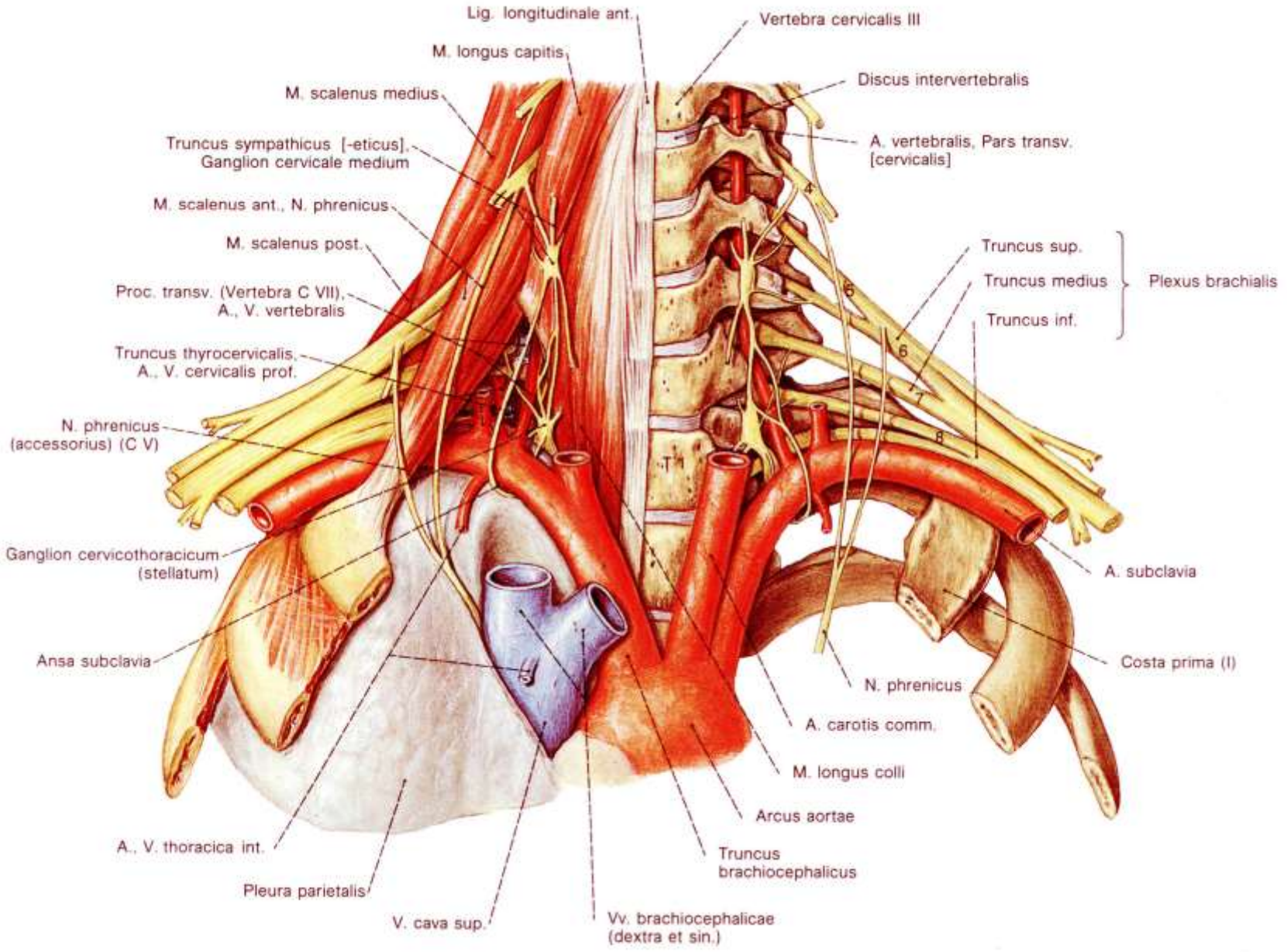
Carpal tunnel

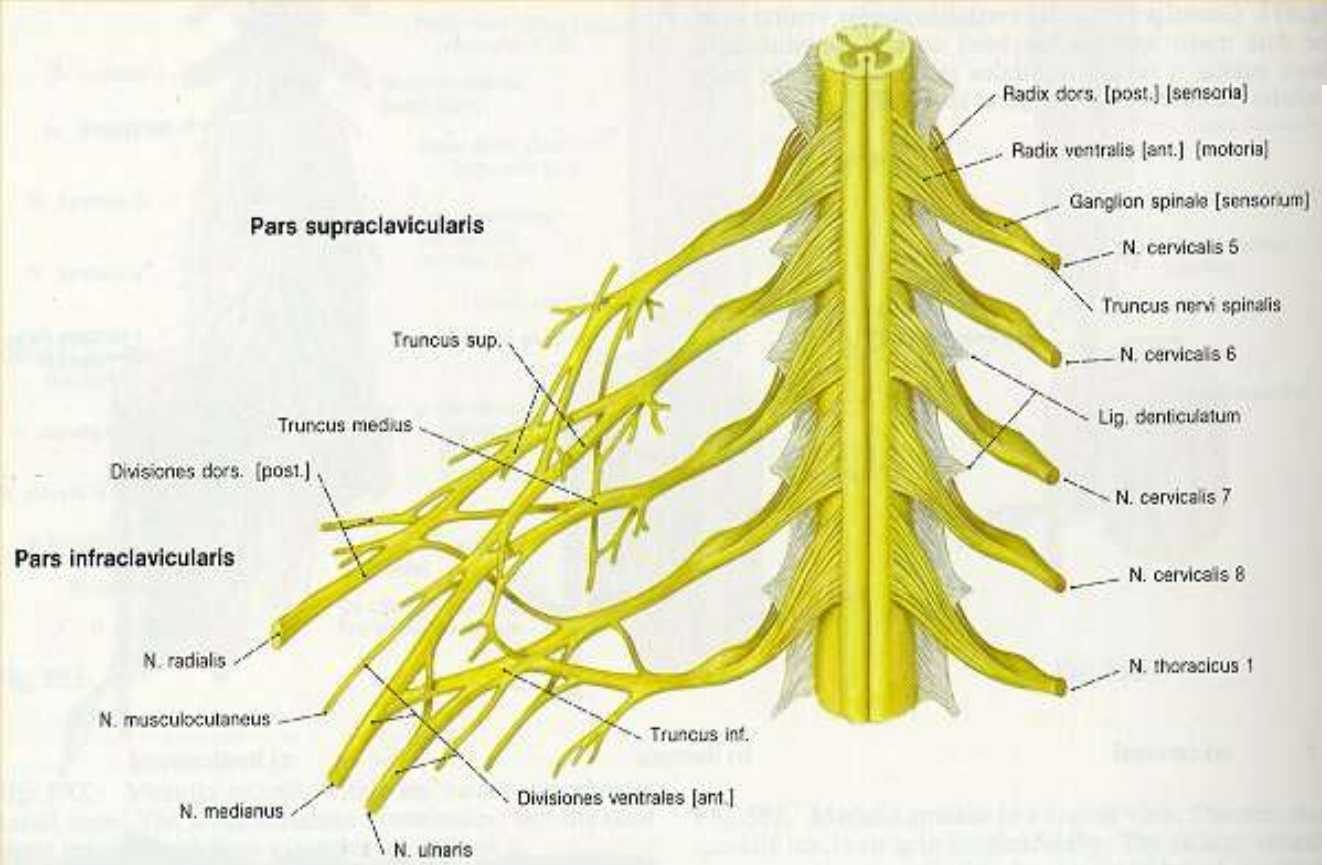
space between prox. and dist. rows of bones and flexor retinaculum

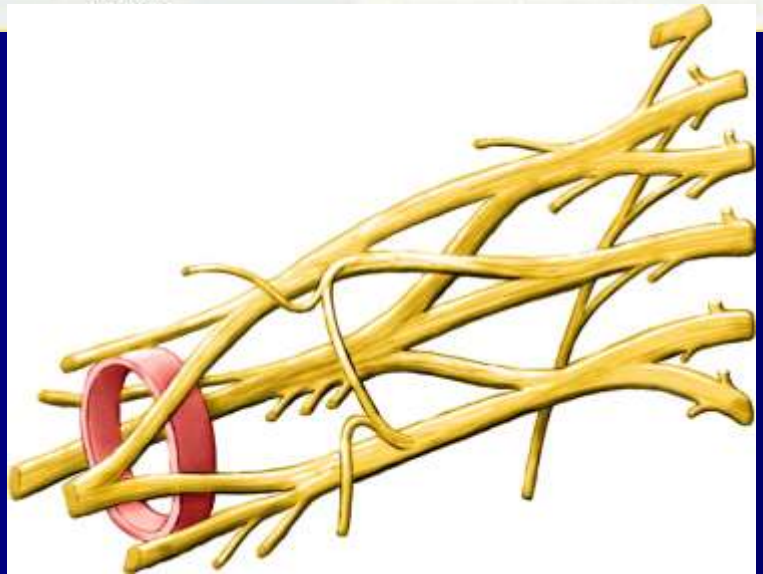


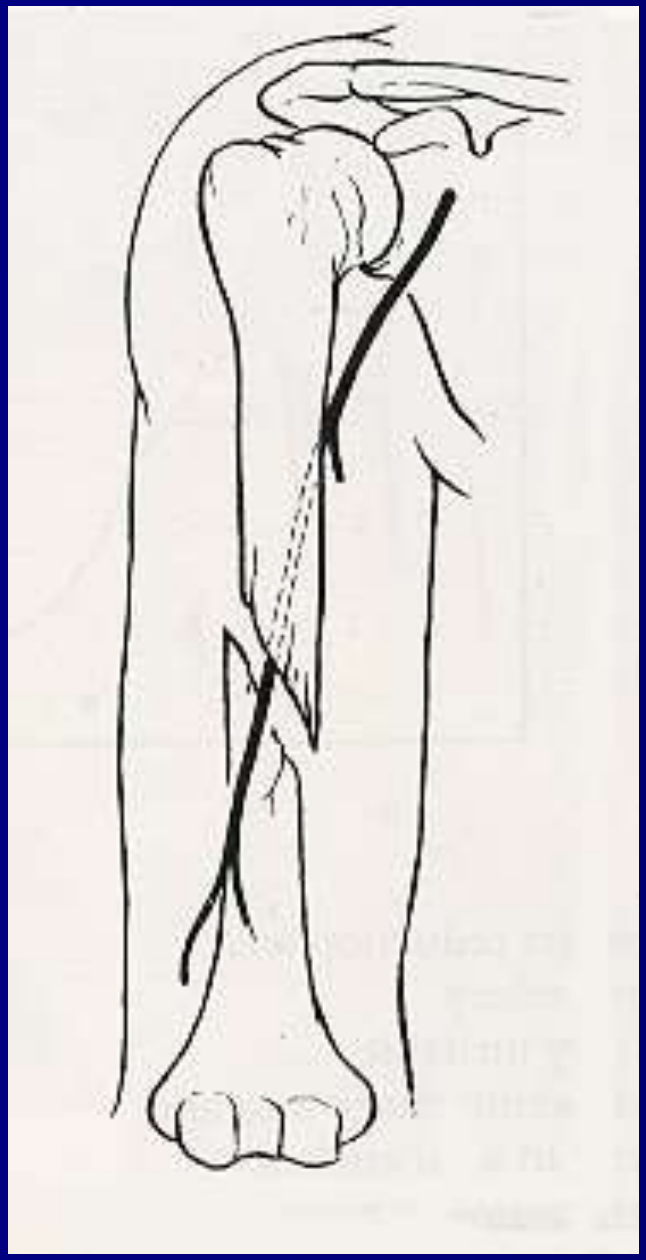


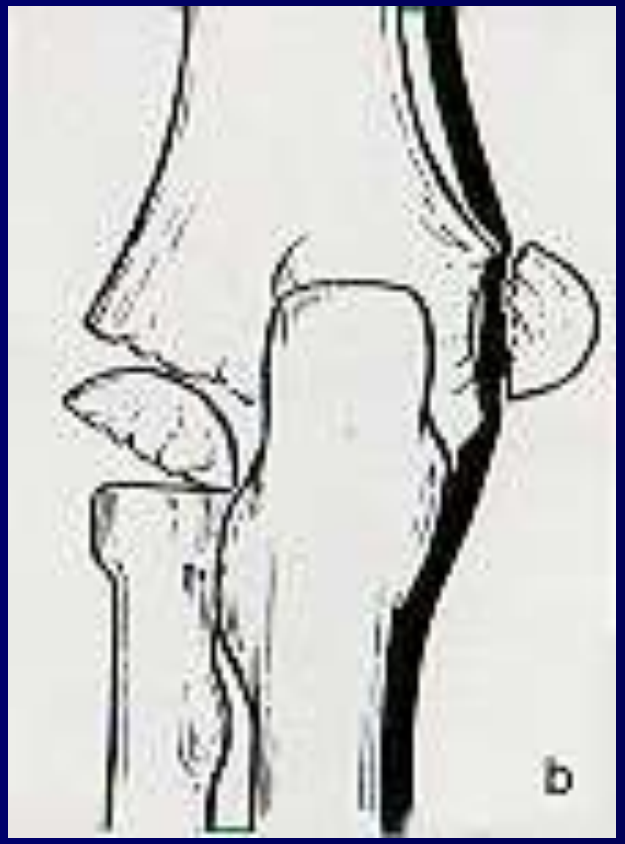
ossification, bone age


Lig. longitudinale ant.
Vertebra cervicalis III
M. longus capitis
Discus intervertebralis
M. scalenus medius
A. vertebralis, Pars transv. [cervicalis]
Truncus sympathicus [-eticus], Ganglion cervicale medium
M. scalenus ant., N. phrenicus
M. scalenus post.
Truncus sup.
Truncus medius
Truncus inf.
Plexus brachialis
Proc. transv. (Vertebra C VII), A., V. vertebralis
Truncus thyrocervicalis, A., V. cervicalis prof.
N. phrenicus (accessorius) (C V)
Ganglion cervicothoracicum (stellatum)
A. subclavia
Ansa subclavia
Costa prima (I)
N. phrenicus
A. carotis comm.
M. longus colli
Arcus aortae
A., V. thoracica int.
Truncus brachiocephalicus
Pleura parietalis
V. cava sup.
Vv. brachiocephalicae (dextra et sin.)

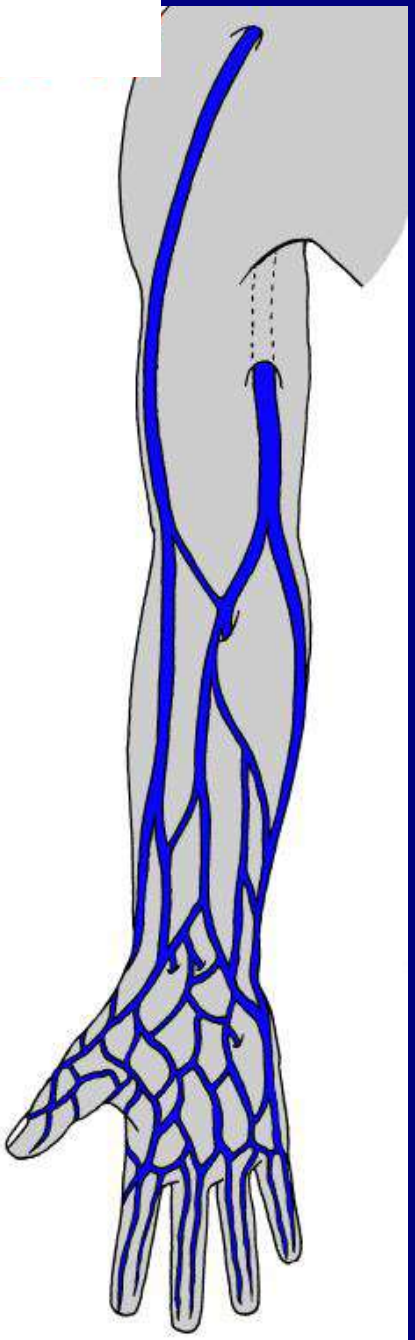

Radix dors. [post.] [sensoria]
Radix ventralis [ant.] [motoria]
Ganglion spinale [sensorium]
N. cervicalis 5
Truncus nervi spinalis
N. cervicalis 6
Lig. denticulatum
N. cervicalis 7
N. cervicalis 8
N. thoracicus 1
Pars supraclavicularis
Truncus sup.
Truncus medius
Divisiones dors. [post.]
Pars infraclavicularis
N. radialis
N. musculocutaneus
N. medianus
N. ulnaris
Truncus inf.
Divisiones ventrales [ant.]

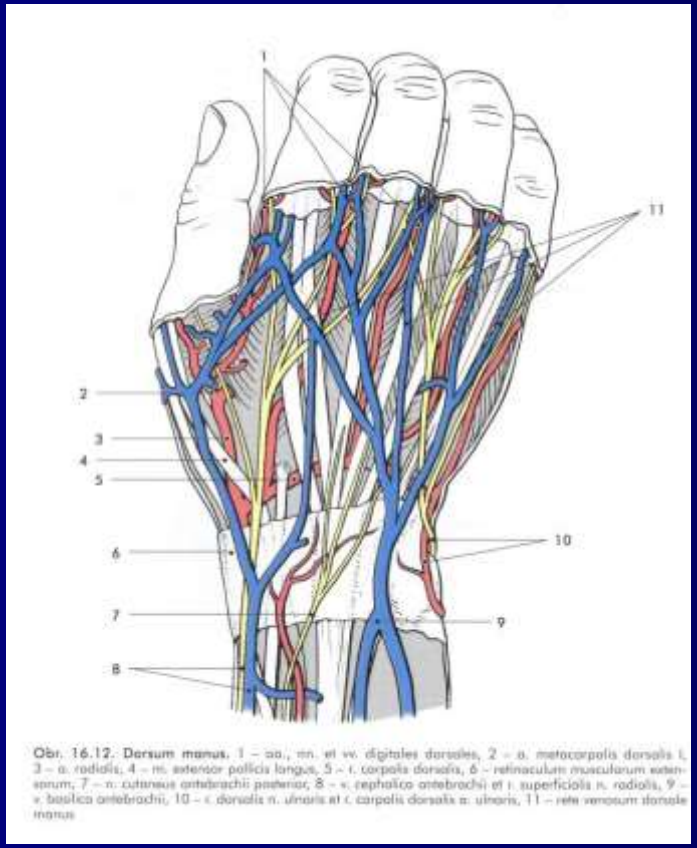




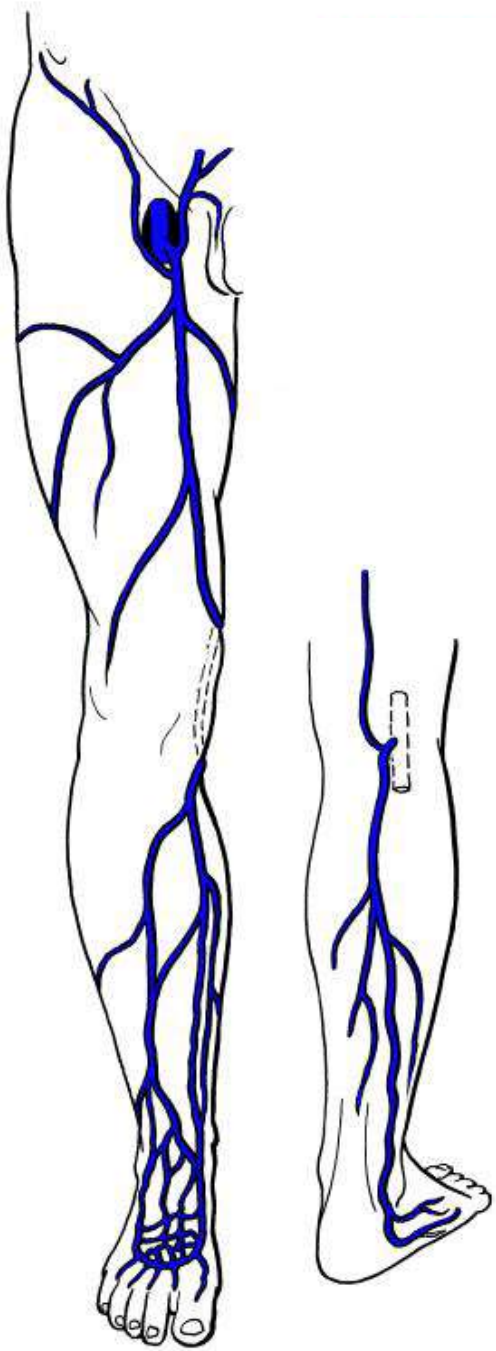


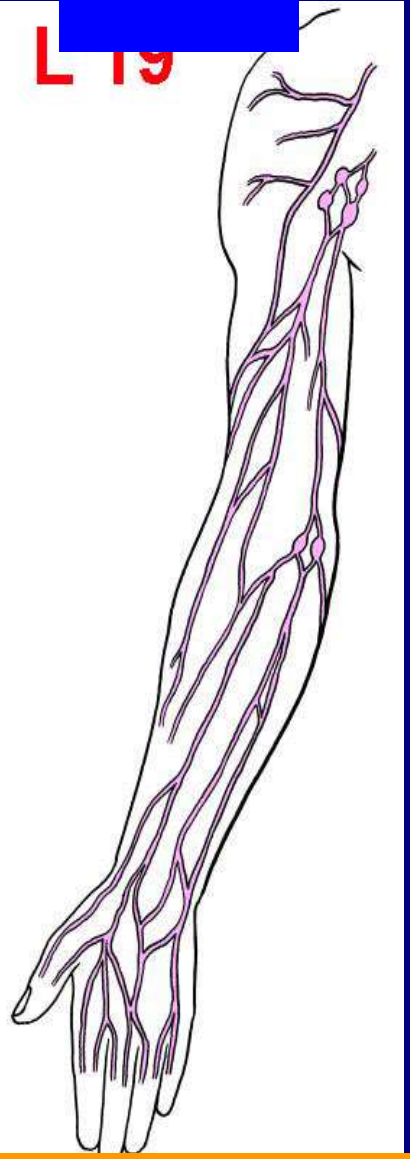
neural damage as a complication of a fracture





Obr. 16.12. **Dorsum manus.** 1 – aa., nn. et vv. digitales dorsales, 2 – a. metacarpalis dorsalis I, 3 – a. radialis, 4 – m. extensor pollicis longus, 5 – r. carpalis dorsalis, 6 – retinaculum musculorum extensorum, 7 – n. cutaneus antebrachii posterior, 8 – v. cephalica antebrachii et r. superficialis n. radialis, 9 – v. basilica antebrachii, 10 – r. dorsalis n. ulnaris et r. carpalis dorsalis a. ulnaris, 11 – rete venosum dorsale manus



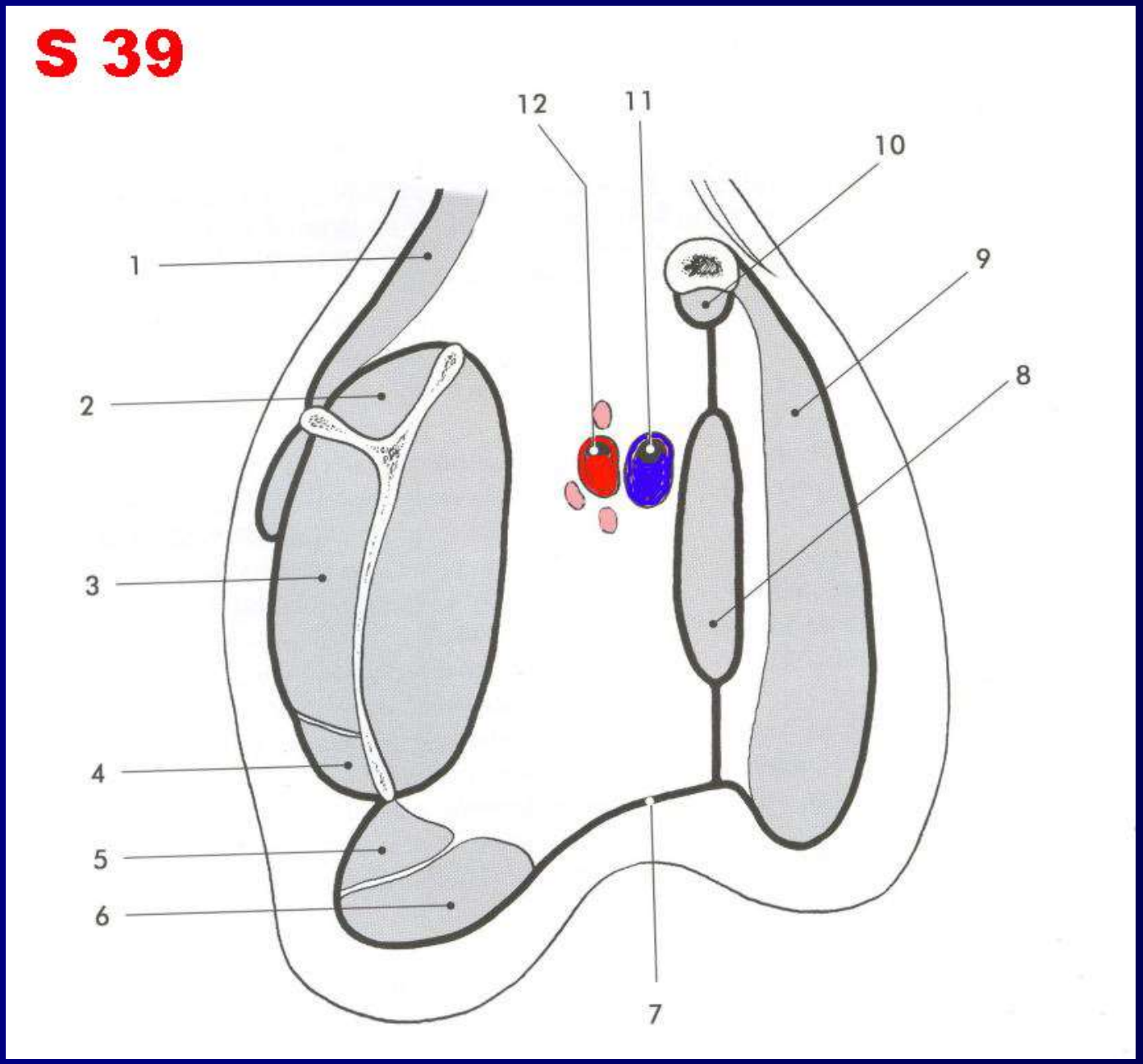


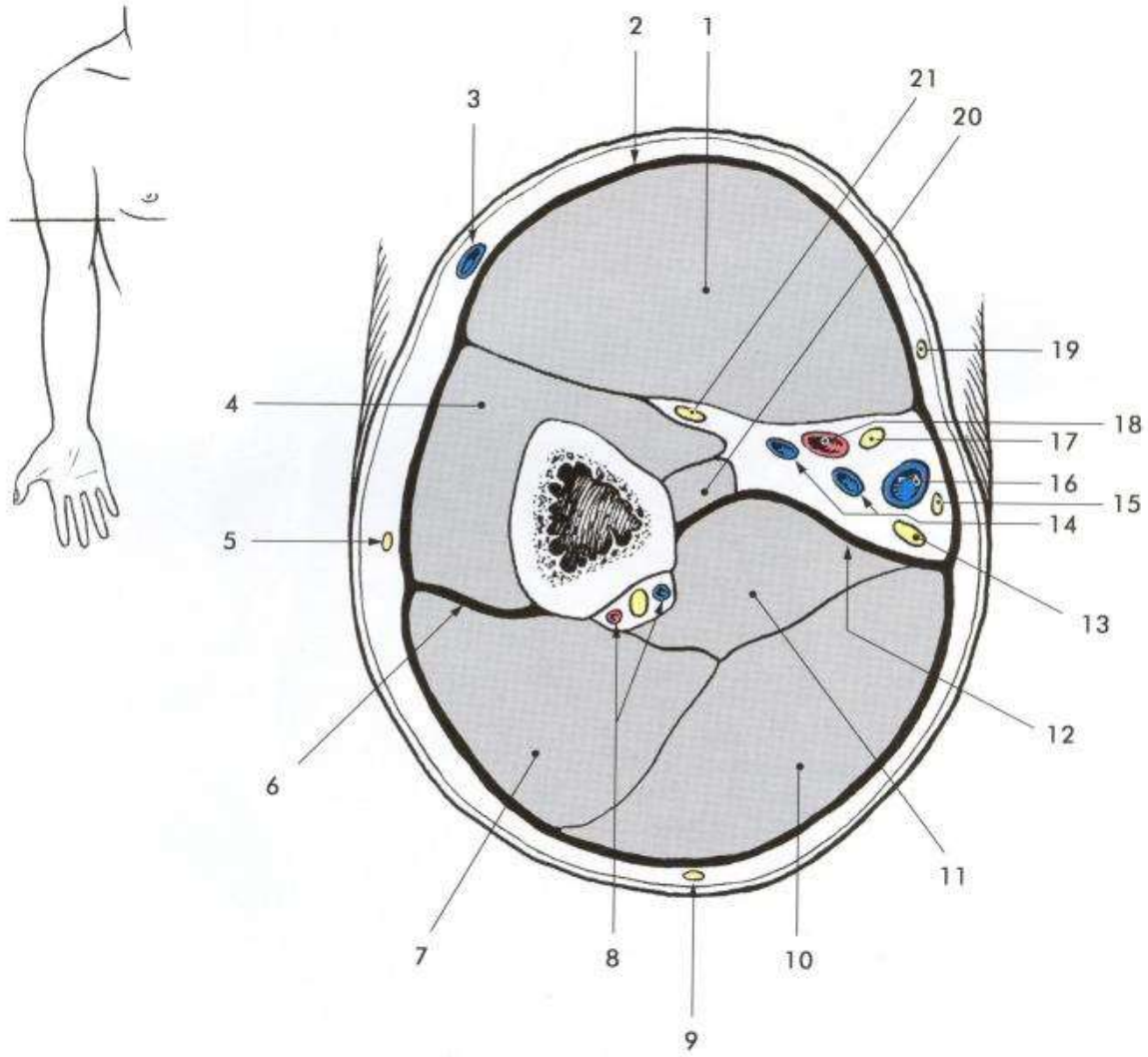
axillary nodes

Lymphedema of right upper limb after breast cancer surgery

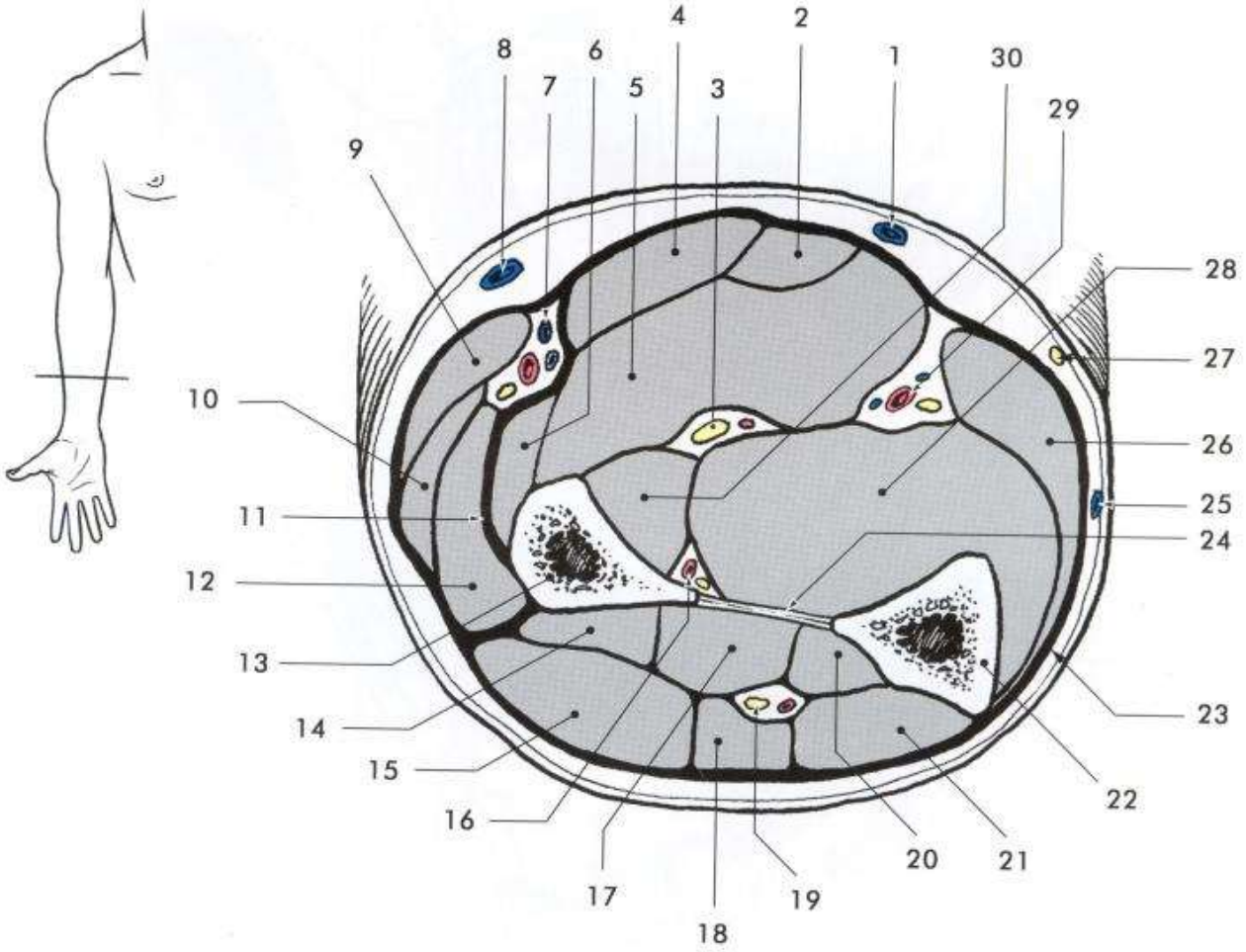
lymphatic drainage of upper limb

S 39

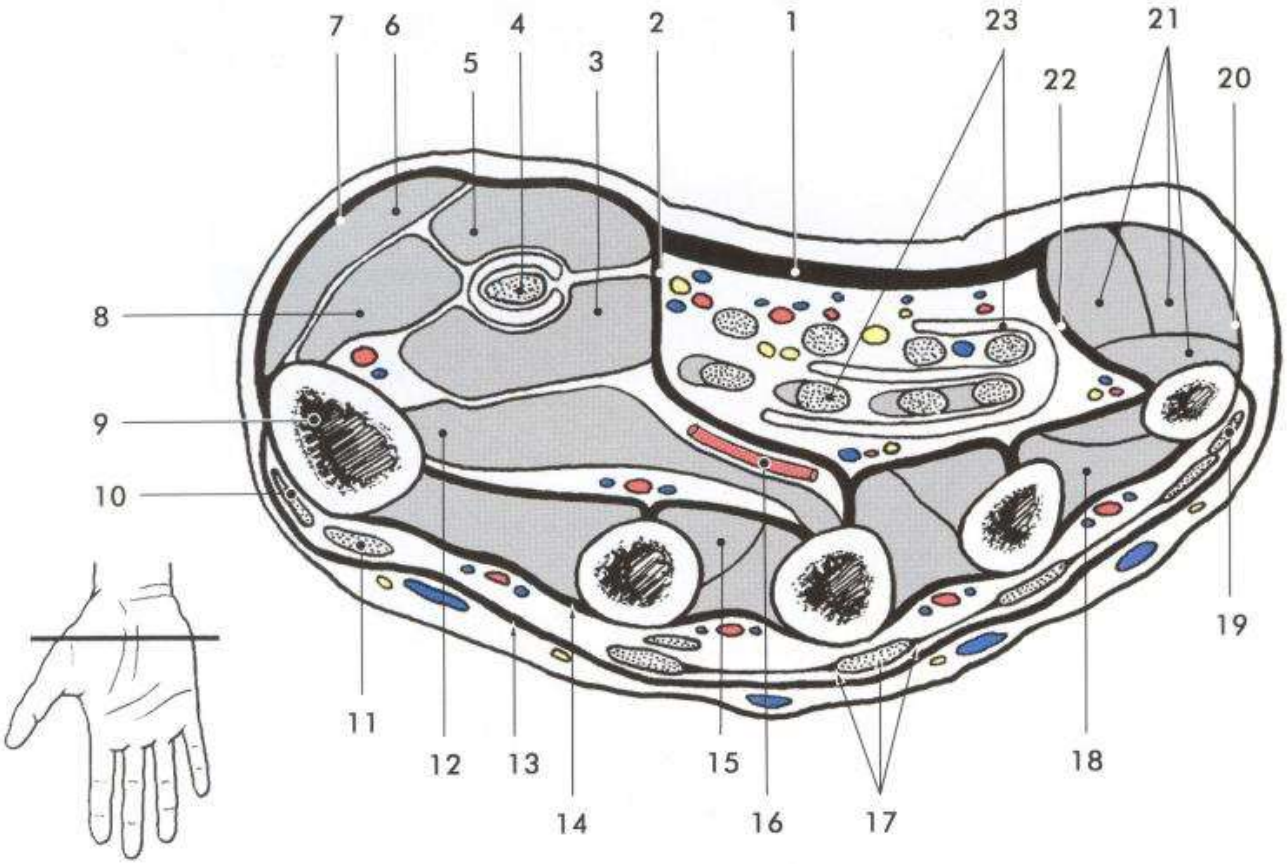




Obr. 16.6. Příčný řez středem paže. 1 – m. biceps brachii, 2 – fascia brachii, 3 – v. cephalica, 4 – m. brachialis, 5 – n. cutaneus brachii lateralis, 6 – septum intermusculare laterale, 7 – caput laterale m. tricipitis brachii, 8 – n. radialis et vasa profunda brachii, 9 – n. cutaneus brachii posterior, 10 – caput longum m. tricipitis brachii, 11 – caput mediale m. tricipitis brachii, 12 – septum intermusculare mediale, 13 – n. ulnaris, 14 – vv. brachiales, 15 – n. cutaneus antebrachii medialis, 16 – v. basilica, 17 – n. medianus, 18 – a. brachialis, 19 – n. cutaneus brachii medialis, 20 – m. coracobrachialis, 21 – n. musculocutaneus



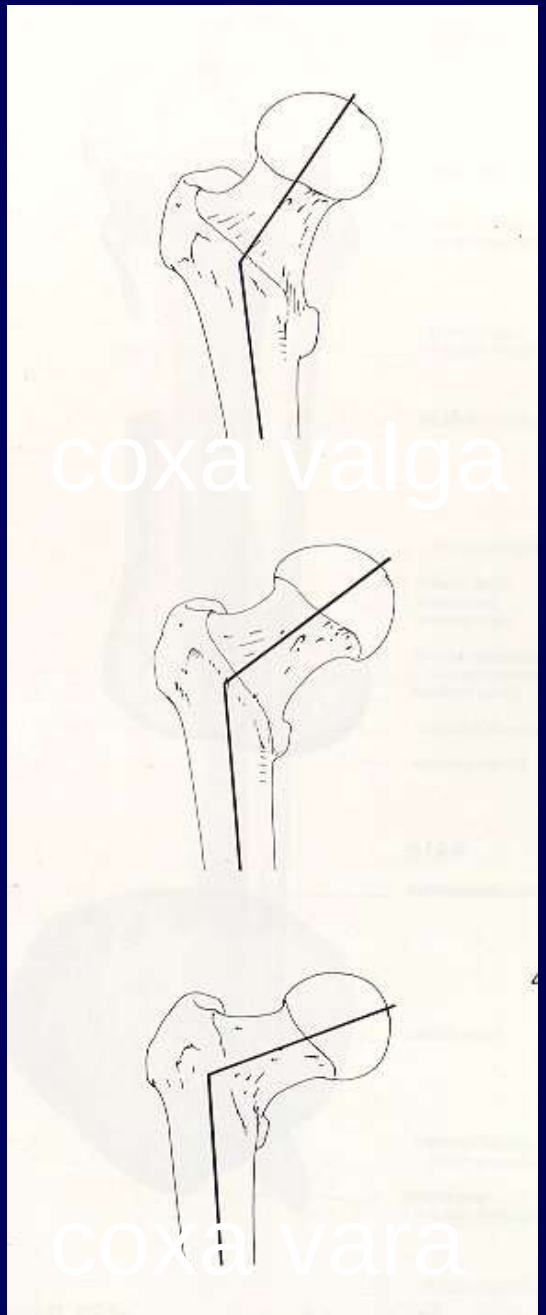
Obr. 16.8. Příčný řez předloktím. 1 – v. mediana antebrachii, 2 – m. palmaris longus, 3 – n. medianus, 4 – m. flexor carpi radialis, 5 – m. flexor digitorum superficialis, 6 – m. pronator teres, 7 – vasa radialia et r. superficialis n. radialis, 8 – v. cephalica, 9 – m. brachioradialis, 10 – m. extensor carpi radialis longus, 11 – radiální intermuskulární septum, 12 – m. extensor carpi radialis brevis, 13 – radius, 14 – m. abductor pollicis longus, 15 – m. extensor digitorum, 16 – n. et vasa interossea anteriora, 17 – m. extensor pollicis brevis, 18 – m. extensor digiti minimi, 19 – r. profundus n. radialis, 20 – m. extensor pollicis longus, 21 – m. extensor carpi ulnaris, 22 – ulna, 23 – fascia antebrachii, 24 – membrana interossea, 25 – v. basilica, 26 – m. flexor carpi ulnaris, 27 – n. cutaneus antebrachii medialis, 28 – m. flexor digitorum profundus, 29 – n. et vasa ulnaria, 30 – m. flexor pollicis longus

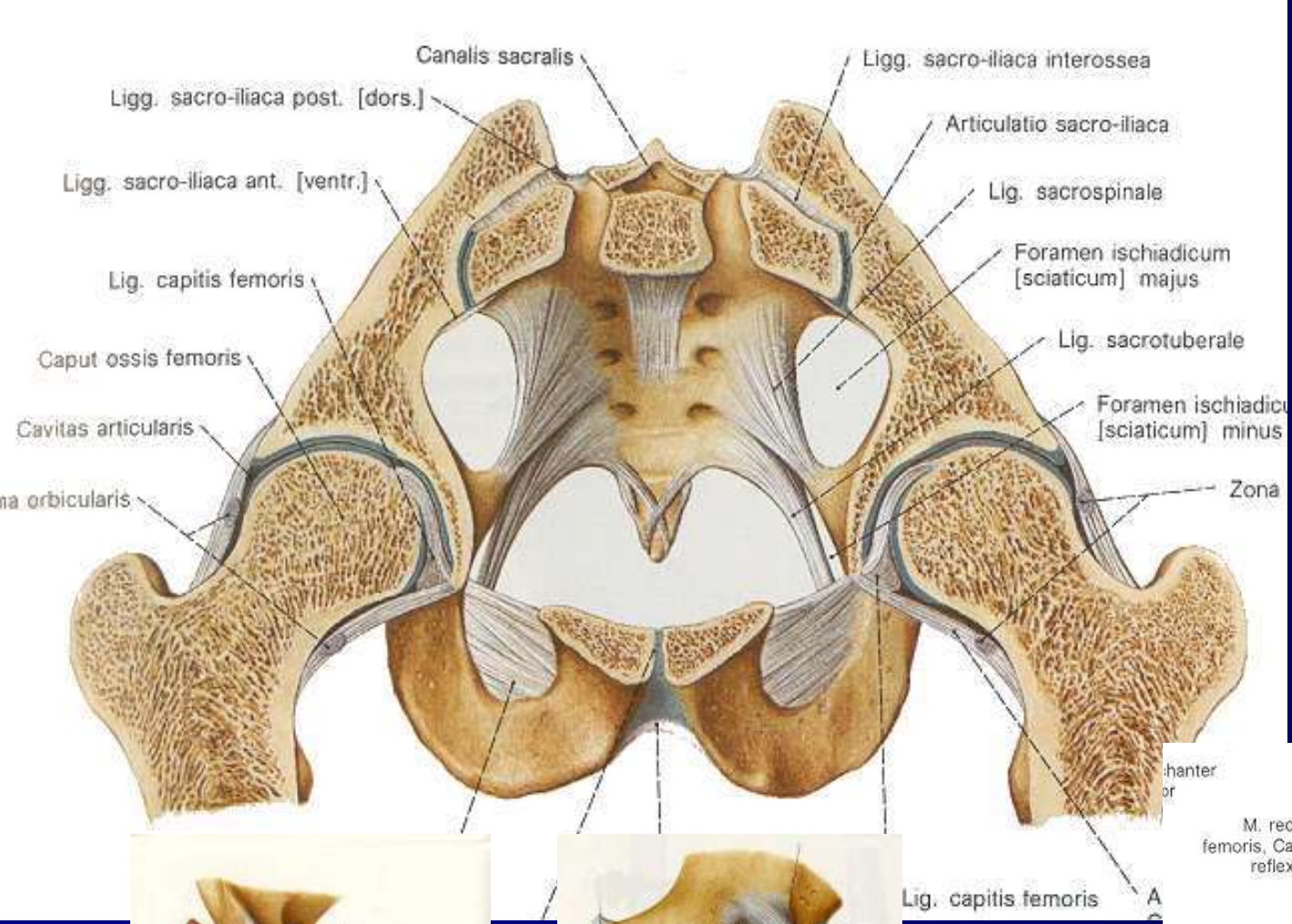


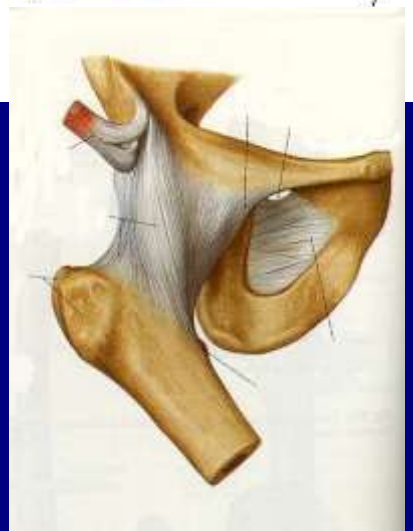
Obr. 16.11. Příčný řez rukou. 1 – aponeurosis palmaris, 2 – palmární thenarové septum, 3 – caput prof. m. flexoris pollicis brevis, 4 – šlacha m. flexor pollicis longus a její synoviální pochva, 5 – caput superficiale m. flexoris pollicis brevis, 6 – m. abductor pollicis brevis, 7 – thenarová fascie, 8 – m. opponens pollicis, 9 – os metacarpale I, 10 – šlacha m. extensor pollicis brevis, 11 – šlacha m. extensor pollicis longus, 12 – m. adductor pollicis (caput transversum), 13 – fascia dorsalis manus superficialis, 14 – fascia interossea dorsalis, 15 – m. interosseus palmaris I, 16 – arcus palmaris profundus, 17 – šlacha m. extensor digitorum pro 3. prst a connexus intertendinei, 18 – m. interosseus dorsalis IV, 19 – šlacha m. extensor digiti minimi, 20 – hypothenarová fascie, 21 – svaly hypothenaru, 22 – hypothenarové septum, 23 – vrstvy šlach m. flexor digitorum superficialis et profundus zavzaté do společné synoviální pochvy; od šlach m. flexor digitorum profundus odstupují mm. lumbricales

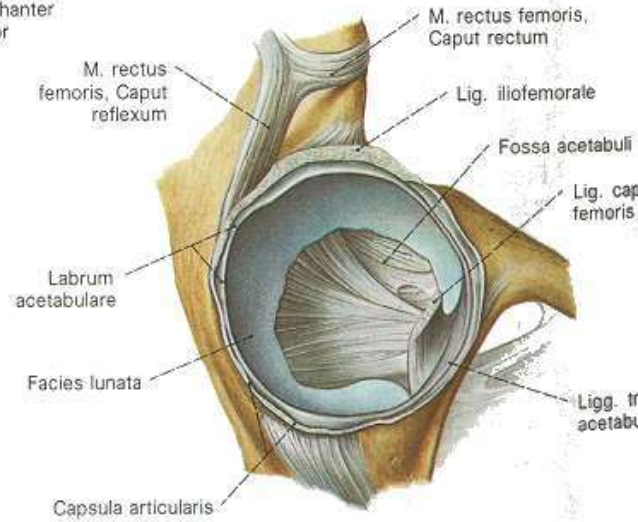
angle of inclination 130

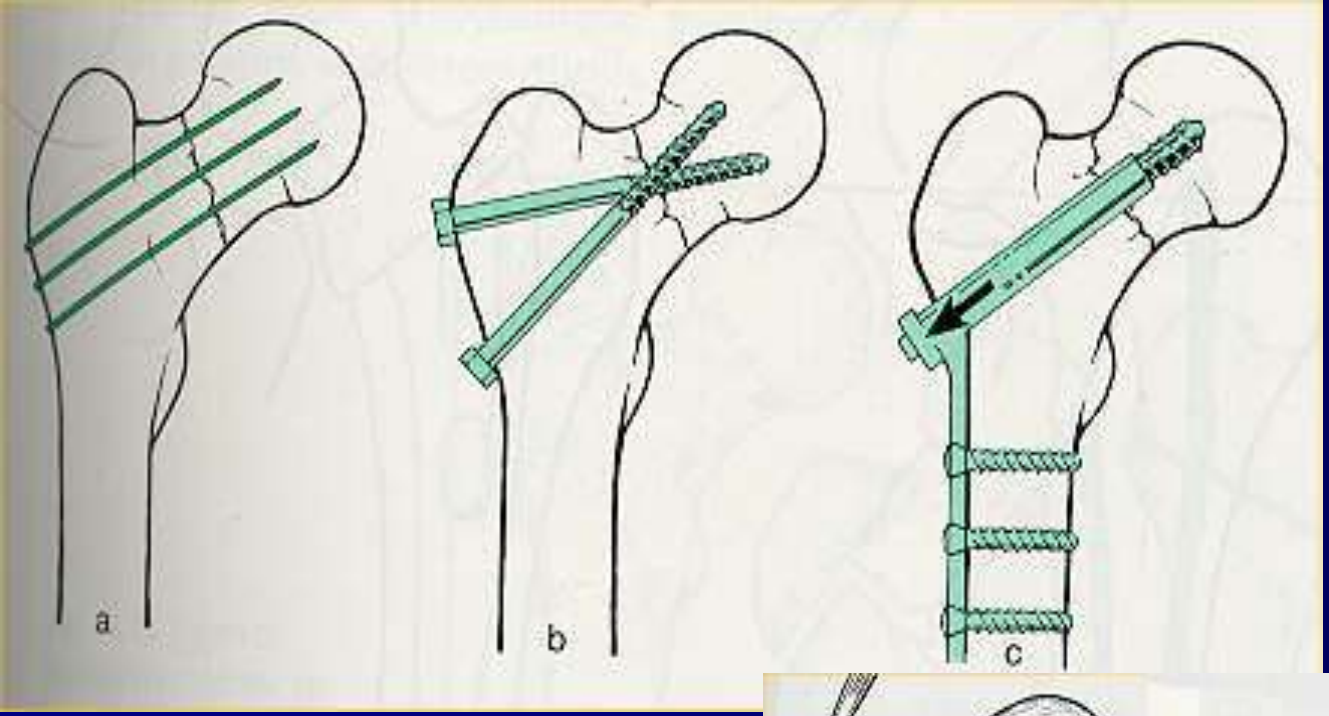
abnormal diemeter of angle of inclination results in **abnormal leg posture**, usually combined with (compensated by) abnormal knee position

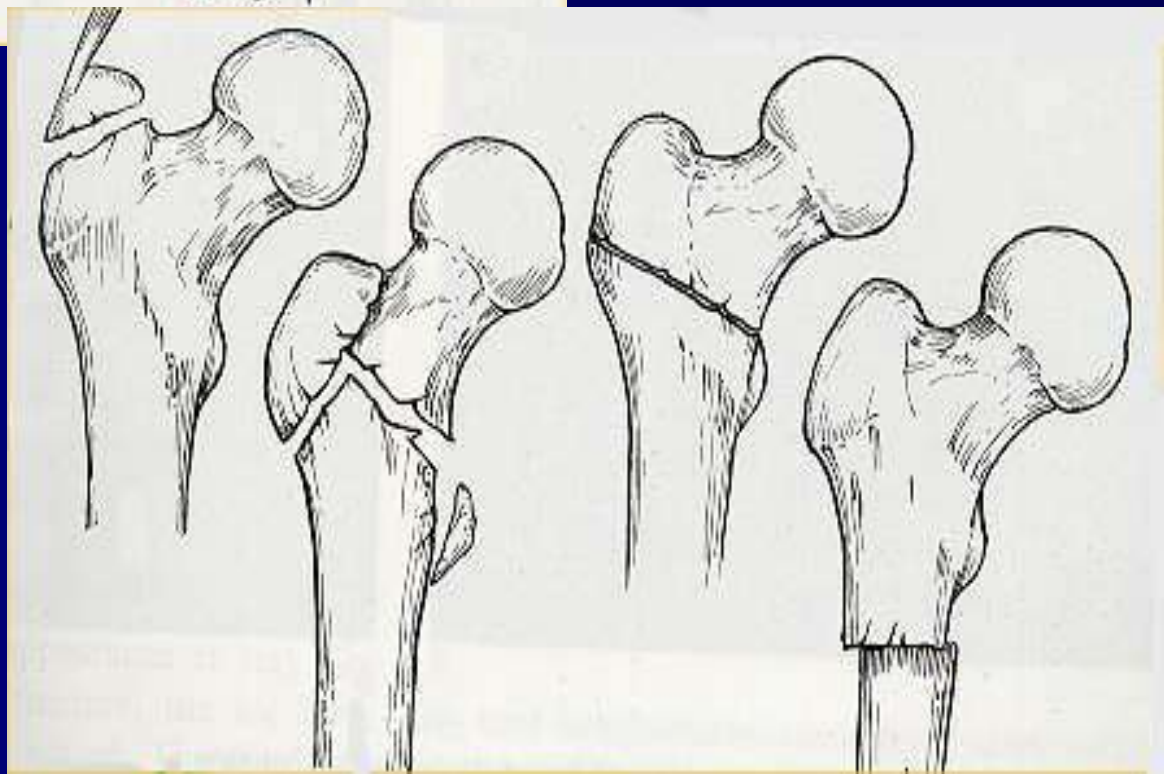



Canalis sacralis
Ligg. sacro-iliaca interossea
Ligg. sacro-iliaca post. [dors.]
Articulatio sacro-iliaca
Ligg. sacro-iliaca ant. [ventr.]
Lig. sacrospinale
Foramen ischiadicum [sciaticum] majus
Lig. capitis femoris
Lig. sacrotuberale
Caput ossis femoris
Foramen ischiadicu [sciaticum] minus
Cavitas articularis
Zona
ma orbicularis
hanter
or
Lig. capitis femoris




M. rectus femoris, Caput rectum
M. rectus femoris, Caput reflexum
Lig. iliofemorale
Fossa acetabuli
Lig. cap femoris
Labrum acetabulare
Facies lunata
Ligg. tr acetabu
Capsula articularis


a
b
c

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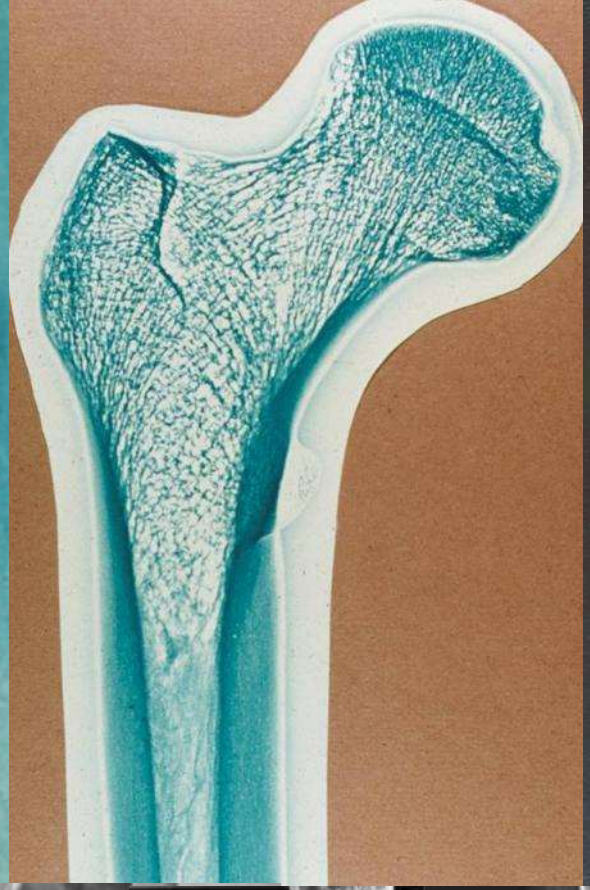

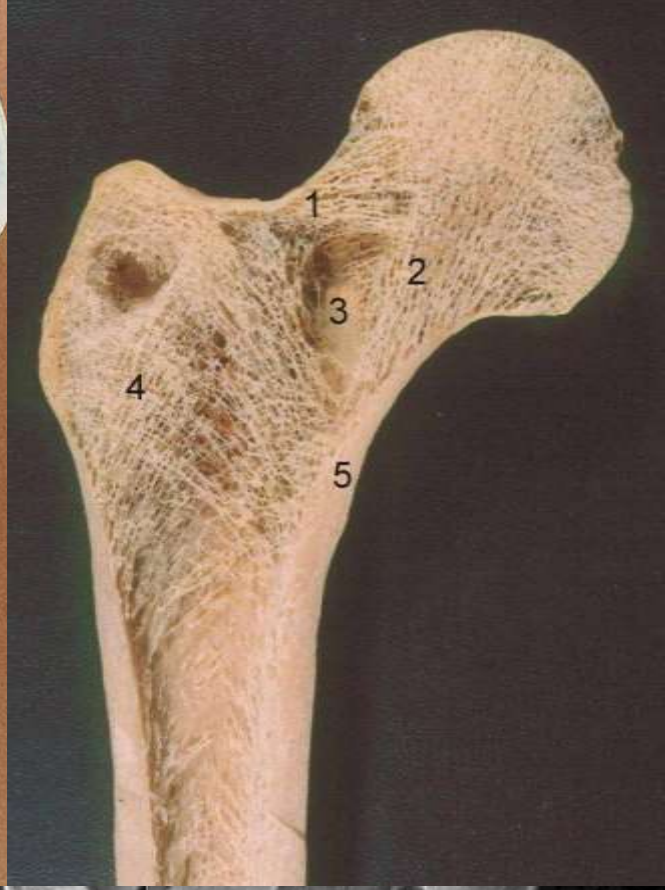
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856v
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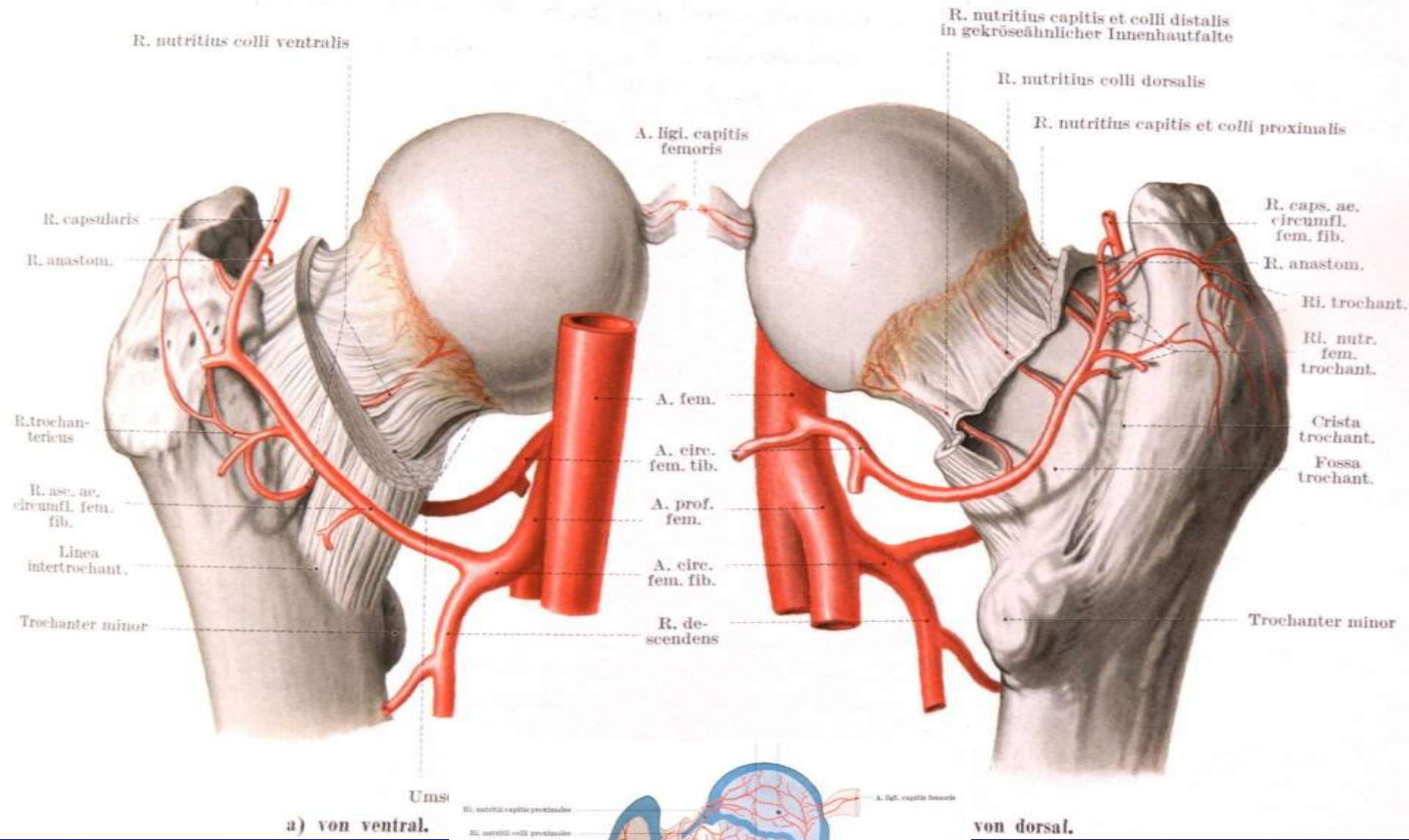
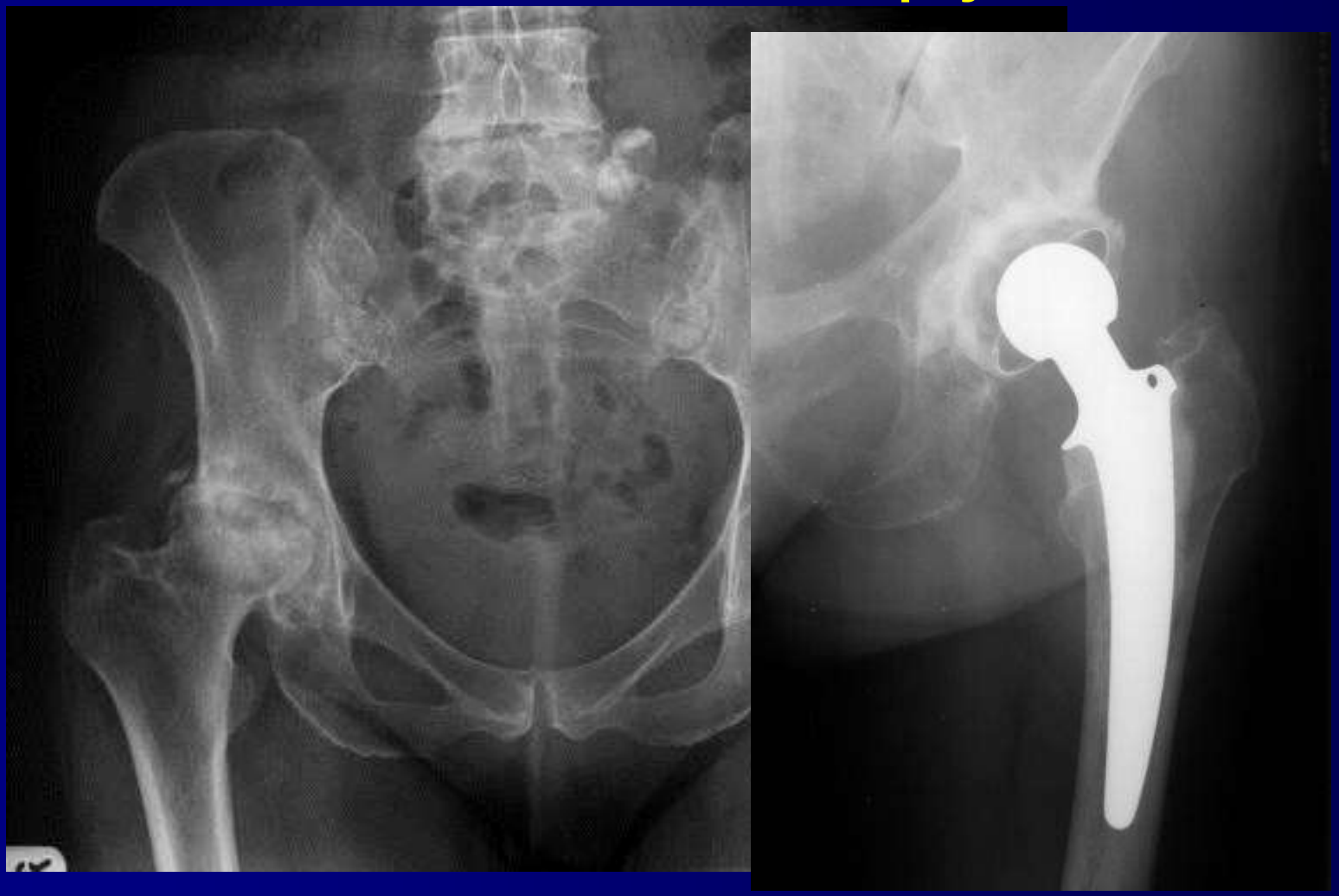
3M


R. nutritius colli ventralis
R. nutritius capitis et colli distalis in gekröseähnlicher Innenhautfalte
R. nutritius colli dorsalis
R. nutritius capitis et colli proximalis
A. ligi. capitis femoris
R. capsularis
R. anastom.
R. caps. ae. circumfl. fem. fib.
R. anastom.
Ri. trochant.
Ri. nutr. fem. trochant.
A. fem.
R. trochanterius
A. circ. fem. tib.
Crista trochant.
Fossa trochant.
R. asc. ae. circumfl. fem. fib.
A. prof. fem.
Linea intertrochant.
A. circ. fem. fib.
Trochanter minor
R. descendens
Trochanter minor
a) von ventral.
von dorsal.

Osteoarthritis of hip joint



Developmental dysplasia of hip joint (DDH)

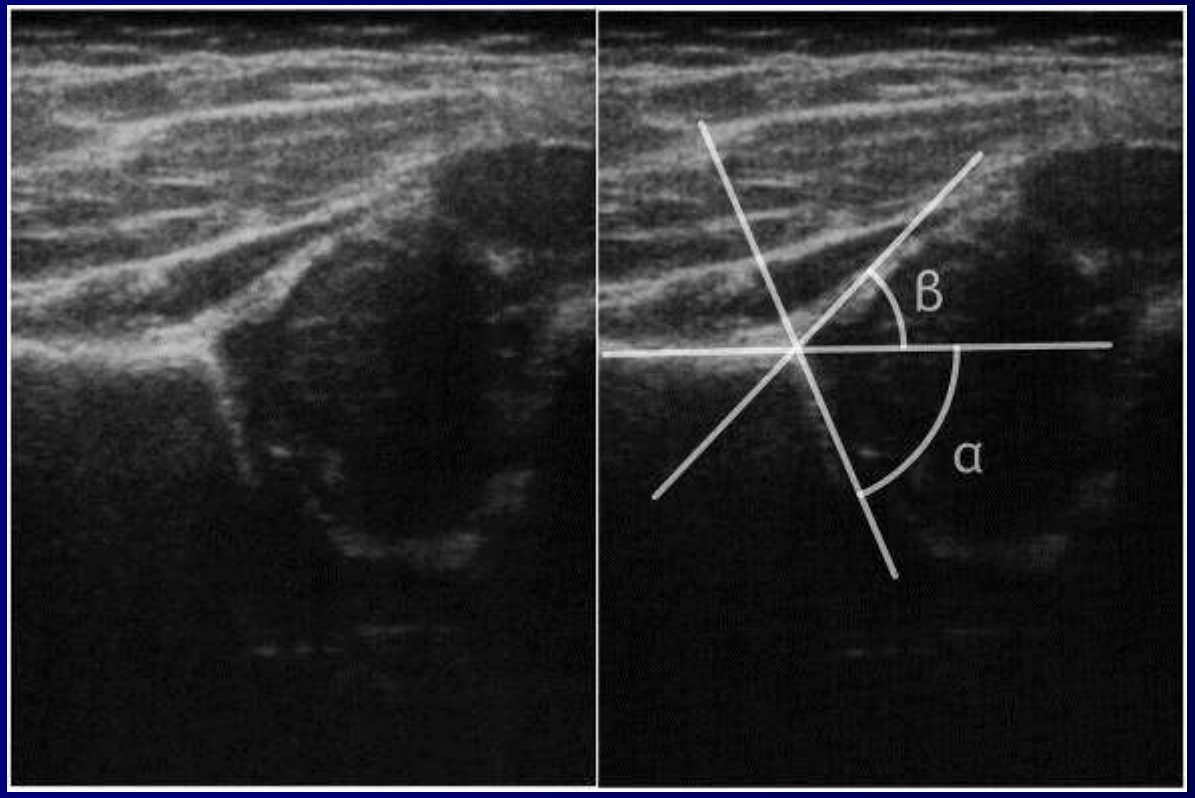
- 5% in Czech population
- 1% in USA polupation

- Congenital disorder of acetabulum

- Perinatal screening and care

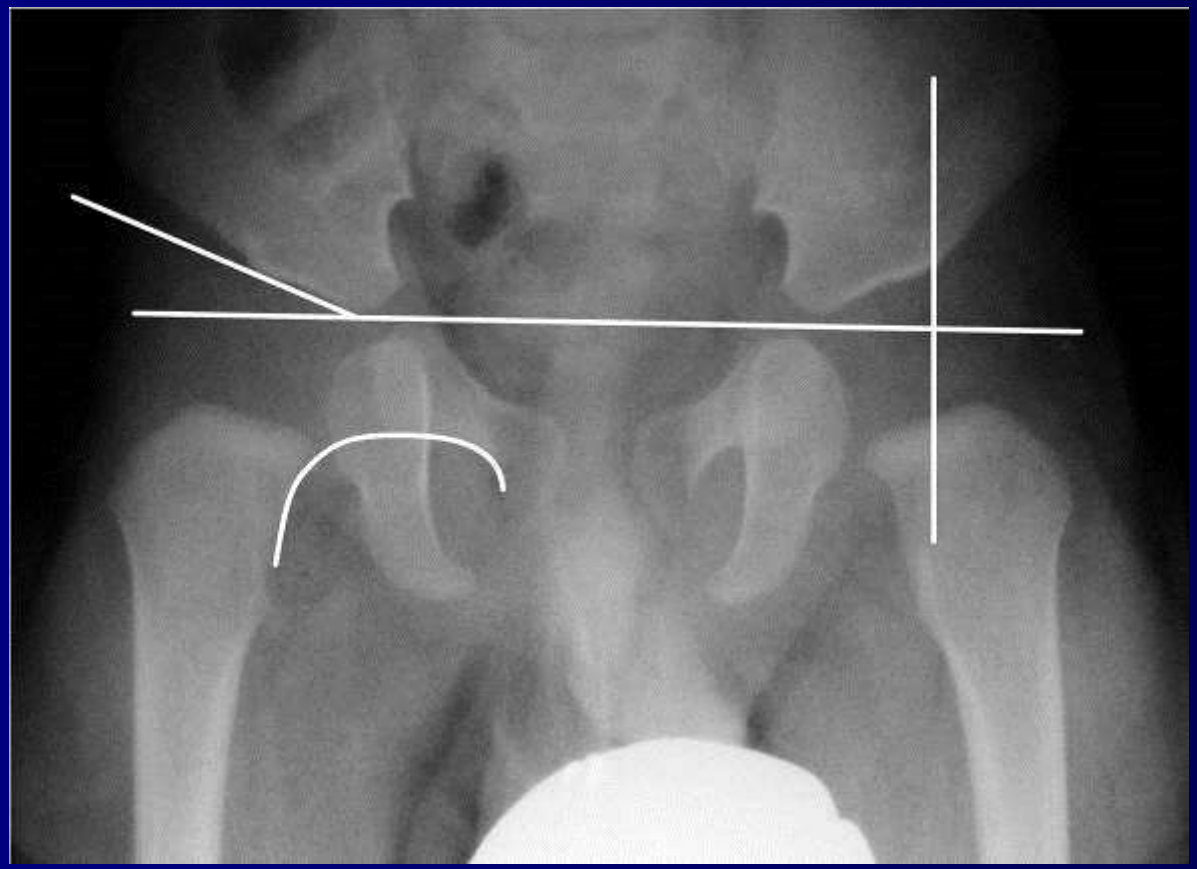
Developmental disease of hip joint (DDH)

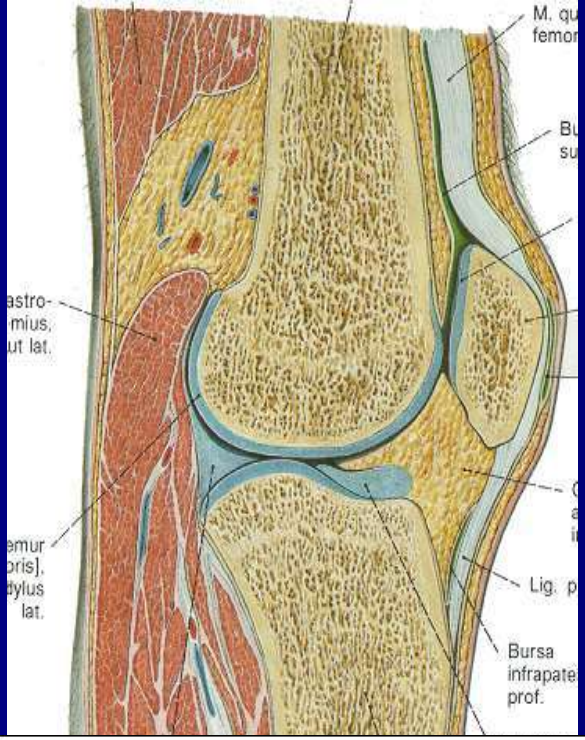
- USG of hip joint - SCREENING
  - 3rd week
  - 6-8 week
  - 12-18 week

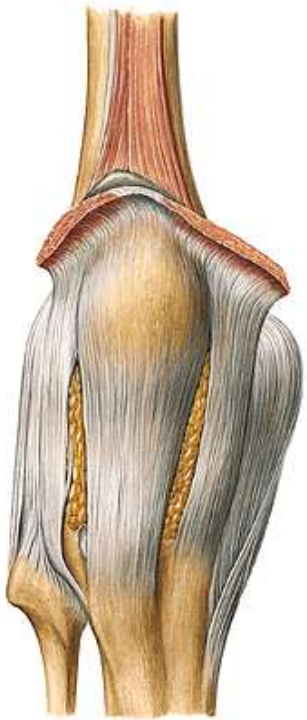


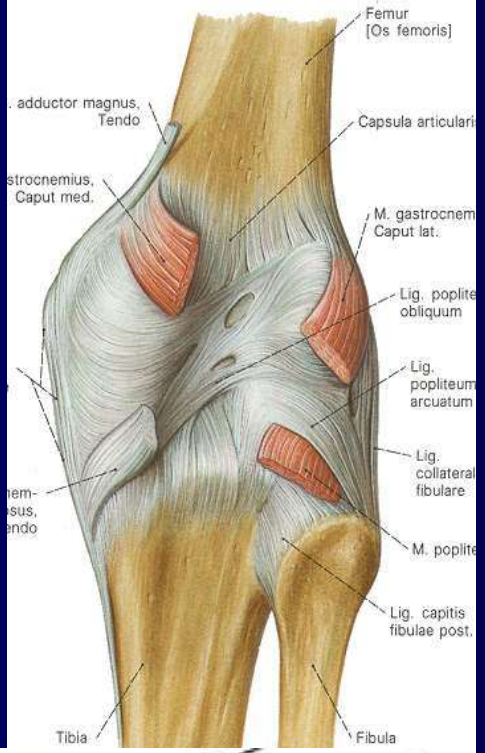
Developmental disease of hip joint (DDH)

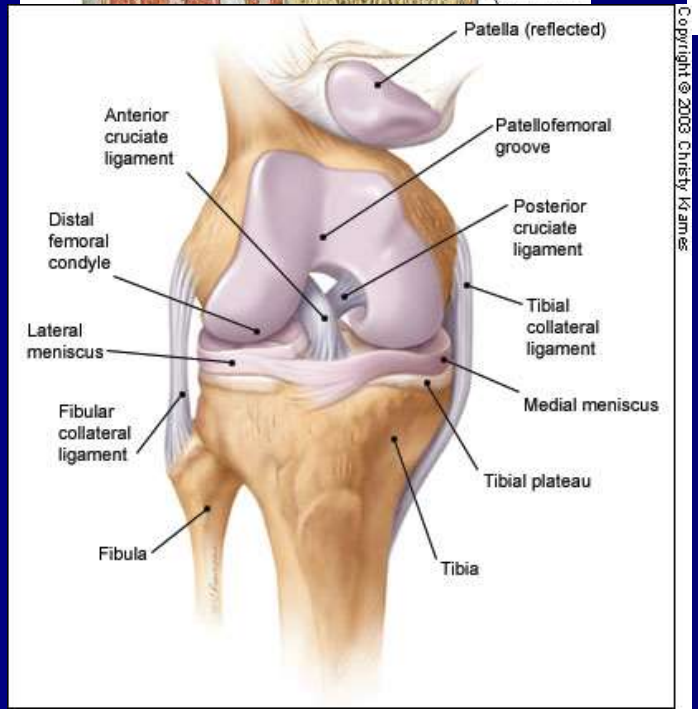
- X-ray of hip joint in 3rd month

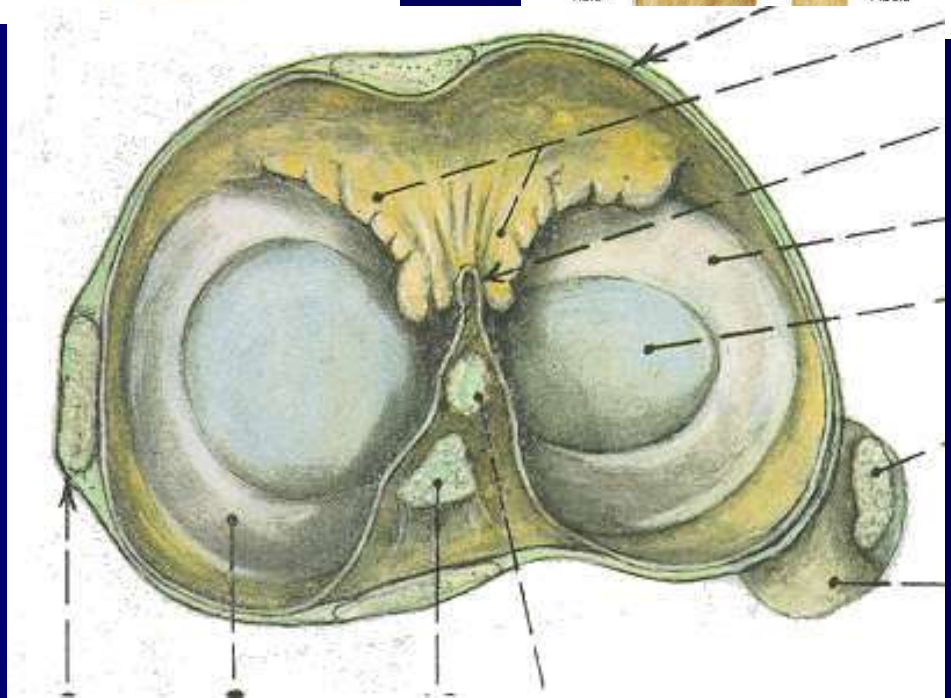


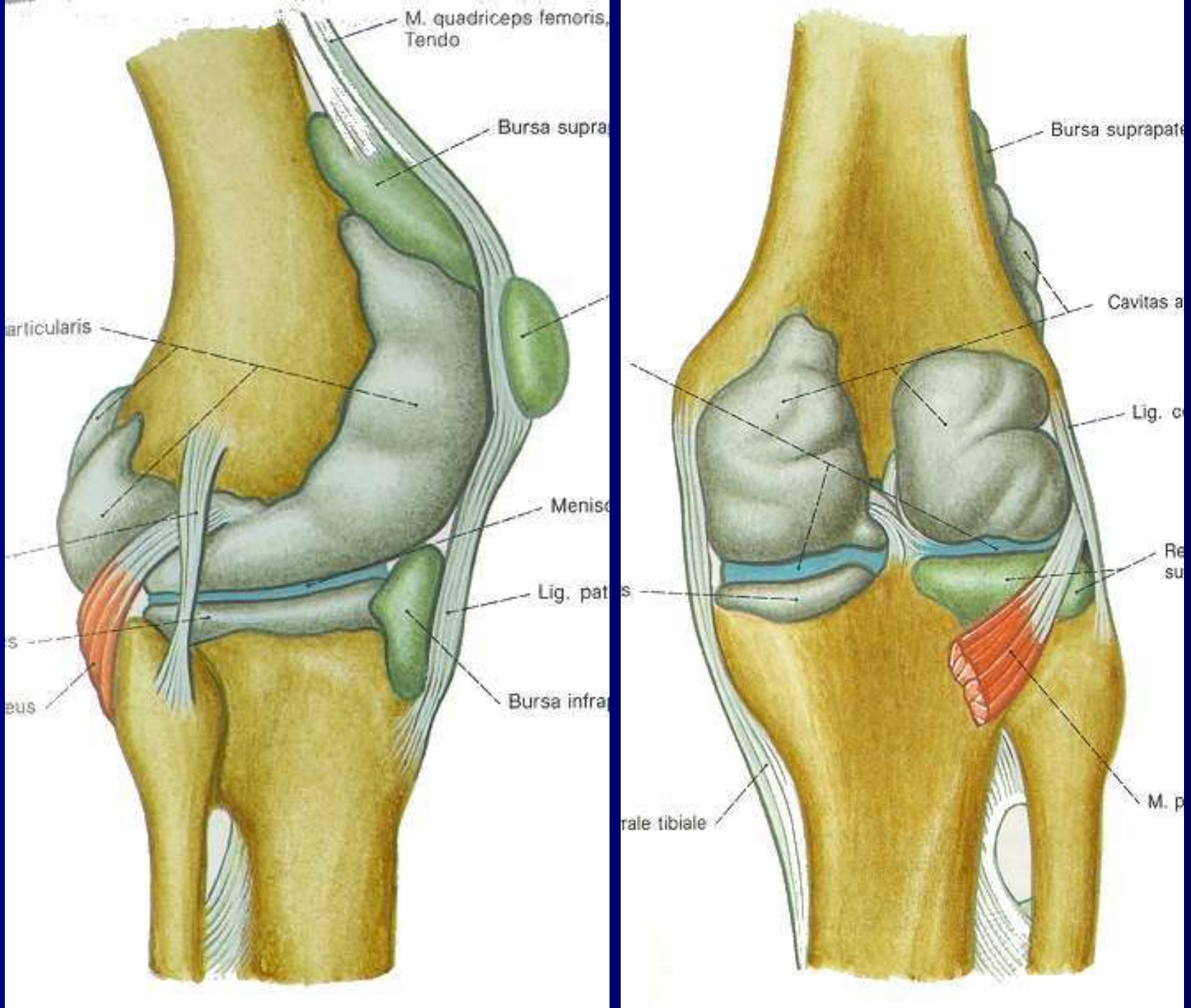


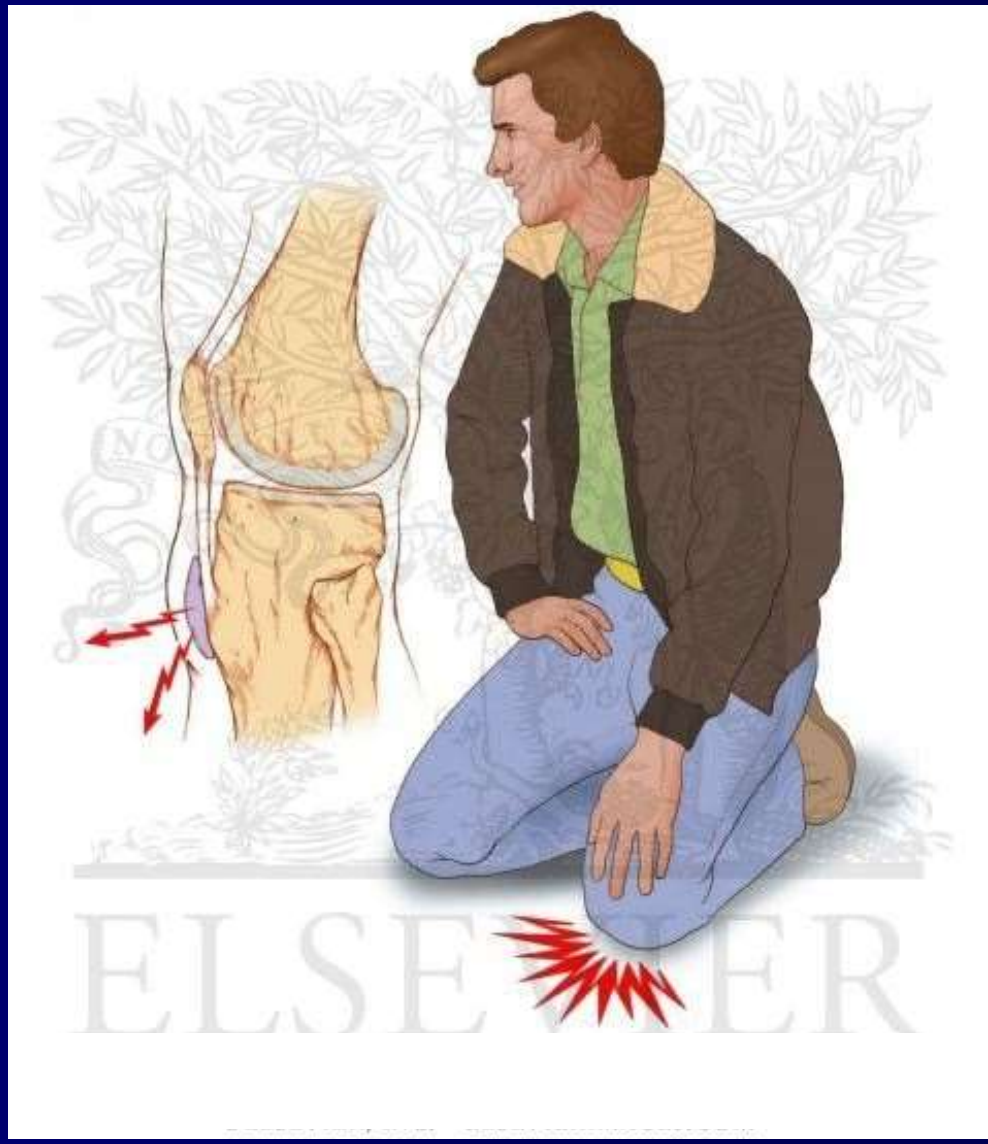


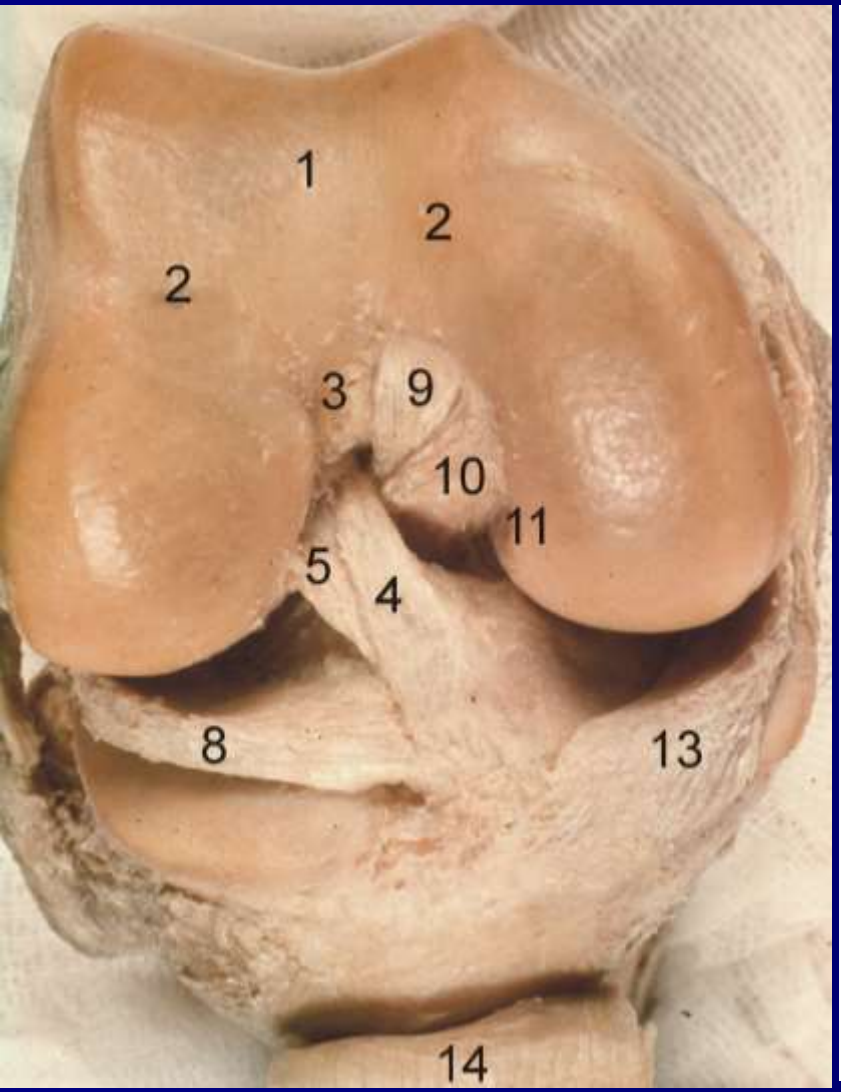







M. quadriceps femoris,
Tendo
Bursa supra
articularis
Menisc
Lig. pat s
Bursa infra
eus
Bursa suprapate
Cavitas a
Lig. c
Re
su
rale tibiale
M. p


ELSEVIER


1
2
2
3
9
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13
14

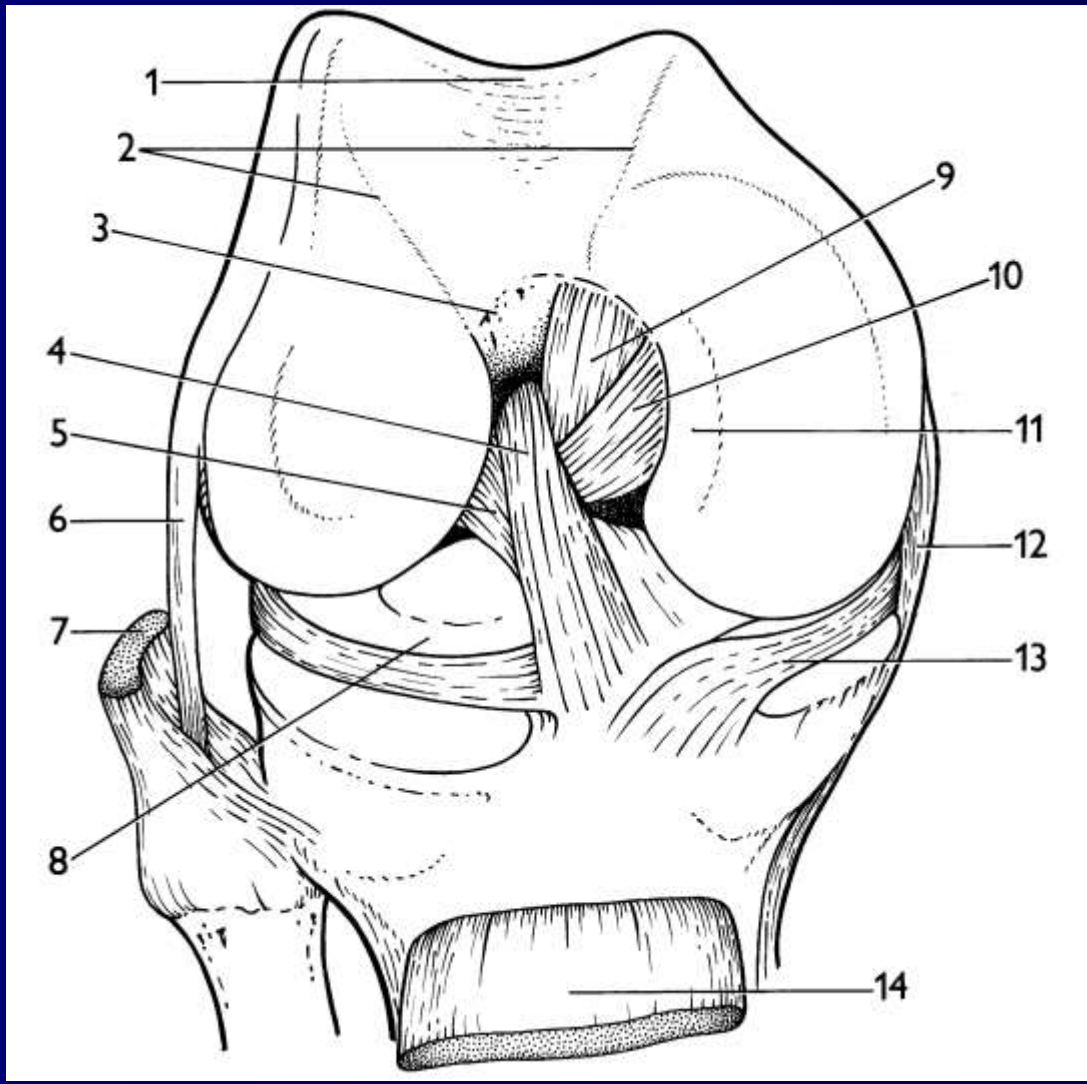
1
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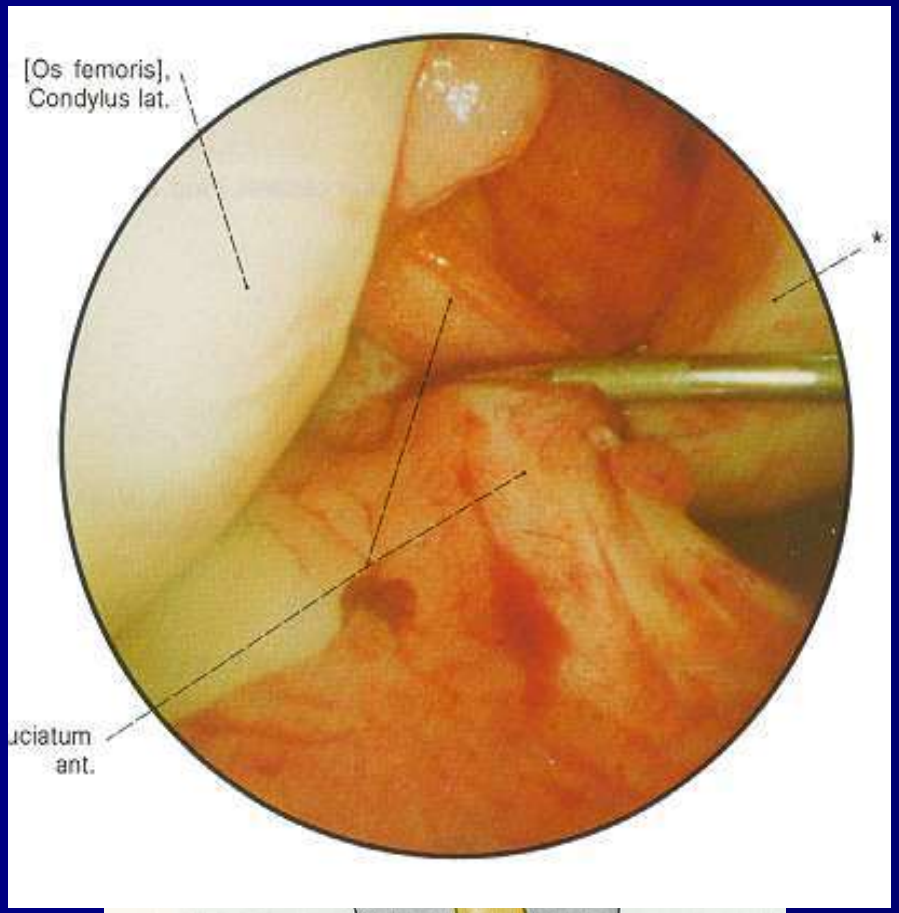
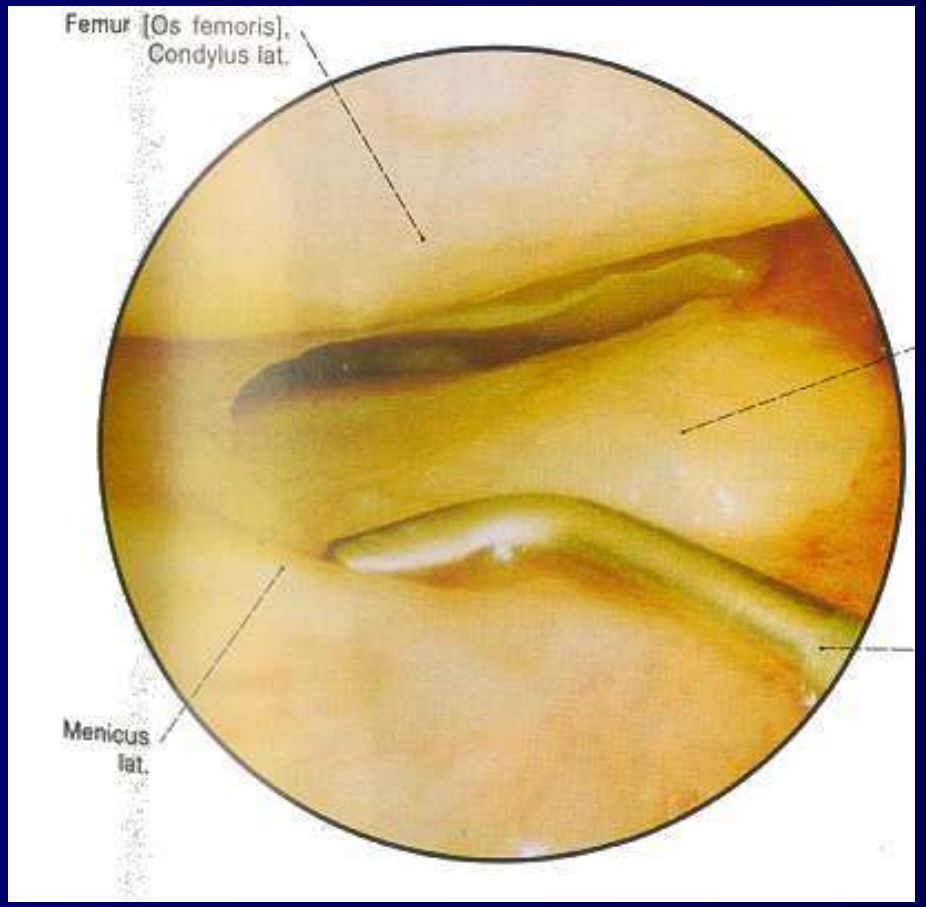
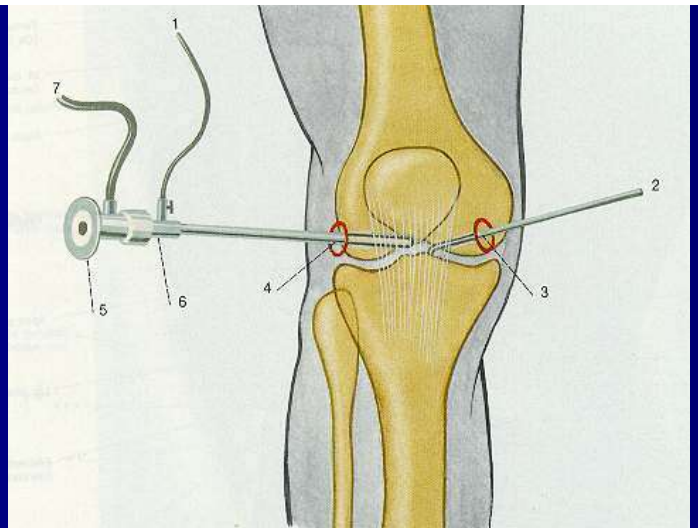
Fig. 14.36 Mechanism of injury of the anterior cruciate ligament.







arthroscopy

Osteoarthritis of knee joint

Compartment syndrom

Definition

is an acute medical problem, in which increased pressure within a confined space.

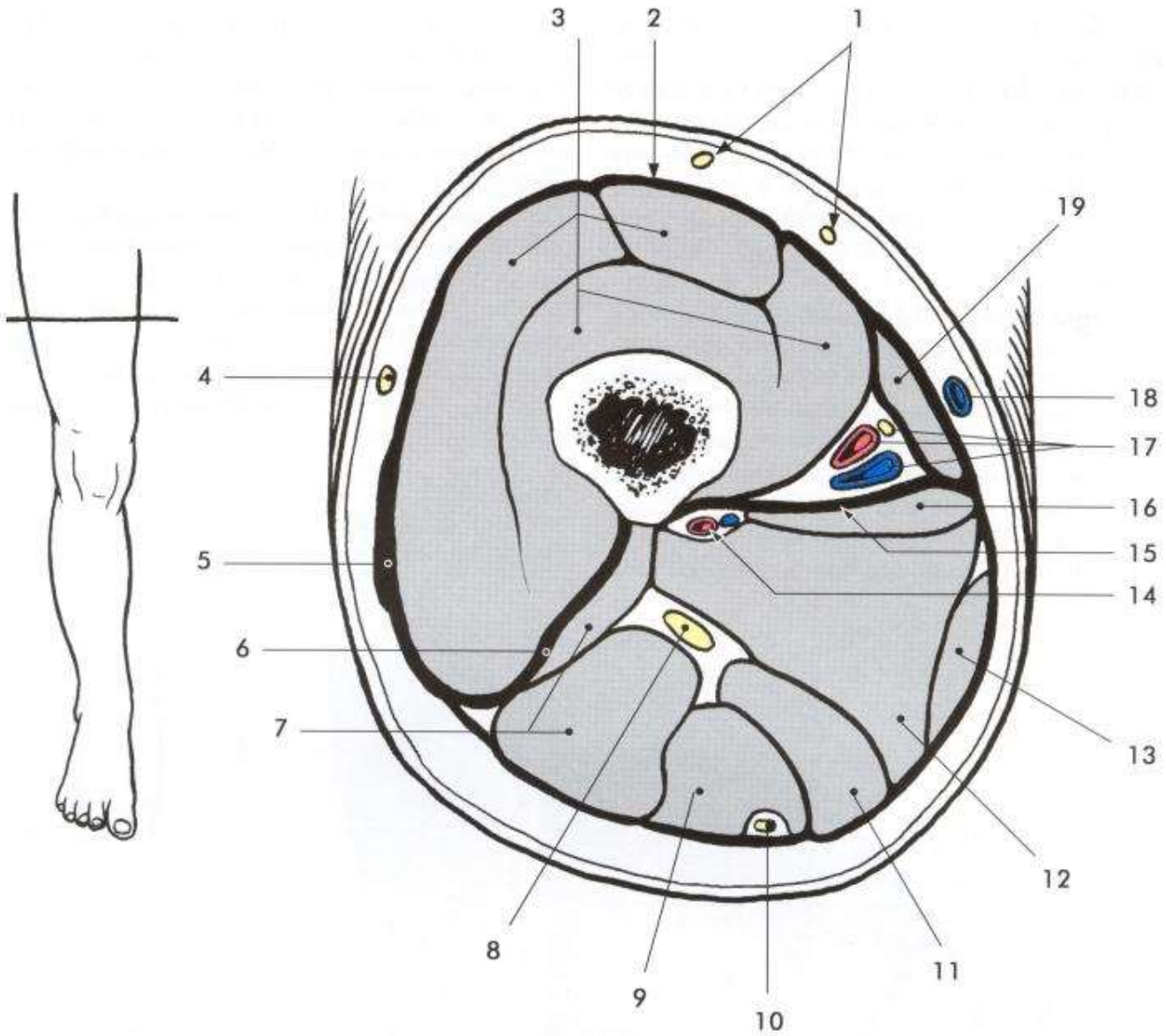
Compartment syndrom

Mechanism

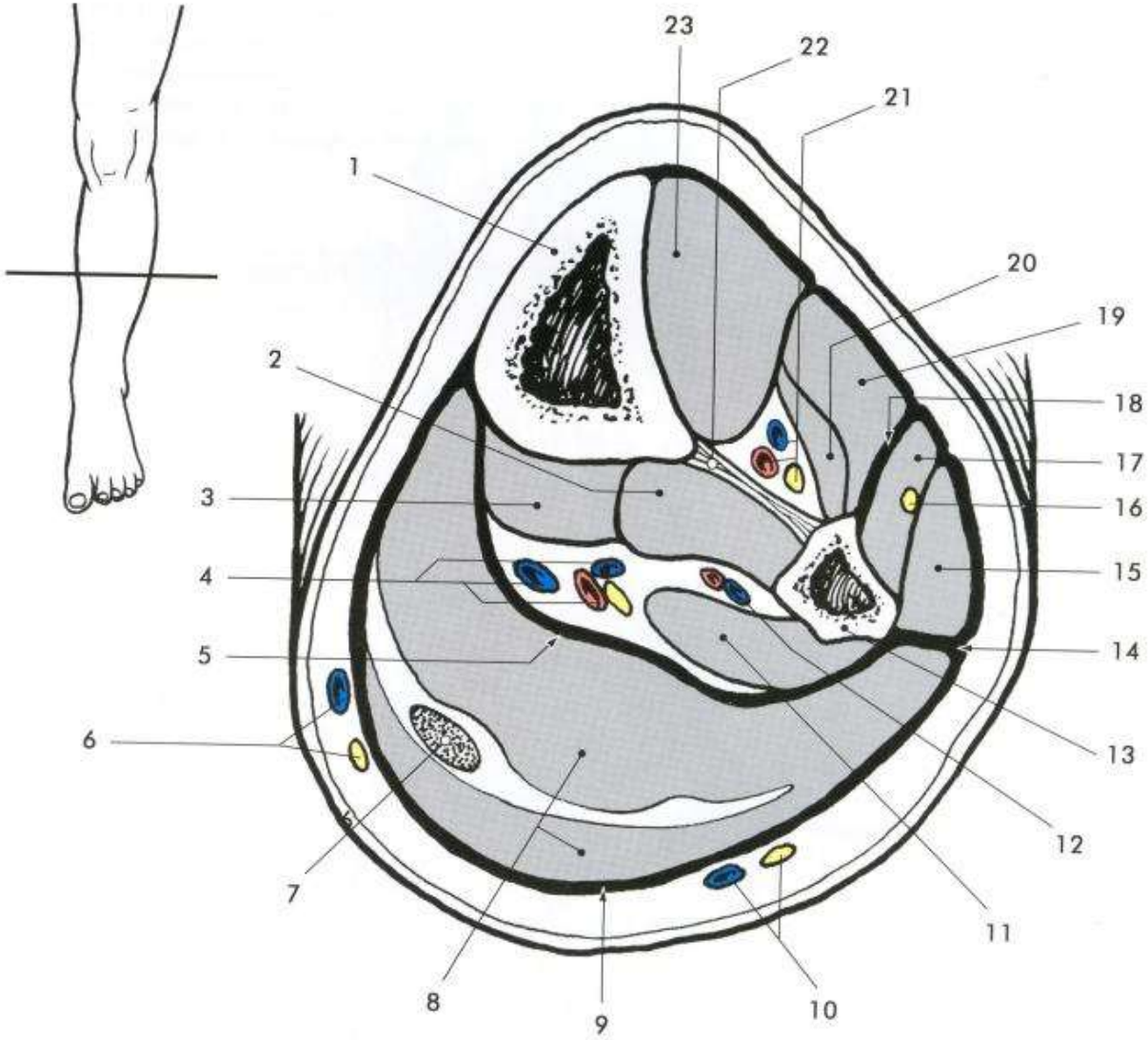
reduction of the space (cast, bandage)
enlargement of a space content (swelling, bleeding)
reduced tolerance for pressure (generalised disorders)

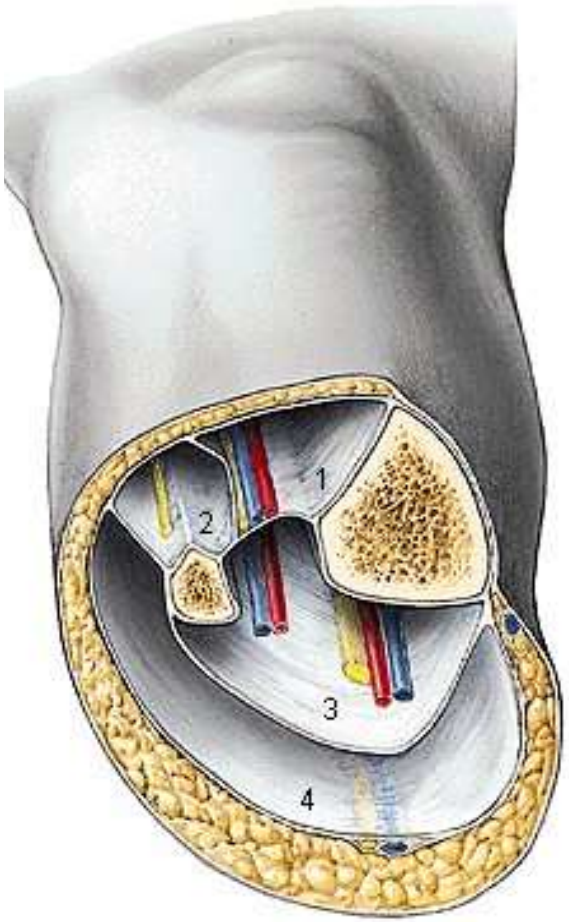
Pressure

Physiological pressure less than 30mm Hg
threatening compartment sy >40 mm Hg
compartment sy >60 mm Hg

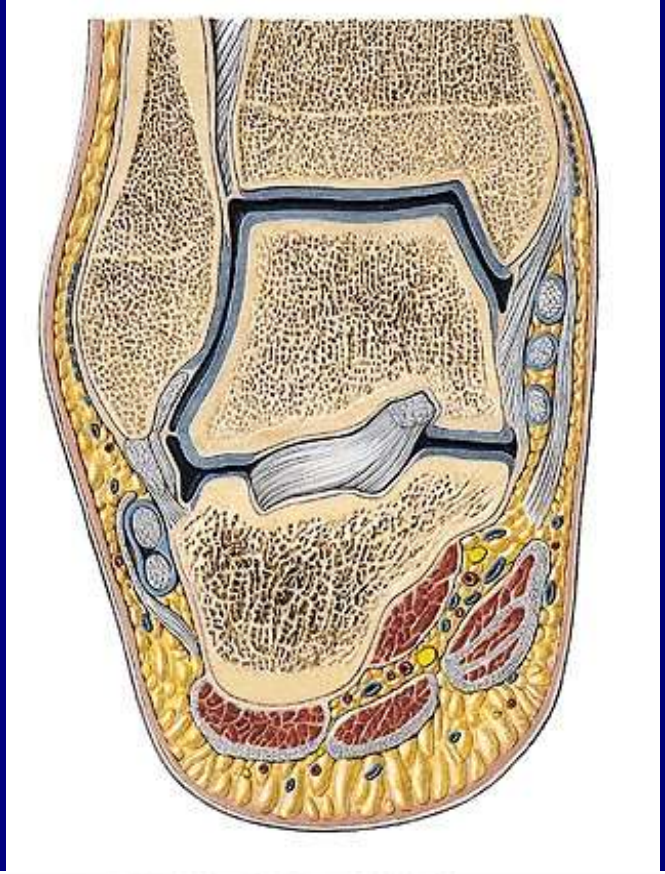


Obr. 17.6. Příčný řez středem stehna. 1 – rr. cutanei anteriores n. femoralis, 2 – fascia lata femoris, 3 – m. quadriceps femoris, 4 – n. cutaneus femoris lateralis, 5 – tractus iliotibialis, 6 – laterální intermuskulární septum, 7 – m. biceps femoris, 8 – n. ischiadicus, 9 – m. semitendinosus, 10 – n. cutaneus femoris posterior, 11 – m. semimembranosus, 12 – m. adductor magnus, 13 – m. gracilis, 14 – a. et v. profunda femoris, 15 – mediální intermuskulární septum, 16 – m. adductor longus, 17 – a. et v. femoralis, n. saphenus, 18 – v. saphena magna, 19 – m. sartorius





Obr. 17.8. Příčný řez bércem. 1 – tibia, 2 – m. tibialis posterior, 3 – m. flexor digitorum longus, 4 – n. tibialis et vasa tibialia posteriora, 5 – hluboký list bércové fascie, 6 – n. saphenus et v. saphena magna, 7 – šlacha m. plantaris, 8 – m. triceps surae, 9 – fascia cruris, 10 – n. suralis et v. saphena parva, 11 – m. flexor hallucis longus, 12 – vasa fibularia, 13 – fibula, 14 – zadní laterální intermuskulární septum, 15 – m. fibularis longus, 16 – n. fibularis superficialis, 17 – m. fibularis brevis, 18 – přední laterální intermuskulární septum, 19 – m. extensor digitorum longus, 20 – m. extensor hallucis longus, 21 – n. fibularis profundus et vasa tibialia ant., 22 – membrana interossea, 23 – m. tibialis anterior



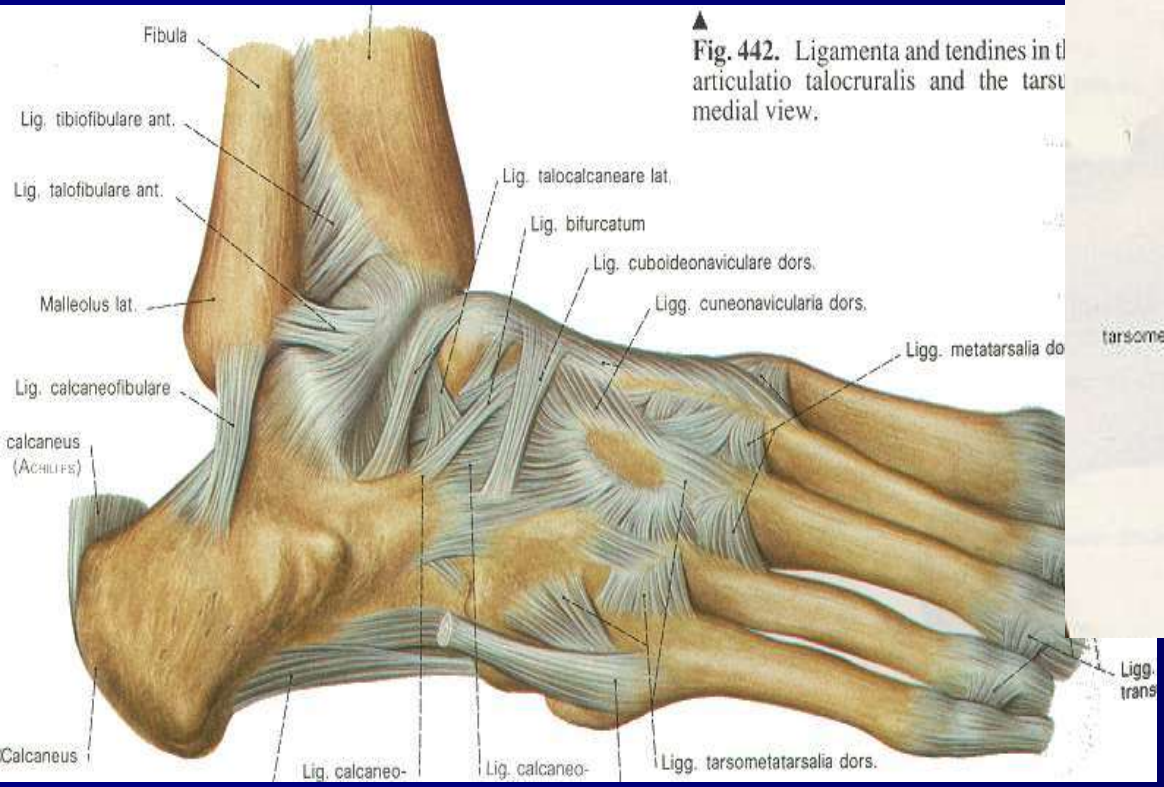
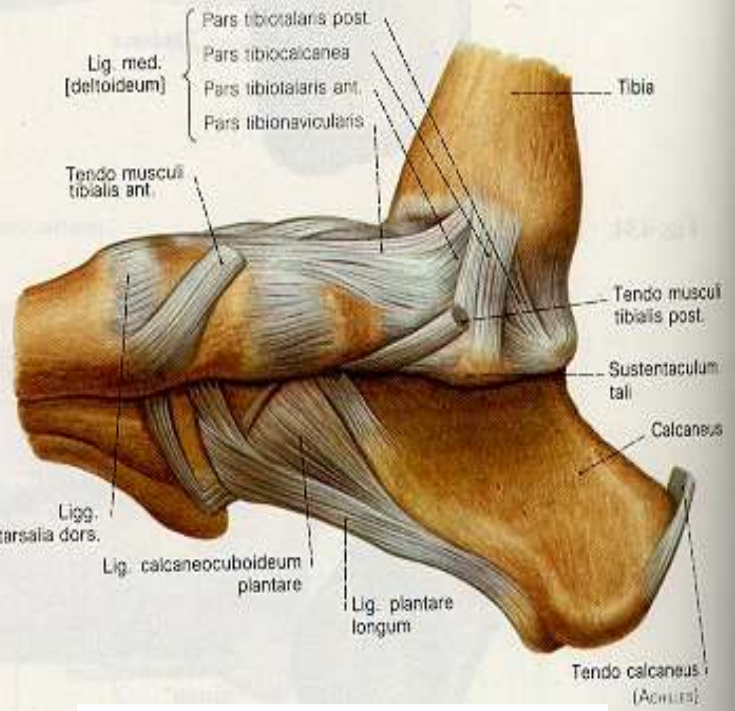
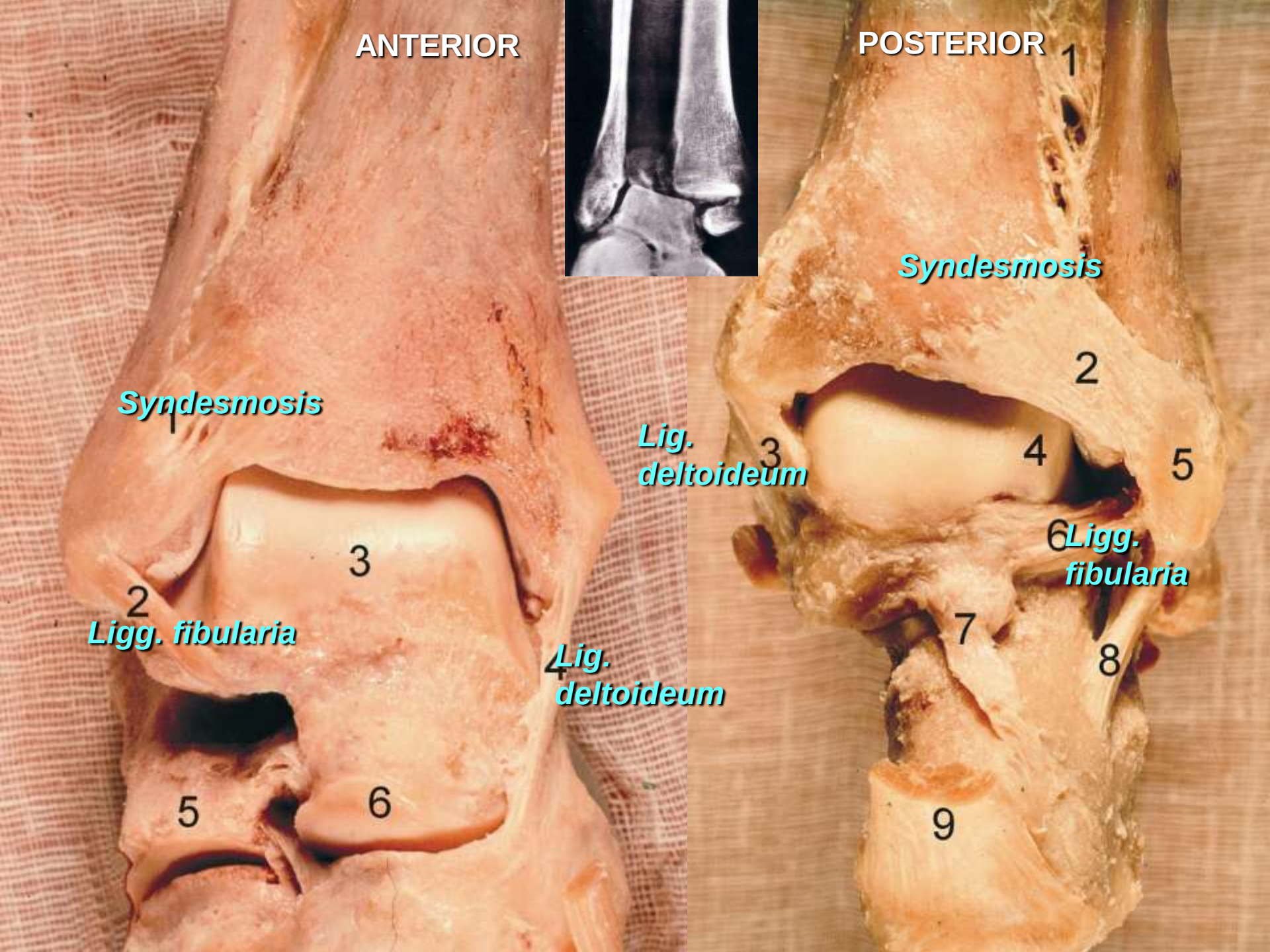
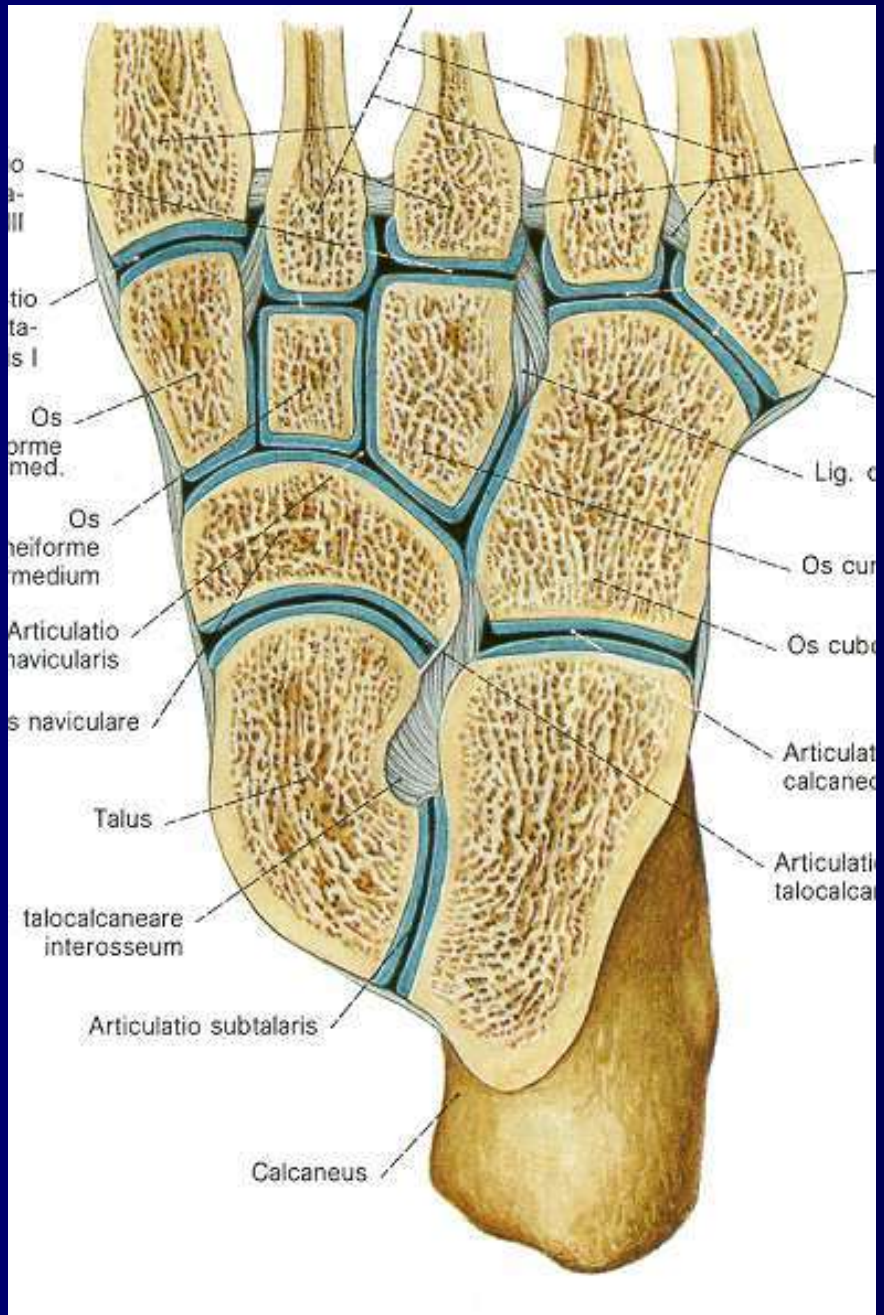


Fig. 442. Ligamenta and tendines in t
articulatio talocruralis and the tarsu
medial view.

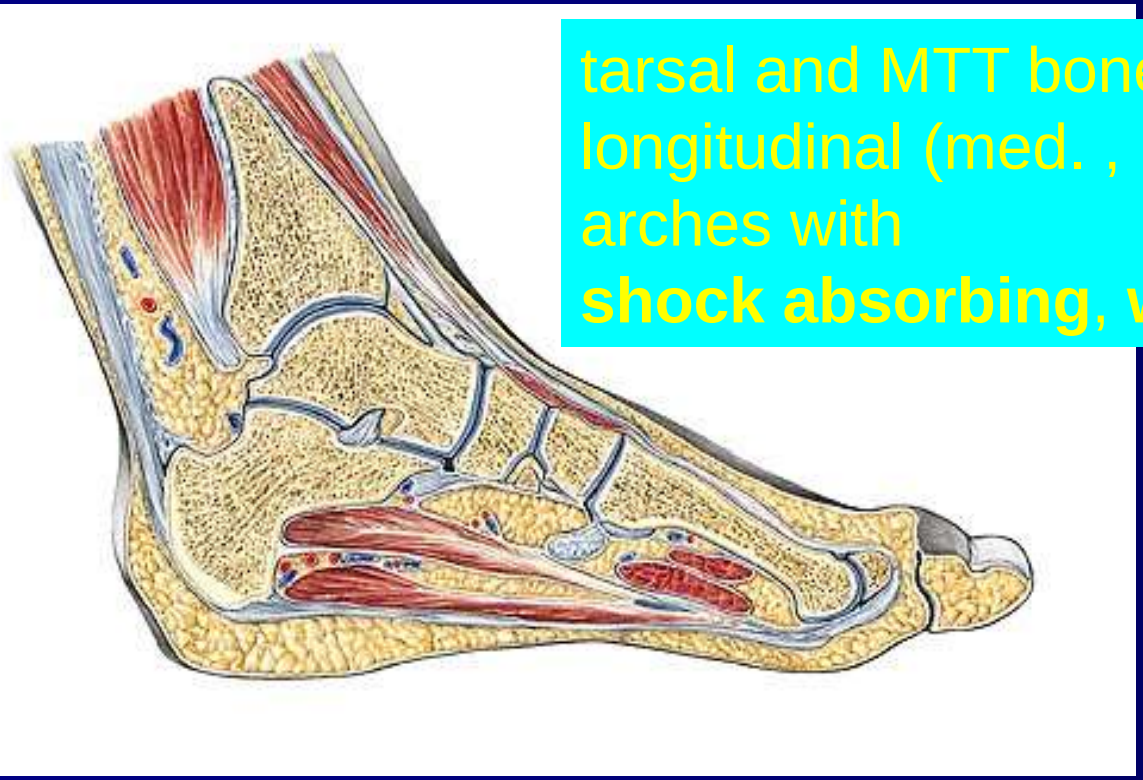


ion of the
ght foot.


ANTERIOR
POSTERIOR
1
Syndesmosis
2
Lig.
deltoideum
3
4
5
6
Ligg.
fibularia
7
8
9
Syndesmosis
1
3
2
Ligg. fibularia
4
Lig.
deltoideum
5
6


Os
Os
Articulatio
s naviculare
Talus
talocalcaneare
interosseum
Articulatio subtalaris
Calcaneus
Lig.
Os cub
Articulat
calcaneo

Foot (plantar) arches



tarsal and MTT bones are arranged in longitudinal (med. , lat.) and transverse arches with
shock absorbing, **weight bearing** function

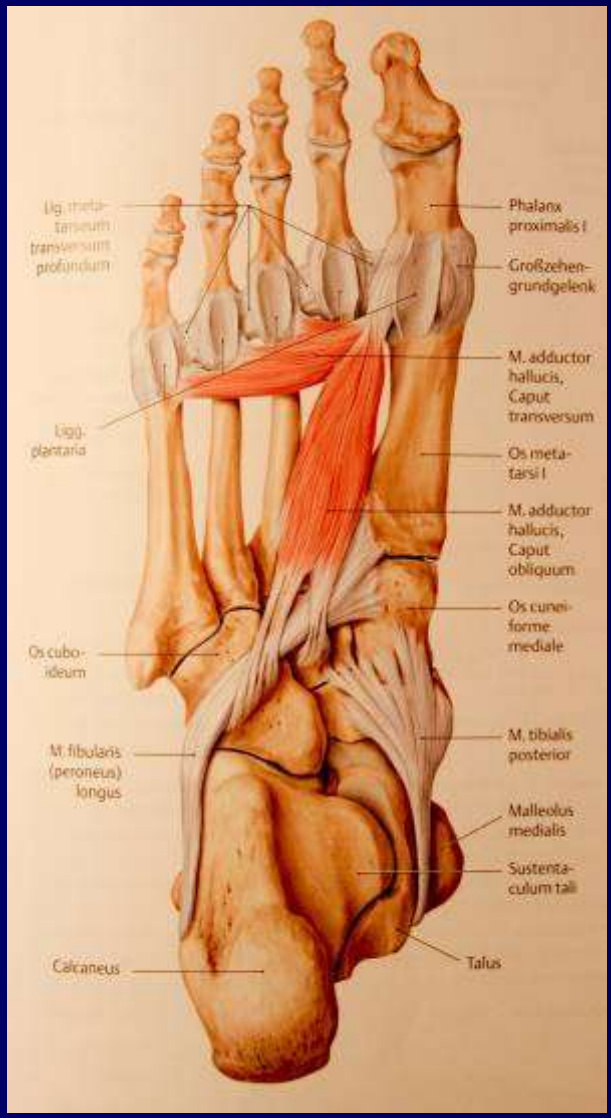
are maintained by:

1. Shape of interlocking bones
2. Strength of the plantar ligg. + plantar aponeurosis
3. Action of tendons of muscles – **tibialis ant. and post., peroneus longus and btrevis, flexors of the foot**

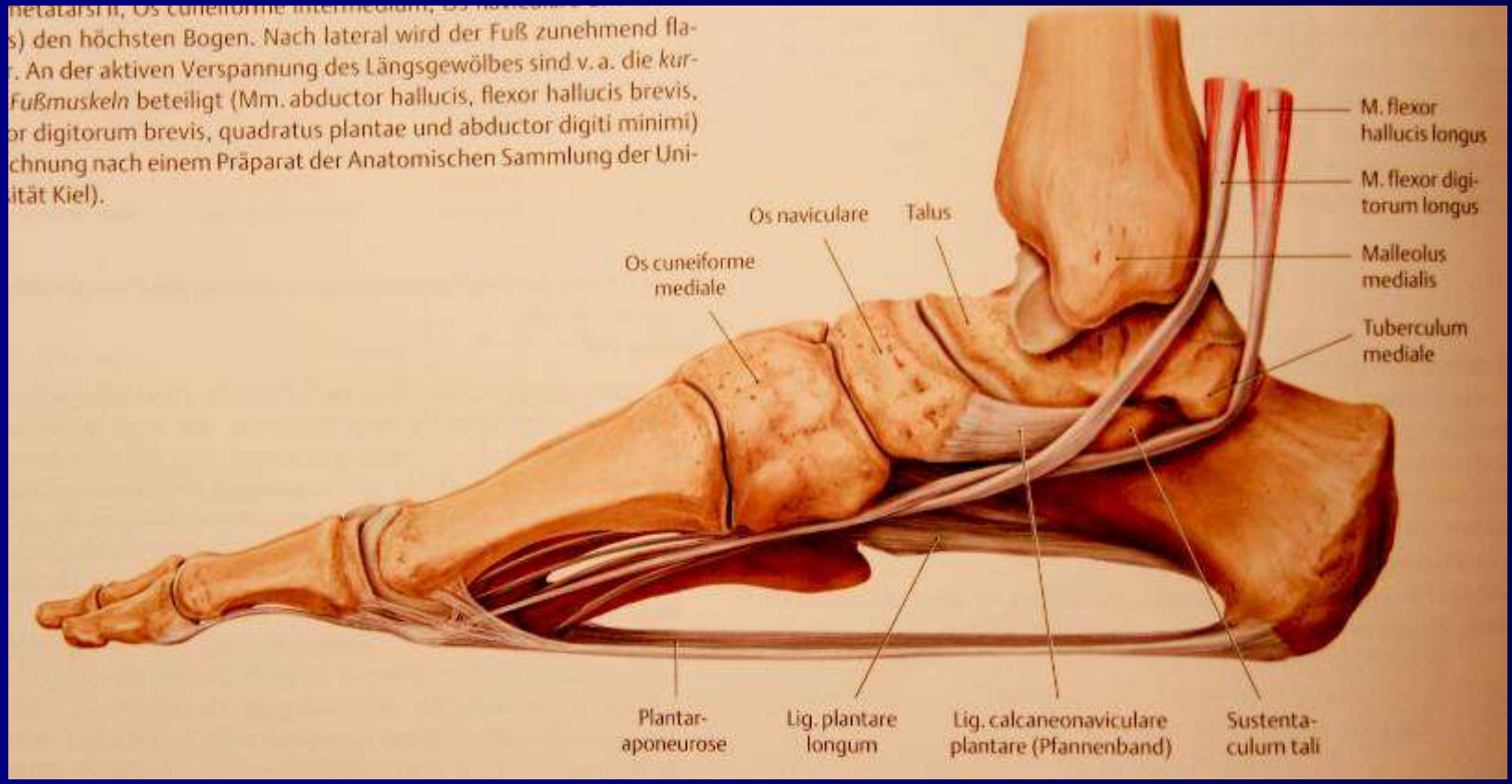
Flat foot

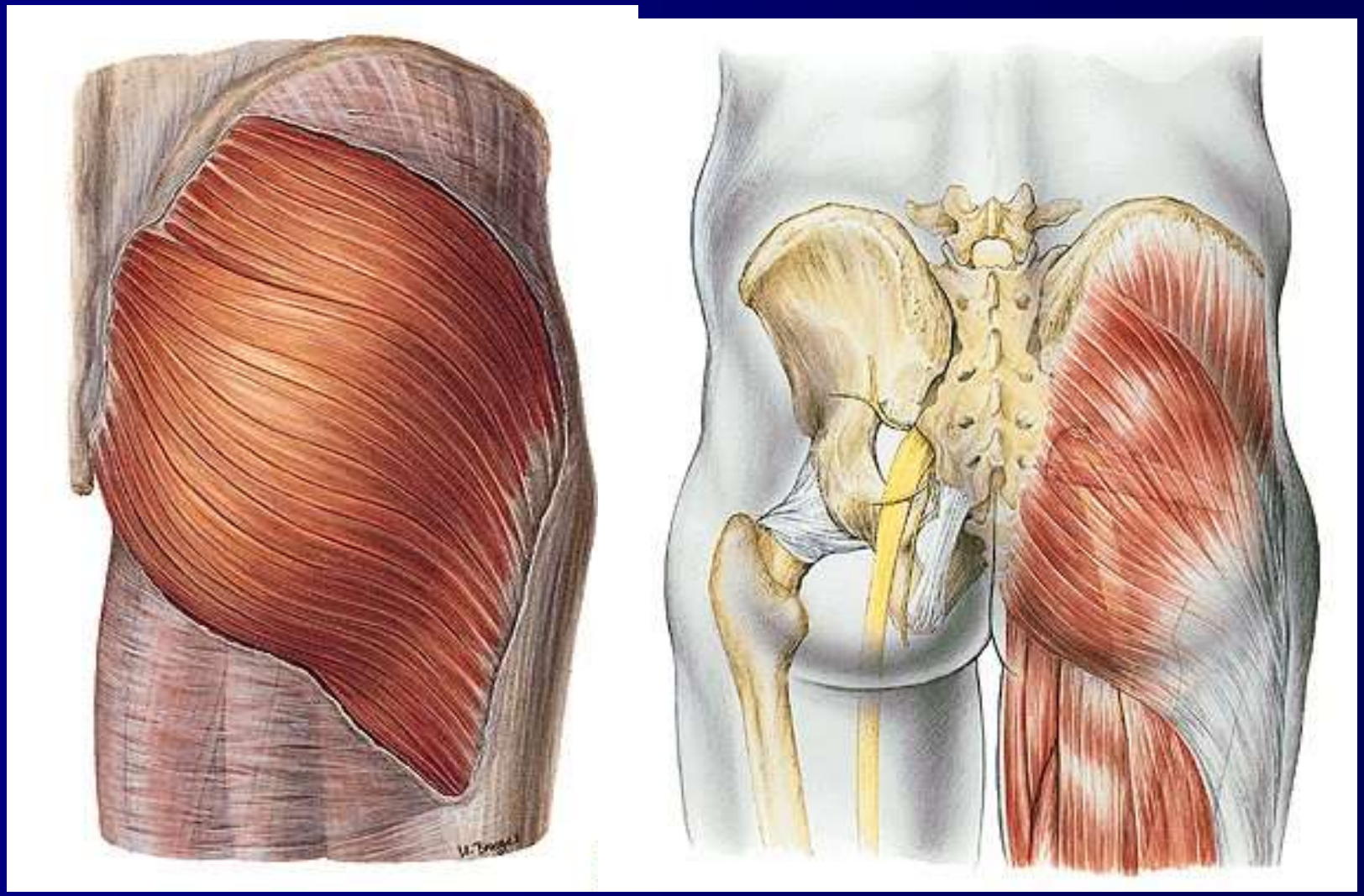
- Plantar calcaneonavicular ligament
- Long plantare ligament
- Plantar aponeurosis

- Tibialis posterior
- Tibialis anterior
- Adductor hallucis
- Peroneus longus
- Foot flexores

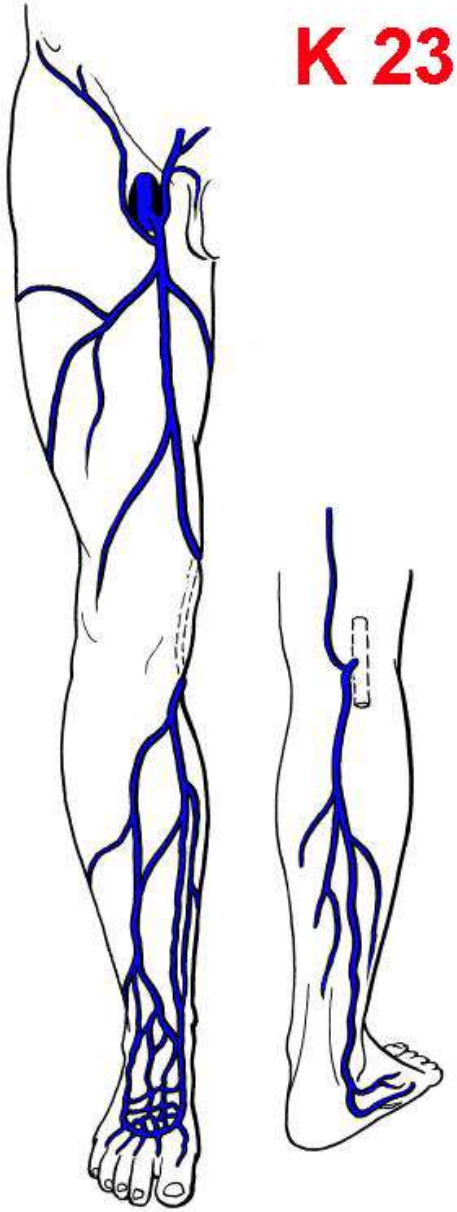


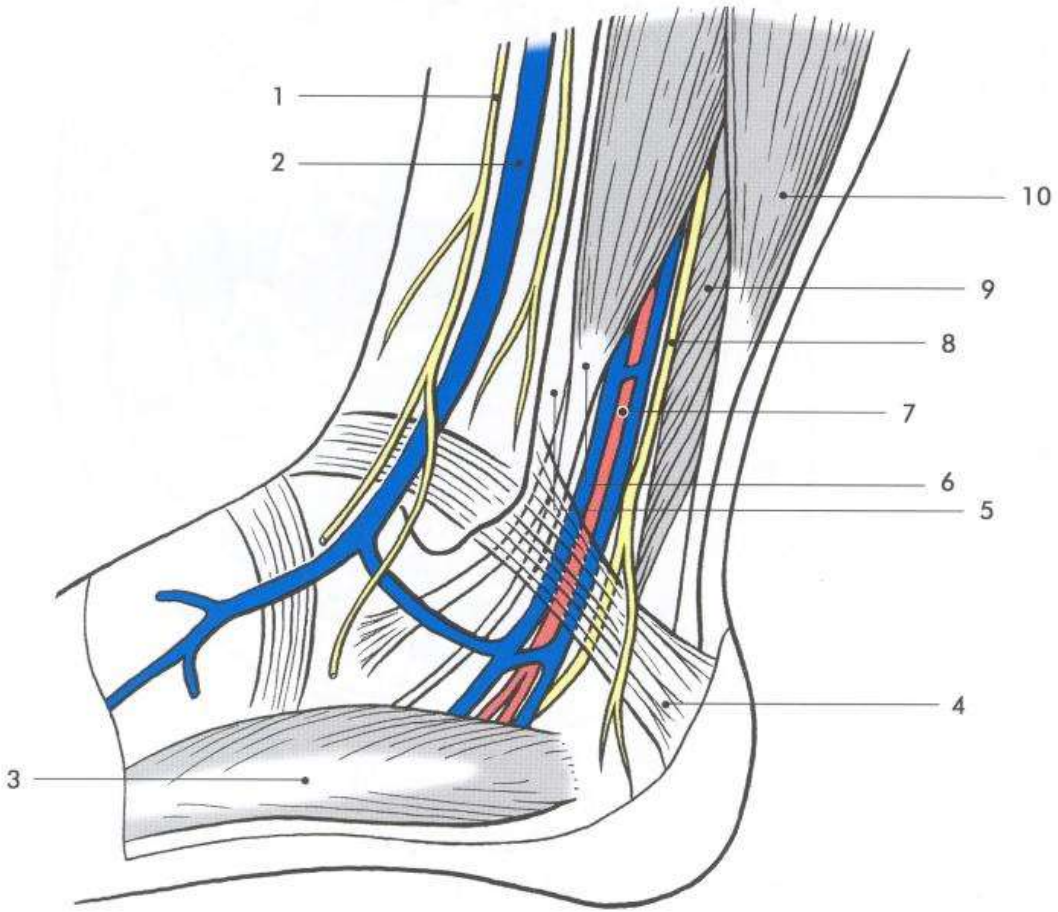
Flat foot


M. flexor hallucis longus
M. flexor digitorum longus
Malleolus medialis
Tuberculum mediale
Os naviculare
Talus
Os cuneiforme mediale
Plantar-aponeurose
Lig. plantare longum
Lig. calcaneonaviculare plantare (Pfannenband)
Sustentaculum tali



K 23





Obr. 17.9. **Regio malleolaris et retromalleolaris medialis.** 1 – n. saphenus, 2 – v. saphena magna, 3 – m. abductor hallucis, 4 – retinaculum mm. flexorum, 5 – šlacha m. tibialis posterior, 6 – šlacha m. flexor digitorum longus, 7 – vasa tibialia posteriora, 8 – n. tibialis, 9 – m. flexor hallucis longus, 10 – m. triceps surae

"perforators" – connection between superf.and deep venous system

Cockett´s connections
6, 13, 18cm above planta