

Hip joint

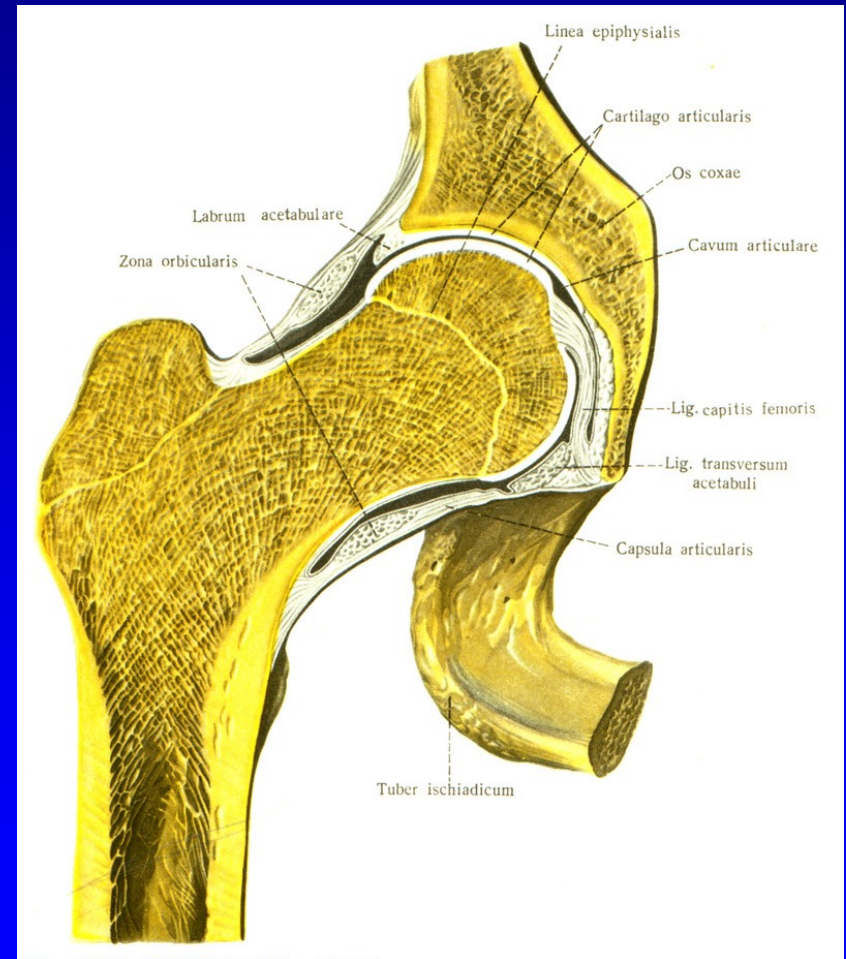
Rozkydal, Z.

Articulatio coxae

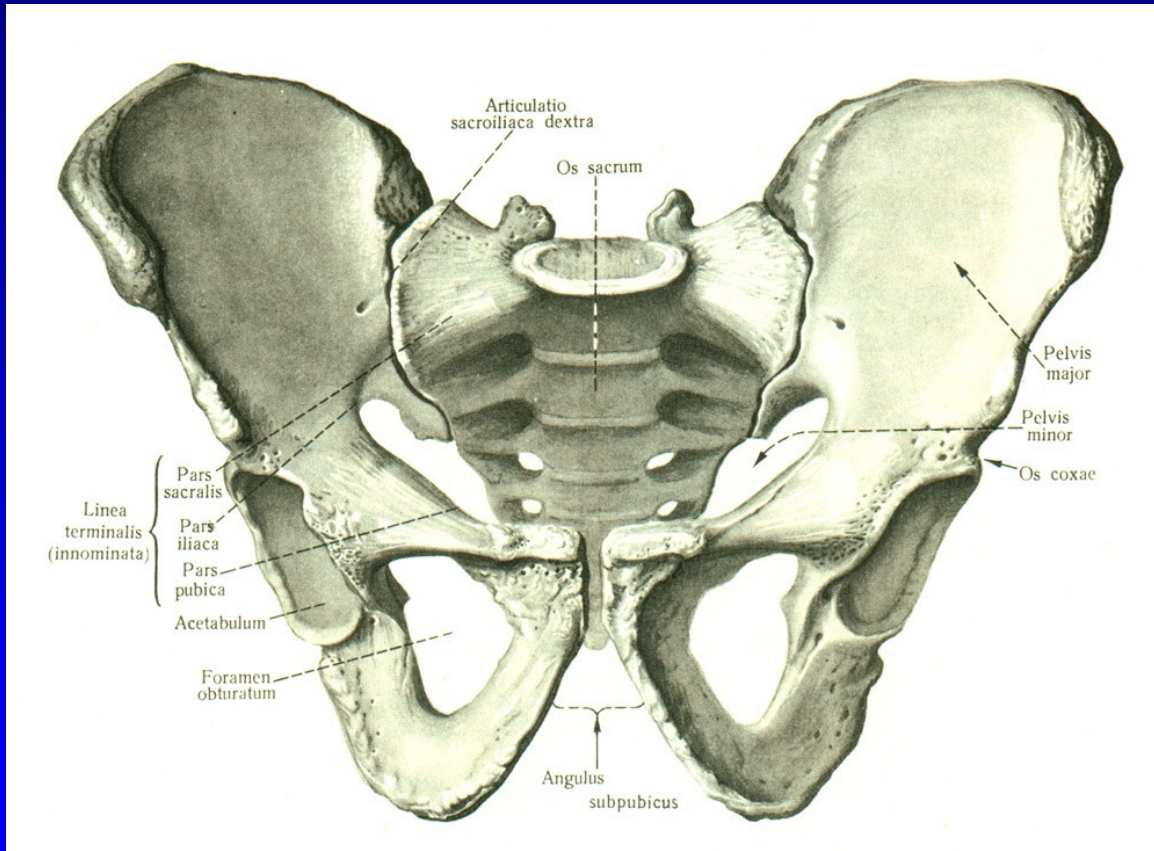
Enarthrosis –

Ball and socket type

Concentric shape
of femoral head



Pelvis



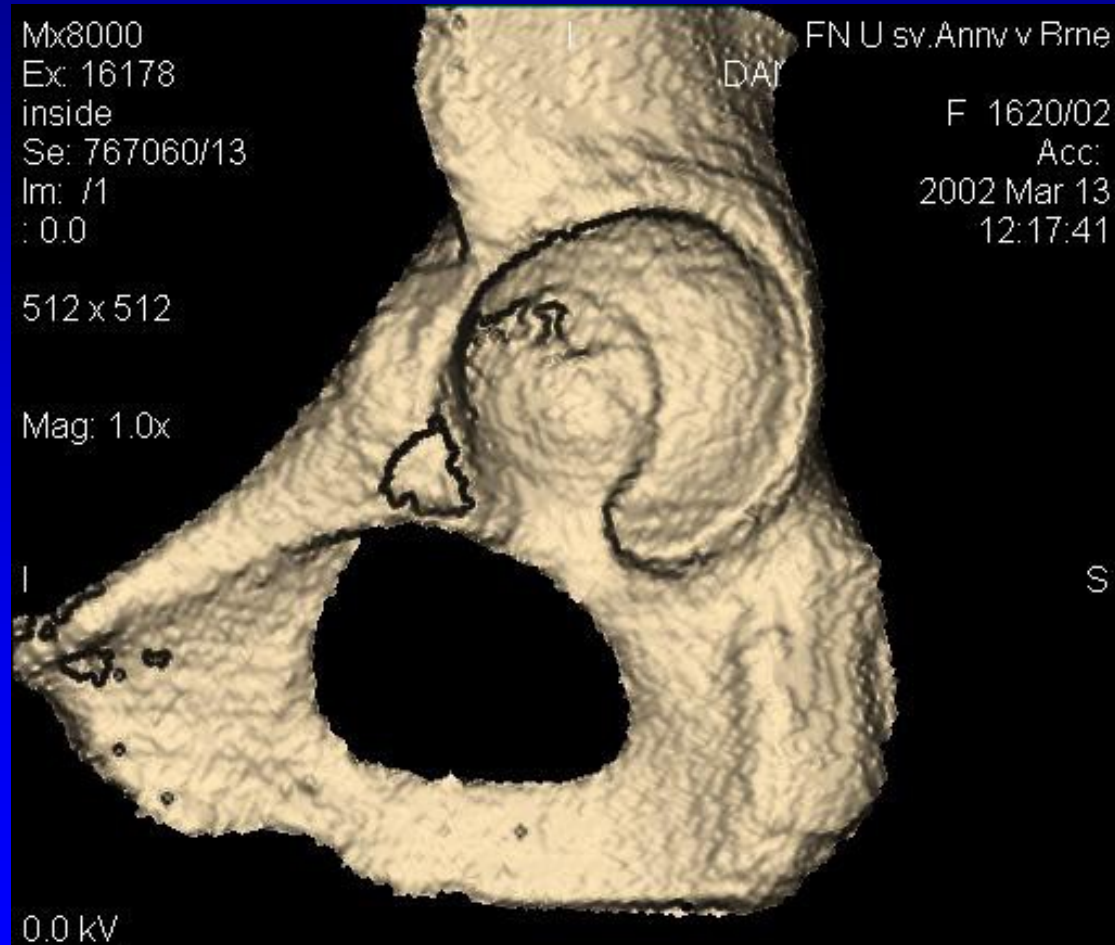
3 D CT

Os ilium

Os pubis-
ramus superior
ramus inferior

Os ischii

Corpus ossis ischii
Ramus ossis ischii-
pars pubica
pars acetabularis
tuber ossis ischii



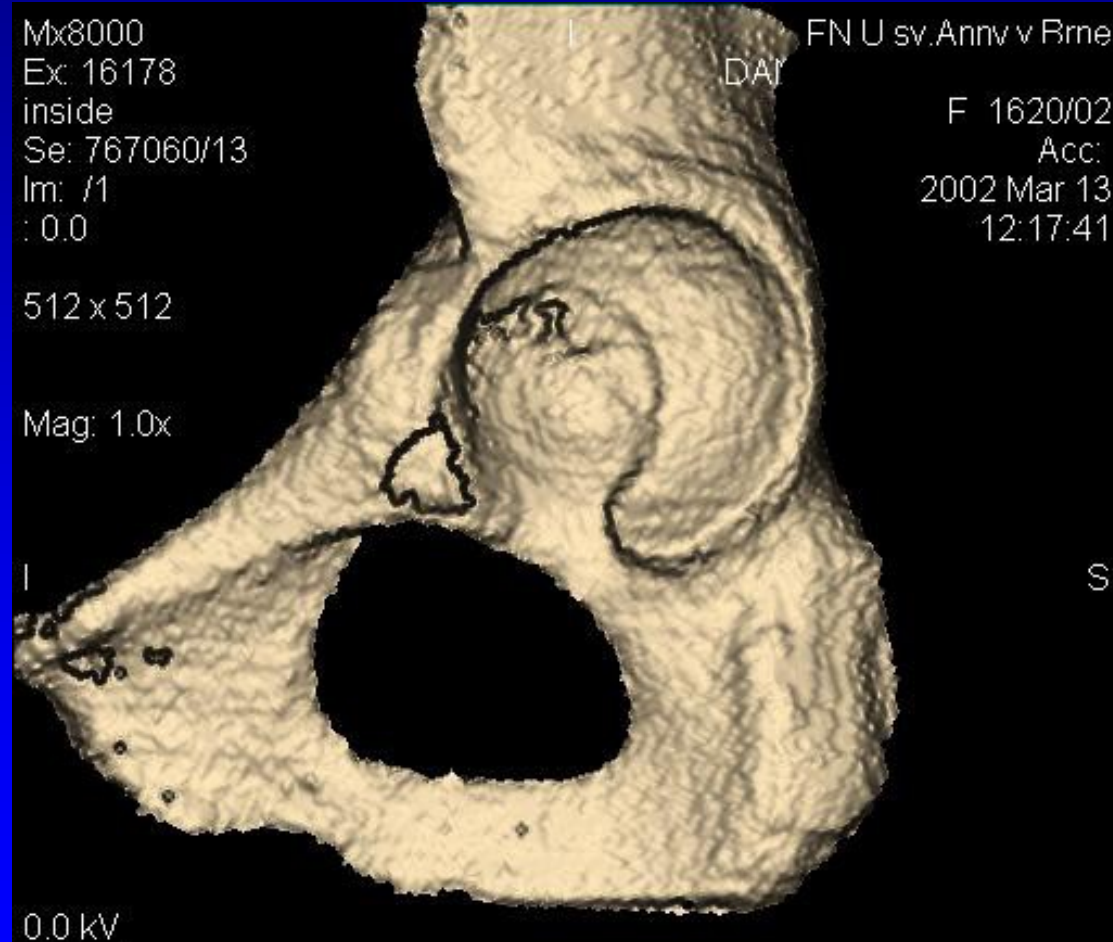
3D acetabulum

Acetabulum

facies lunata

fossa acetabuli

incisura acetabuli



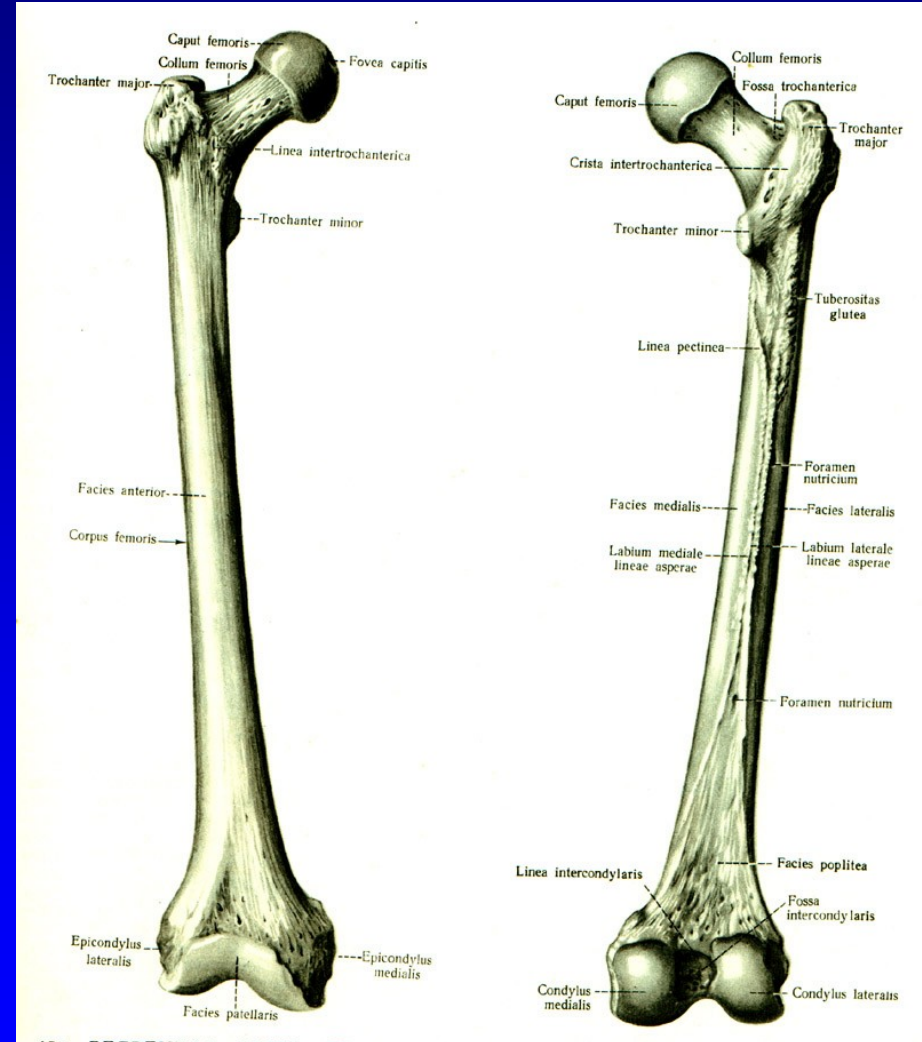
Femur

Anterior

Linea intertrochanterica
- Attachment of capsule

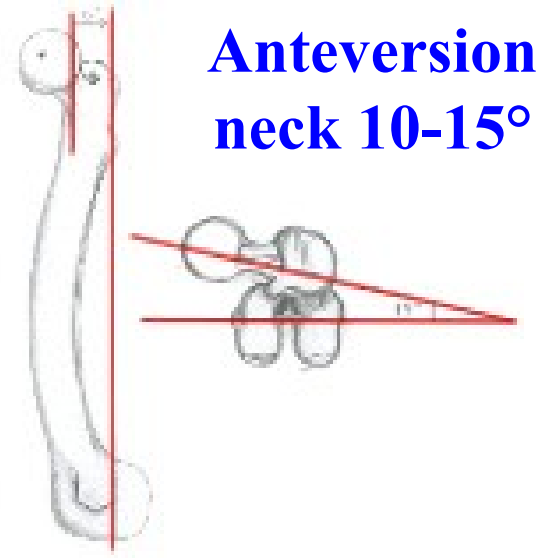
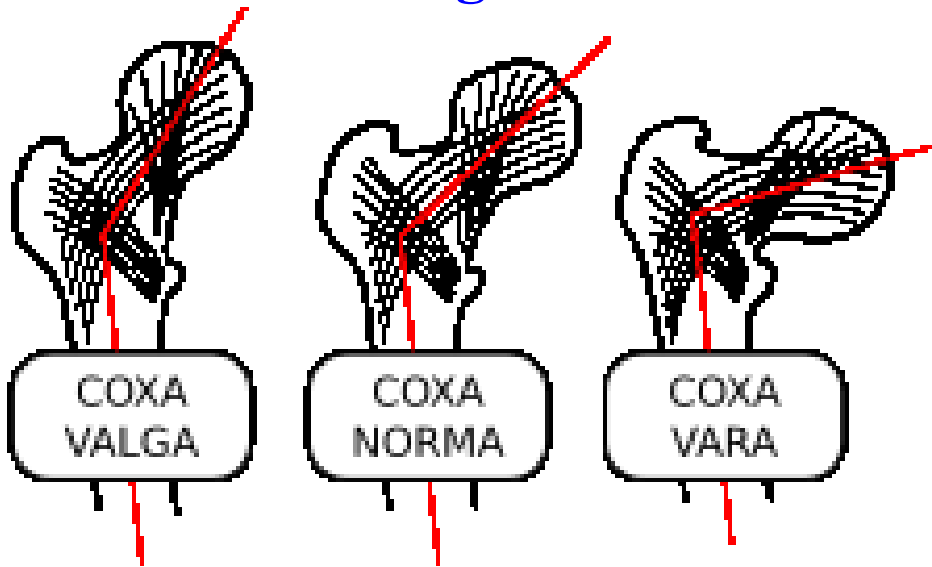
Posterior

Crista intertrochanterica
- Attachment of quadratus femoris



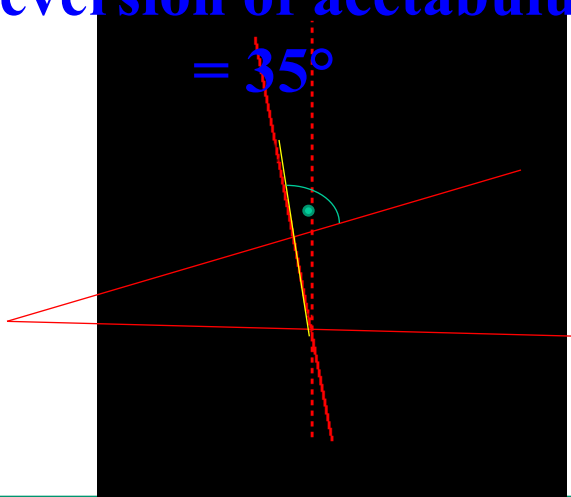
Anatomy

CCD angle = $125 \pm 5^\circ$



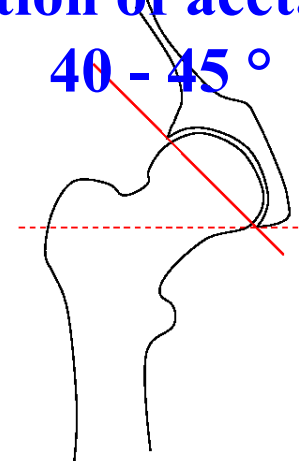
Anteversion of acetabulum

= 35°



Inclination of acetabulum

40 - 45°

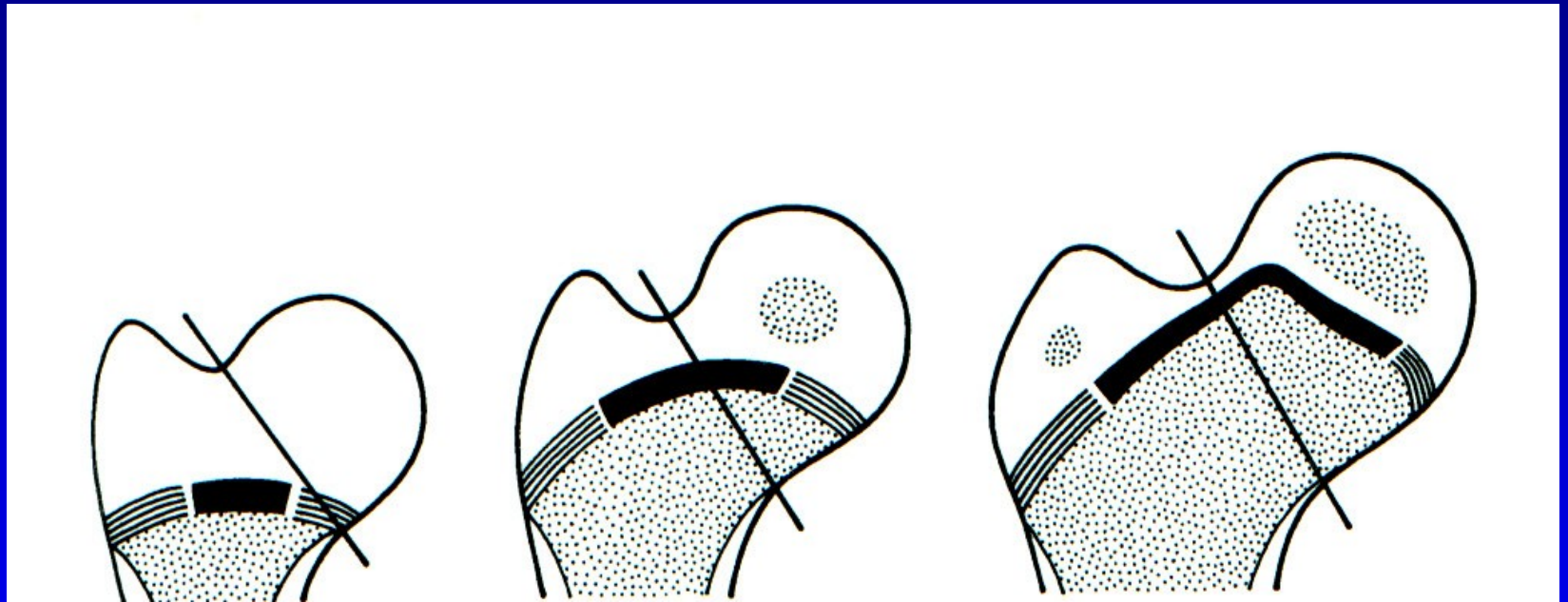


Boy, 6 years

Triradiate cartilage



Chondroepiphysis



Birth

6 months

3,5 years

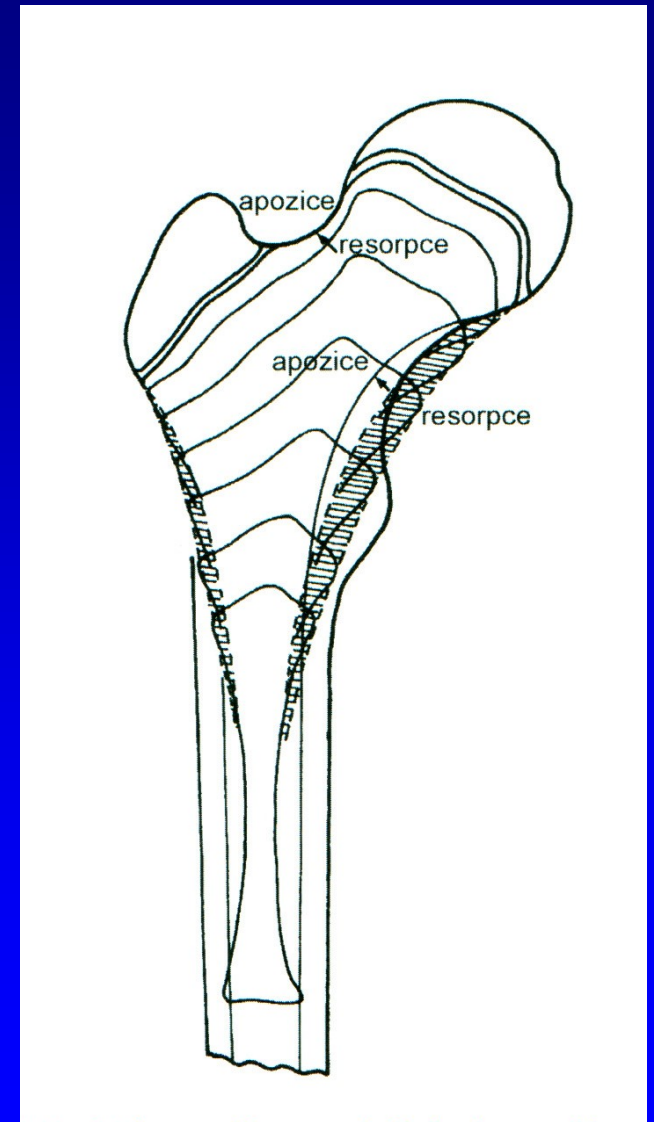
Ossification of proximal femur

Boy, 6 years old

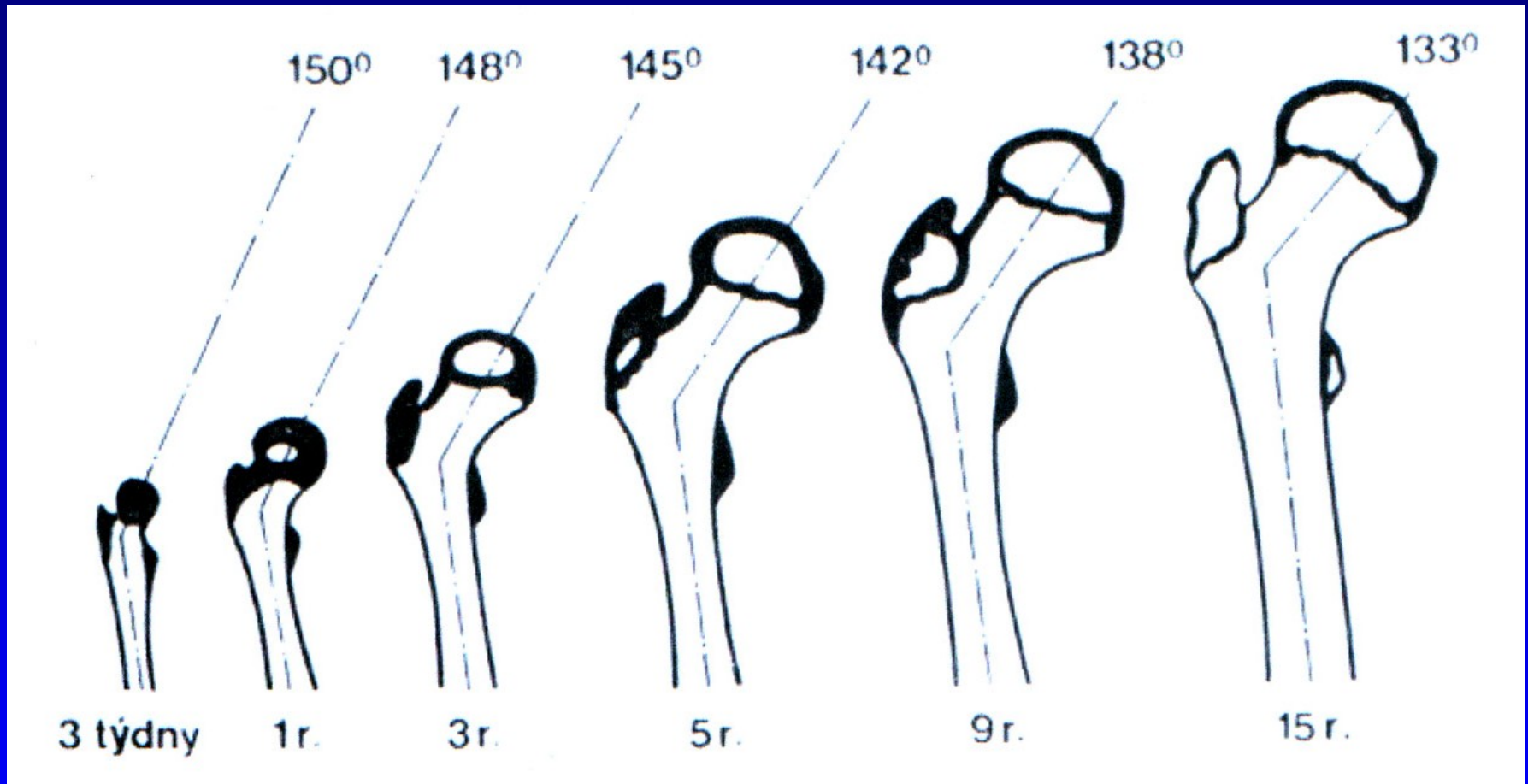


Growth in length

30 % of the whole femur



Change of CCD angle



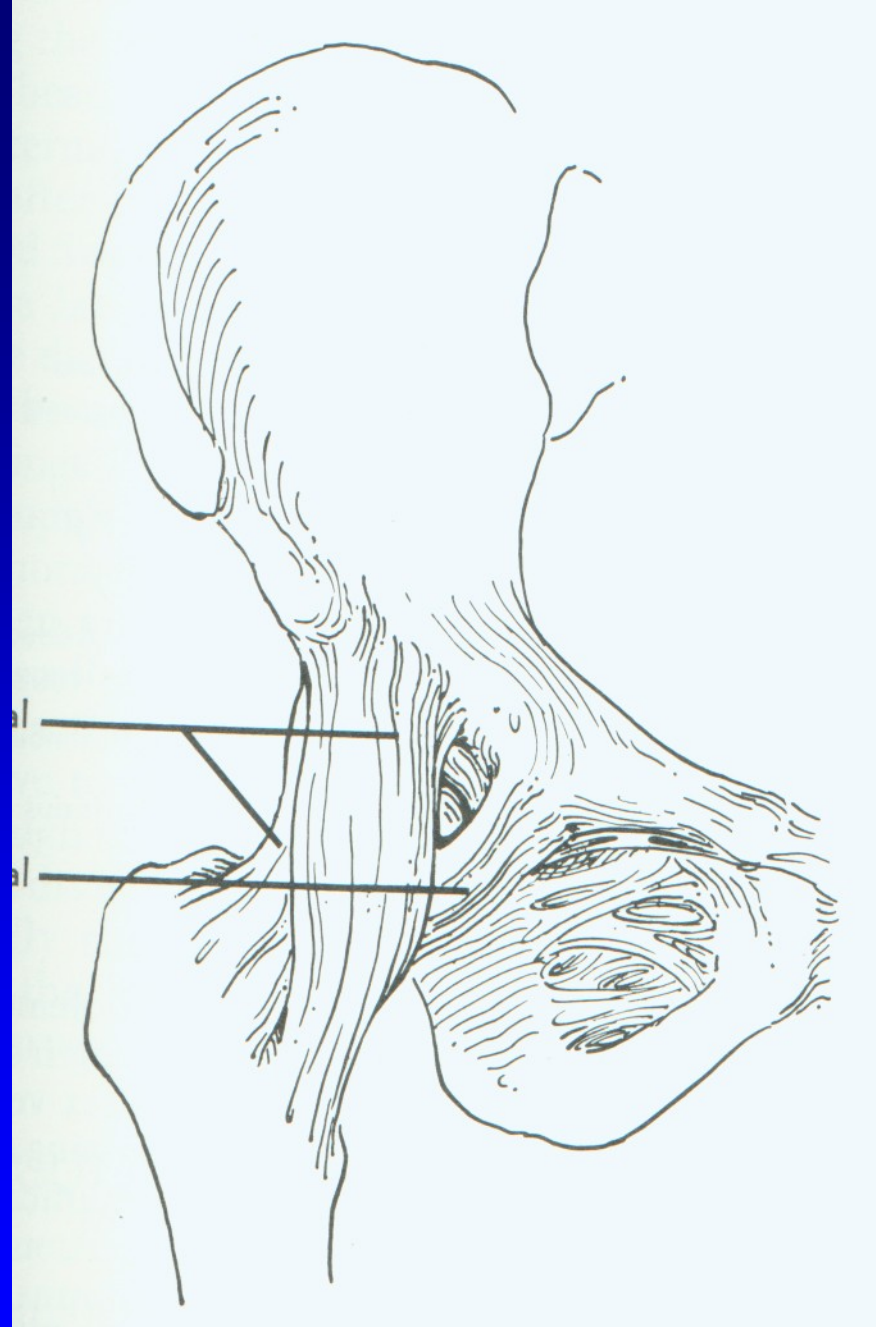
Change of anteversion of the neck
Birth 40°, puberty 11°

Joint capsule

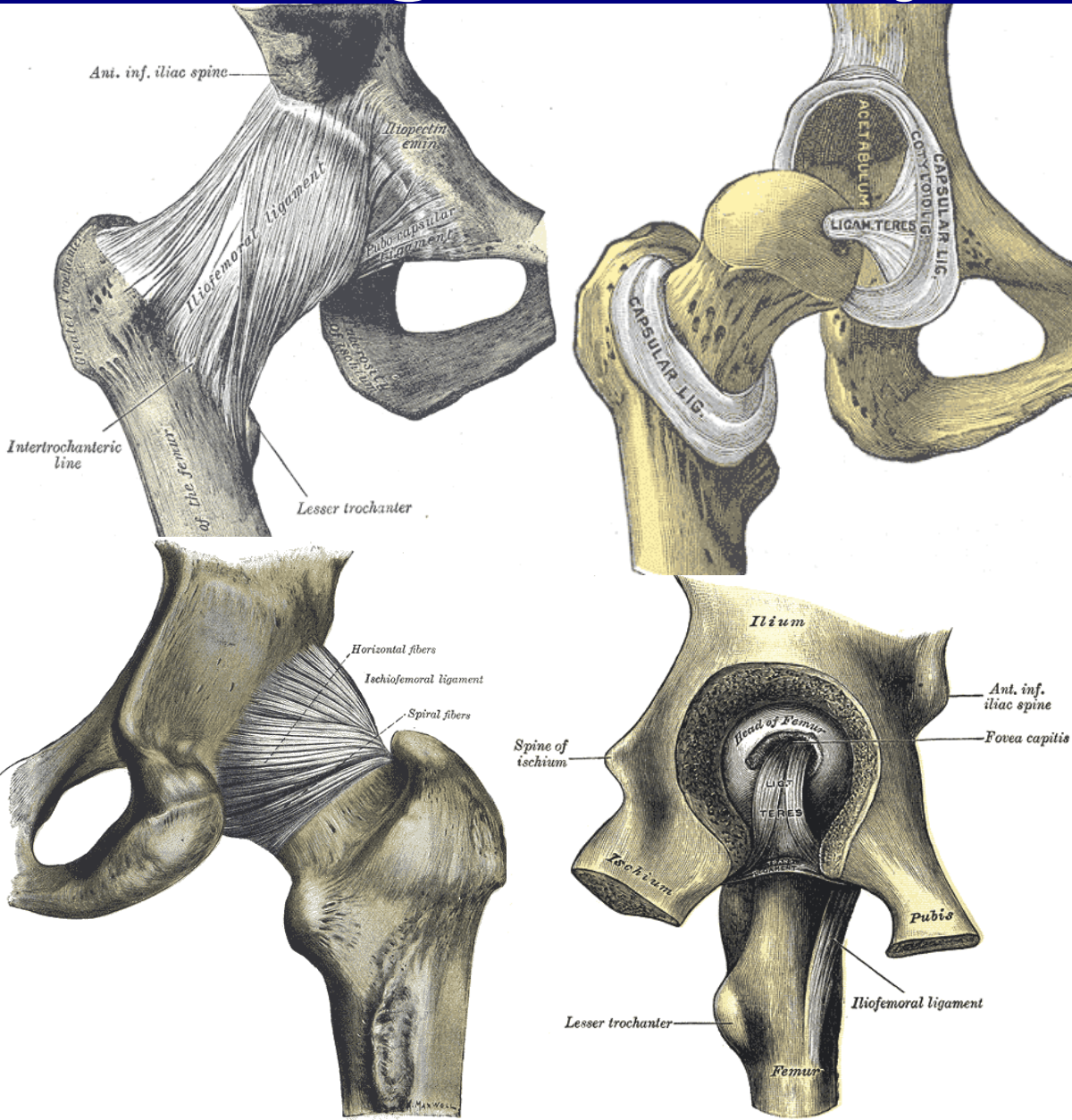
Lig. iliofemorale

Lig. pubofemorale

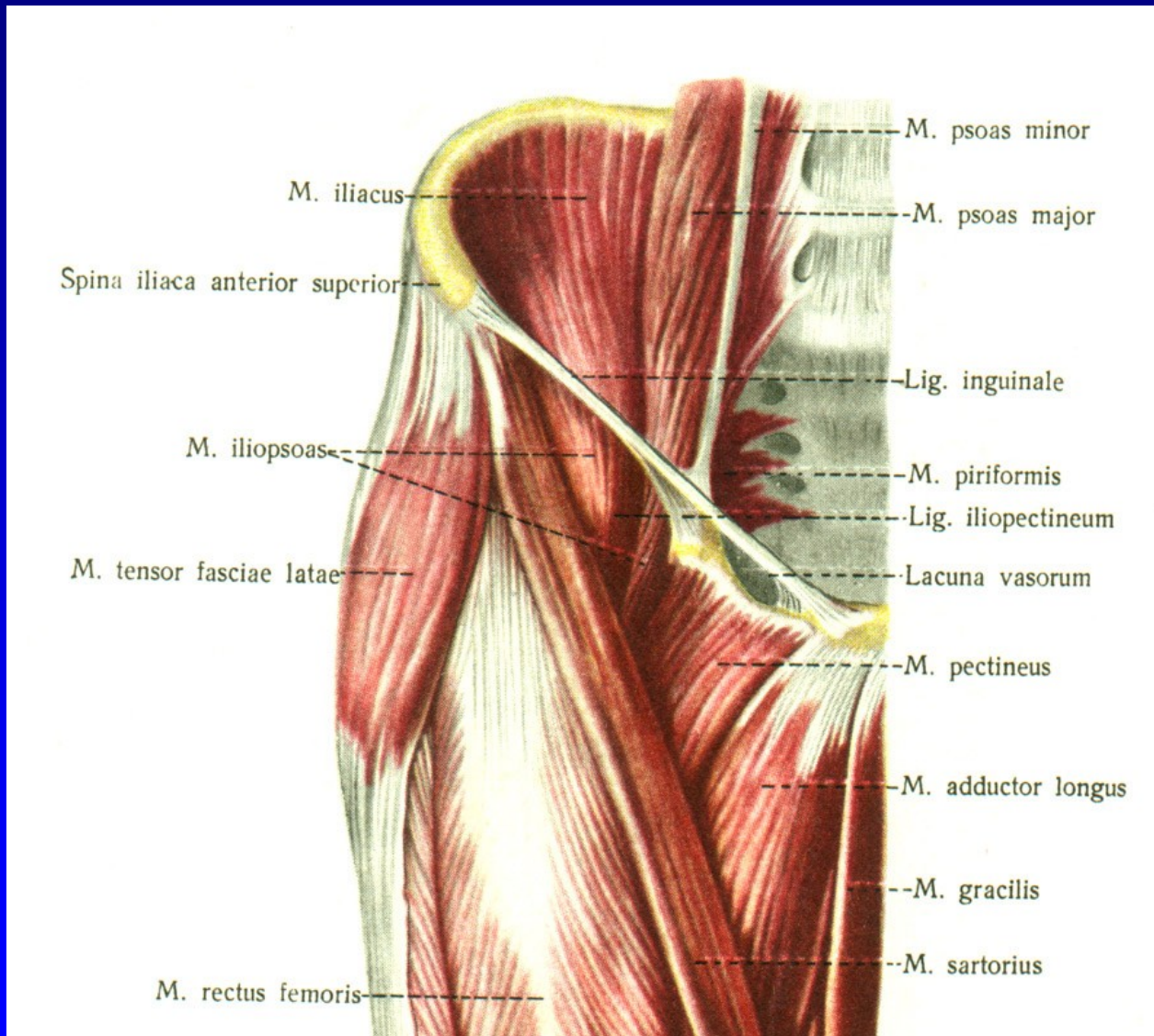
Lig. ischiofemorale



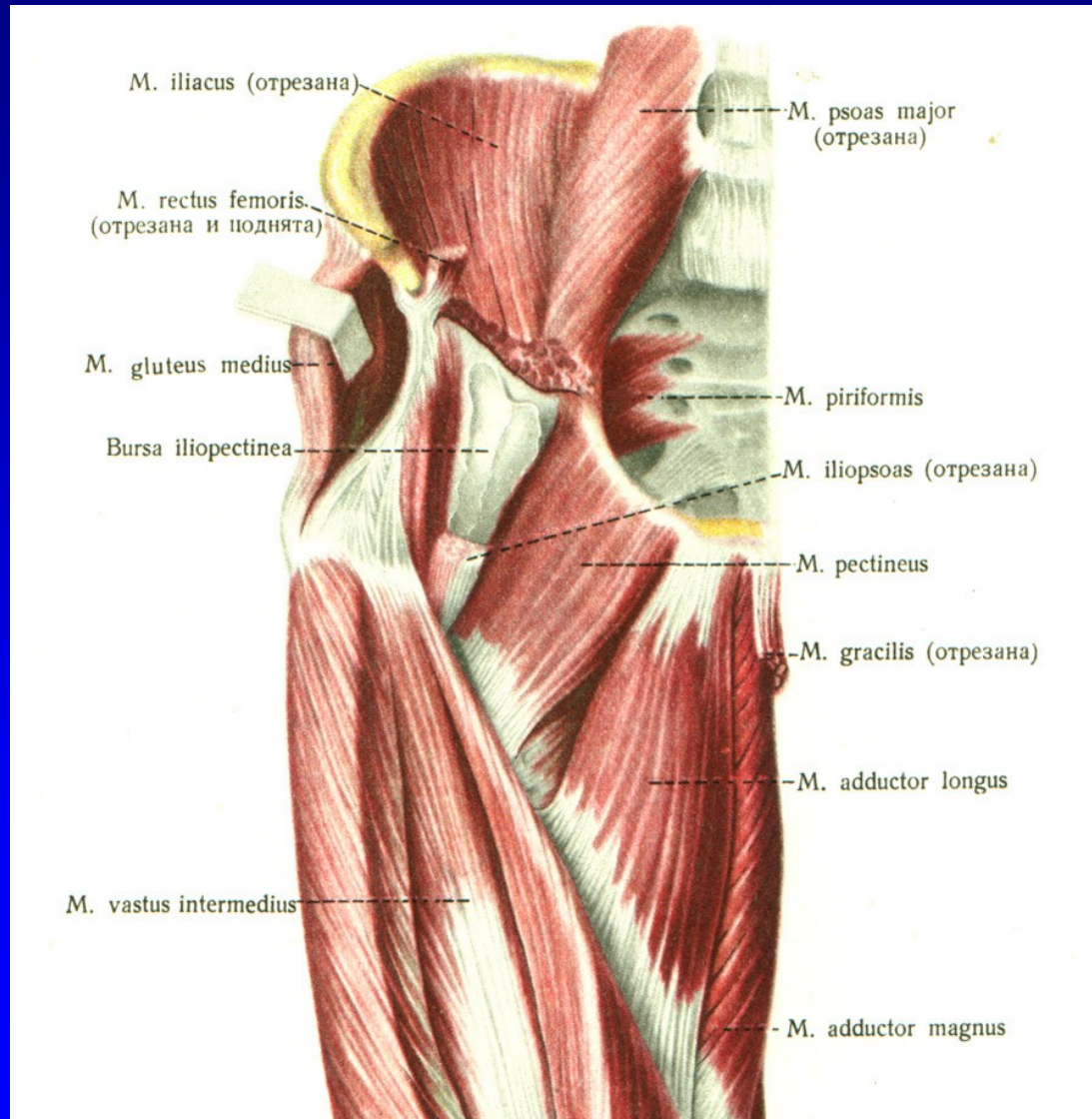
Ligaments of joint capsule



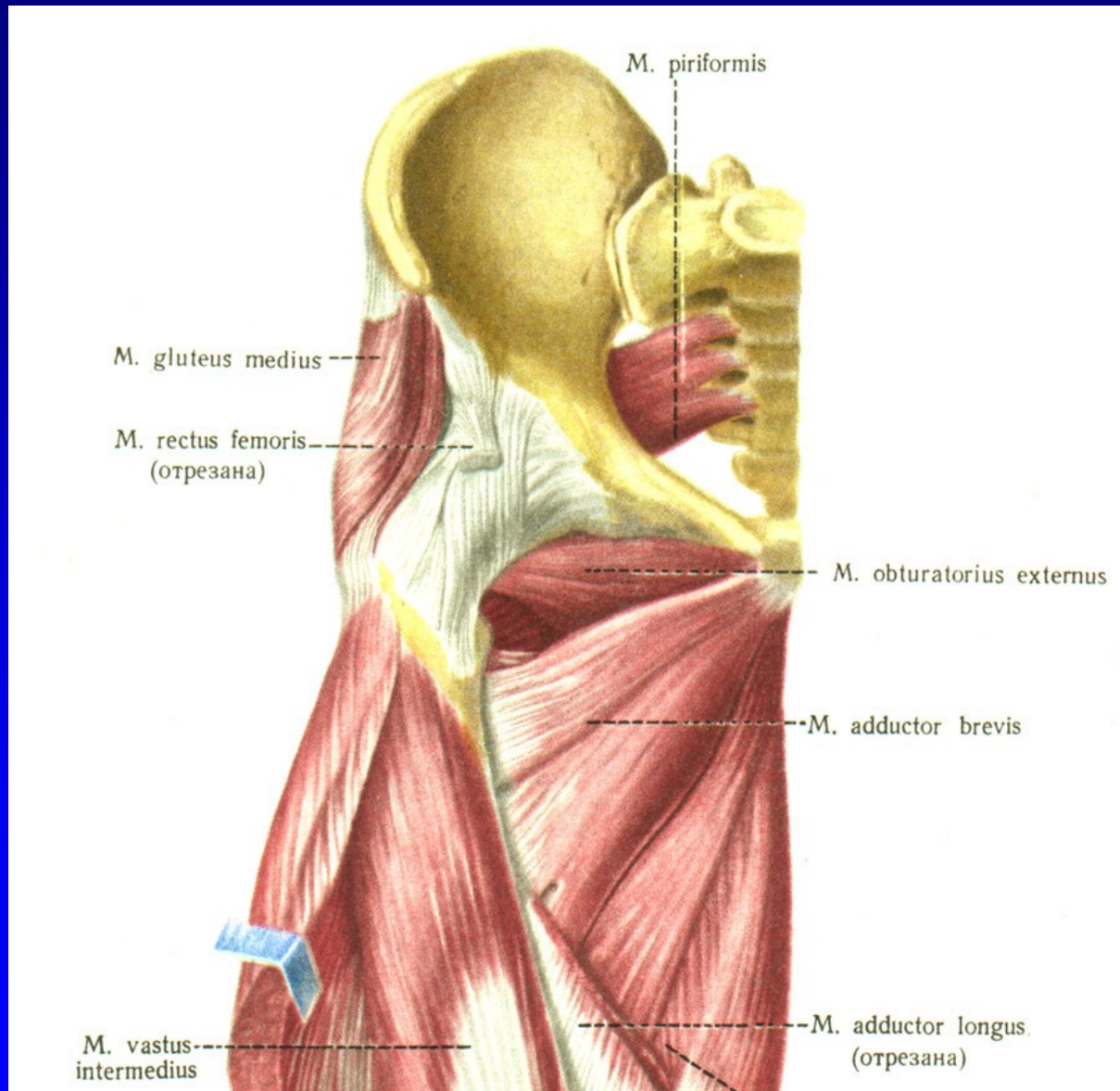
Muscles



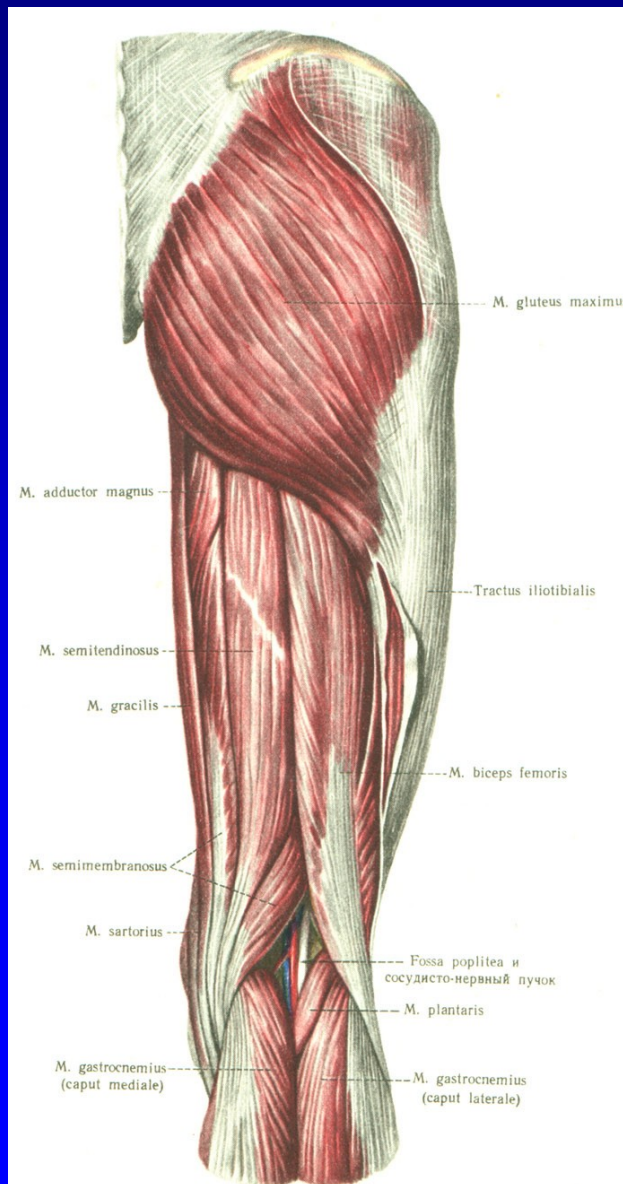
Muscles



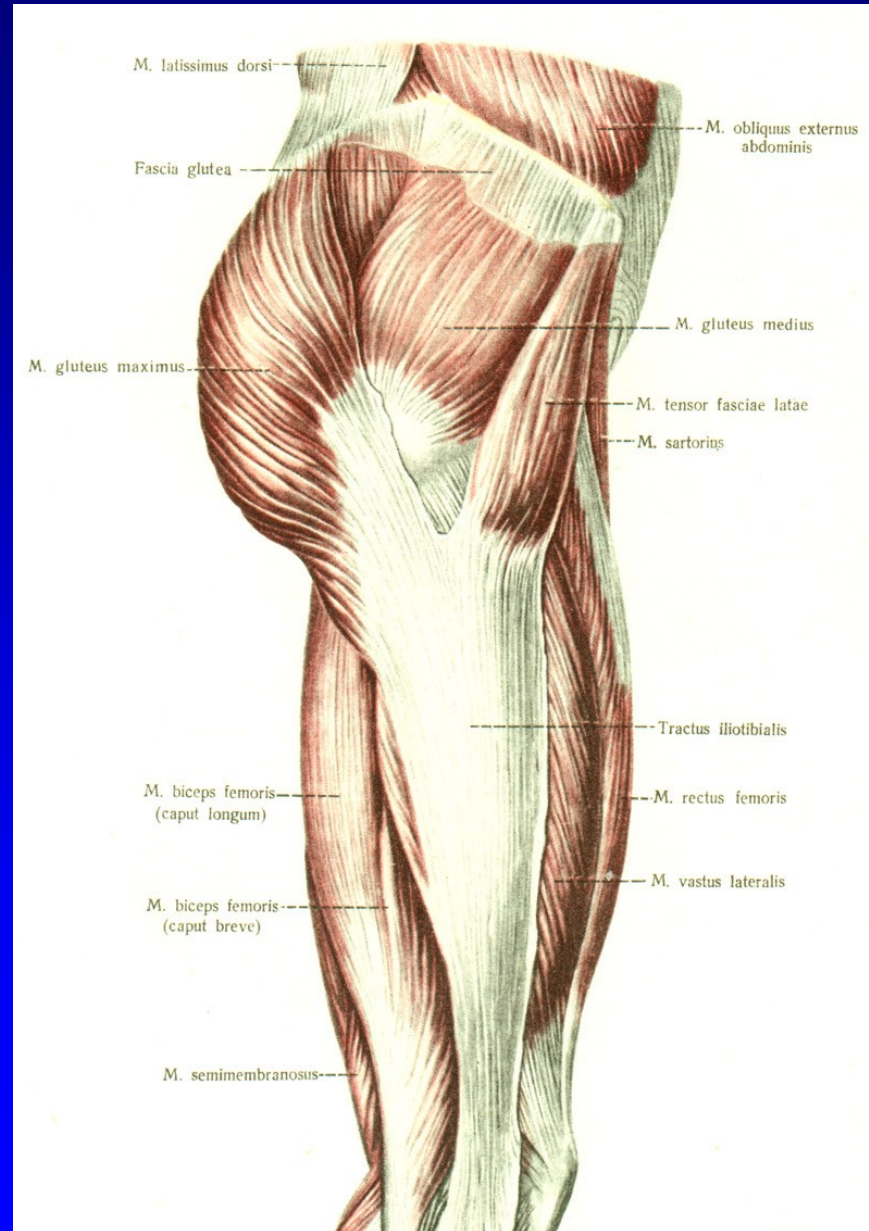
Muscles



Muscles



Muscles



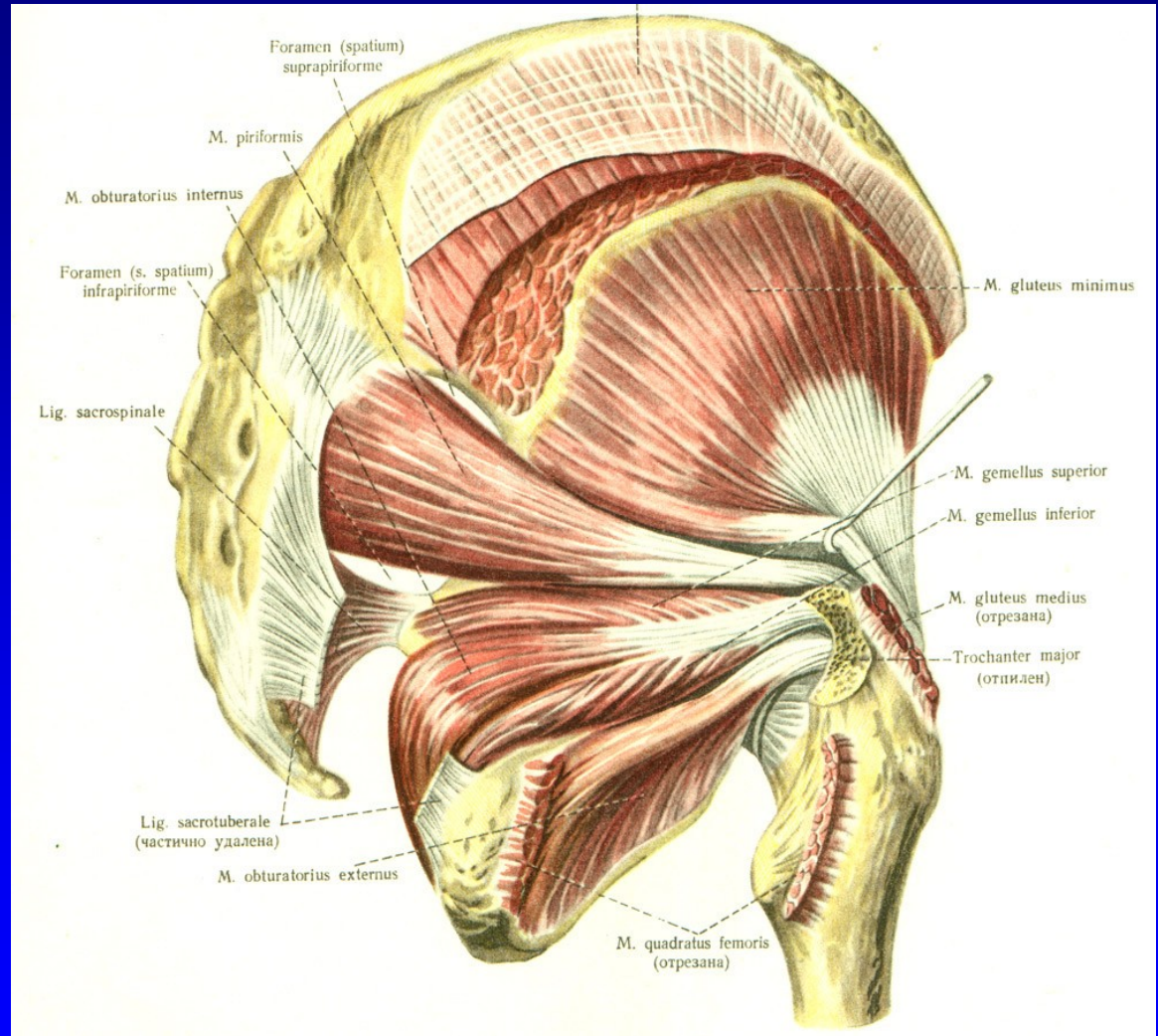
External rotators

M. triceps coxae:

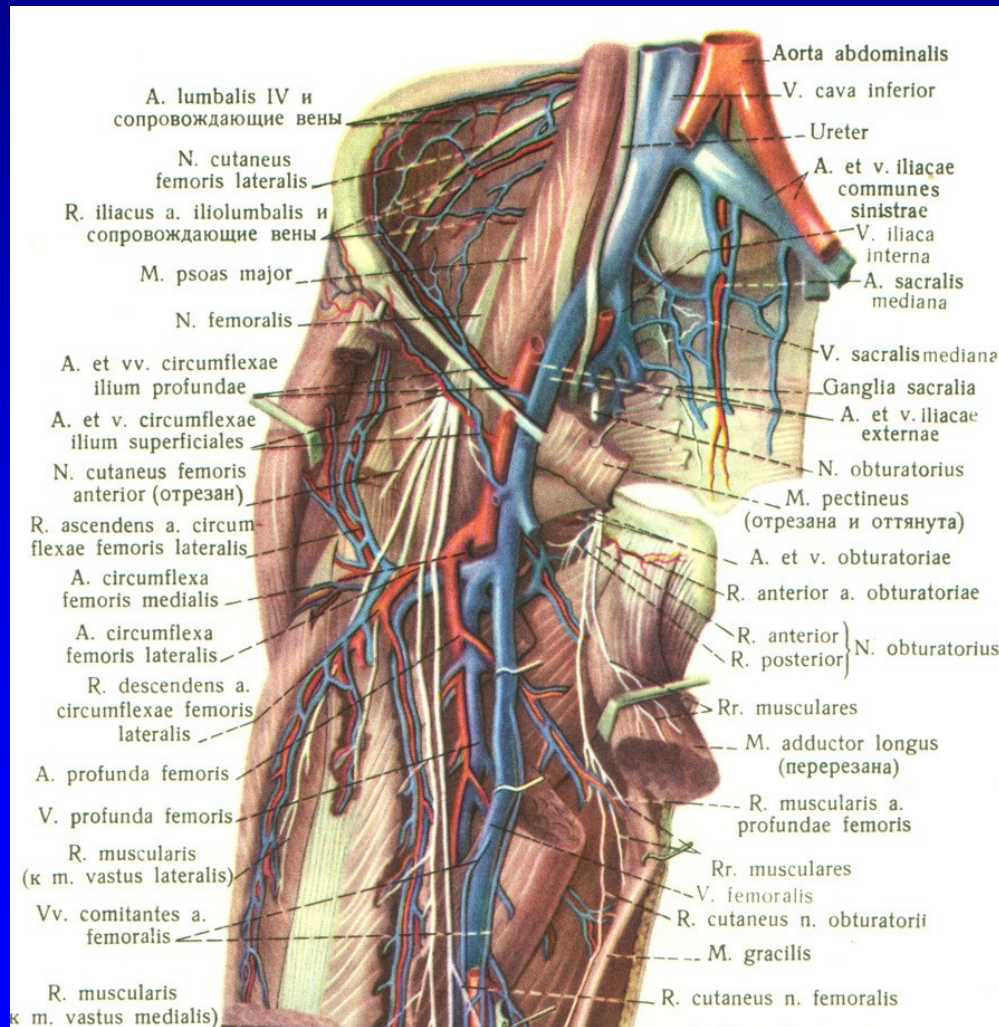
m. obturatorius int.

m. gemellus sup.

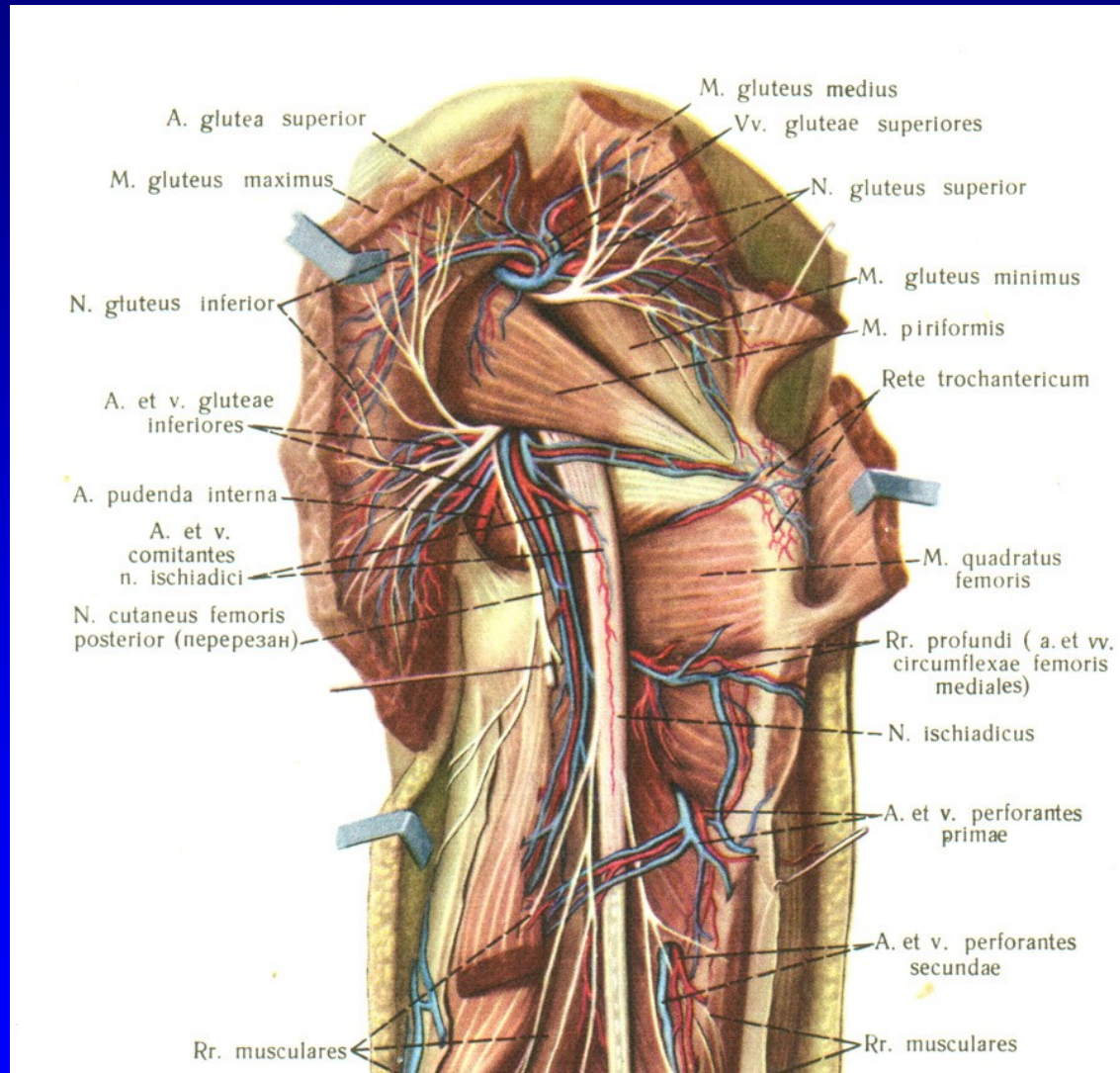
m. gemellus inf.



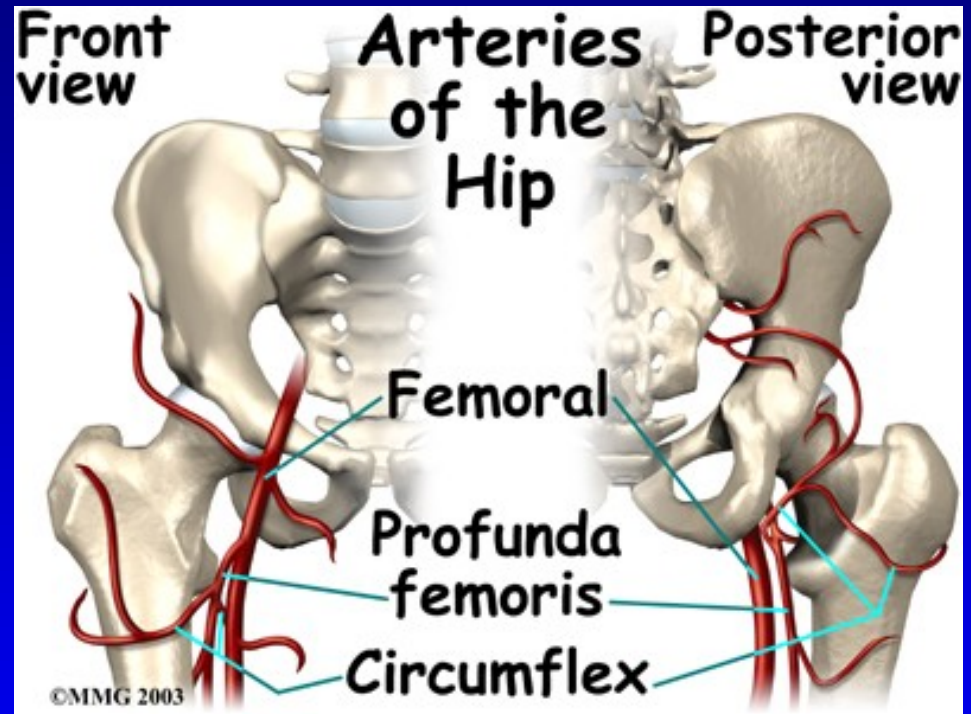
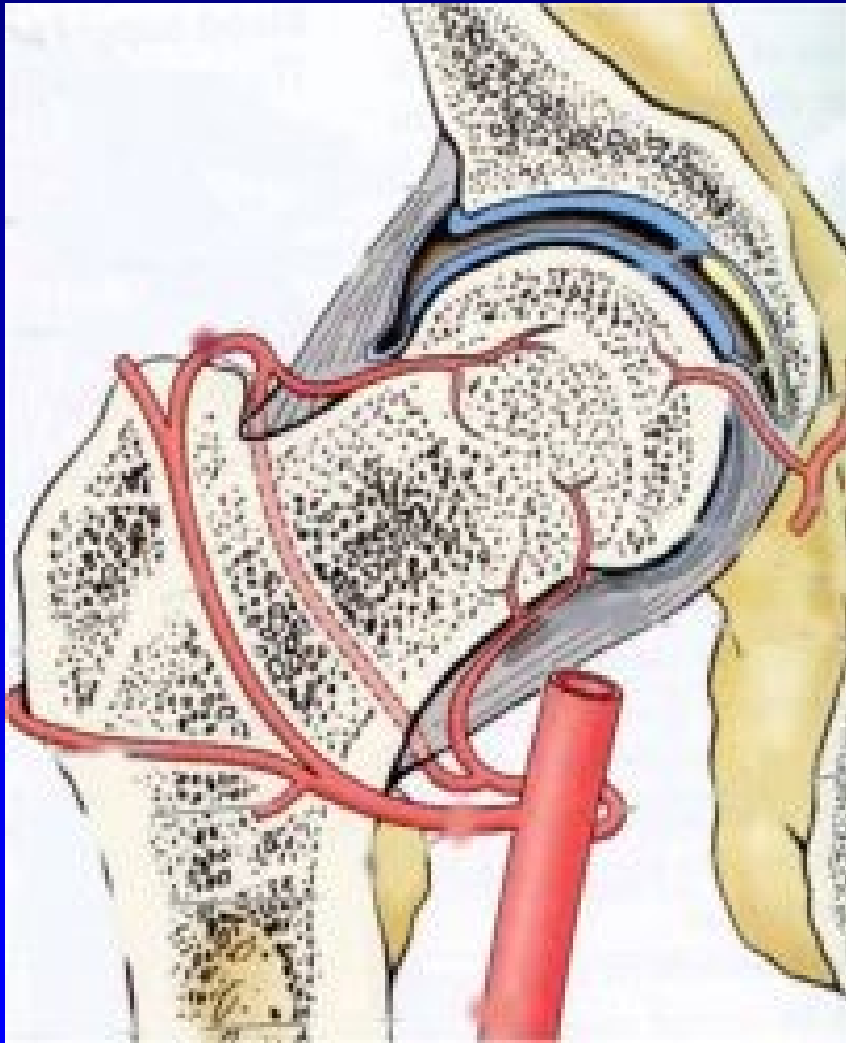
N. femoralis, a. v. femoralis n. obturatorius



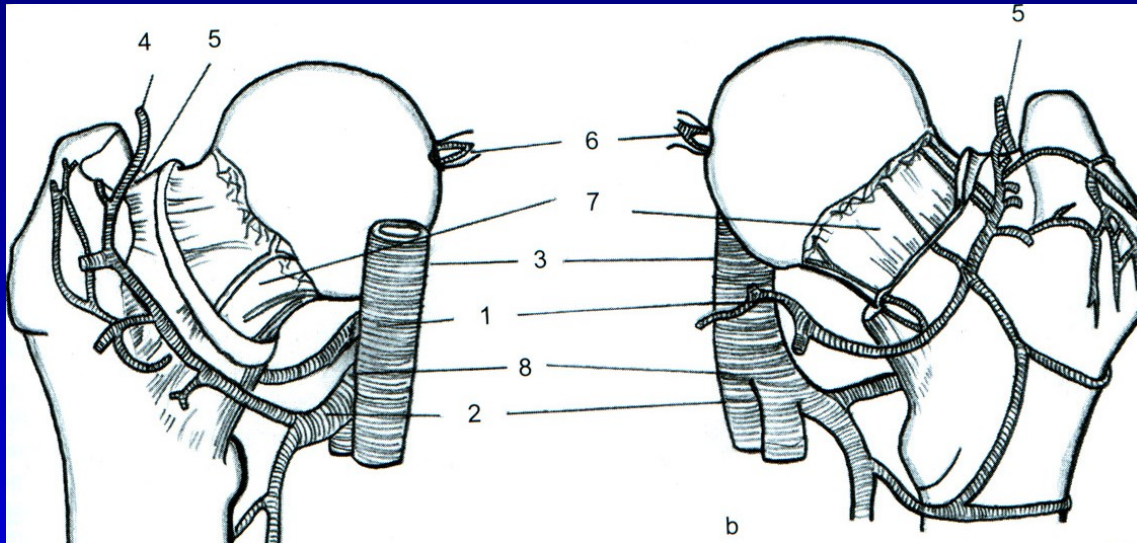
N. ischiadicus- sciatic nerve



Vessels



Vessels



A. femoralis, a. profunda femoris

a. circumflexa femoris medialis – posterior surface of neck

a. circumflexa femoris lateralis – anterior surface of neck

a. glutea superior et inferior,

a. obturatoria

a. capitis femoris

Vessels

1. Basal circle

3/4 a. CFM

1/4 a. CFL

2. Retinacular vessels

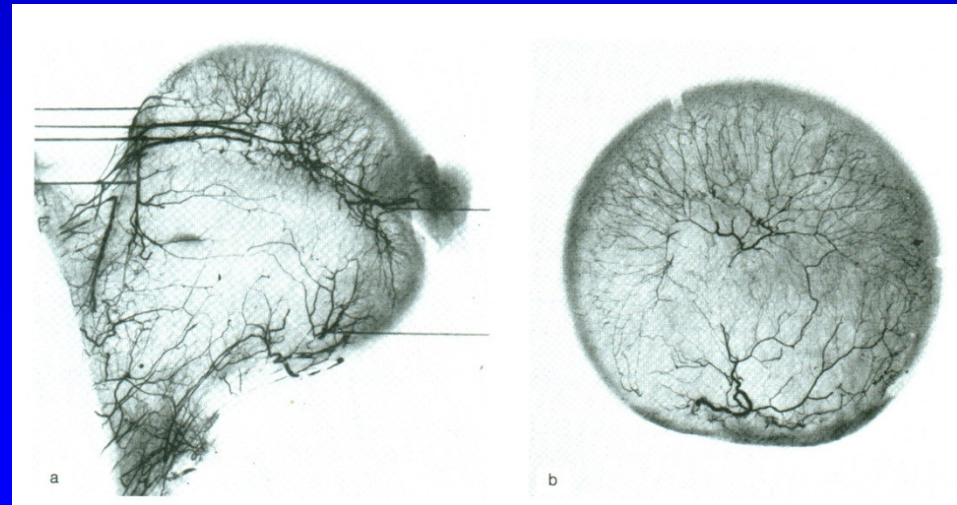
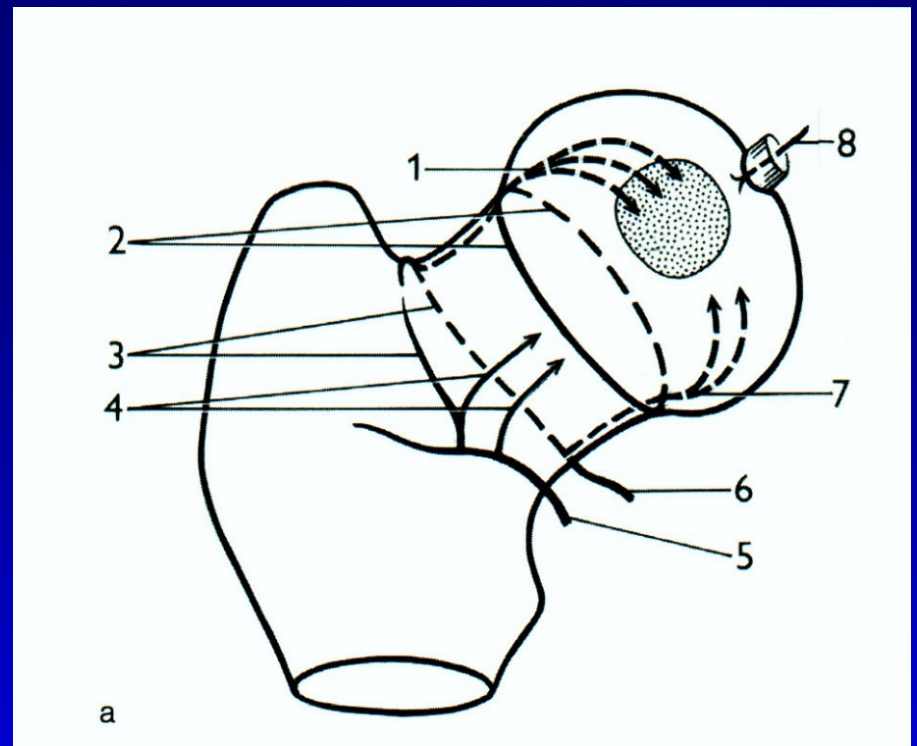
- posterosuperior

- posteroinferior

- anterior

3. Hunter subsynovial circle

Epiphyseal vessels



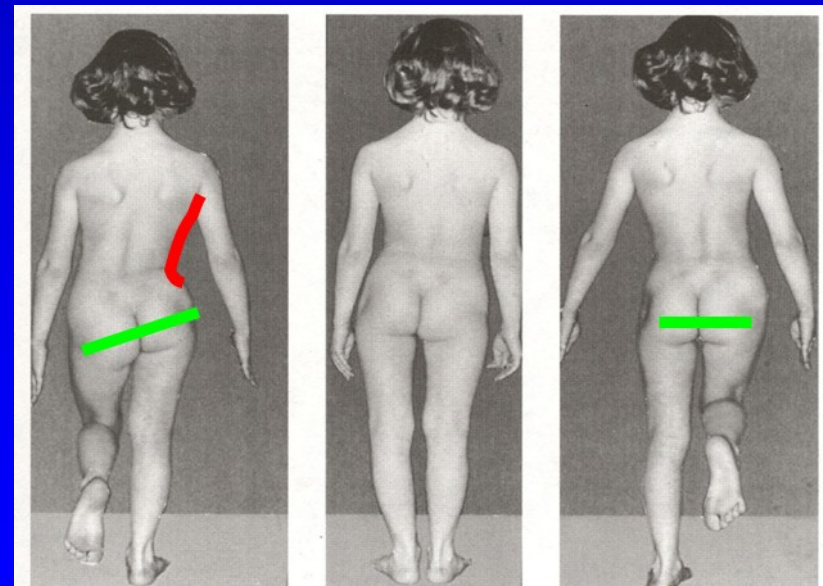
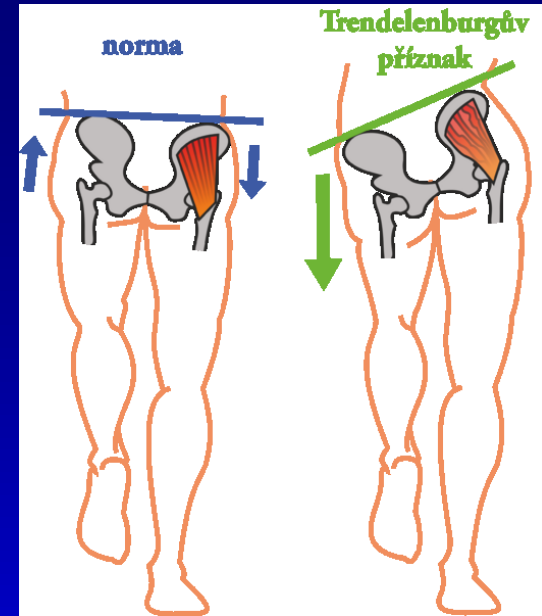
Terminal branches in femoral head

Clinical examination

- Gait, limping, sitting
- Kinetic chain- L spine, SI joint, hip, knee, leg
- L spine
 - Hyperlordosis
 - Antalgic position of L spine
 - Scoliosis
 - Tilting of the pelvis

Trendelenburg sign

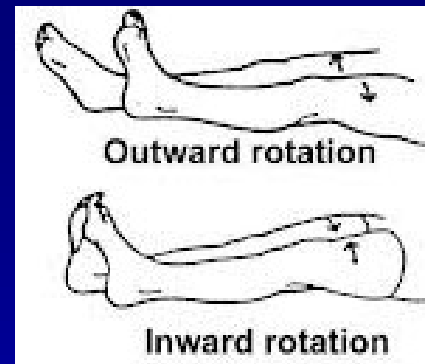
- Stability of the hip
- Strength of abductors
- Negative
- Positive
- Cause
 - Insufficiency of abductors
 - High position of greater trochanter



Movements, ROM

– Active

– Passive

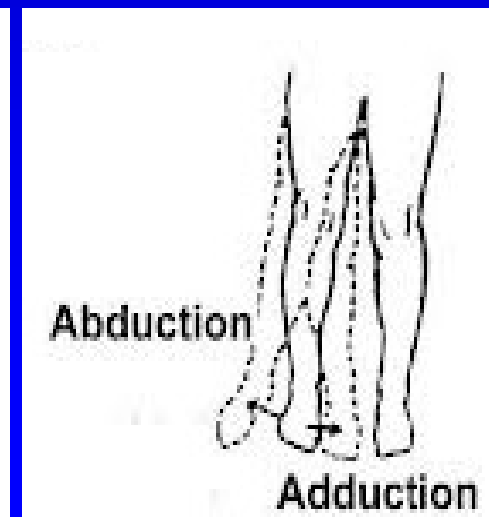
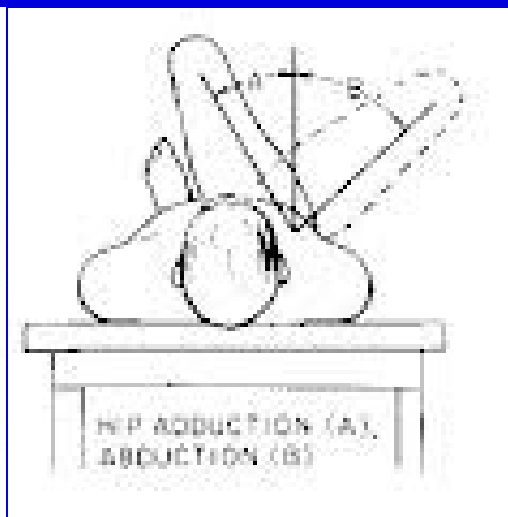
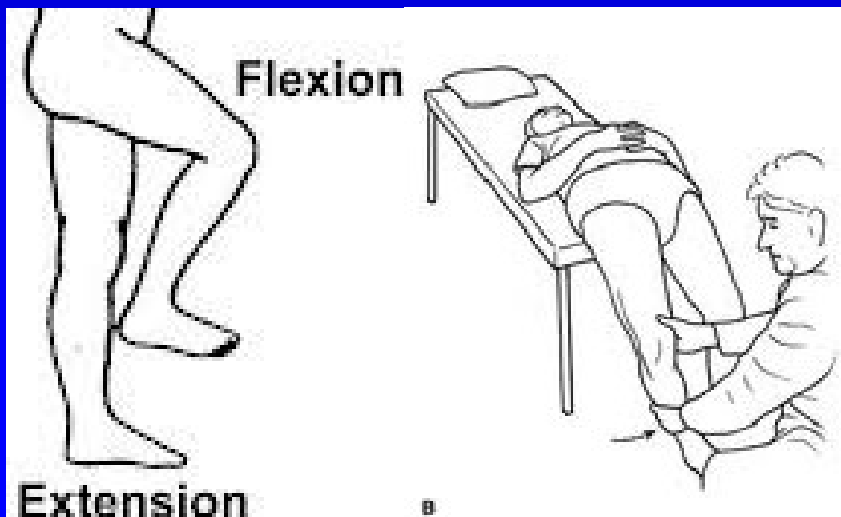


S: extension - 0 - flexion
15 - 0 - 140

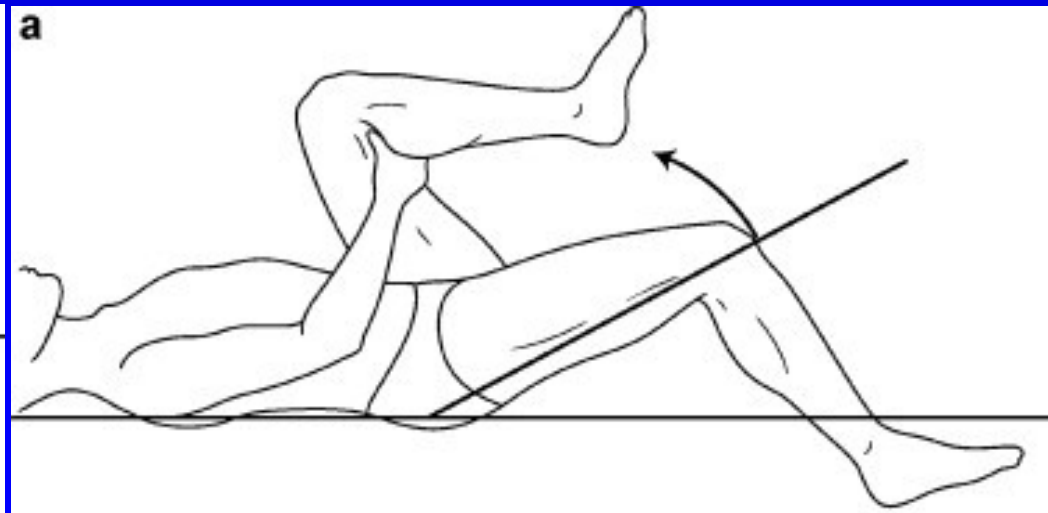
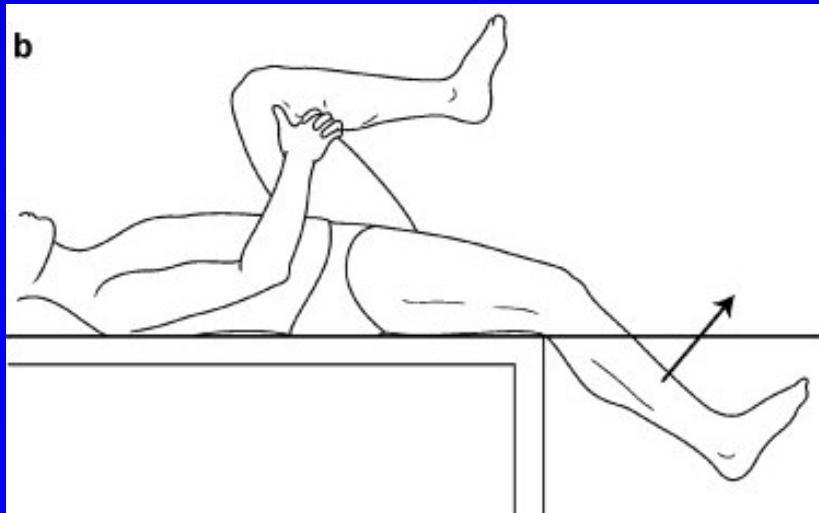
F: abduction - 0 - adduction
60 - 0 - 40

T: abduction - 0 - adduction
80 - 0 - 30

R: ER - 0 - IR
50 - 0 - 40



- **Contracture in hip joint**
 - antalgic (semiflexion)
 - typical contracture in cerebral palsy (adduction, flexion, inner rotation – iliopsoas, adductors, rectus femoris.
 - **Thomas sign**
 - Maximal flexion in contralateral hip – balanced hyperlordosis
 - Thigh goes into flexion



Duncan-Ely test

- **Contracture of rectus femoris**
- **In prone position with flexion in the knee joint**
- **Positive- lifting of the pelvis**



Imaging methods

- **X ray**
 - AP
 - Axial
 - Lauenstein, frog leg position



- **USG** (children, effusion, bursitis)
- **Arthrography** (children)
- **CT, MRI**
- **Scintigraphy**



AP view of the pelvis: centre umbilicus- symphysis
inner rotation



AP view of the hip: centre over the hip in level of symphysis
neutral rotation



Basic parameters

Frequent pathology

- **Children**

- DDH
- Perthes disease
- Slipped upper femoral epiphysis
- Coxitis
- Non specific synovitis

Adults

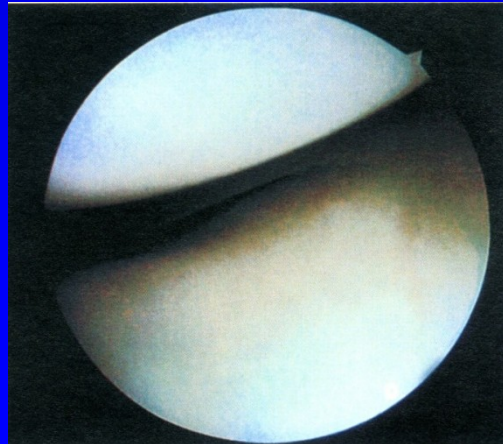
- O.A., R.A.
- Necrosis of femoral head
- FAI
- Coxitis
- **Trauma, posttraumatic conditions**
- **Tumors**

Frequent pathology

- Entesopathies, bursitis
- Snapping hip
- Irradiation of the pain from L spine

Osteoarthritis

- Degenerative, slow and progressive disease of hyaline cartilage of synovial joint
- All conditions changing the structure and function of hyaline membrane and surrounding tissues lead to osteoarthritis



Osteoarthritis deformans

- Primary (after 40 years of age)
- Secondary – the cause is known

Osteoarthritis

15 percent of the population

50 percent of people above 65 years

80 percent of people above 75 years

Primary O.A.

Begins over 40 y.

Small joint in hands

Cervical and lumbar spine

Hip and knee joints



Secondary O.A.

1. Mechanical factors (DDH, Perthes disease, aseptic necrosis, slipped femoral epiphysis, condition after fractures)
2. Metabolic disorders (ochronosis, gout, chondrocalcinosis, Gaucher disease)
3. Hormonal disorders (acromegaly, diabetes m.)
4. Inflamated disorders (septic arthritis, R.A.)

DDH- developmental dysplasia of the hip joint



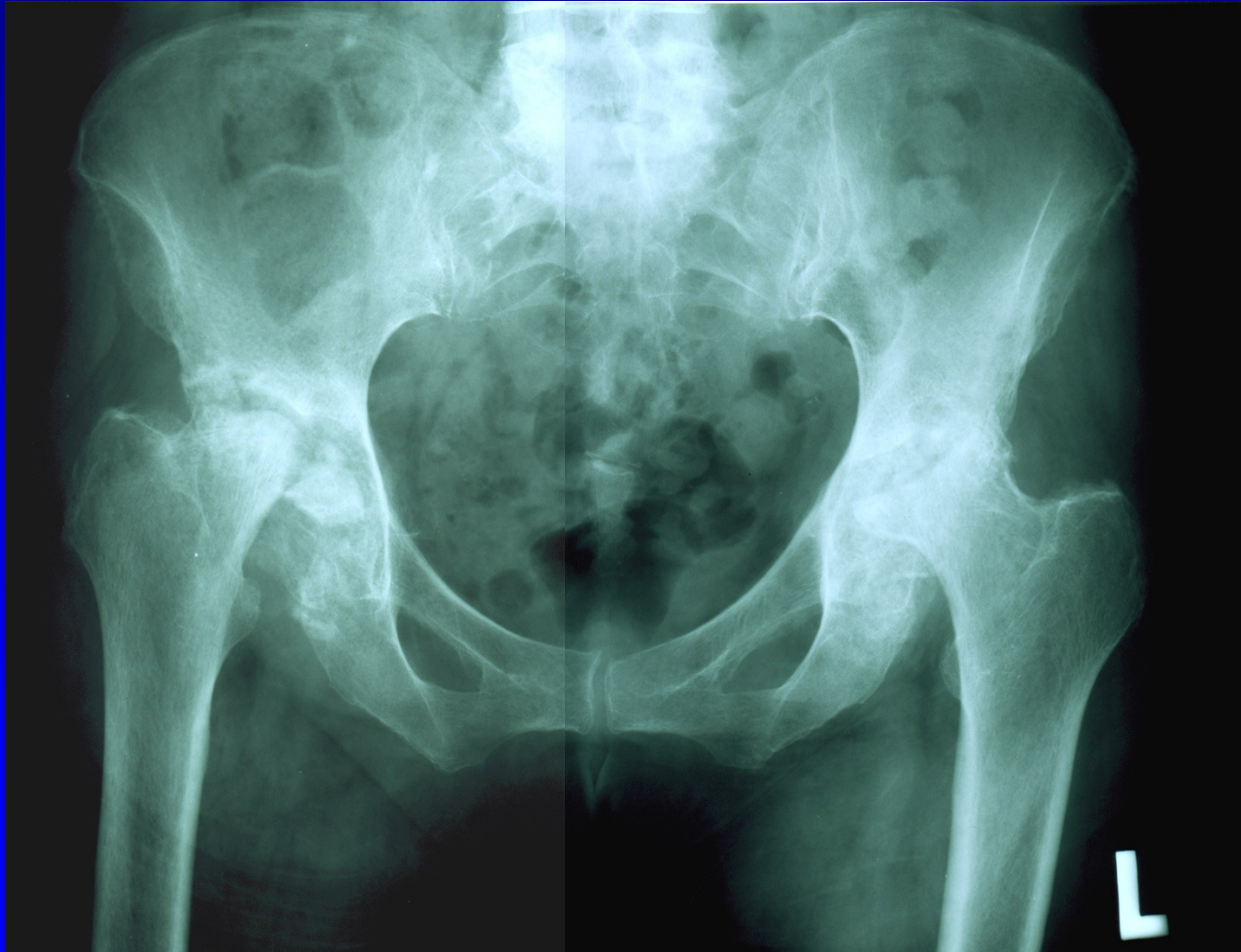
Obr. 6

Condition after Perthes disease



Obr. 8

Rheumatoid arthritis



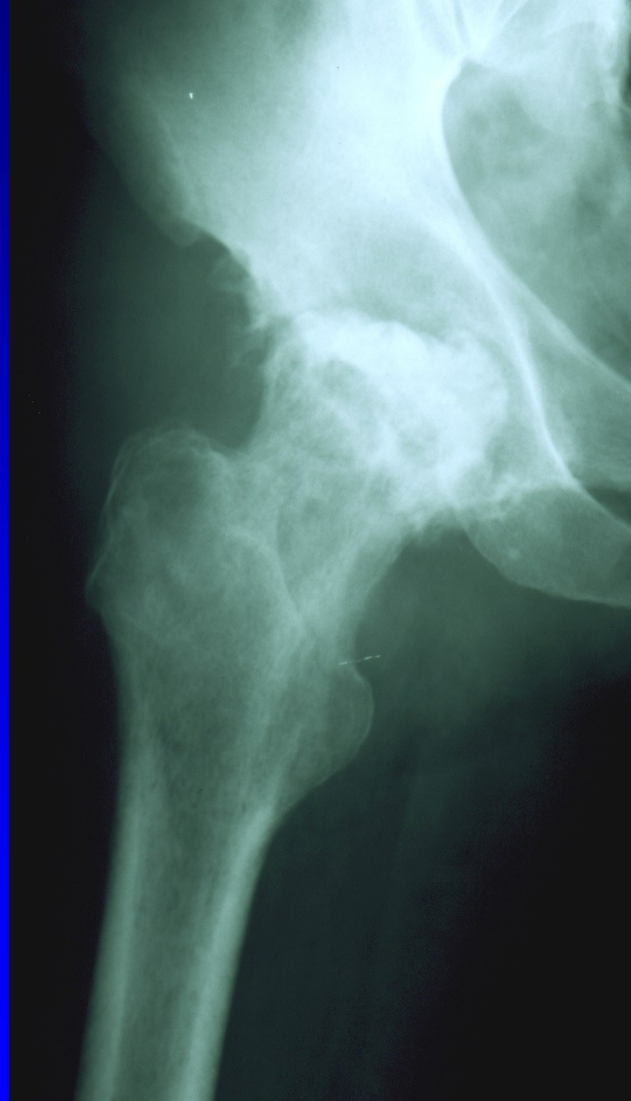
Obr. 10

Ancyllosing spondylitis



Obr. 12

Septic arthritis



Obr. 13

Osteoarthritis - symptoms

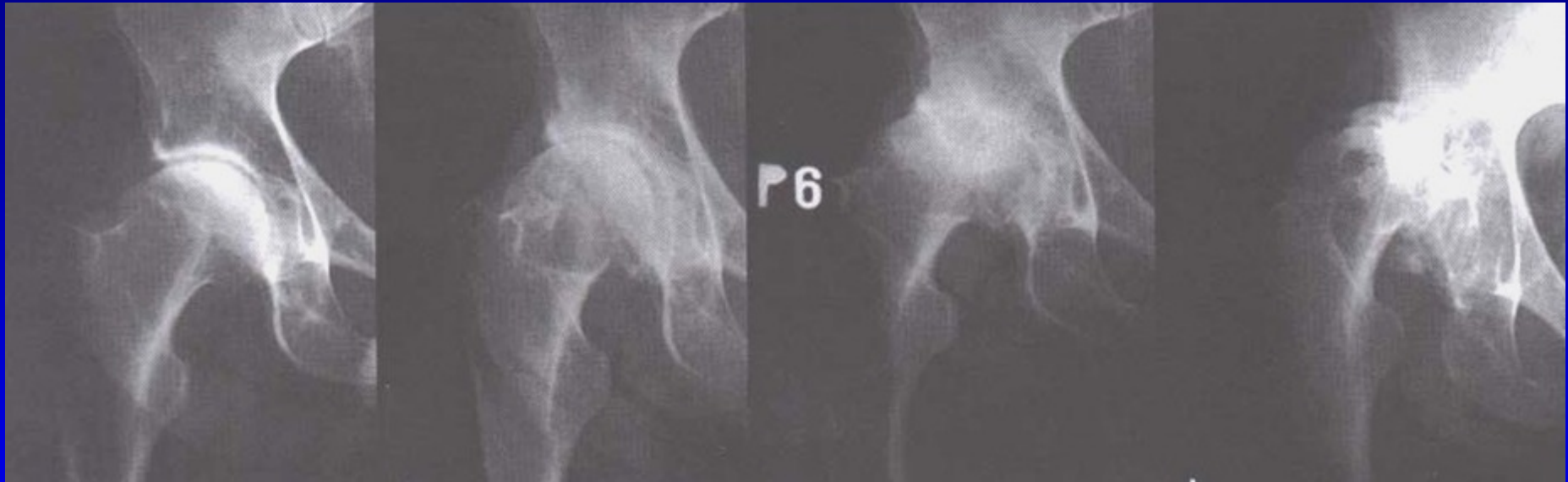
- Pain
- Tenderness
- Limited movements
- Muscle spasm, contracture
- Limping
- Gait- limited length, walking aids

I.

II.

III.

IV.



Kellgren- Lawrence classification I- IV.

O.A. management

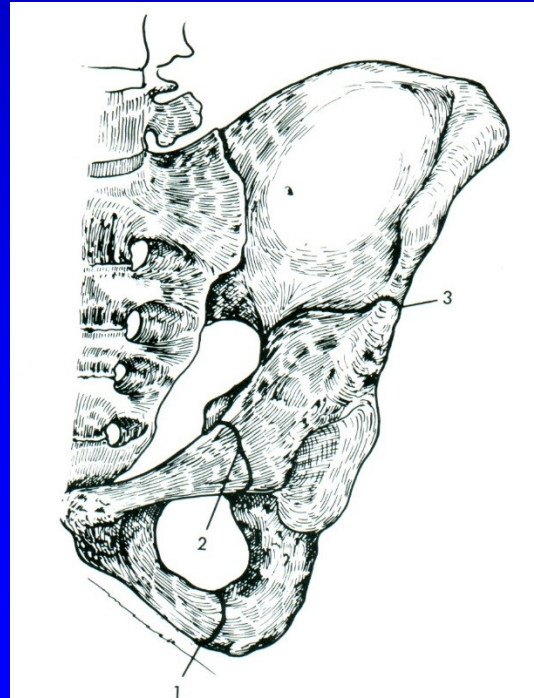
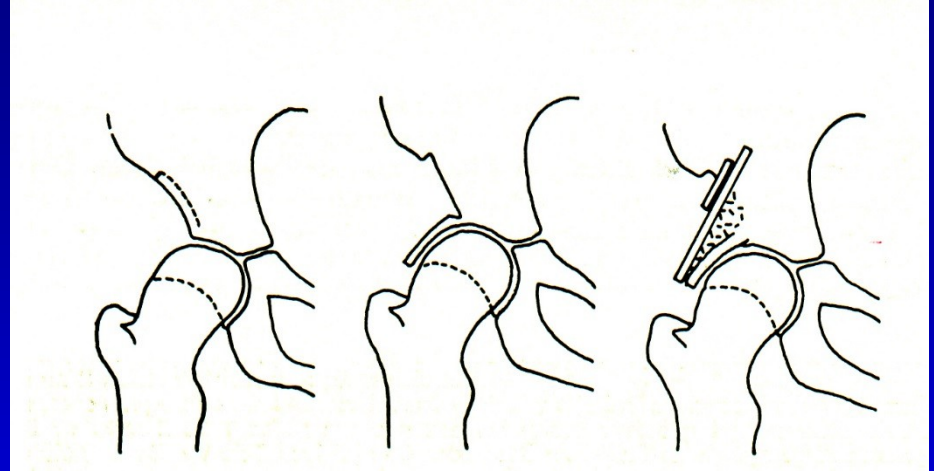
- Conservative
- Surgical treatment:
ASC, osteotomy, total hip replacement

Arthroscopy

- Labral lesions
- Osteochondral lesion
- Loose bodies
- Synovectomy
- Transchondral fracture

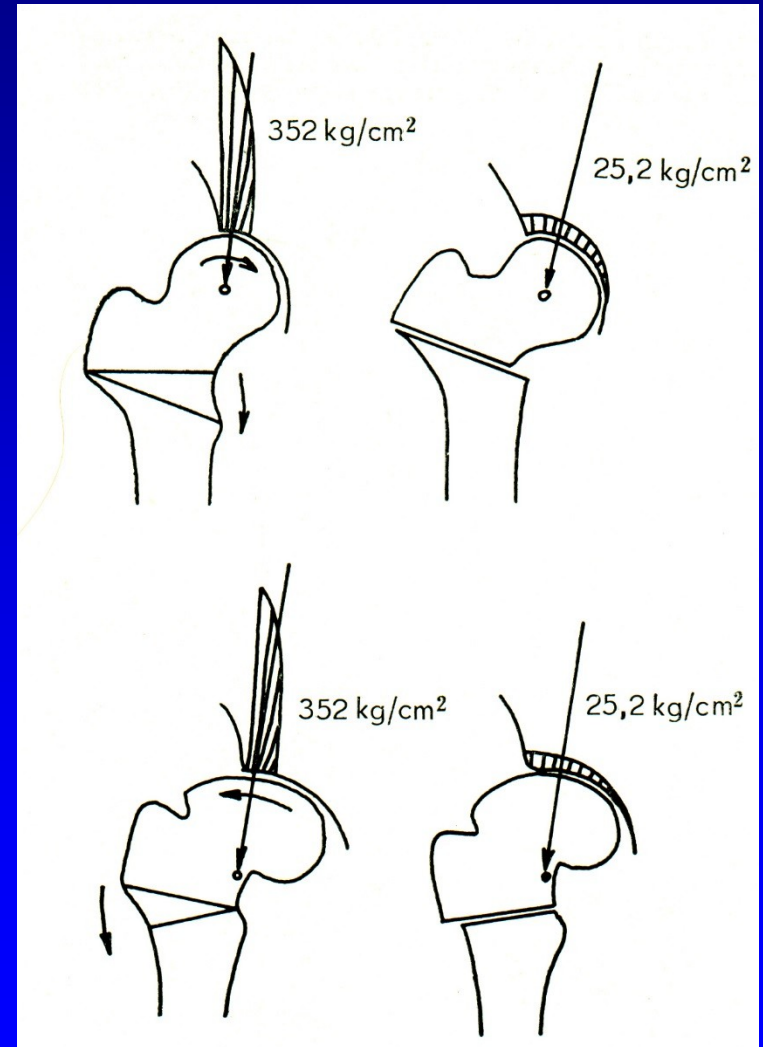
Osteotomy of the pelvis

- Capsular arthroplasty
- Shelf procedure
- Osteotomy-
- Steel, Sutherland
Bernese

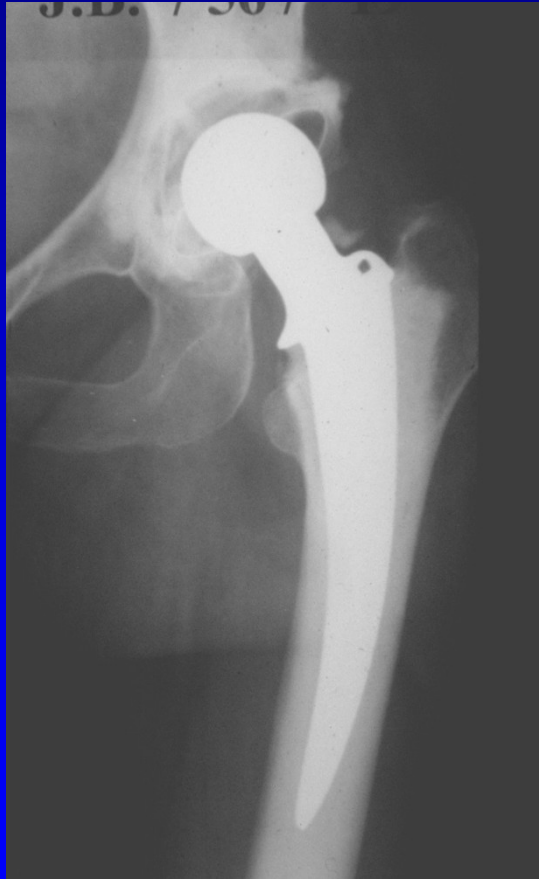


Femoral osteotomy

- Varus
- Valgus
- Derotation
- Angulation



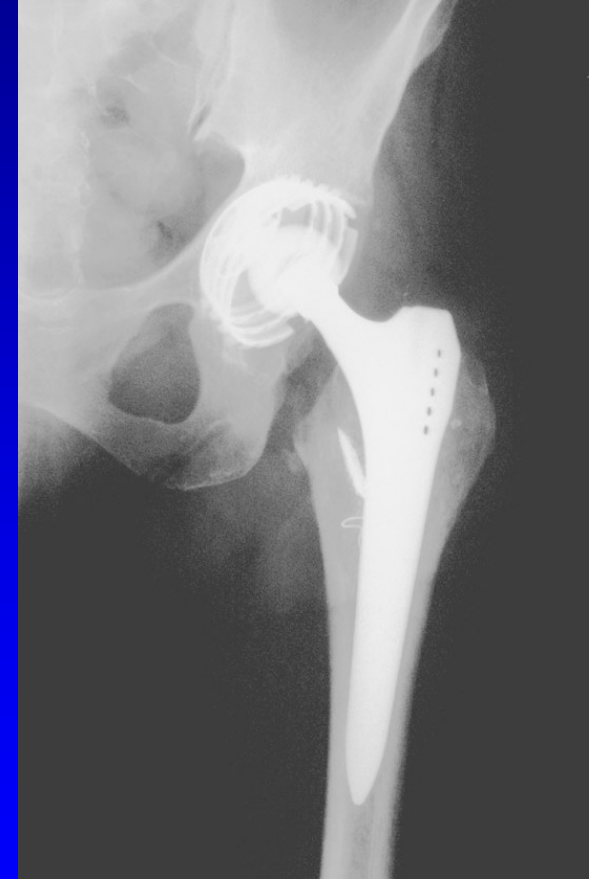
THA



Cemented

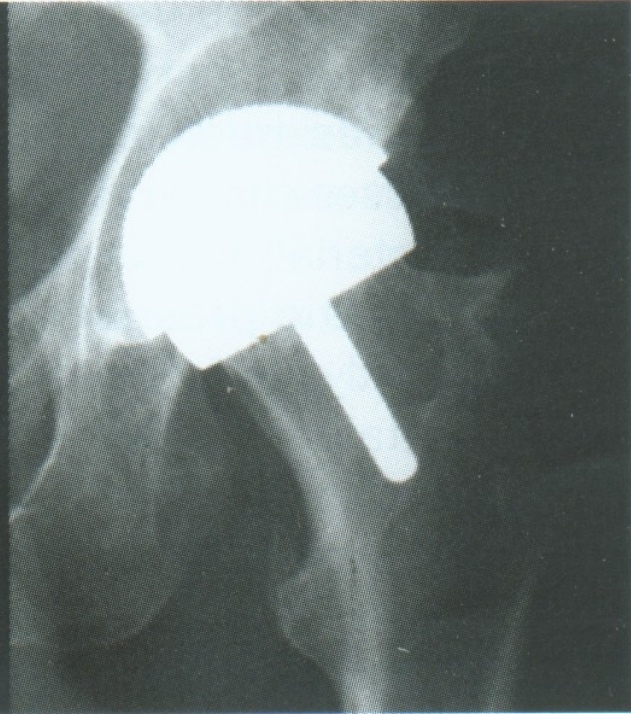
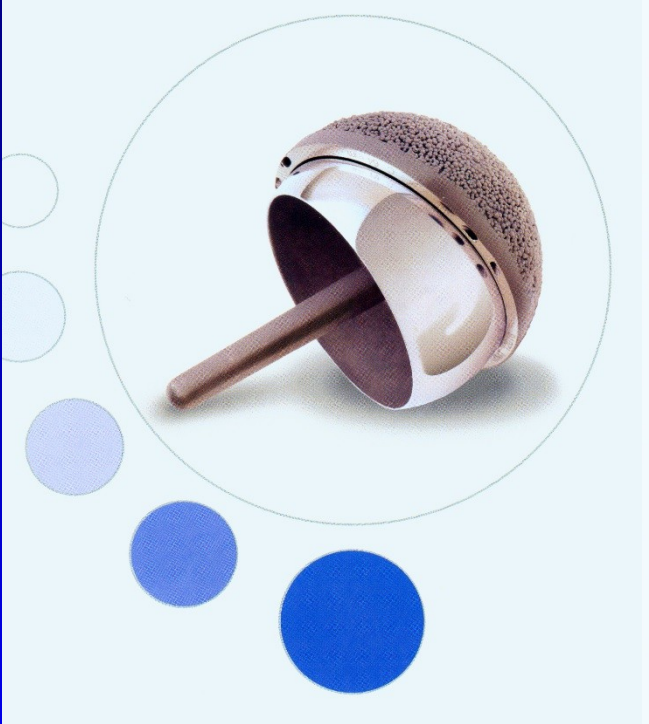


Hybrid



Uncemented

Resurfacing



Girdlestone procedure



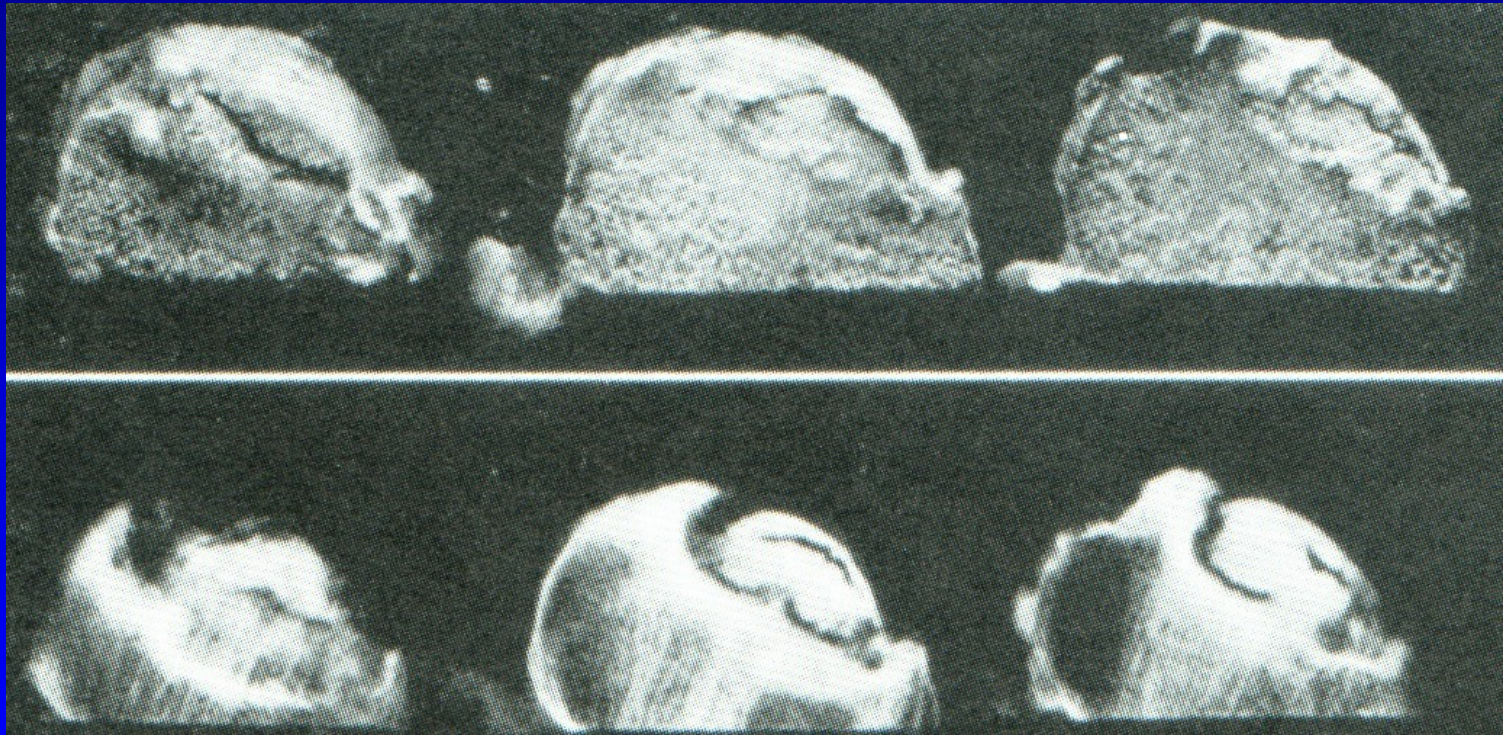
Idiopathic avascular necrosis of femoral head

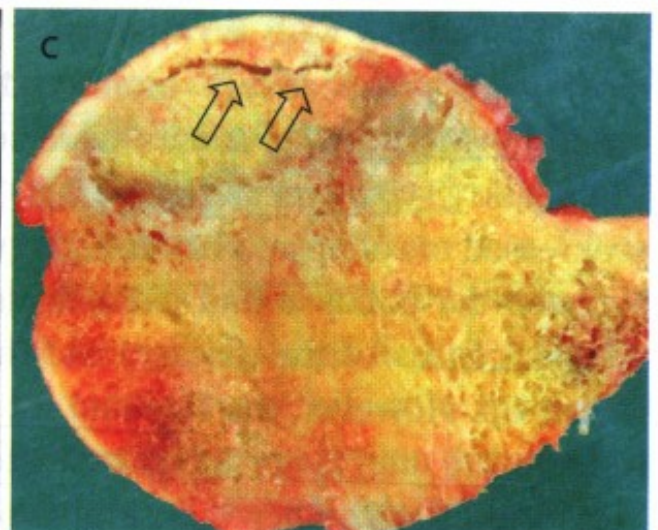
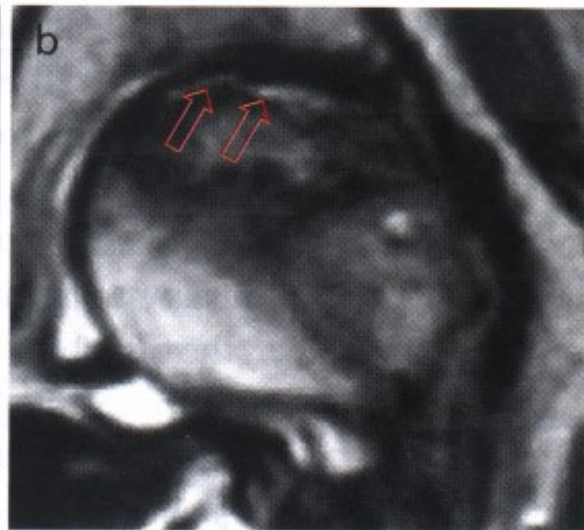
- Male 20-40 years
- Progressive pain
- X-ray CT, MRI, scintigrafie
- **Etiology** – unknown, coagulopathy, radiation, corticoids, alcoholic



Pain
Limited movements
Impaired gait

Idiopathic avascular necrosis of femoral head

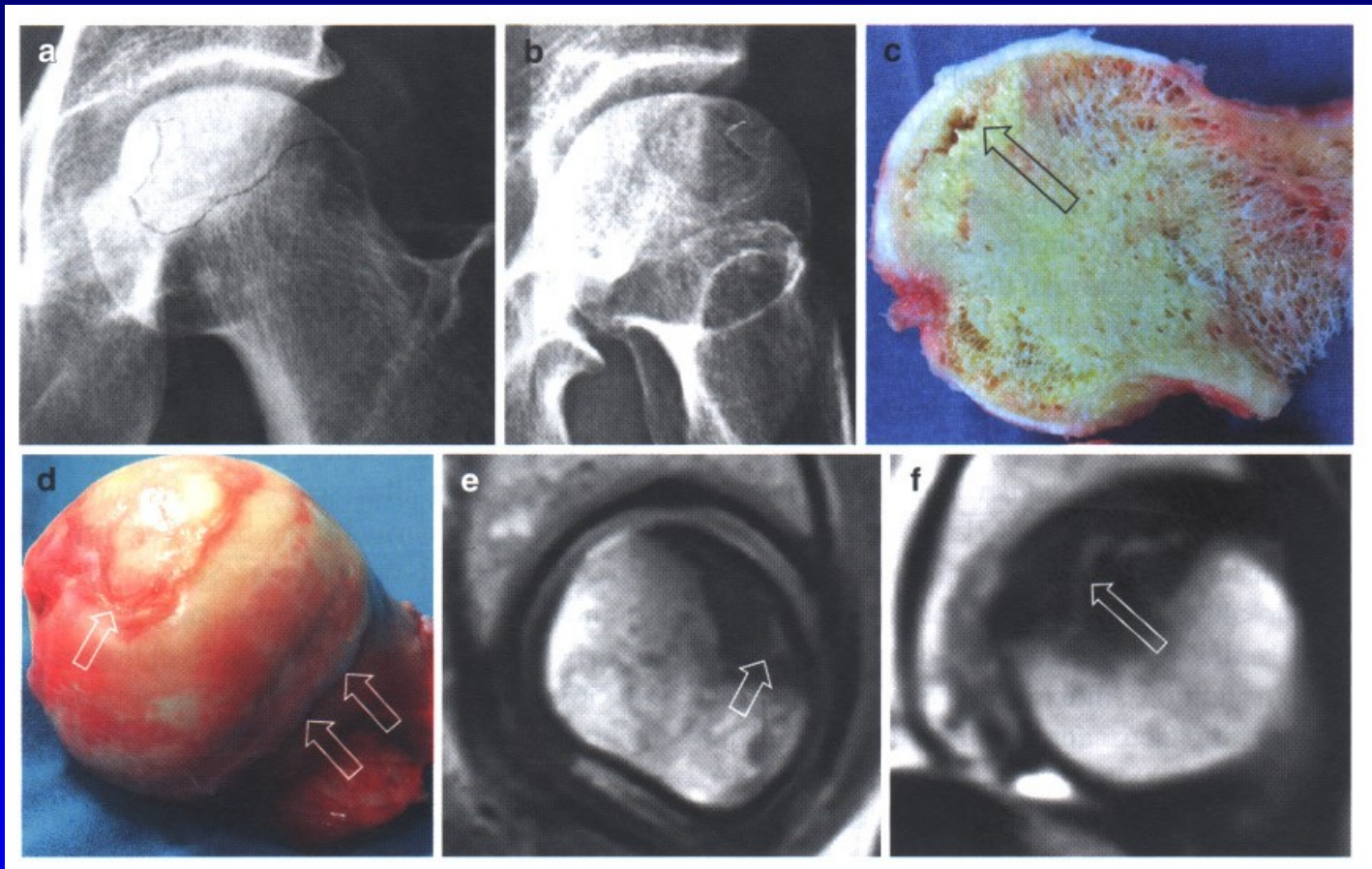




X ray

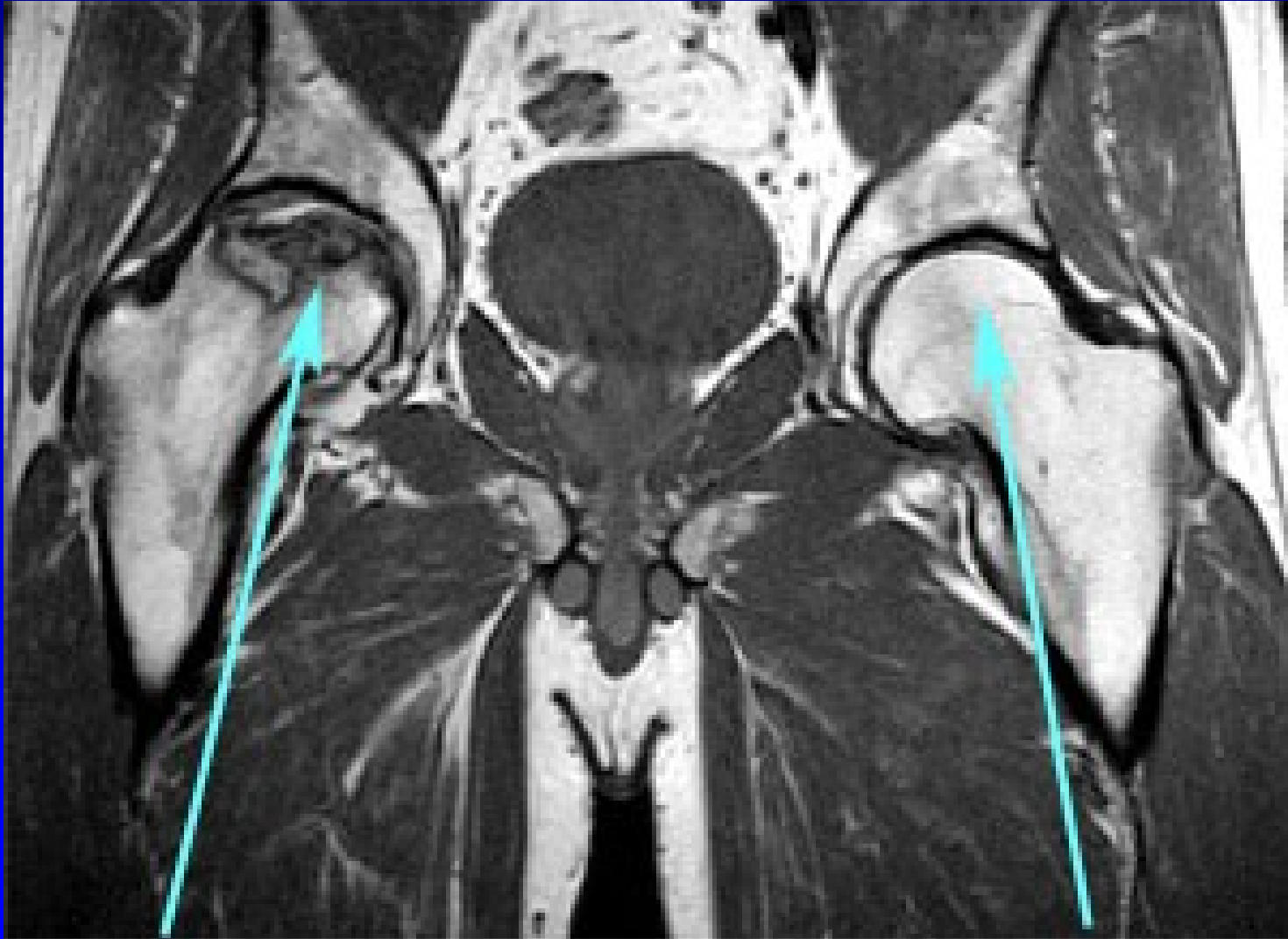
MRI

Excised head



Subchondral fracture

MRI- idiopathic avascular necrosis of femoral head

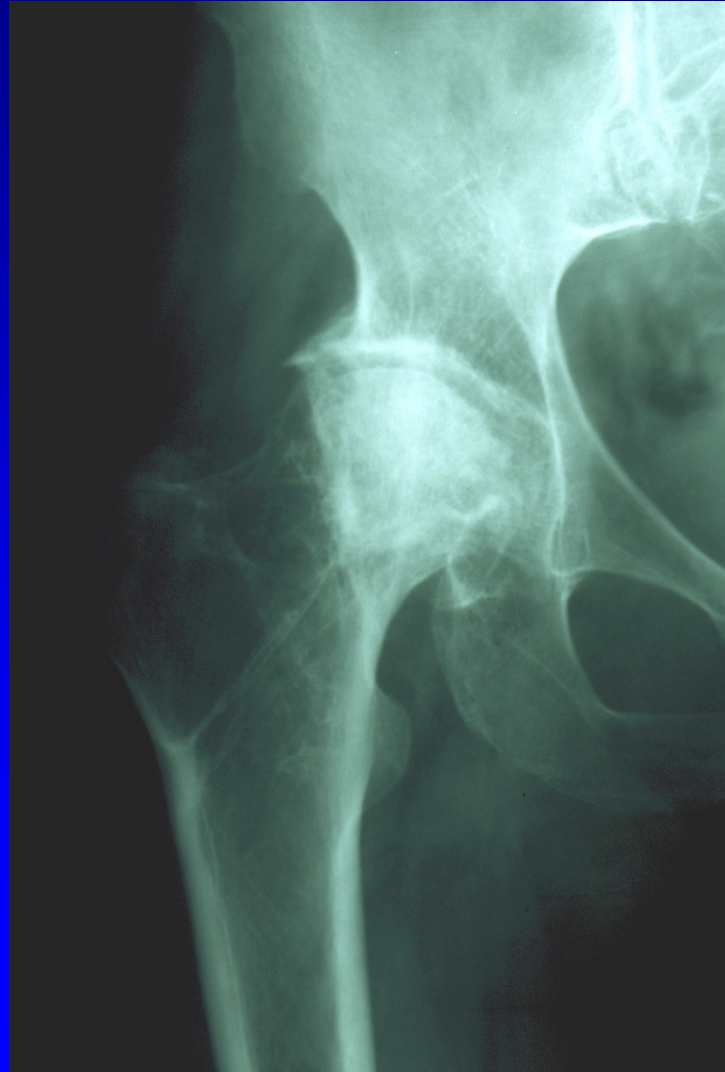


Idiopathic necrosis of the femoral head



Obr. 7

Necrosis after femoral neck fracture



Obr. 9

Management

Non weight bearing

Forrage

Curretage , bone grafting

Fibular graft

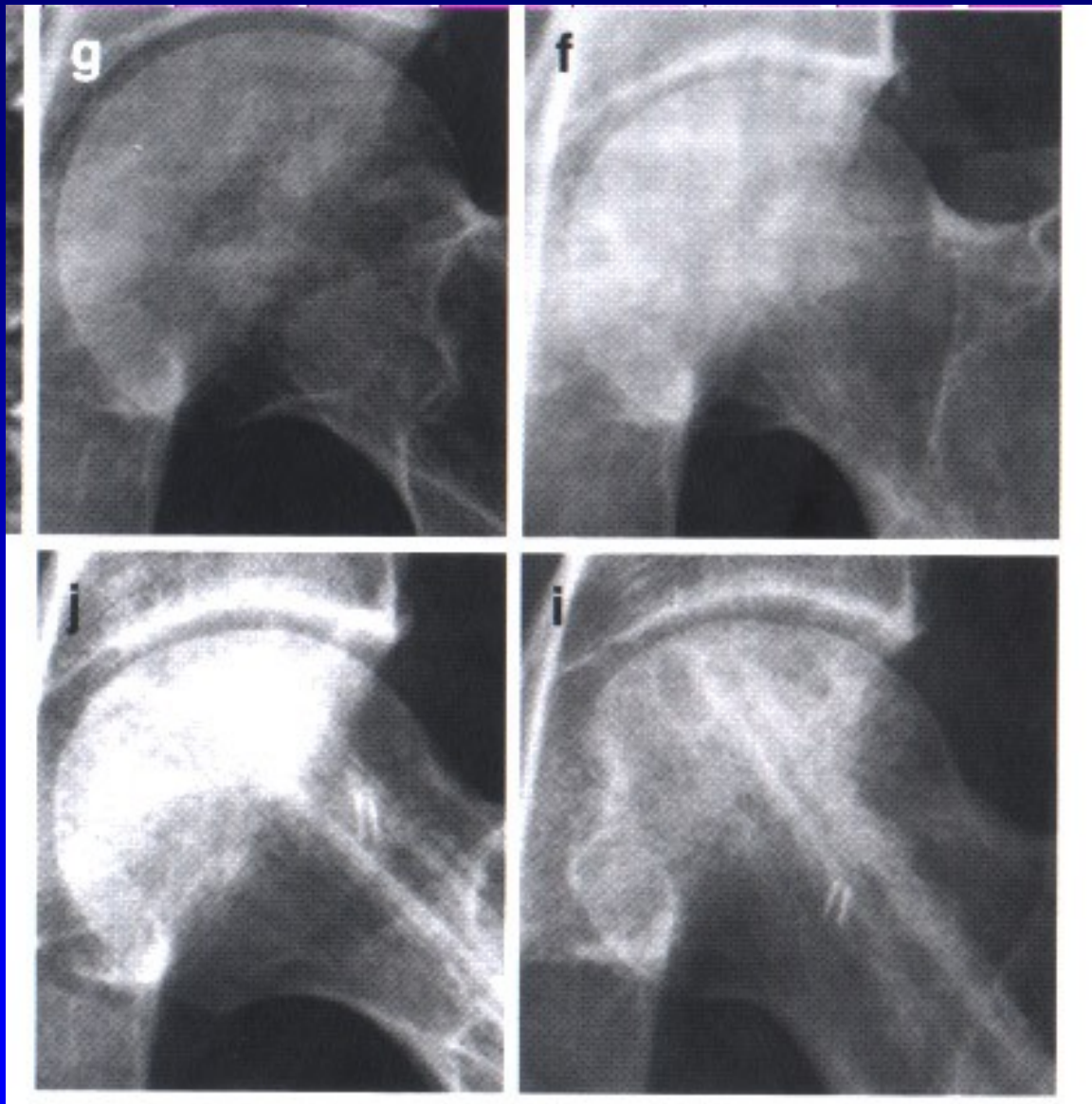
Graft from greater trochanter

Osteotomy

Tantal rods

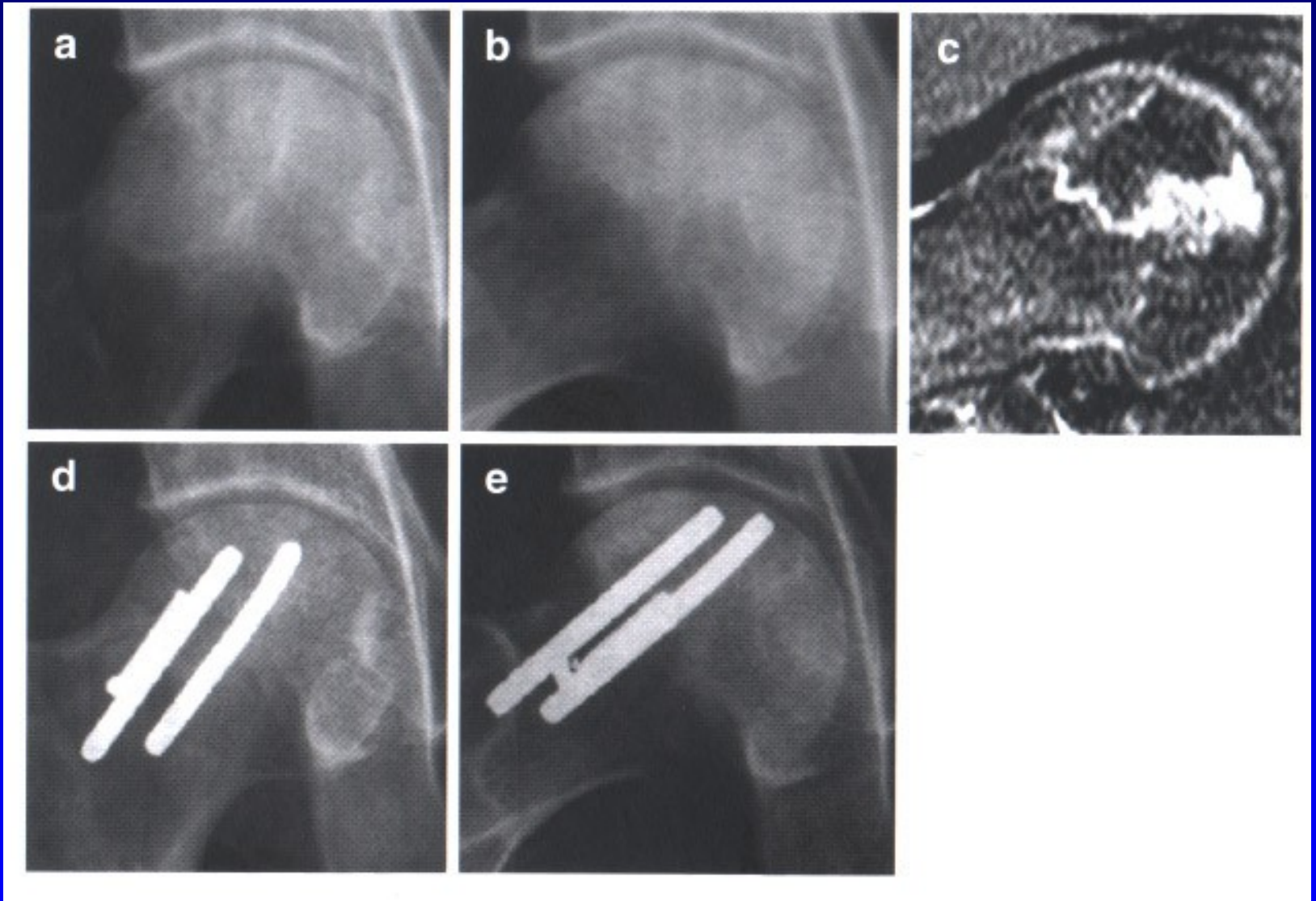
Hyperbaric chamber

THR



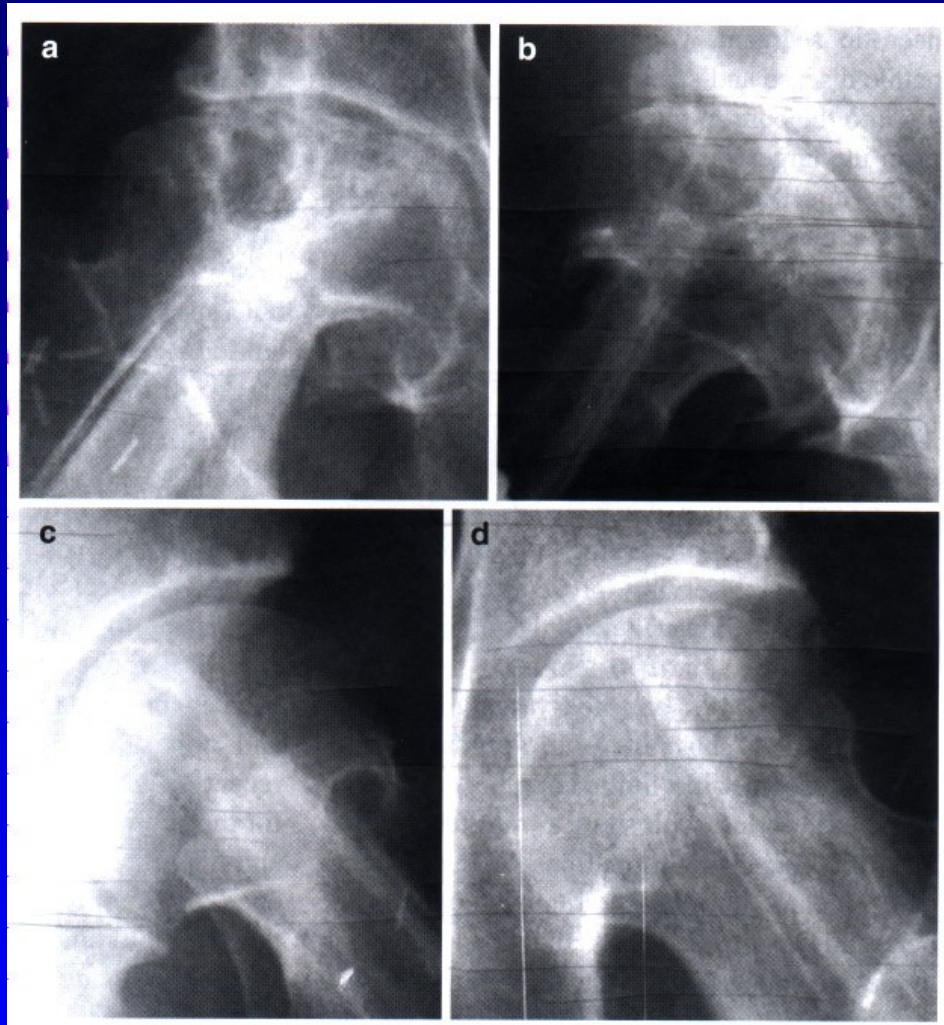
Preop.

Vascular fibular graft, 5 y. postop.



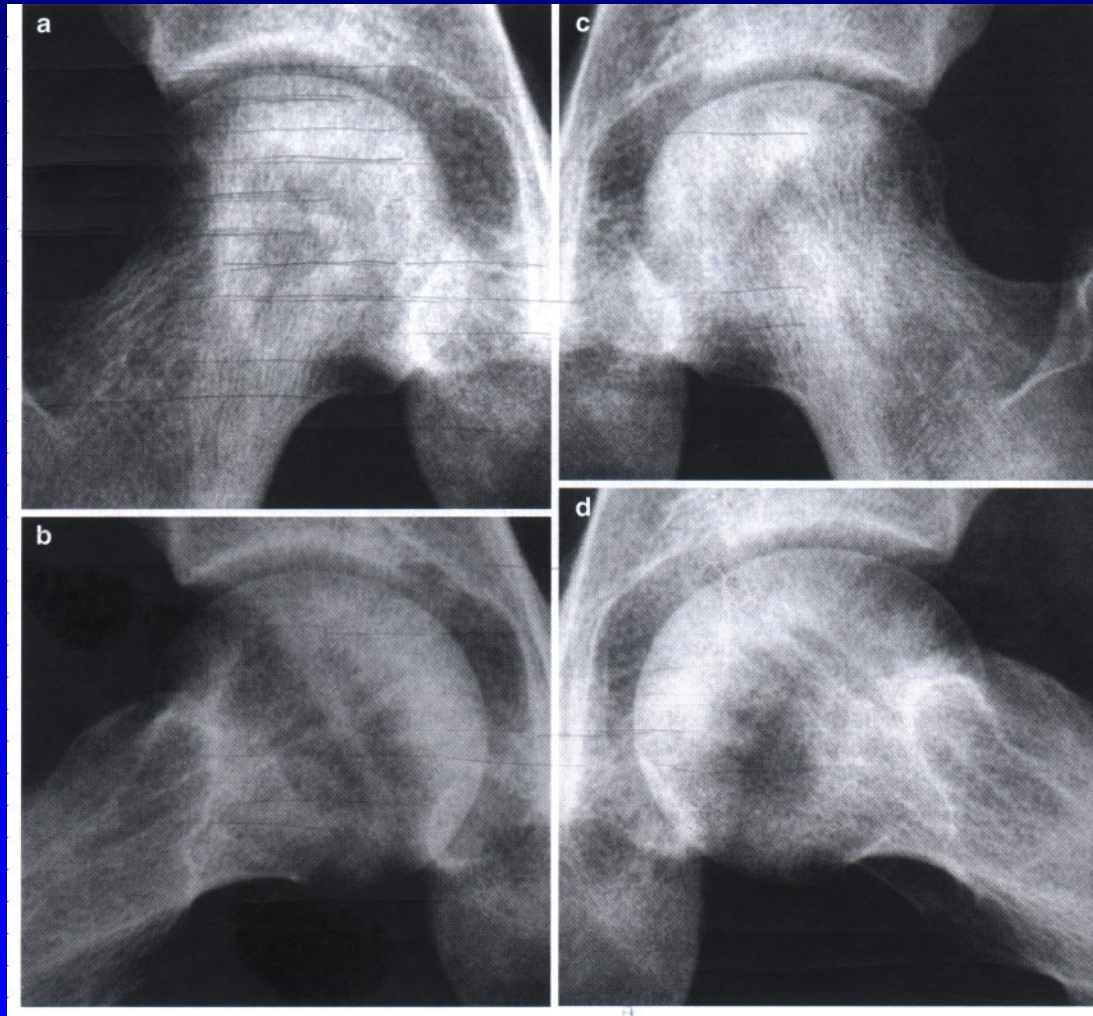
Tantal rods , 4 y. postop.

11 y. postop.
refuses THA



10 y. postop.
Asymptomatic.

Vascular fibular graft



LED, percutaneous drilling with Steinman pin

Synovitis

- Overloading
- Decompensated O.A.
- R.A.
- During or after infection disease

Idiopathic protrusion of the acetabulum

- X ray changes in childhood
- Slowly limited movements
- Several synovitis
- Secondary O.A.

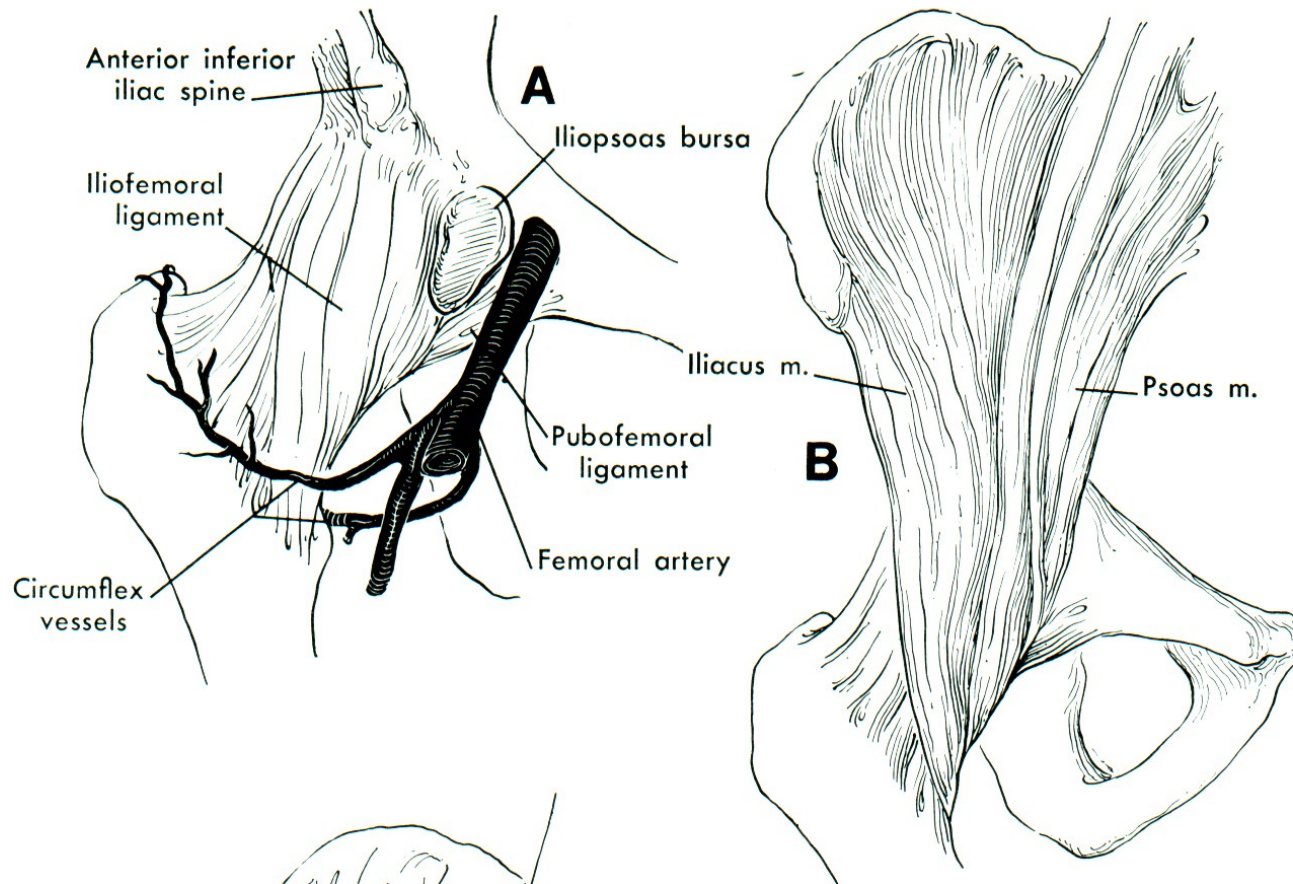
- Therapy: conservative, THR



Bursitis

- Greater trochanter bursitis
- Iliopectineal bursitis
- Ischial bursitis
- Dg.- clinical, USG, X.ray
- Th.- NSAID, local corticoids, surgery

Bursa ileopectinea

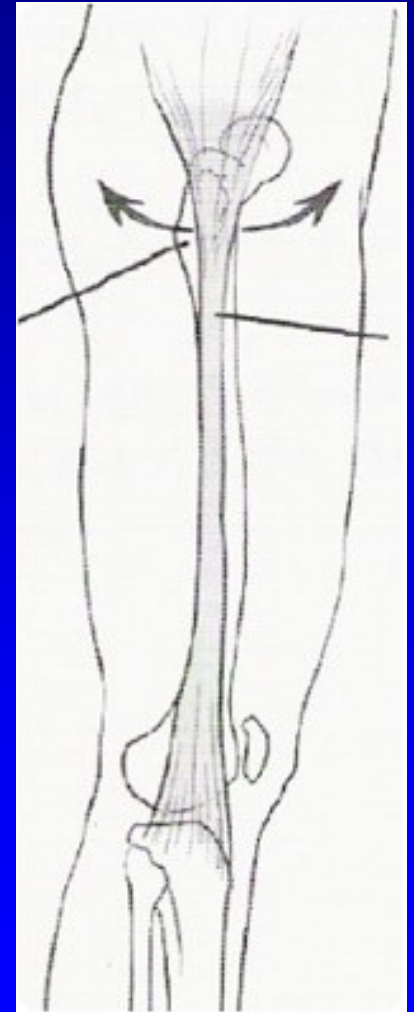


Entesopathies

- Adductors
- Abductors
- Spina iliaca ant. inf.
- Hamstrings - tuber ossis ischii
- Iliopsoas – lesser trochanter
- Painful groin- gracilis syndrom

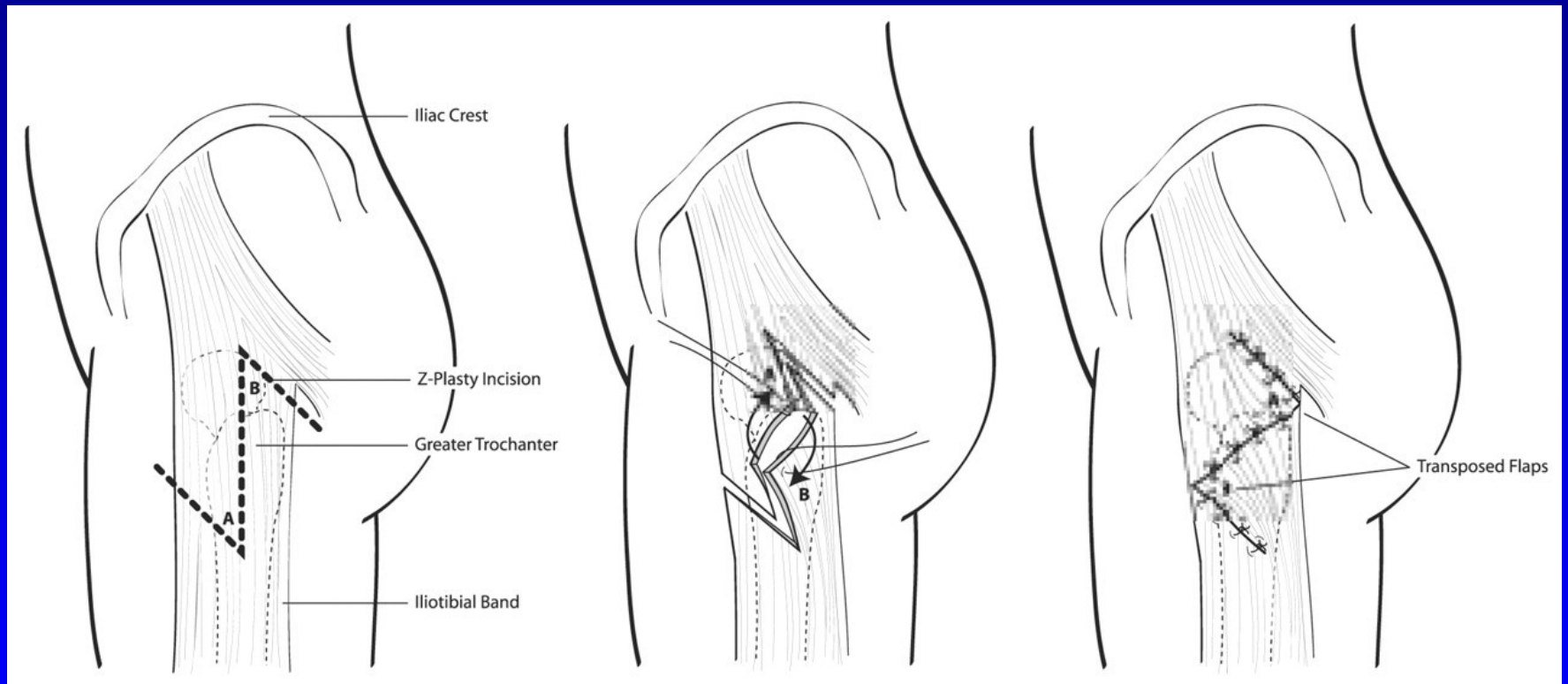
Snapping hip

- Pain during gait
- Snapping of the hip
- Thickening of tensor fascia lata
- Surgery: Z- plasty
- Diff. dg.- FAI, osteochondroma..



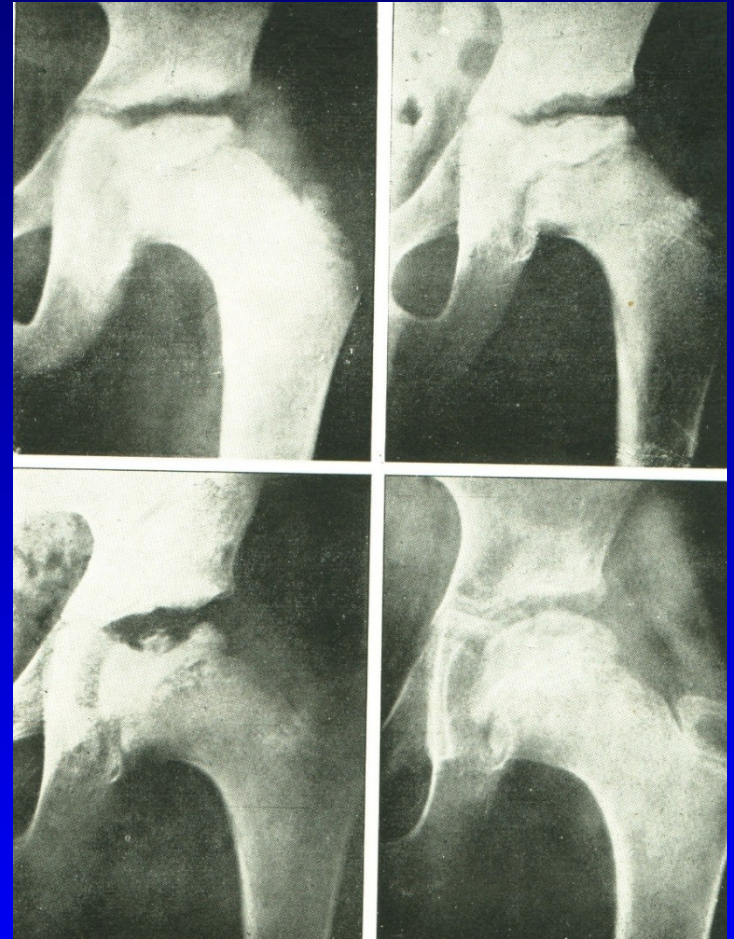
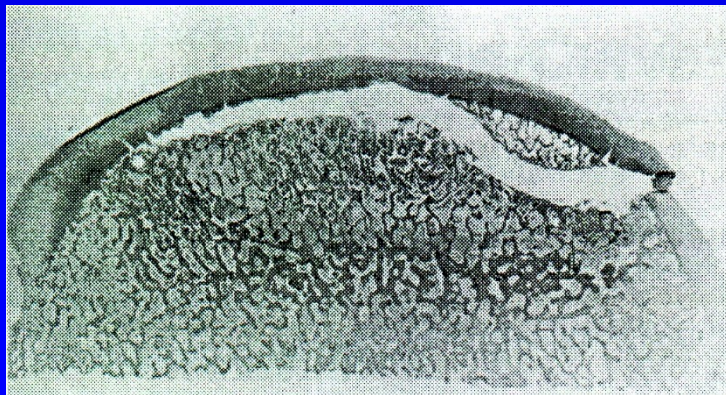
Snapping hip

- surgery



Perthes disease

Ischemia of the whole epiphysis
Articular cartilage continues to grow
Bone is resorbed and replaced by woven bone
The bone is soft and vulnerable
Subchondral fracture
- shows the extent of damage
New bone is gradually revascularised
New bone is plastic-
can be deformed



Subchondral fracture
of femoral epiphysis

M. Perthes

1. Ischemic stage: avascular necrosis
growth arrest of epiphysis
revascularisation from periphery
ossification
2. Ischemic stage: trauma, subchondral fracture
resorption under the fracture
replacement by plastic woven bone
subluxation, deformity

Catterall classification

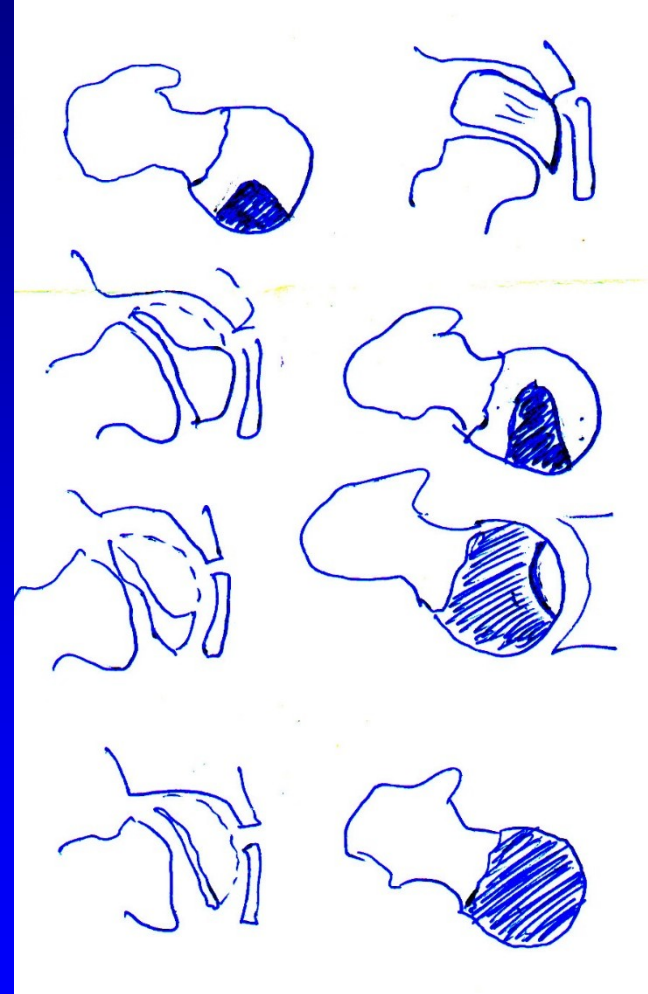
I. 25 %

II. 50 %

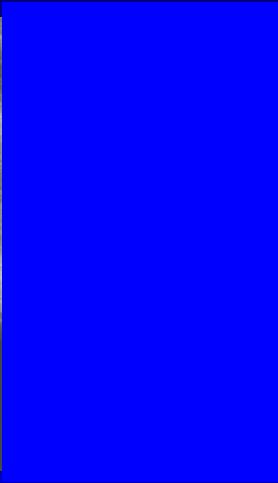
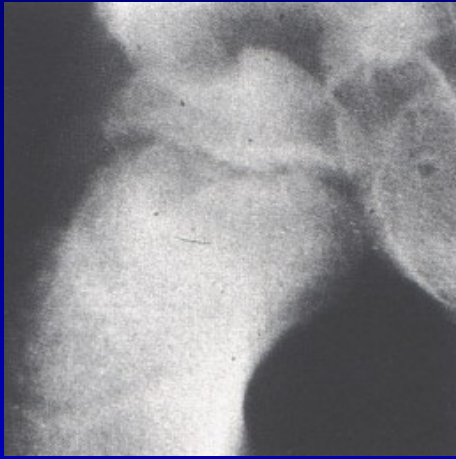
med.- lateral column

III. 75 %

IV. 100 %

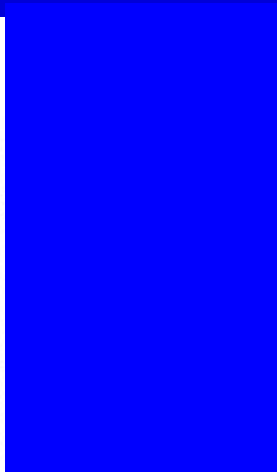


Obr. 7



Catterall I

Obr. 8



Catterall II

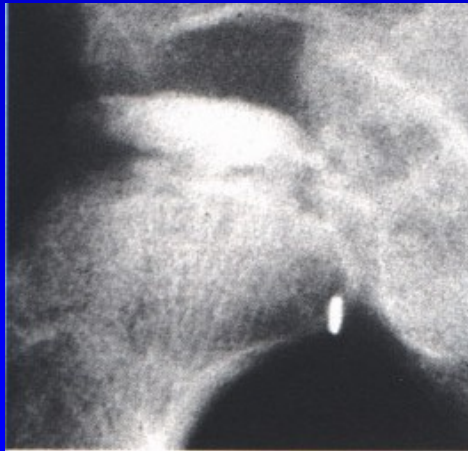
Obr. 9



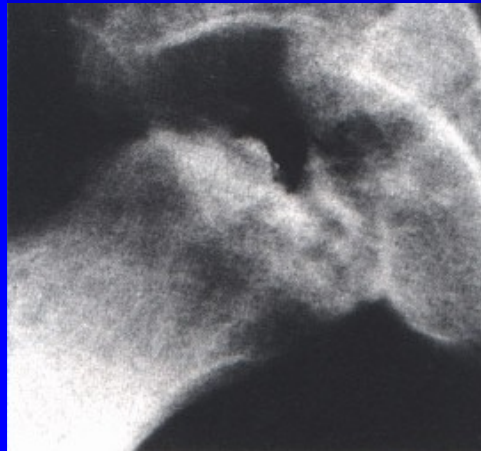
Obr. 10



Catterall III



Obr. 11



Catterall IV

Stage



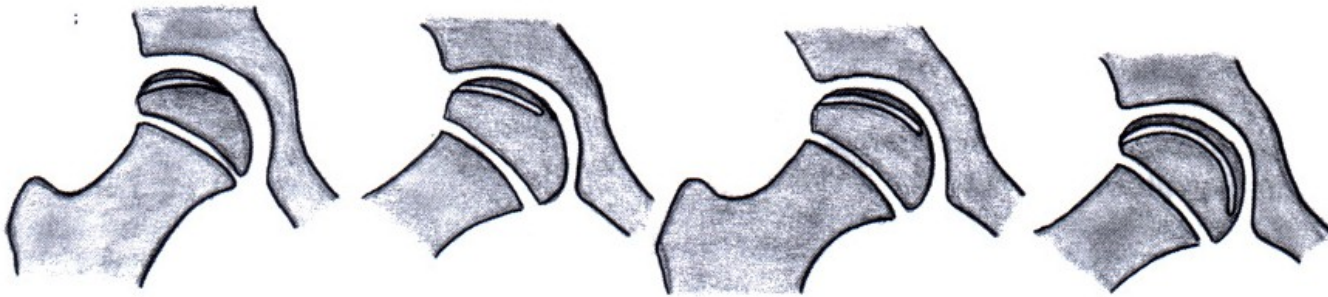
a I.

b II.



c III.

d IV.



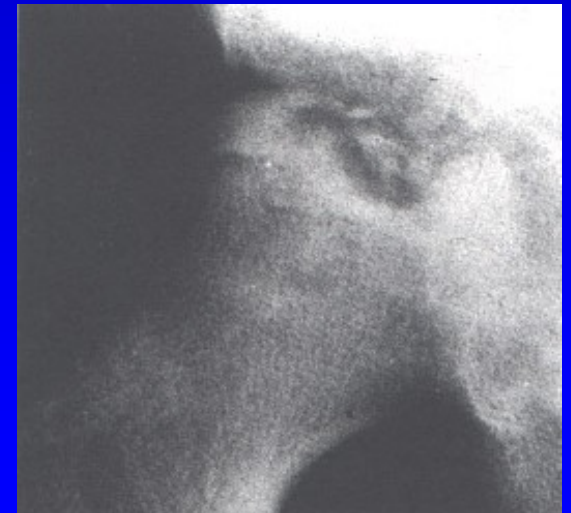
Subchondral
fx

Salter classification

- A Catterall I. a II.
less than one half of the epiphysis
short subchondral fracture
lateral column intact
conservative treatment



Obr. 12



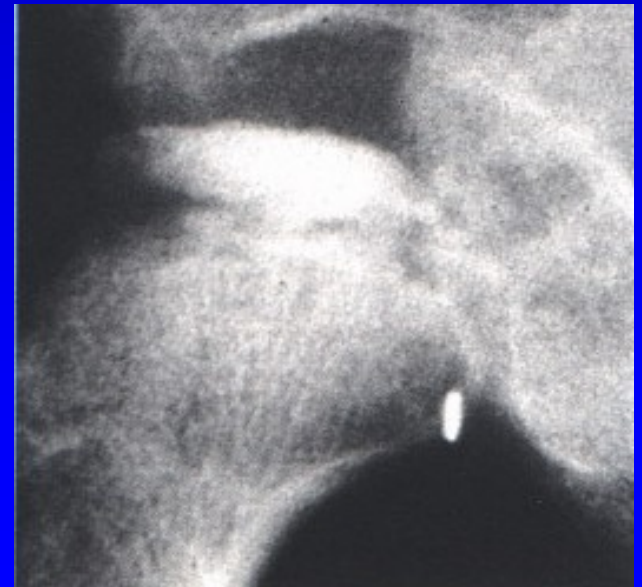
Obr. 13

Salter classification

B Cateral III. a IV.
more then one half of the epiphysis
long subchondral fracture
lateral column is absent
operative treatment

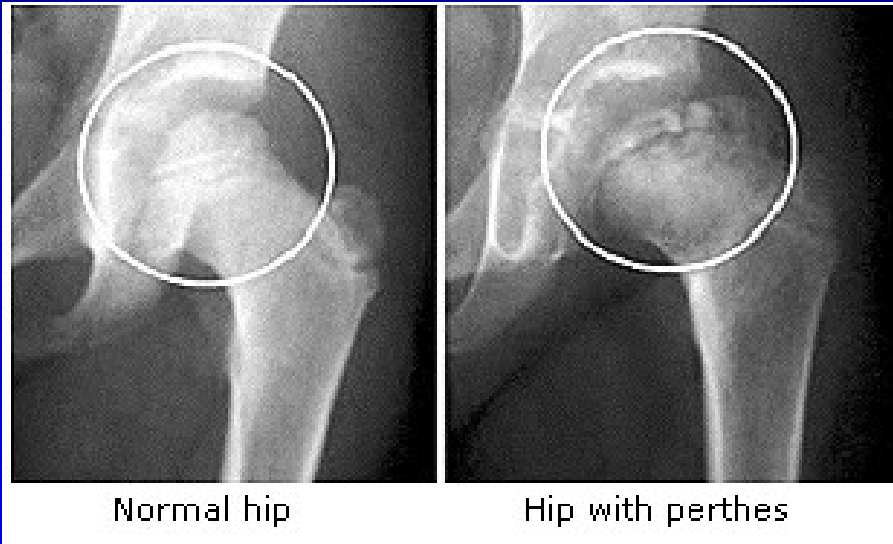


Obr. 14



Obr. 15

- **X-ray**



Examination

X-ray

Arthrography

CT - 3 D reconstruction

MRI

Scintigraphy

Ultrasonography

Prognosis

I. a II. stage	good prognosis
III. a IV. stage	wrong prognosis

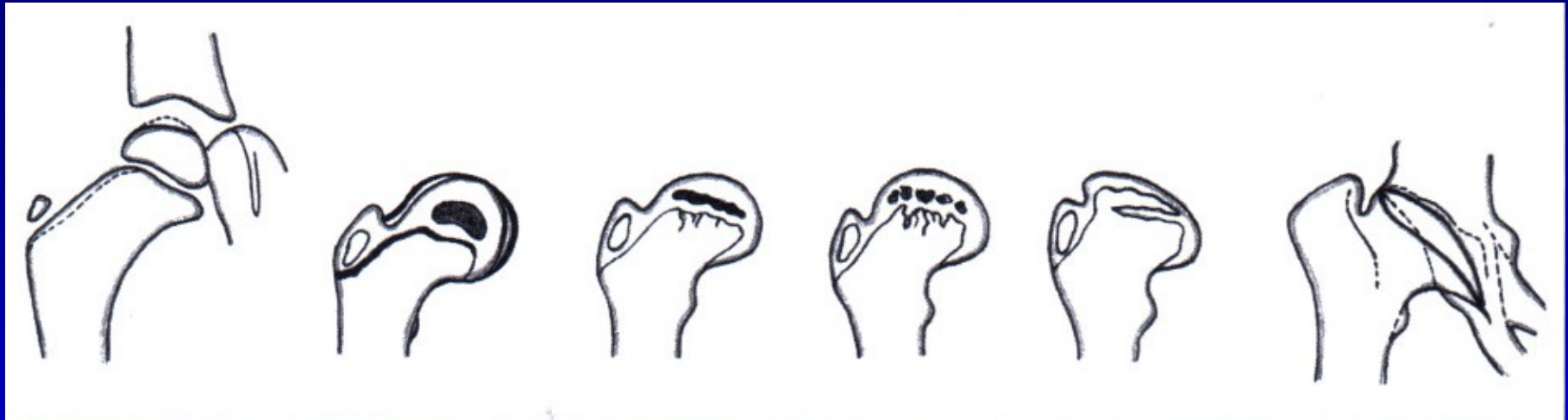
Risk factors:

Older age

Loss of containment, subluxation

Large extent

Limited movements



Types of deformity in Perthes disease

Management

- containment of the head in the acetabulum
- good range of motion

Conservative methods

- Atlanta orthosis

Operative methods

Osteotomy of the pelvis (Salter, Steel, Sutherland, Dugl)

Osteotomy of the femur

Conservative methods

Rest in bed
Nonweight bearing
Crutches
Atlanta orthosis

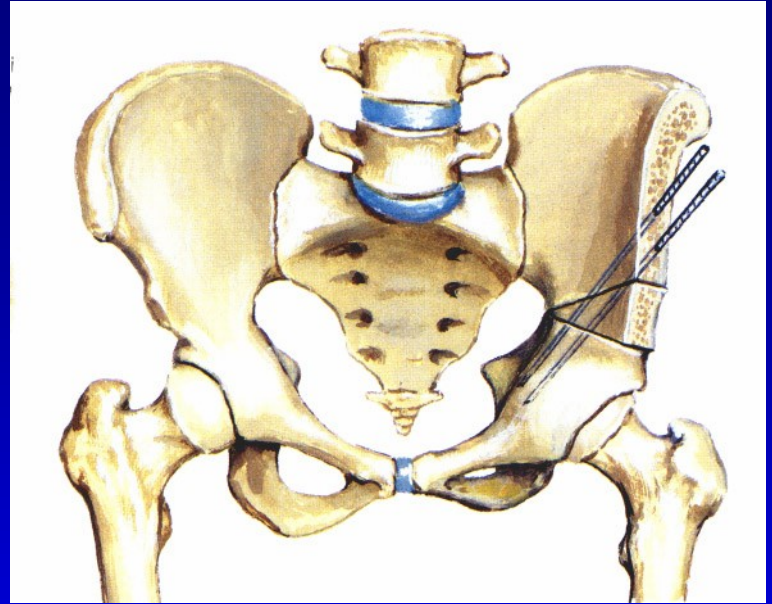


Atlanta orthosis

Operative methods

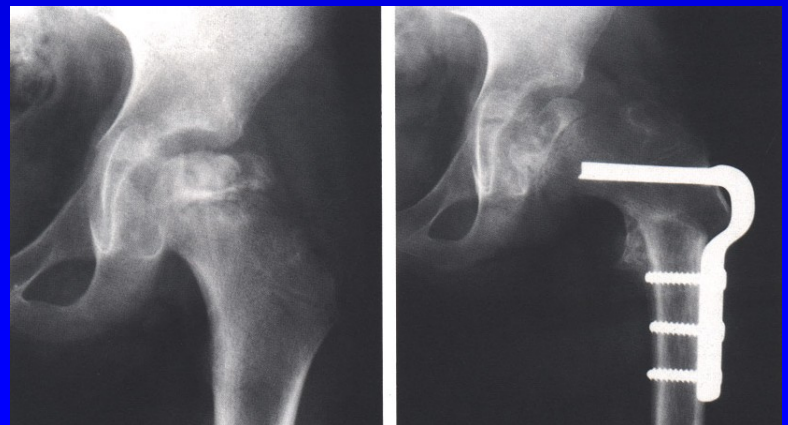
Salter pelvic osteotomy

Obr. 17

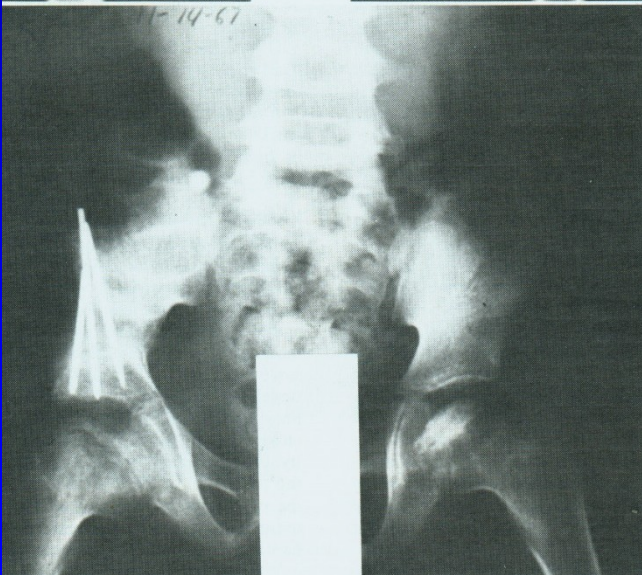
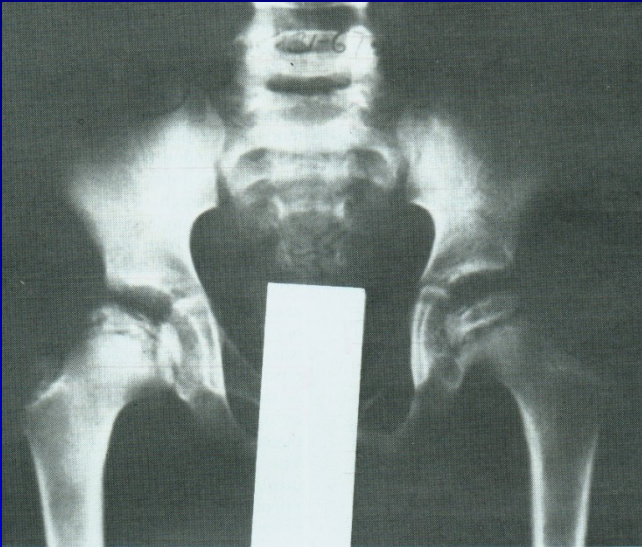


Varus osteotomy of the femur

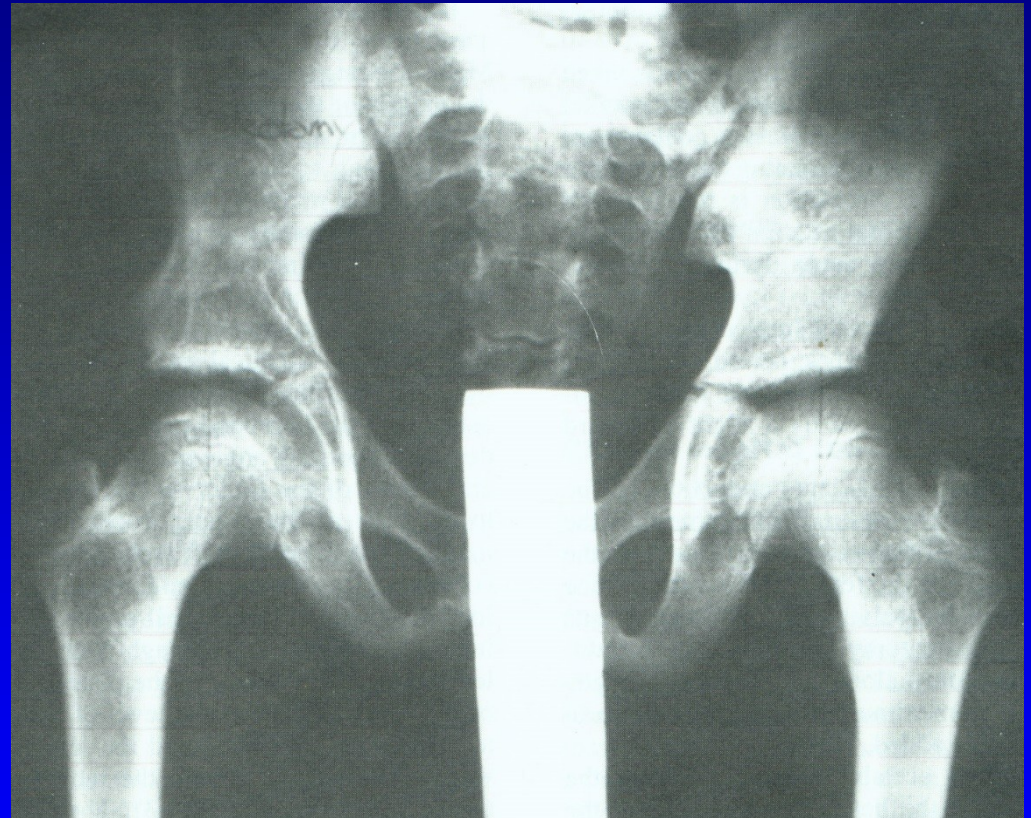
Obr. 18



Salter osteotomy



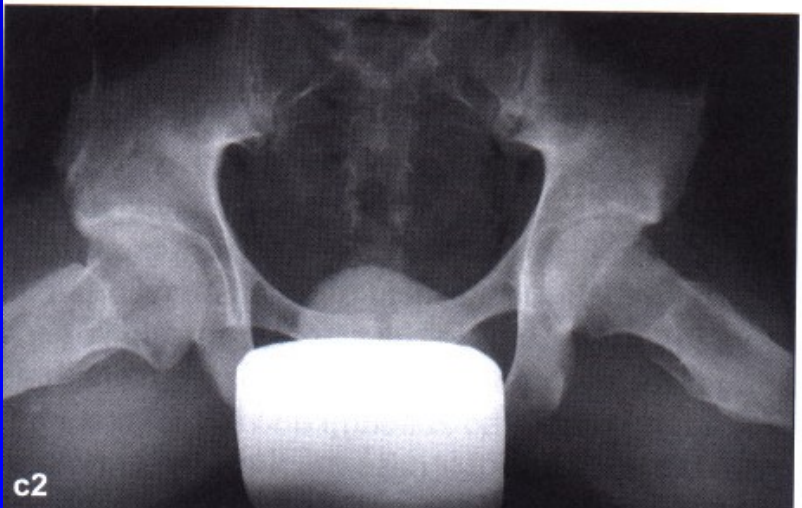
Obr. 19



Obr. 20



Perthes disease on the right hip
after Salter osteotomy
Almost normal hip
in 18 years of age



Perthes disease on the right hip
after Salter osteotomy
Almost normal hip
in 18 years of age

Consequences of Perthes disease

Coxa plana

Shortening of the leg

Limited movements

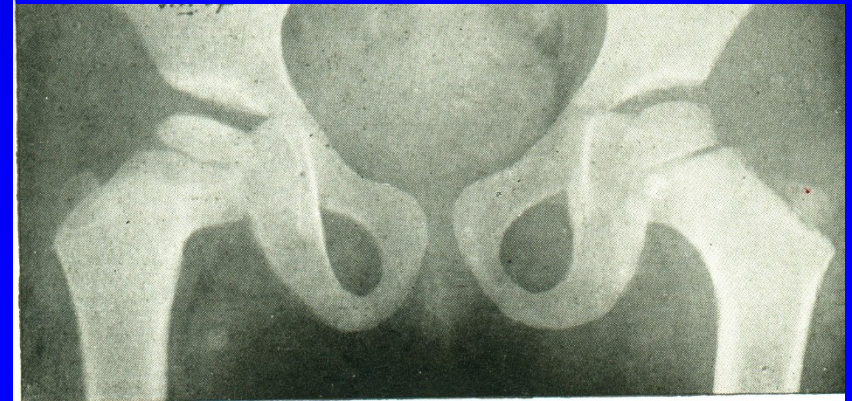
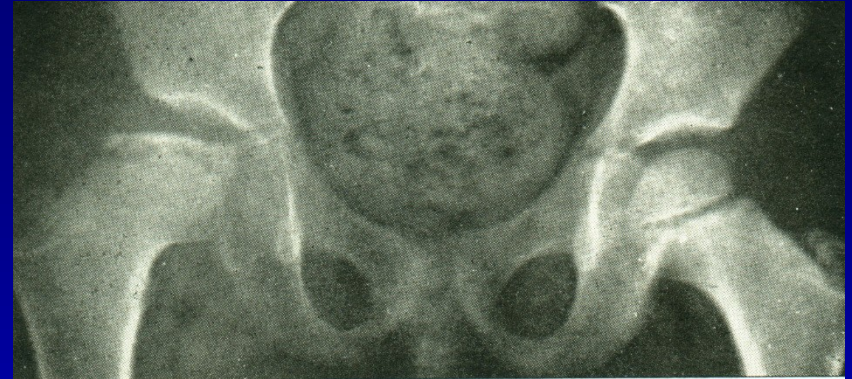
Early osteoarthritis

Better prognosis

Younger age

Less extent of damage

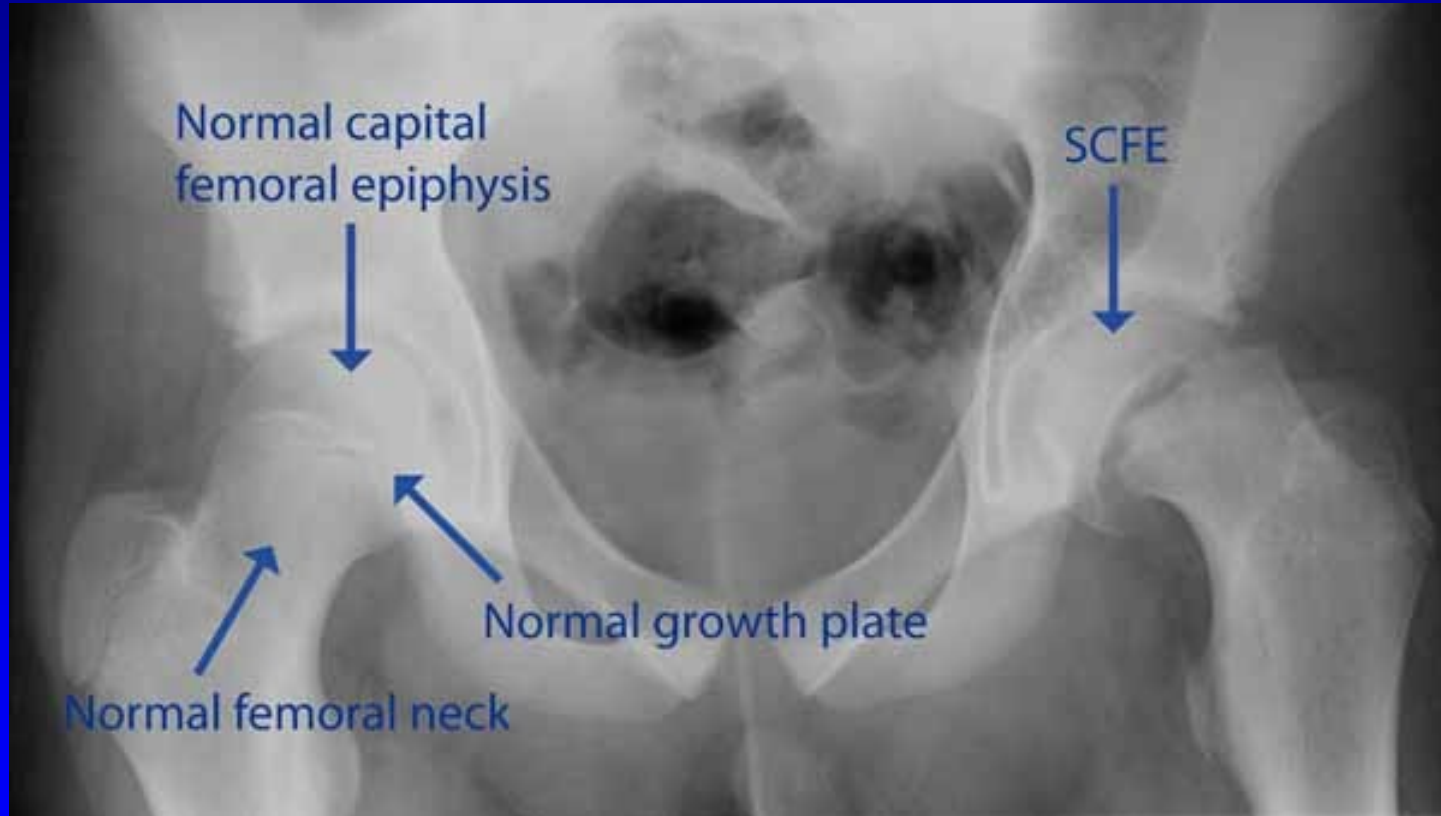
No subluxation



Condition after Perthes disease



Slipped upper femoral epiphysis

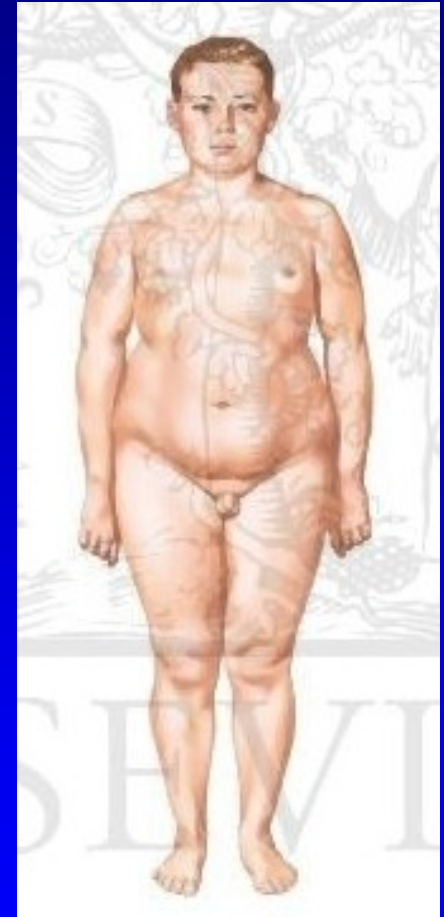
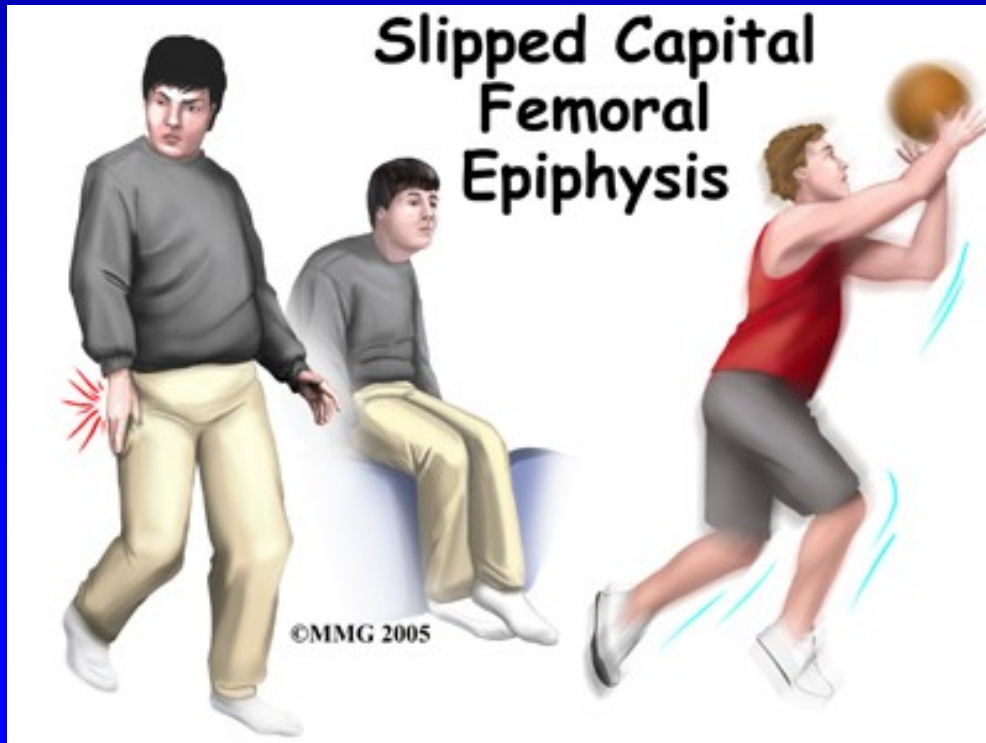


- **Etiology**

- **Obesity**

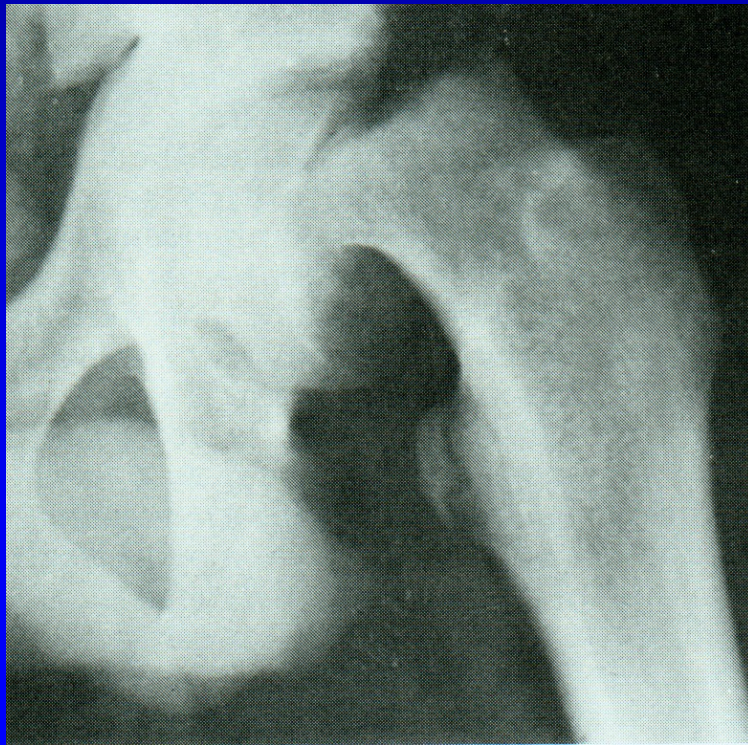
- **Hormonal changes**

- **Habitus adiposogenital, eunuchoid**



Slipped upper femoral epiphysis

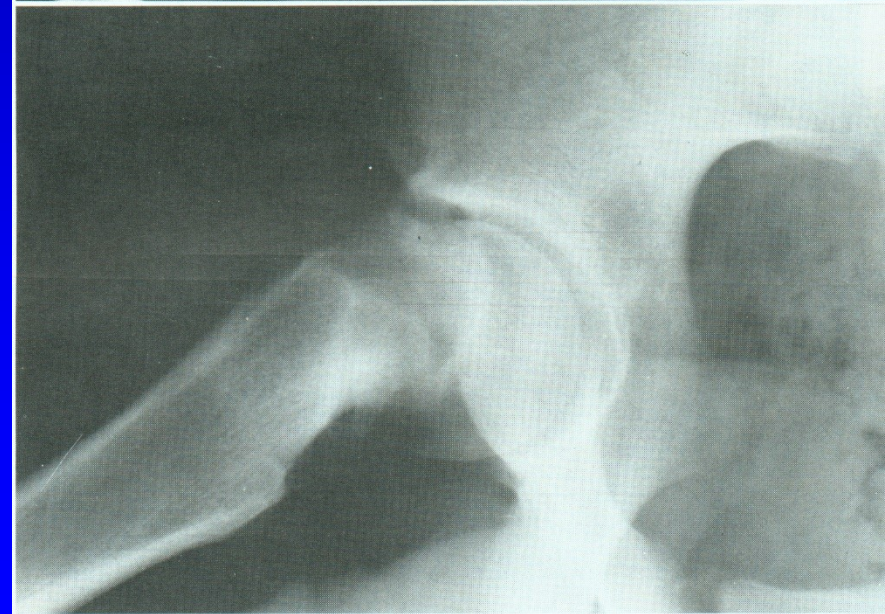
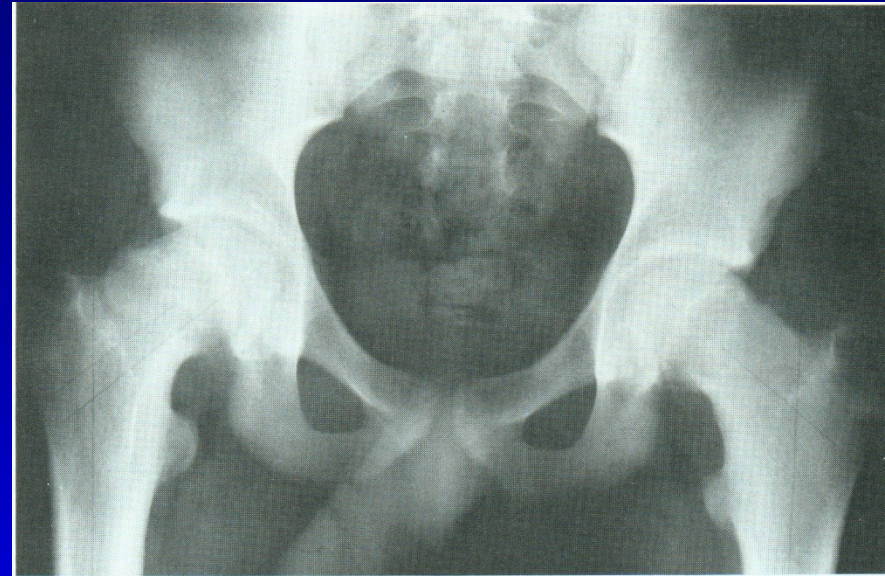
Growth plate of proximal epiphysis
of the femur is weak and soft



Slipped upper femoral epiphysis

Slipping of epiphysis
down and backwards
to varus and to retroversion

Metaphysis goes proximally
and to external rotation



Symptoms

Pain in groin and in the thigh

Limping

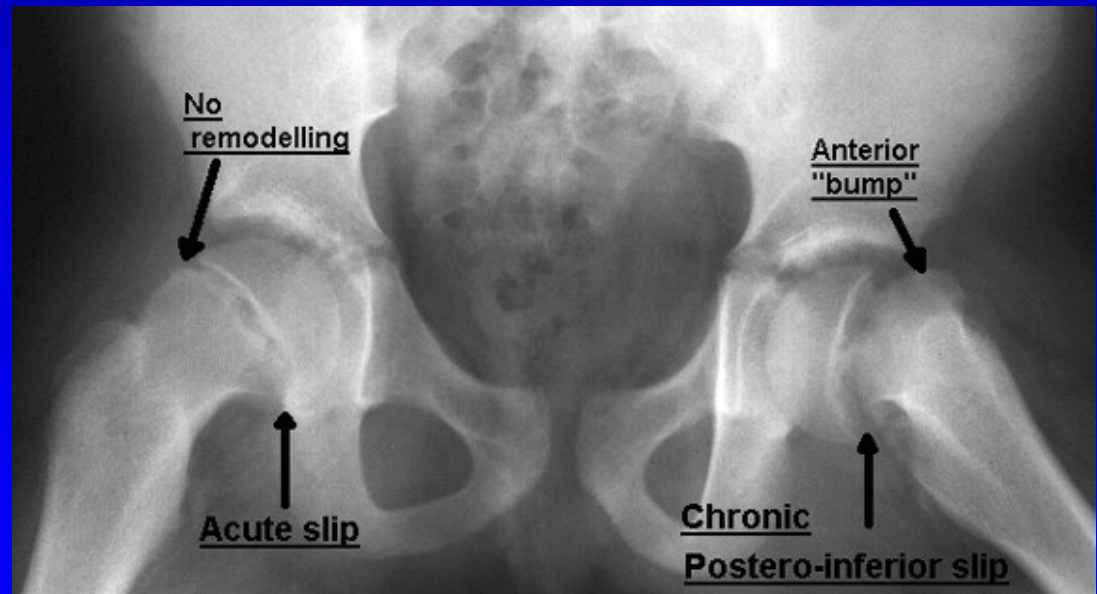
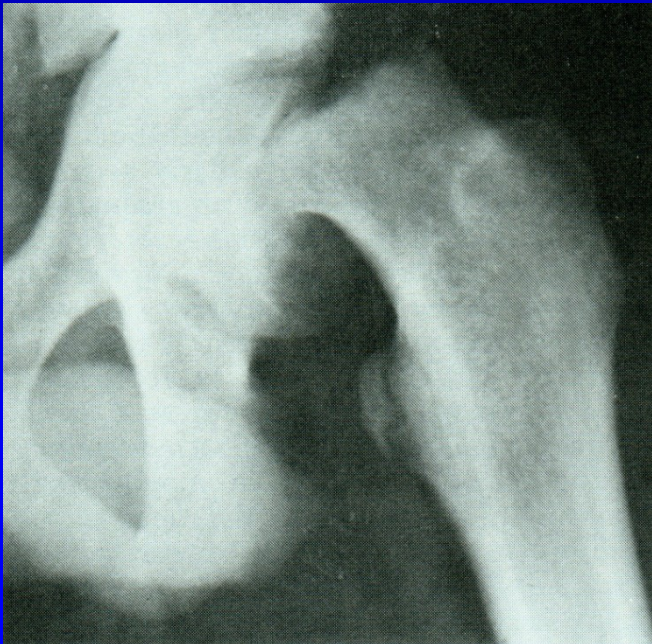
Shortening of the leg

Limited abduction and external rotation

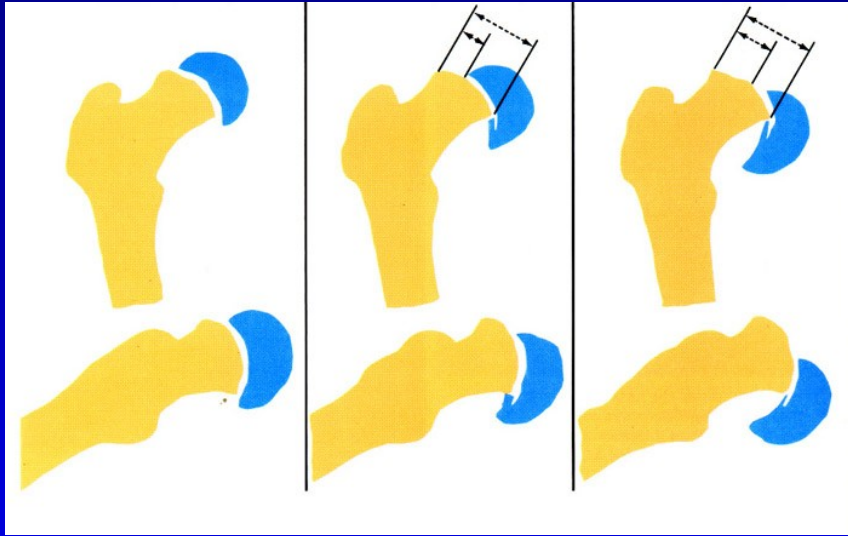
Positive Trendelenburg sign

Types

1. Preslip (6%)
2. Acute slip (11%)
3. Chronic slip (after two weeks, 60 %)
4. Acute slip on chronic slipping (23%)



Stages



Slight: slip up to 30%

2. Moderate : slip 30-60 %

3. Severe: slip above 60 %

1.

2.

3.

Management

Fixation in situ (K wires, Knowles pins)

Closed reduction and K wires

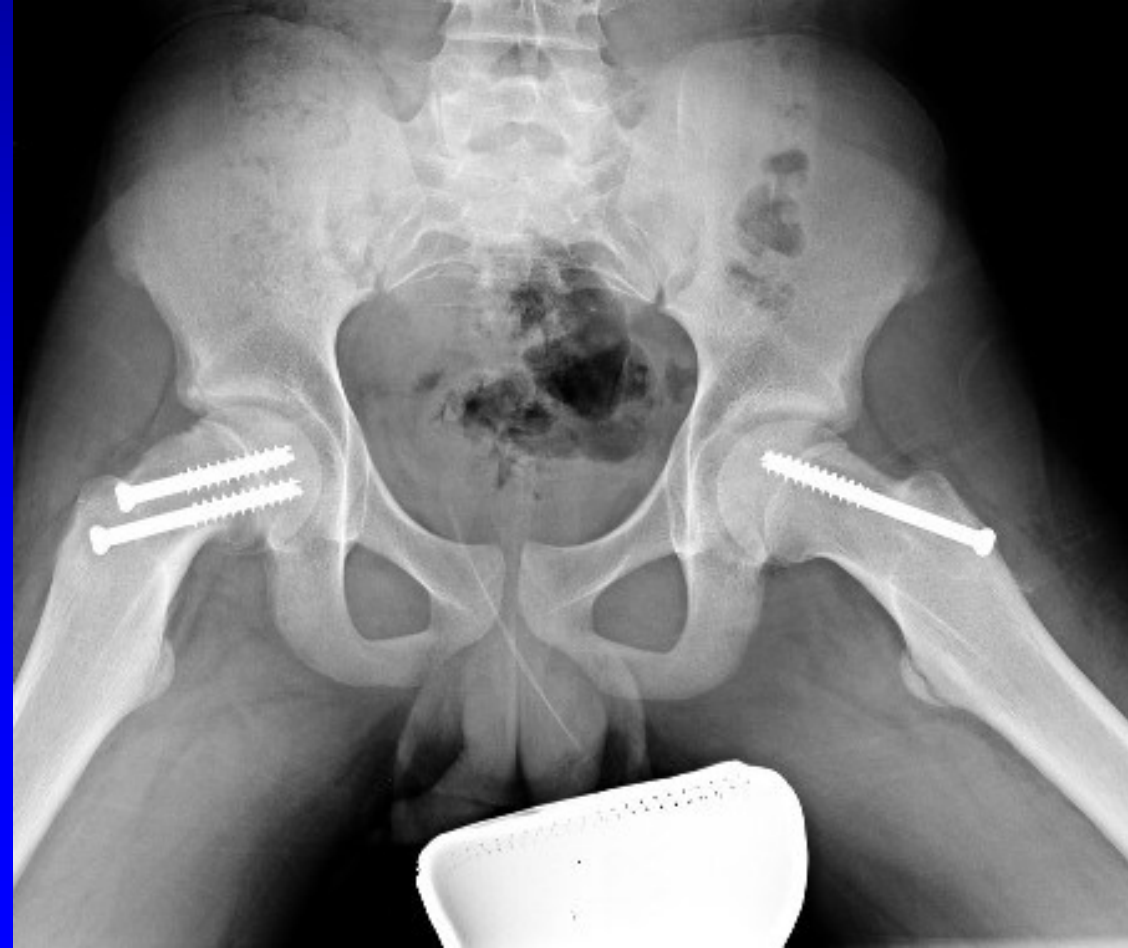
Open reduction

Osteotomy of proximal femur -
Southwick, Imhäuser-Weber

Acute slip

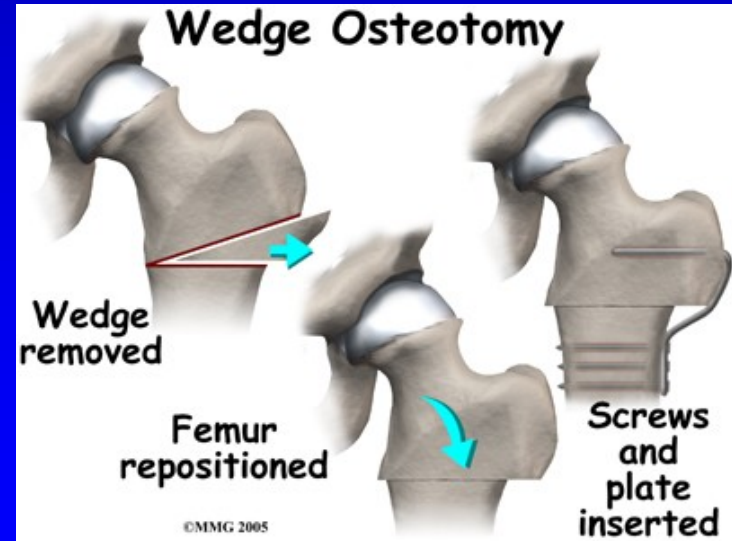
up to 30°– in situ pinning / epiphyseodesis

over 30°– reduction, in situ pinning / epiphyseodesis

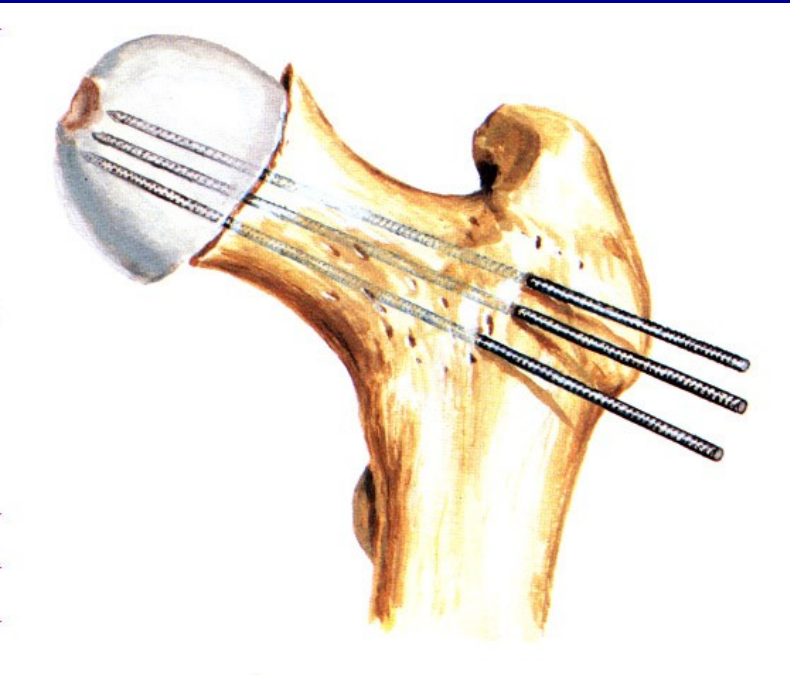


– Chronic slip

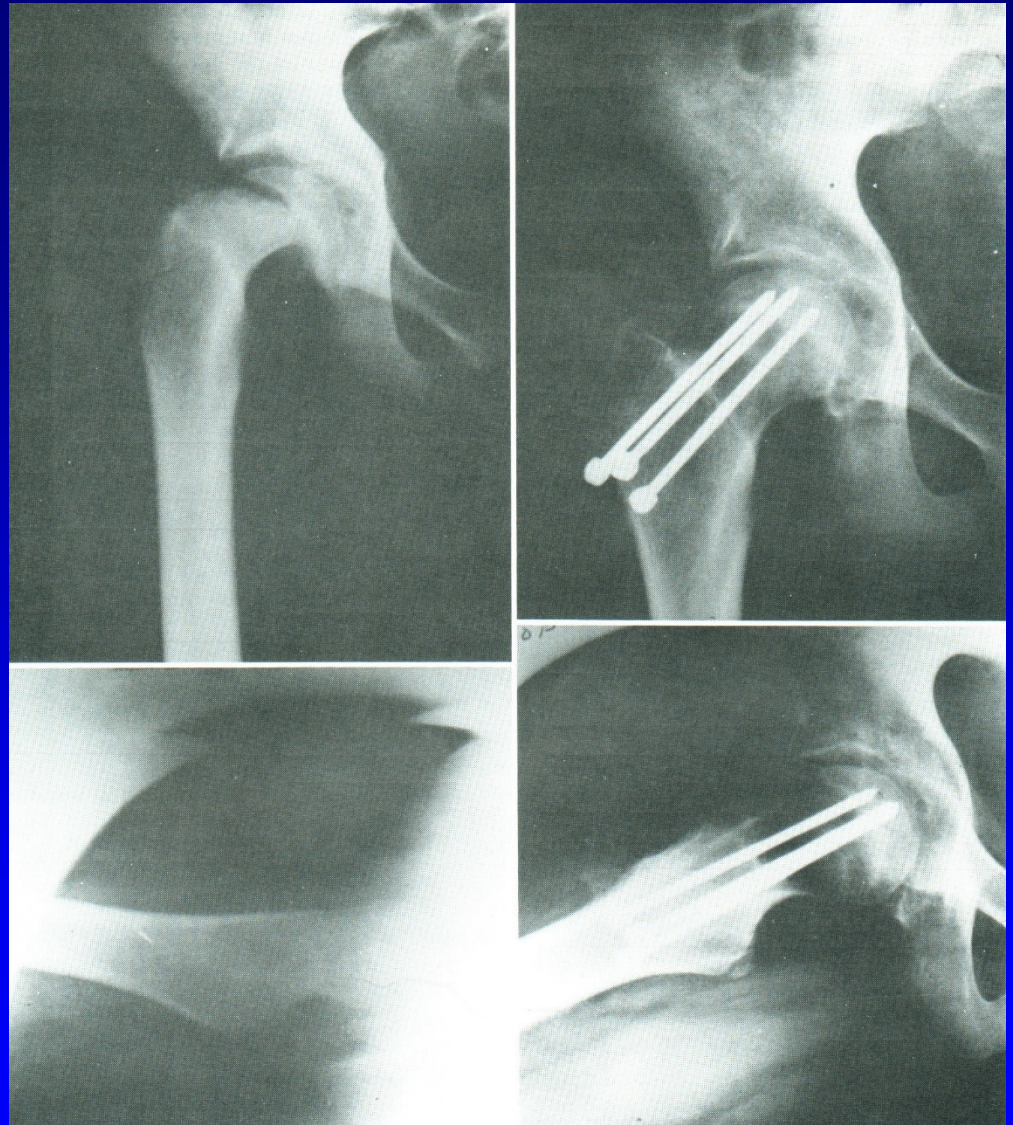
- Up to 30° – epiphyseodesis
- Over 30° – corrective OT
 - Subcapital (Dunn)
 - Basicervical (Krämer)
 - Intertrochanteric (Immhäuser – Weber)
 - Subtrochanteric (Southwick)



Fixation in situ

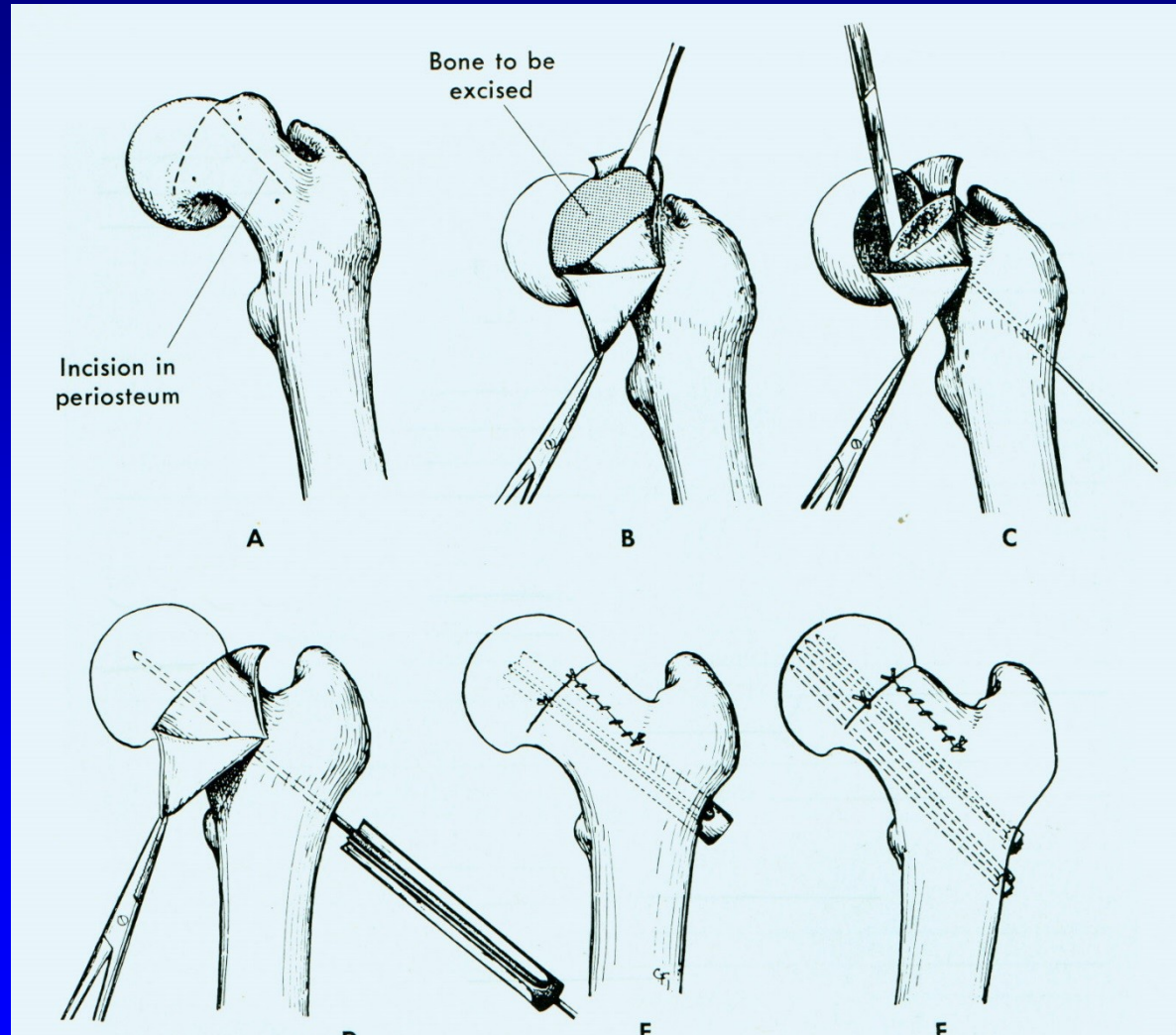


Obr. 31



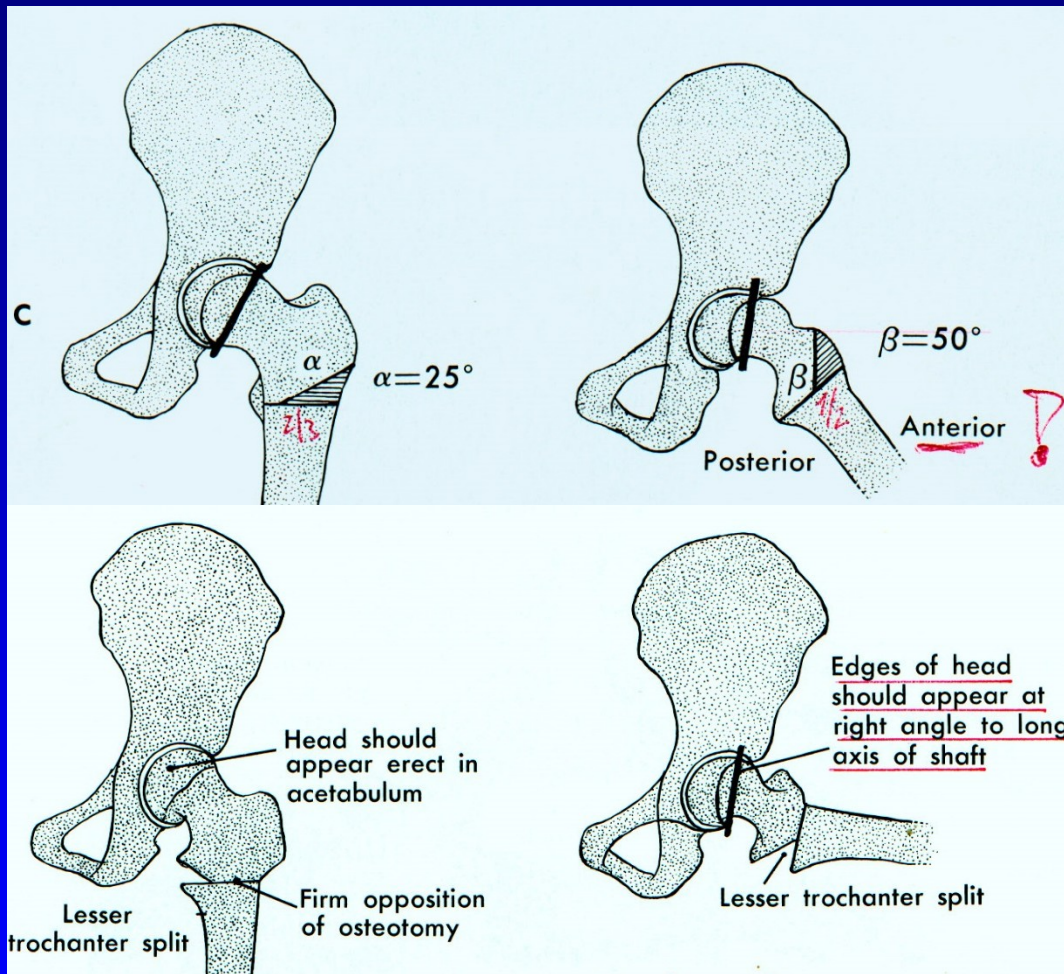
Obr. 32

Open reduction

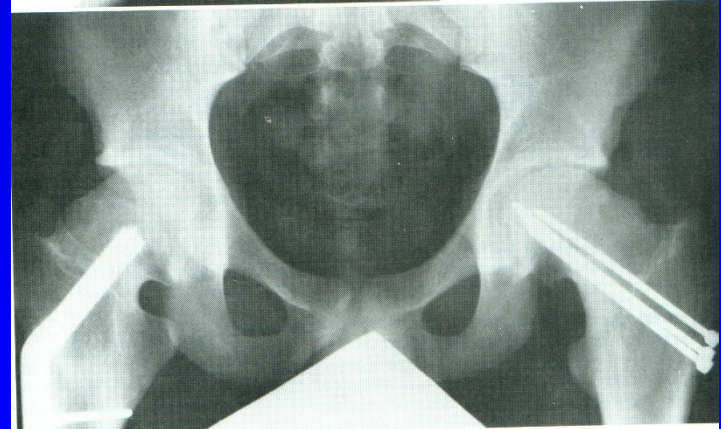


Obr. 33

Southwick osteotomy



Pertrochanteric osteotomy



Obr. 35

Complication of slipped upper femoral epiphysis

Avascular necrosis of the femoral head

Chondrolysis of the femoral head

Osteoarthritis of the hip

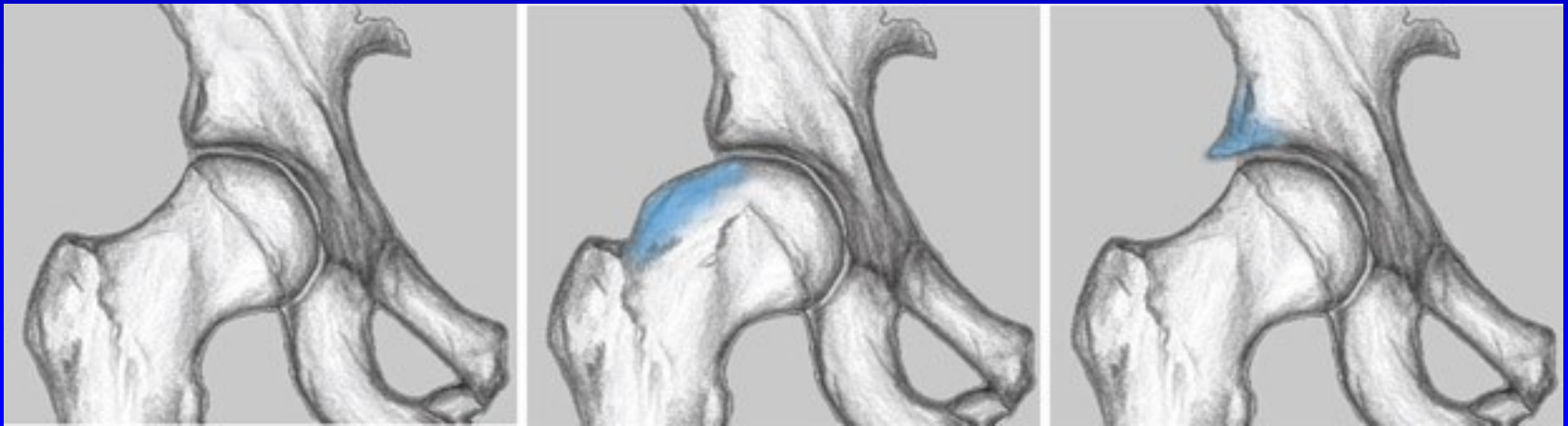
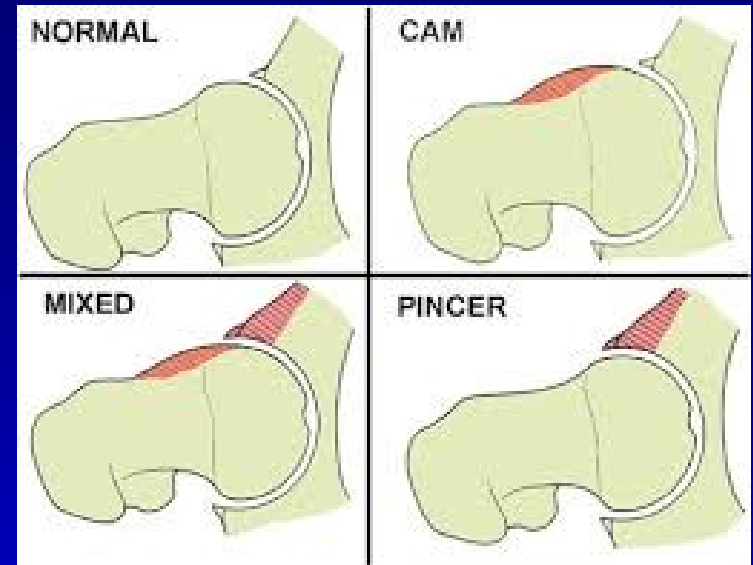
Femoroacetabular impingement

FAI

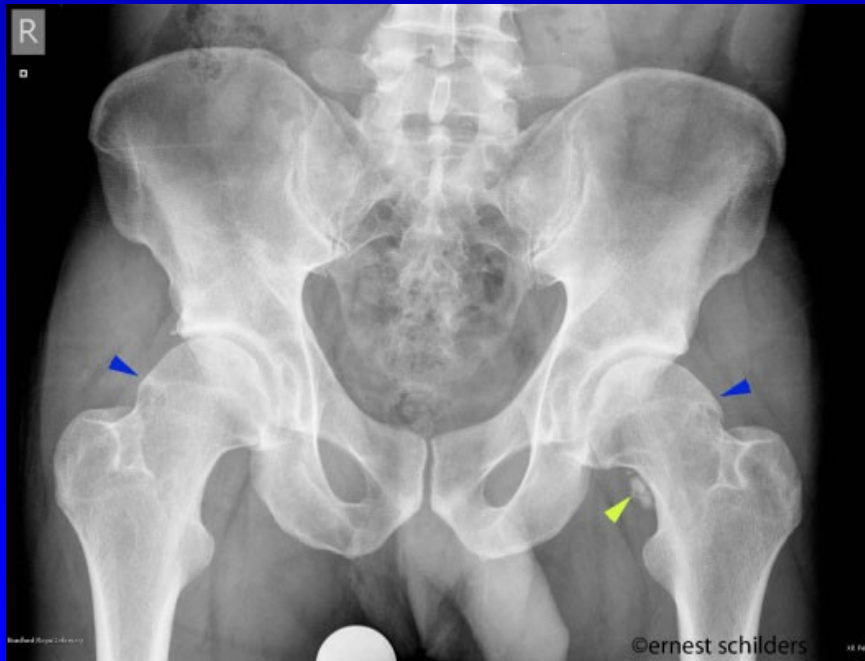
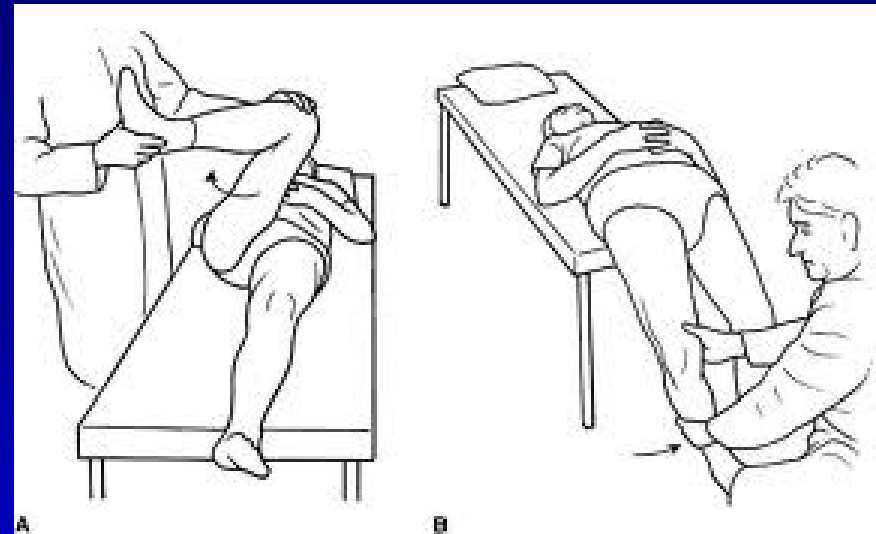
- Pathological contact between femoral head and the acetabulum
- Changes of the shape and orientation of the acetabulum and the femoral head
- Damage to the labrum and cartilage
- Limited movements, pain, progression into O.A.

Classification

- **CAM type** – femur
- **PINCER type** – acetabulum



- Tests
- Imaging methods
 - X ray, CT, MRI**

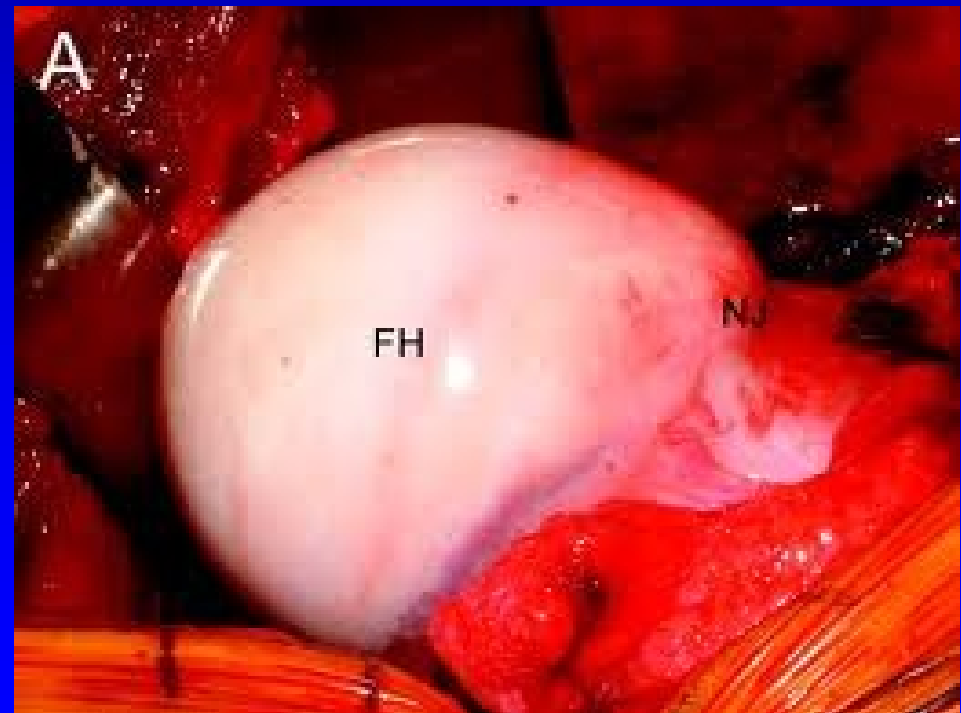
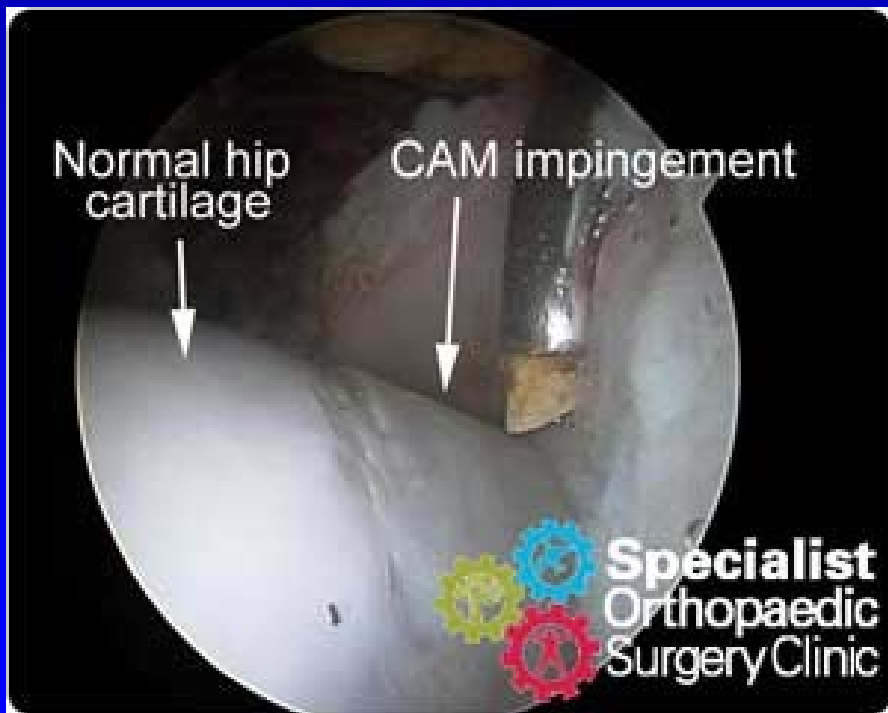


- **Therapy**

- **Labrum, cartilage, remodeling of the femoral head**

- 1. Open surgery with dislocation of the head**

- 2. Arthroscopy**



Cerebral palsy

Spastic paralysis	50 %
Athetosis	25 %
Ataxia	7 %
Tremor	1 %
Rigidity	7 %
Combinations	10 %



Hemiparesis

30 % of all cases

1/2 normal intelligence

Good walking ability



Diparesis

Both lower extremities are involved more than upper extremities

Retarded motoric and psychologic development

Strabismus

Scissors gait

Flexion and adduction contracture in hip

Flexion contraction of the knee

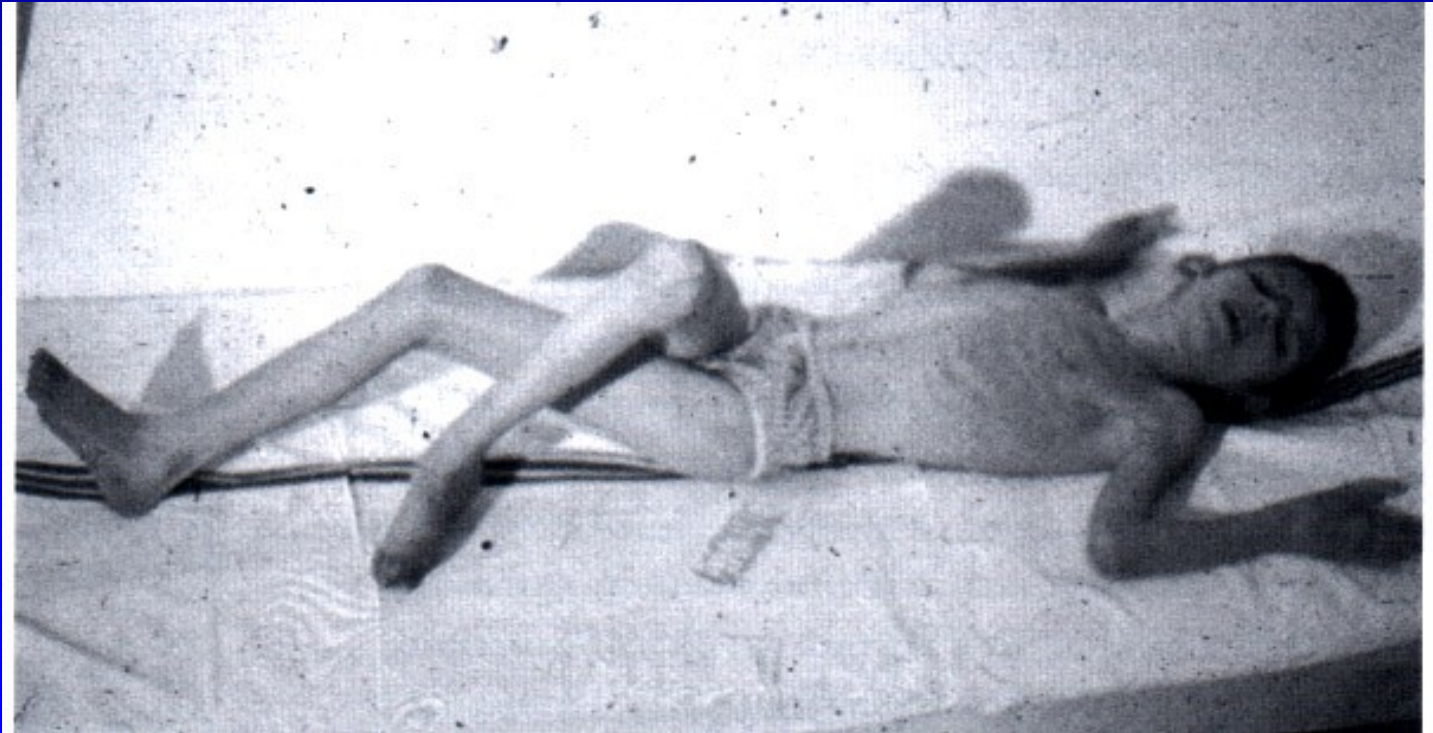
Equinosity of the feet, tip toe walking



Quadraparesis, tri paresis

Severe paralysis of both extremities

Head nerves involvement, debilitated patients



Orthopaedic procedures in the hip joint

Adductos tenotomy

Transposition of adductor of the hip

Iliopsoas recession

Open reduction of dislocated hip

Varus osteotomy of the femur

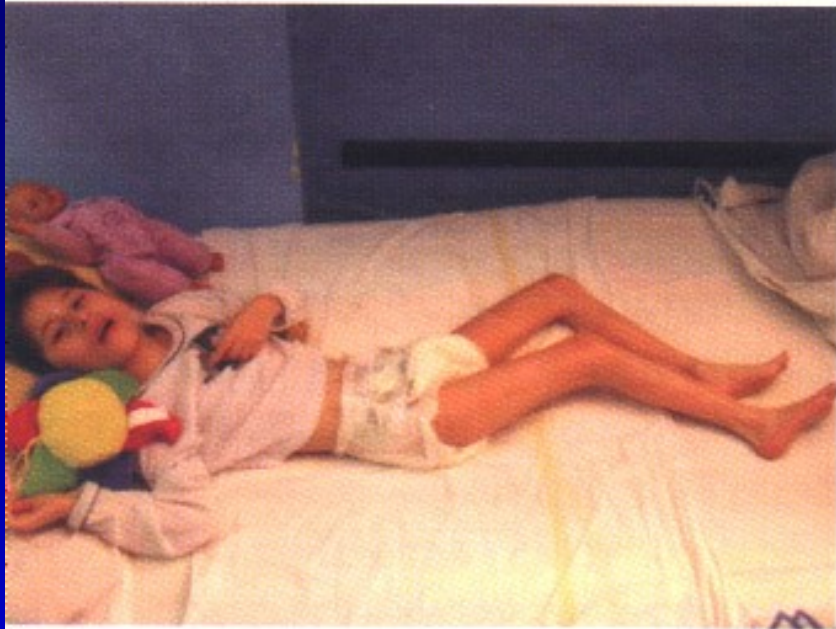
Acetabuloplasty, shelf procedures

Osteotomy of the pelvis

Girdlestone

Schanz

THA



Adductor tenotomy





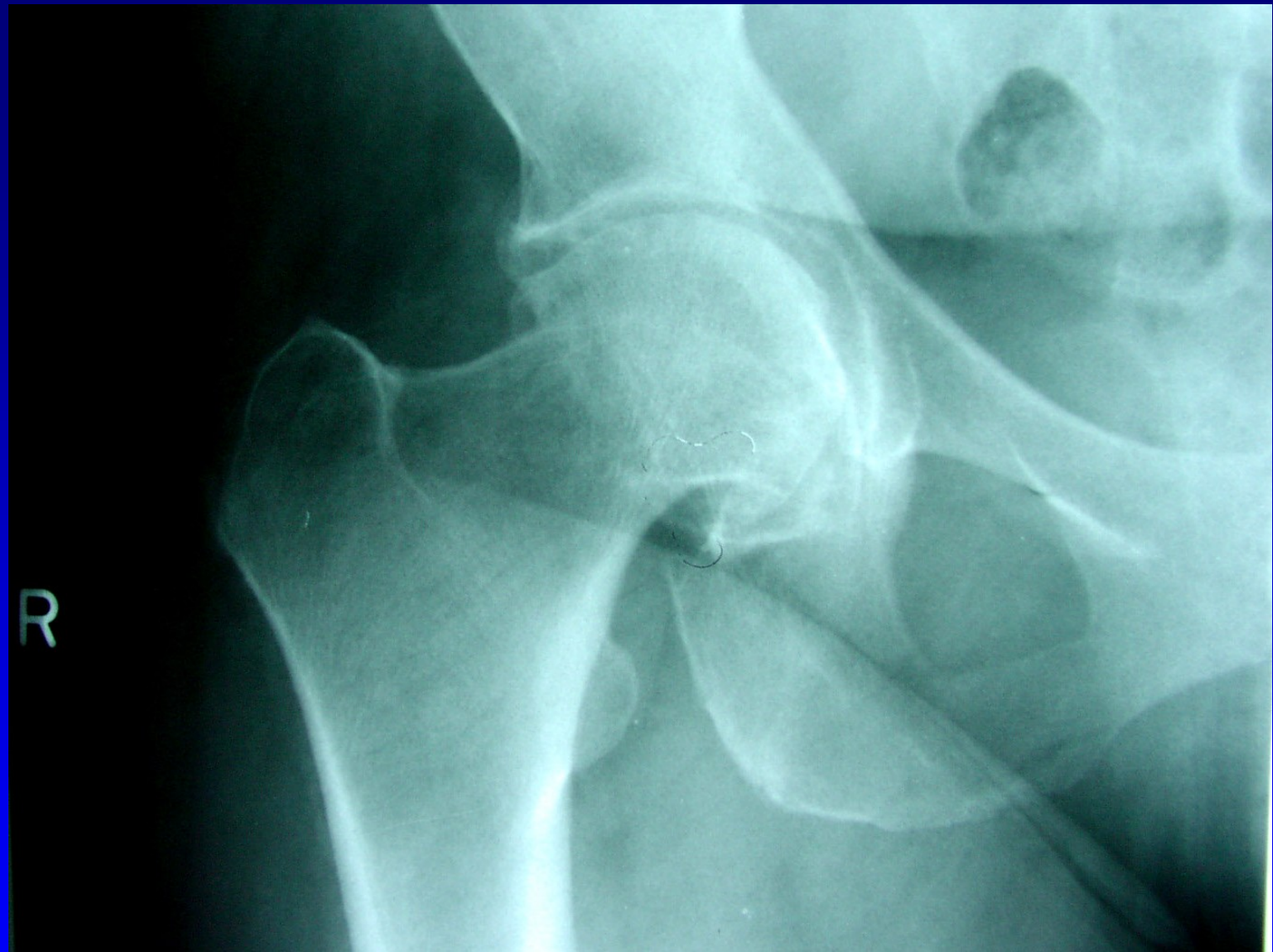
Flexion contracture of the hip and knee joints
Before surgery, after surgery

Pyogenic coxitis

- Clinical symptoms
- Laboratory tests
- Aspiration
- Bacteriology, PCR, cytology

Management

- Admission to the hospital
- ATB, revision, lavage
- Girdlestone, synovectomy

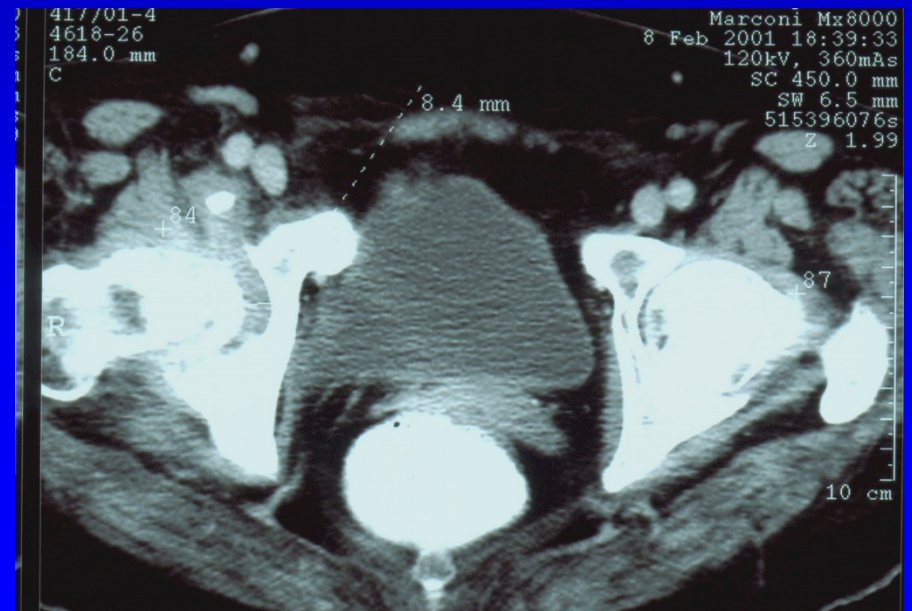


F, 50 y., O.A. of the right hip,
Infection of the big toe



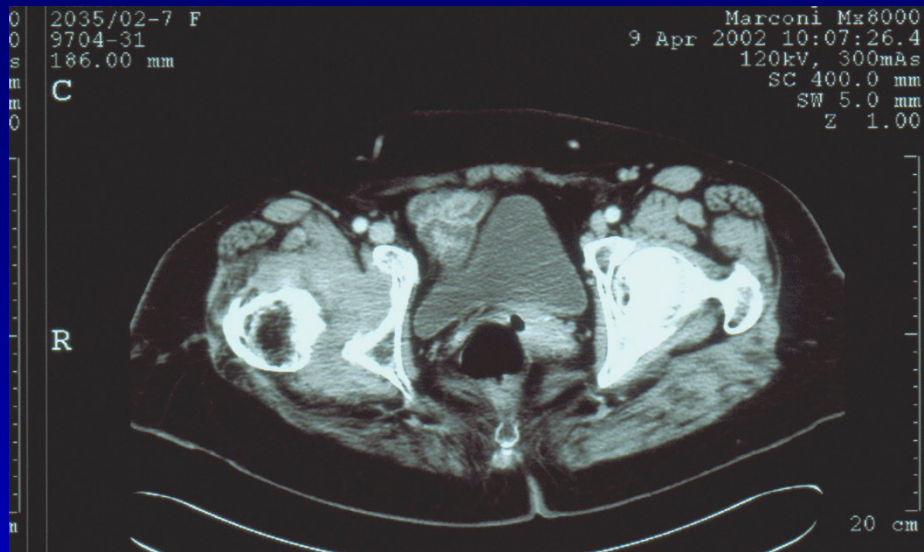
F, 50 y.
Intrapelvic absces
Pyogenic coxitis,
Staphylococcus aureus

F, 50 y.
chronic synovitis,
erosion of the head
and the edges

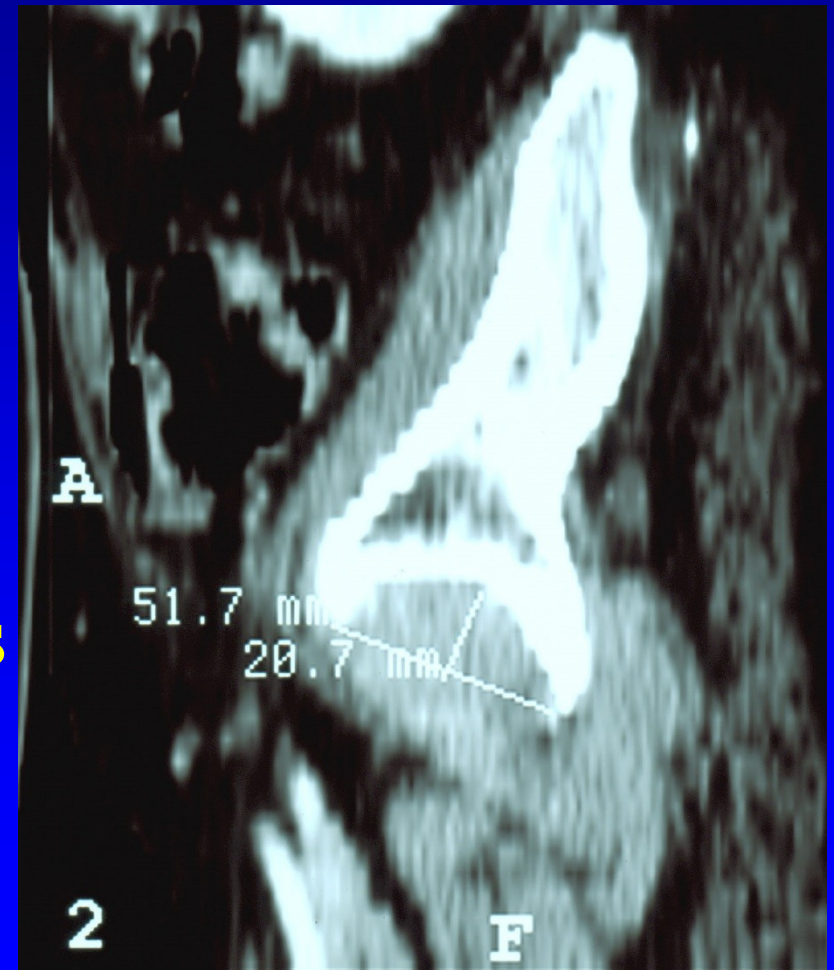


Op. sec. Girdlestone

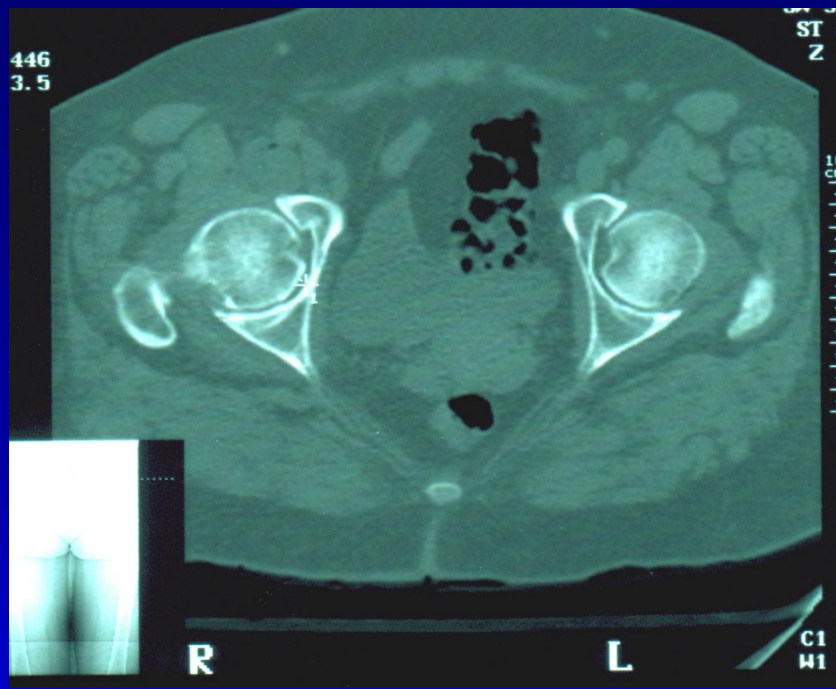




CT reconstruction,
width 51,7 mm

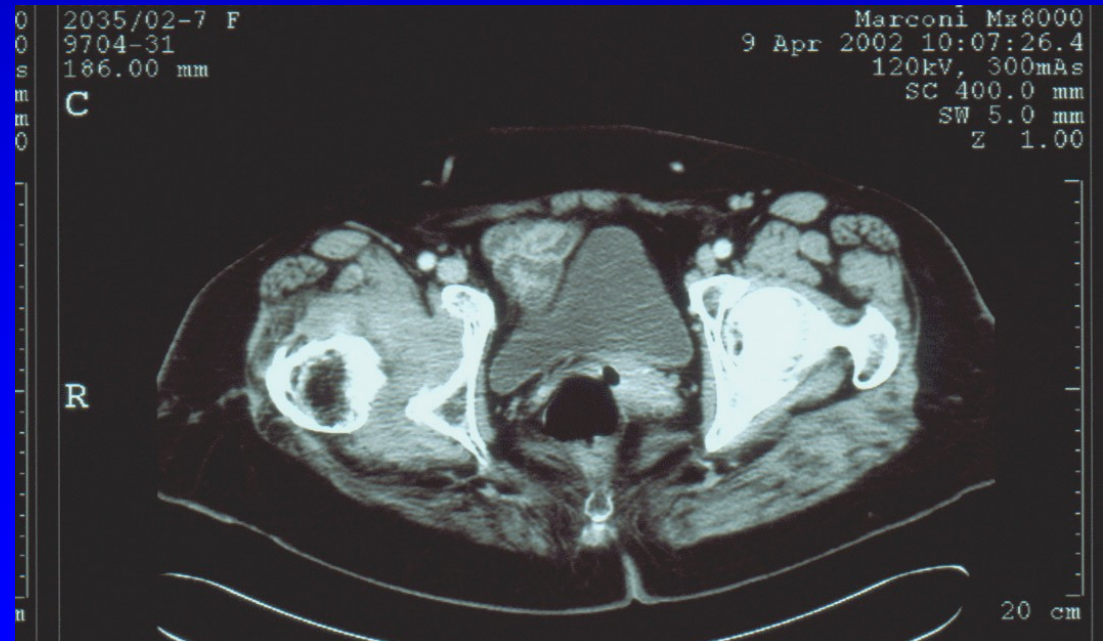


F, 50 y., after one year,
Girdlestone situation,
deep scar tissue,
osteopenia, resorbed edges
of the acetabulum,
thin medial wall.



CT scan
at the onset of symptoms,
normal shape of the
edges

After one year,
resorbed edges of the
acetabulum



HHS 95 points, 2 y. after surgery



Other diagnoses

- Osteopathies
- Stress fractures of the femoral neck
- Fractures, nonunion, necrosis
- Tumors
- Osteomyelitis
- TB
- Neurological disorders

Irradiated pain

- Lumbar spine
- Pelvis- GI, urogenital
- Pain from the knee to the thigh and hip joint