Hip joint

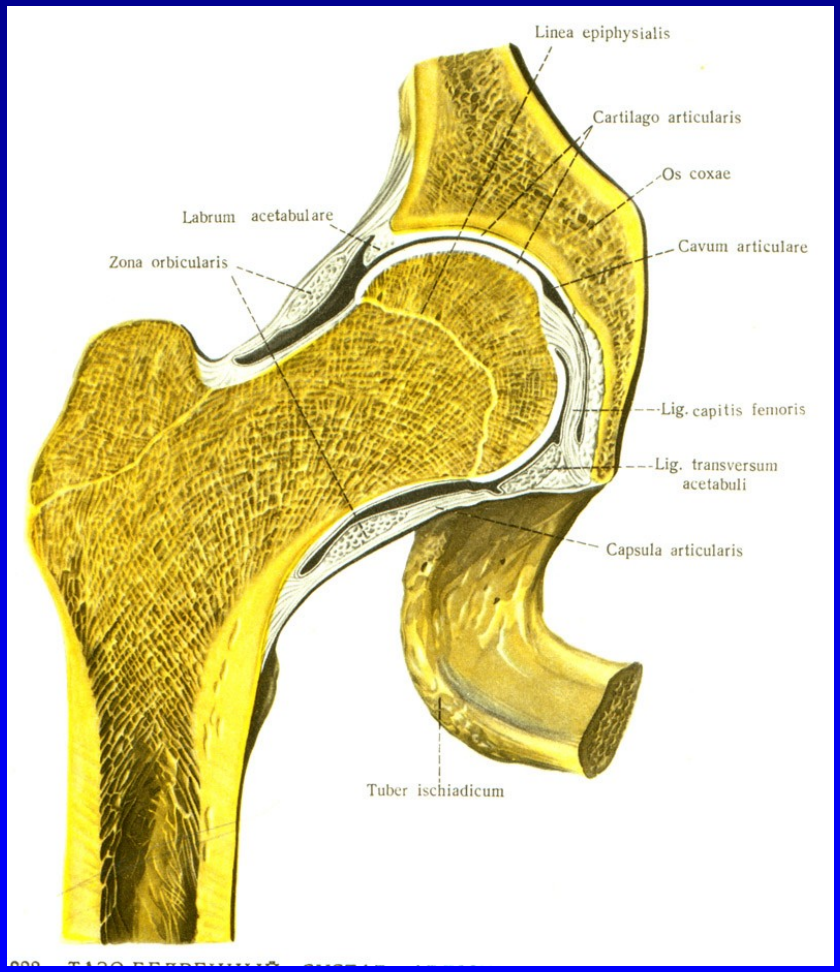
Rozkydal, Z.

Articulatio coxae

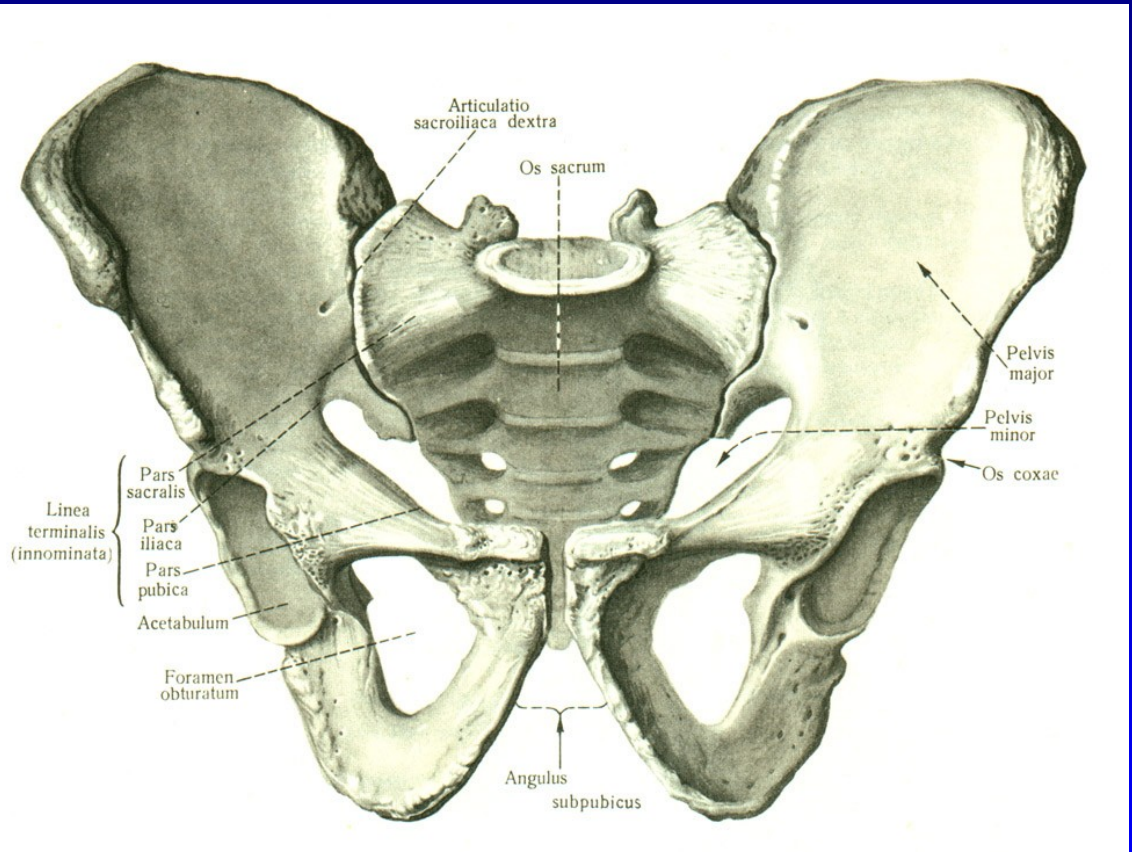
Enarthrosis –

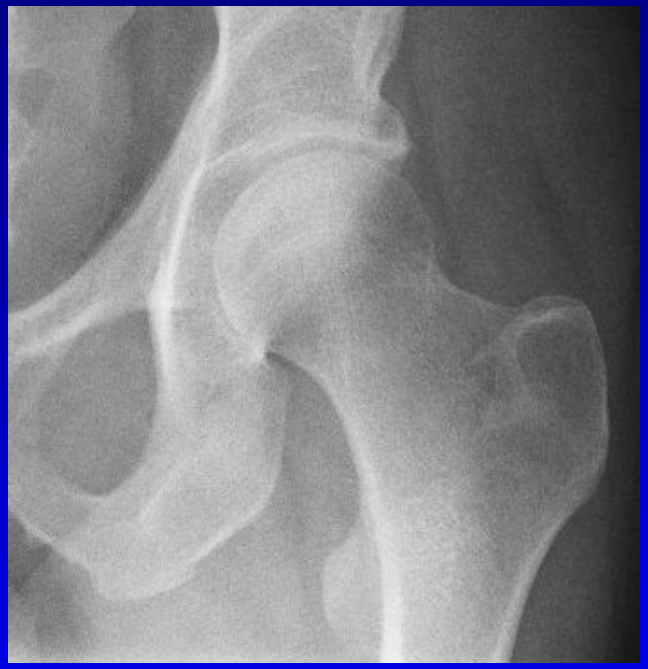
Ball and socket type

Concentric shape
of femoral head



Pelvis

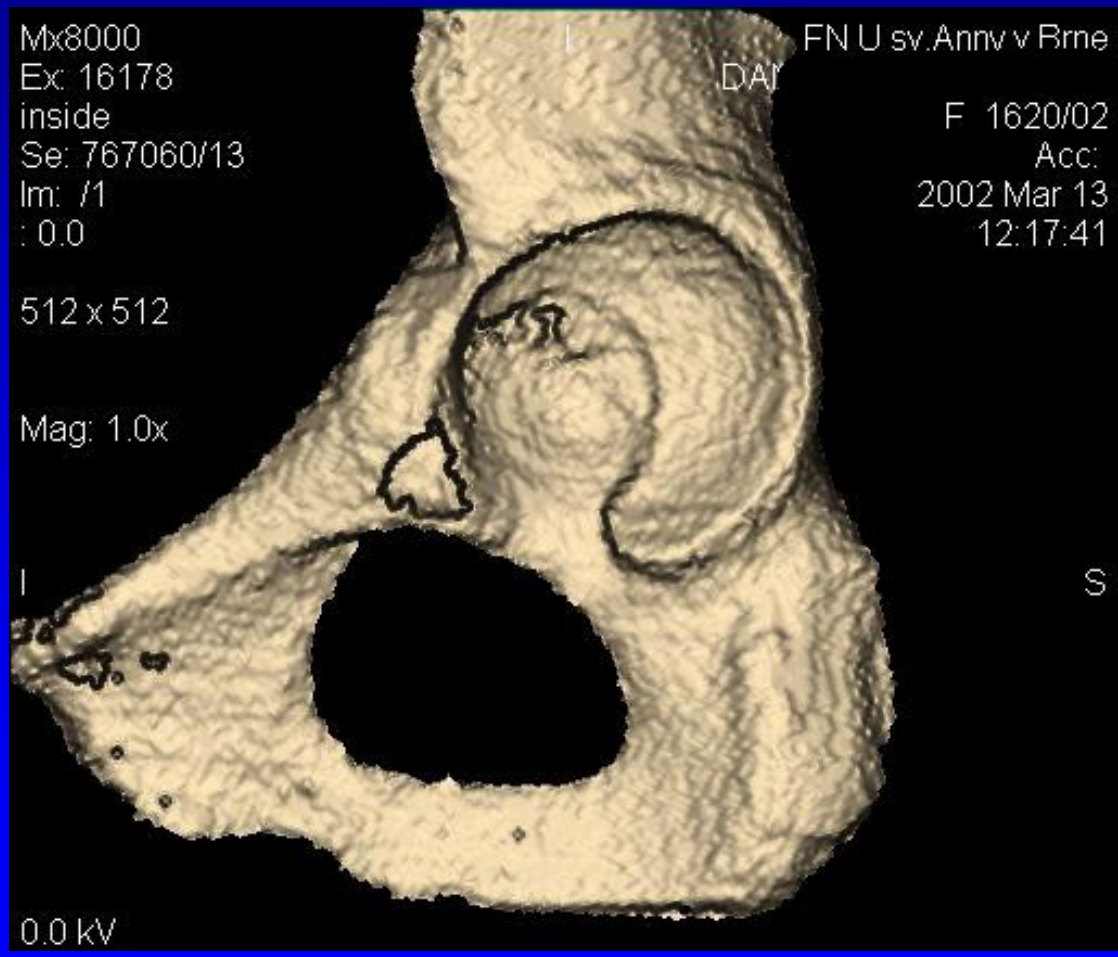

Articulatio sacroiliaca dextra
Os sacrum
Pelvis major
Pelvis minor
Os coxae
Linea terminalis (innominata)
Pars sacralis
Pars iliaca
Pars pubica
Acetabulum
Foramen obturatum
Angulus subpubicus



3 D CT

Os ilium
Os pubis-
ramus superior
ramus inferior

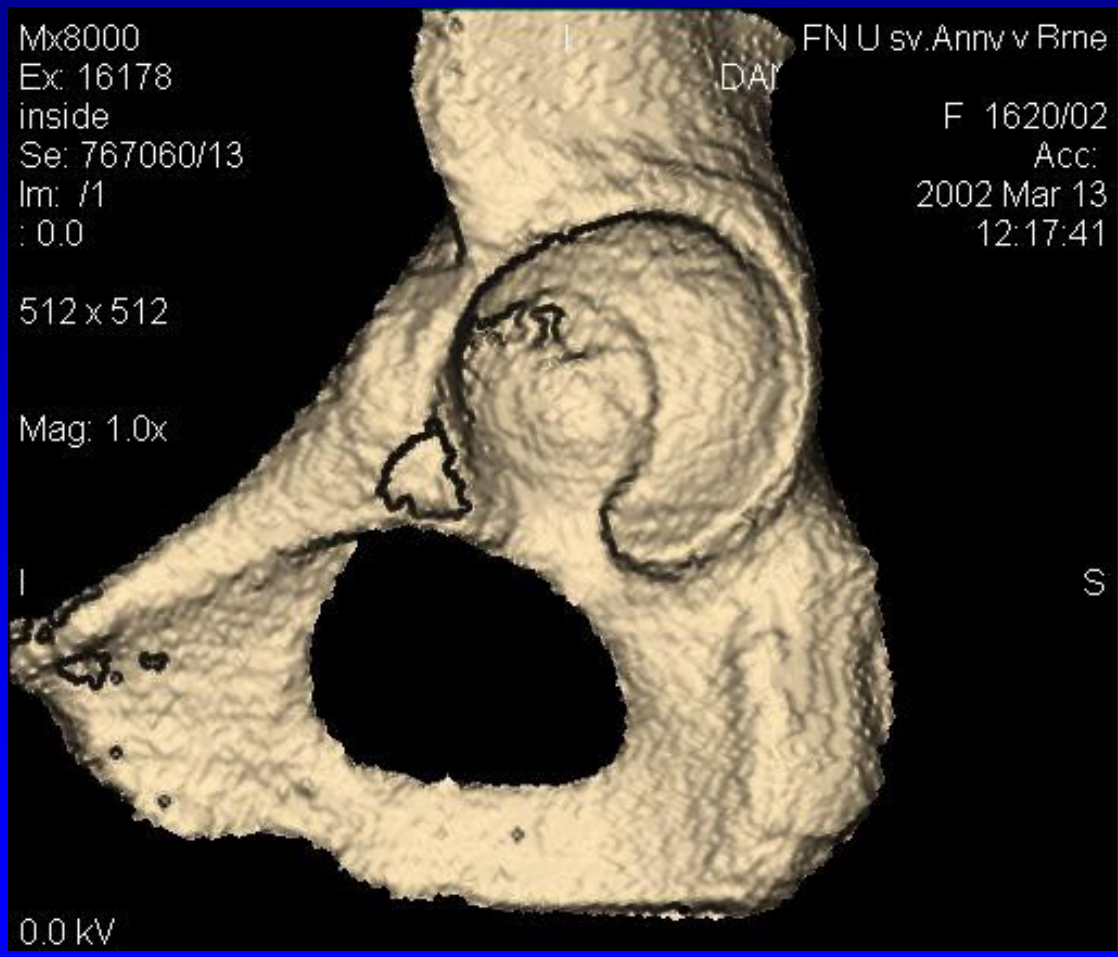
Os ischii
Corpus ossis ischii
Ramus ossis ischii-
pars pubica
pars acetabularis
tuber ossis ischii



3D acetabulum

Acetabulum

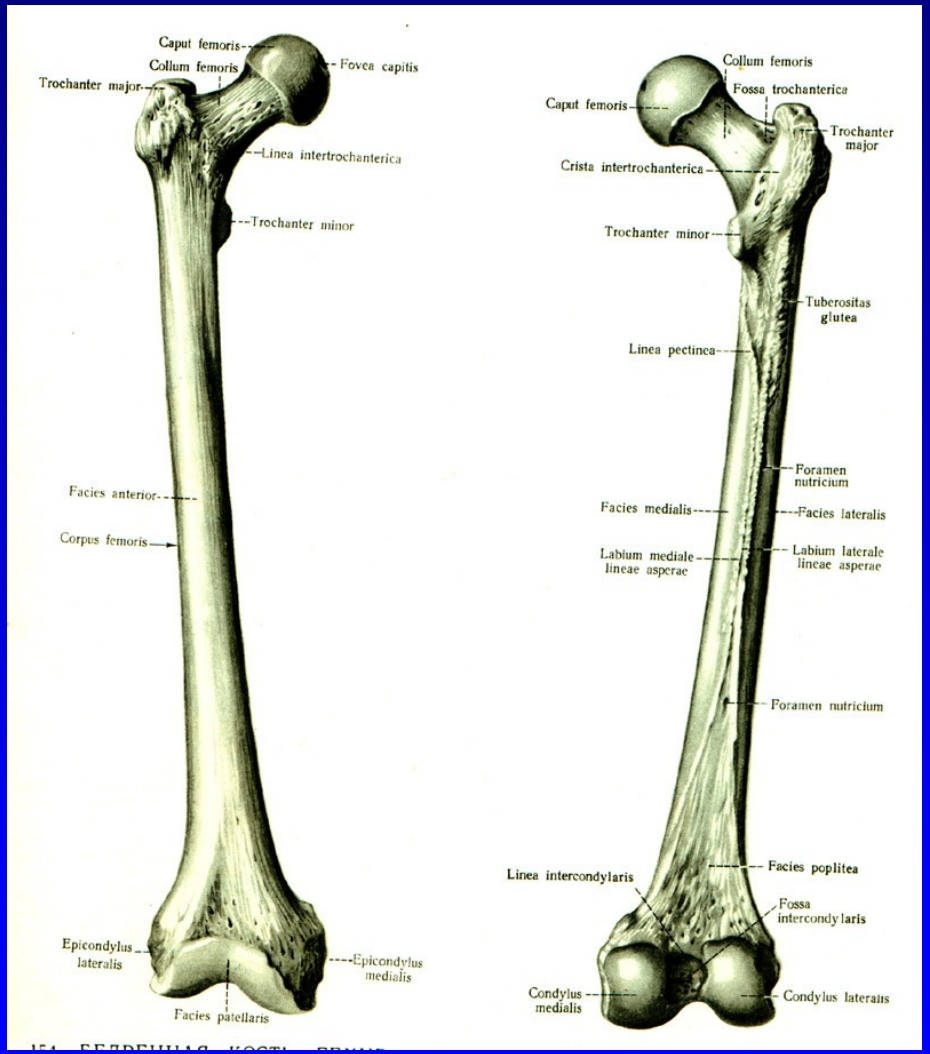
facies lunata
fossa acetabuli
incisura acetabuli



Femur

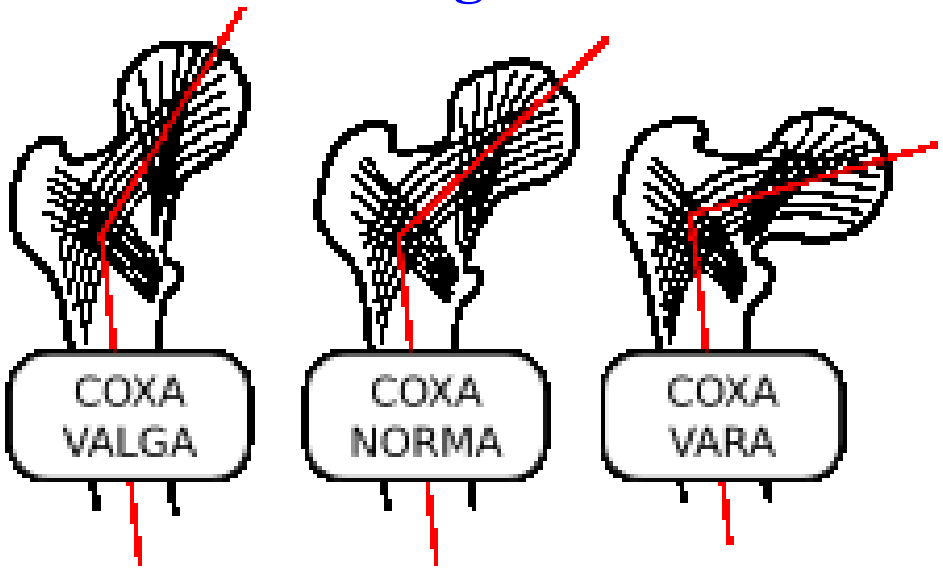
Anterior
Linea intertrochanterica
- Attachment of capsule

Posterior
Crista intertrochanterica
- Attachment of quadratus femoris

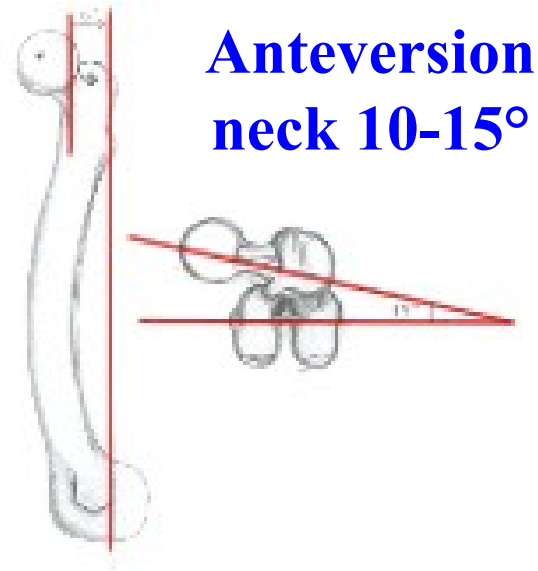


Anatomy

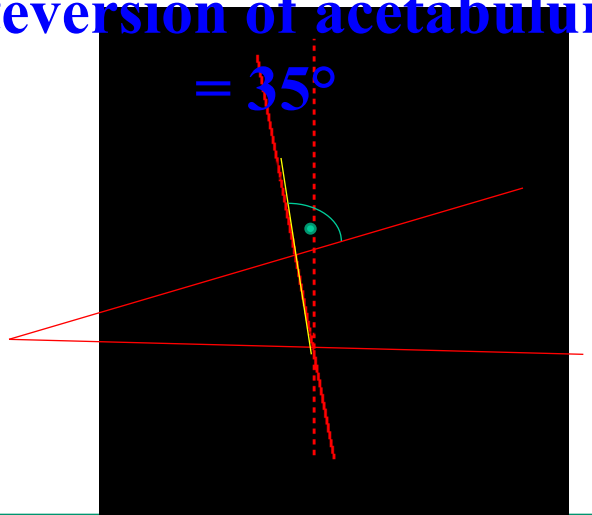
CCD angle = 125±5°



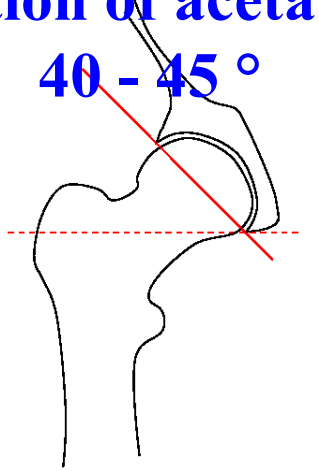
Anteversion neck 10-15°



Anteversion of acetabulum = 35°



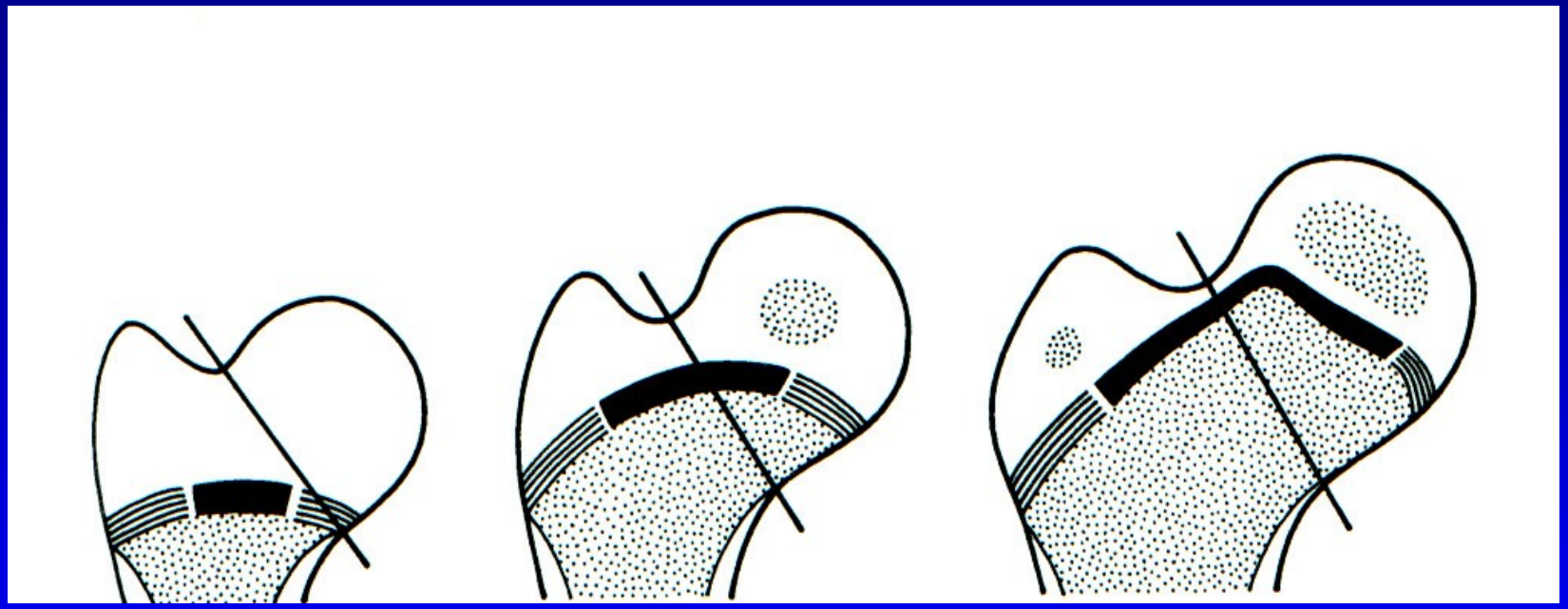
Inclination of acetabulum 40 - 45 °



Boy, 6 years

Triradiate cartilage

Chondroepiphysis



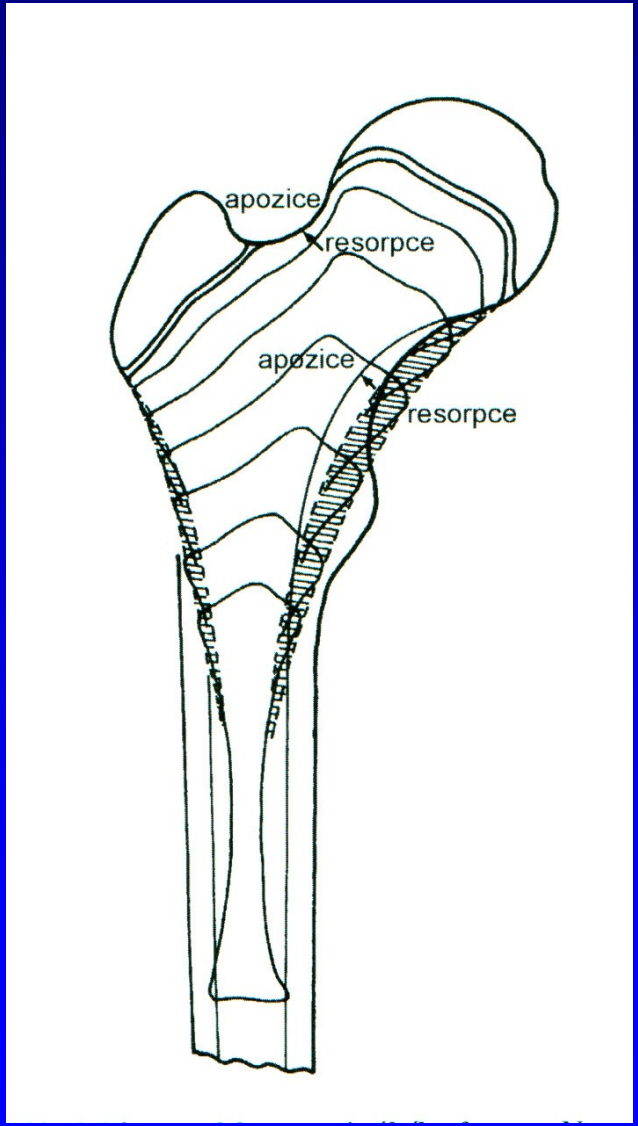
Birth 6 months 3,5 years

Ossification of proximal femur

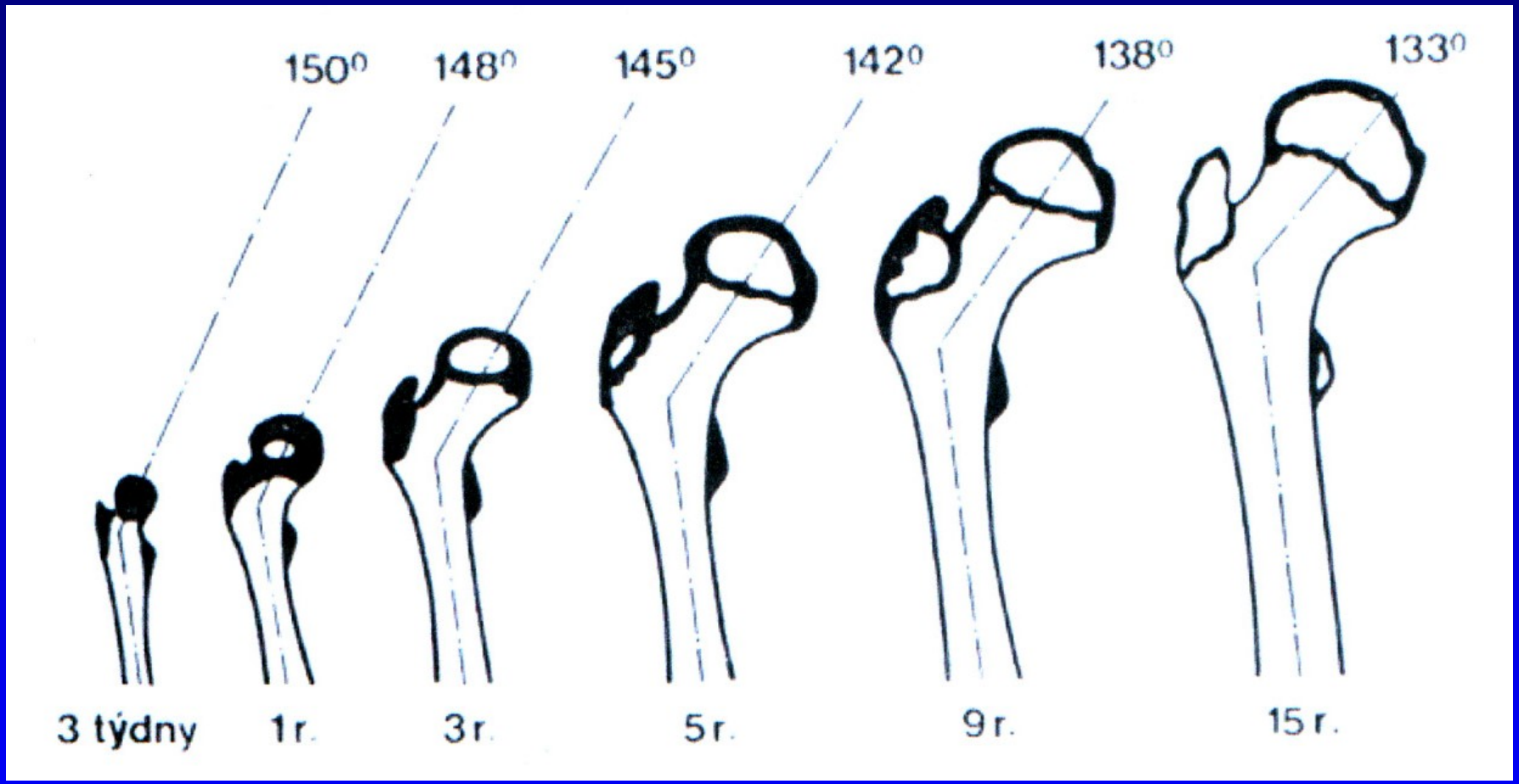
Boy, 6 years old

Growth in length

30 % of the whole femur



Change of CCD angle



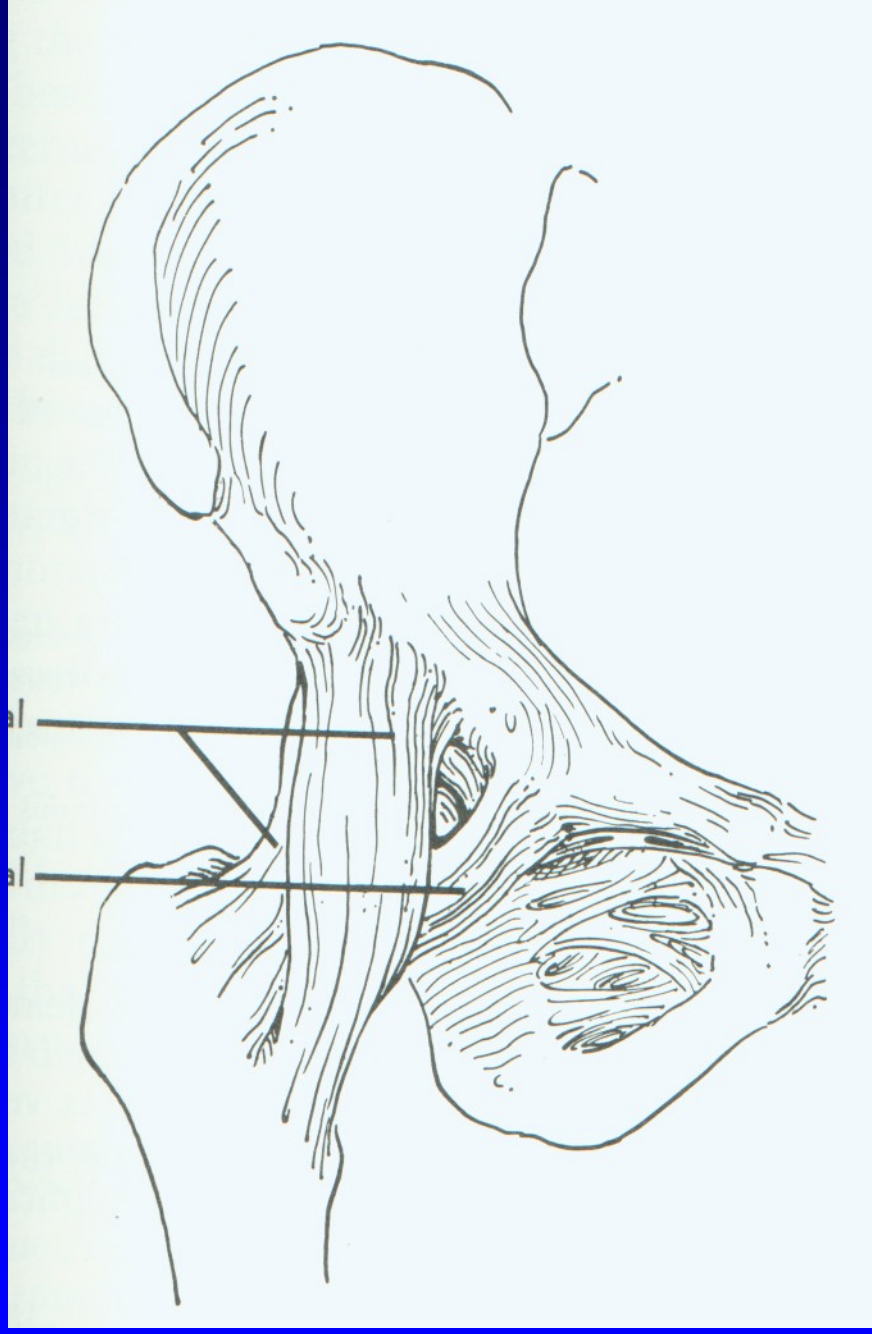
Change of anteversion of the neck
Birth 40°, puberty 11°

Joint capsule

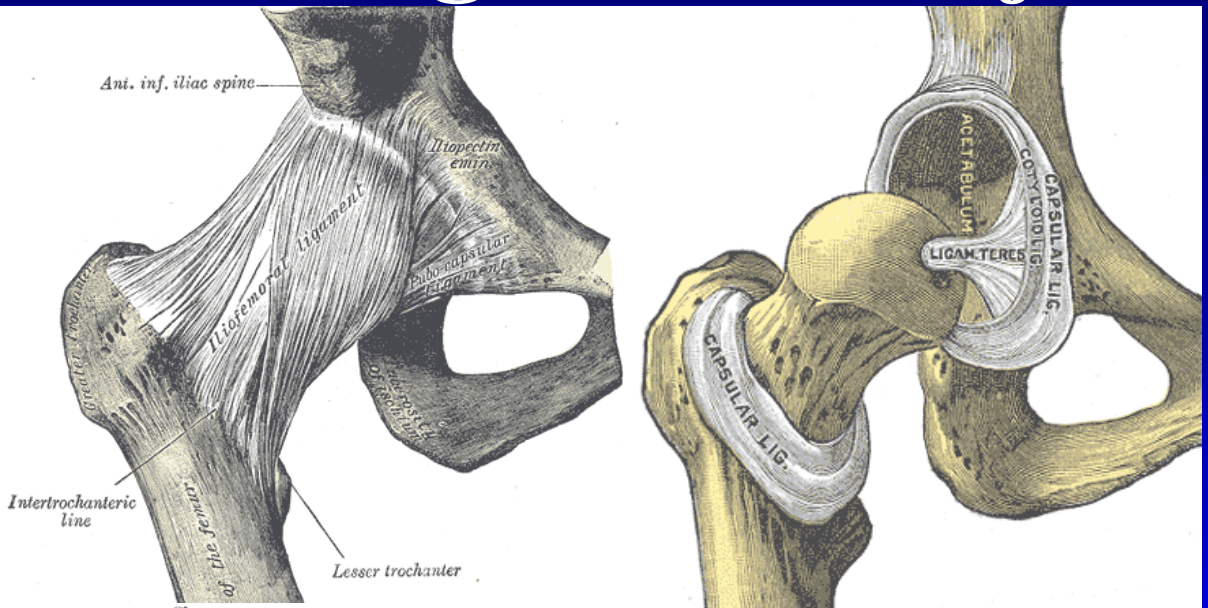
Lig. iliofemorale

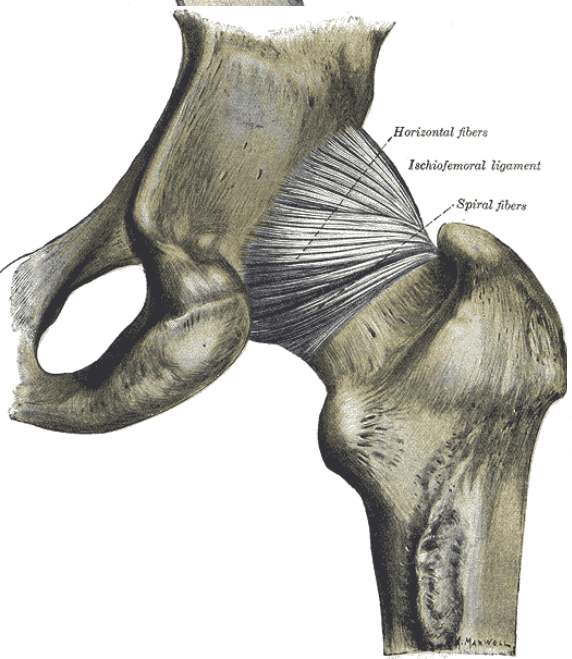
Lig. pubofemorale

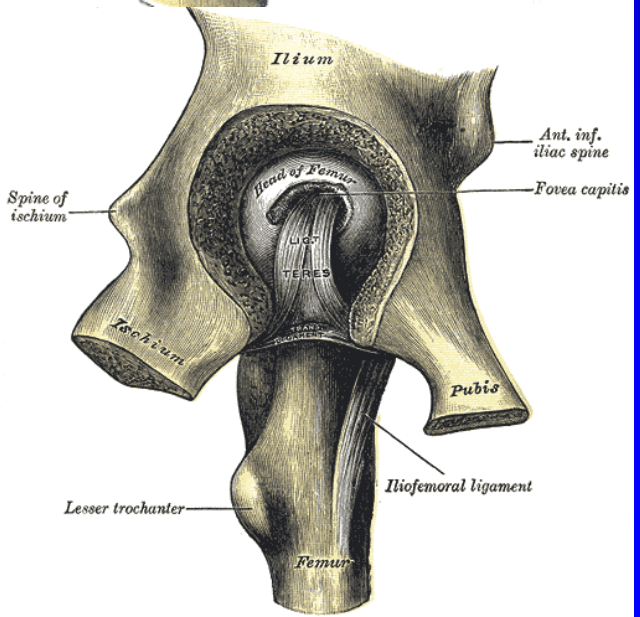
Lig. ischiofemorale



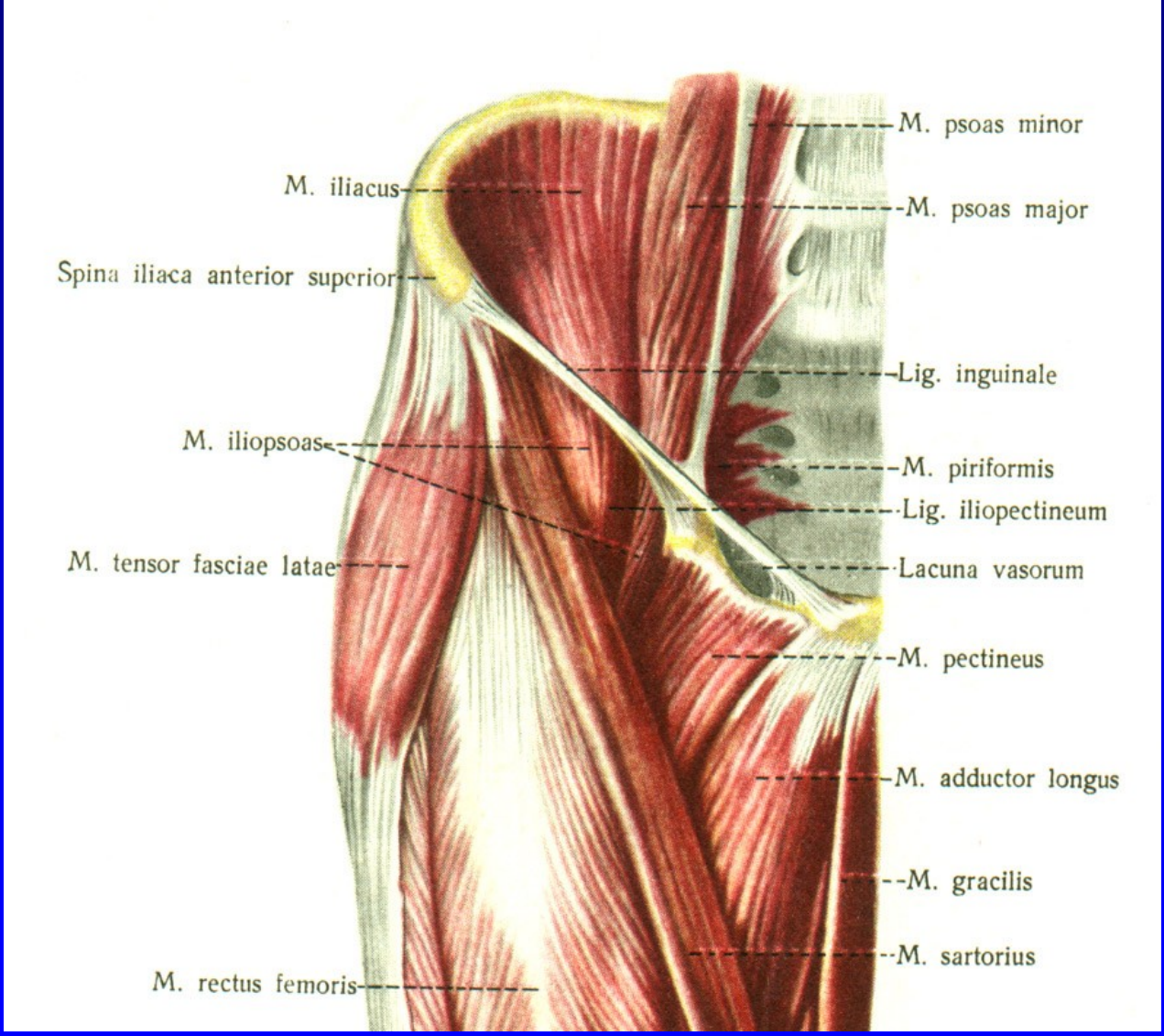
Ligaments of joint capsule



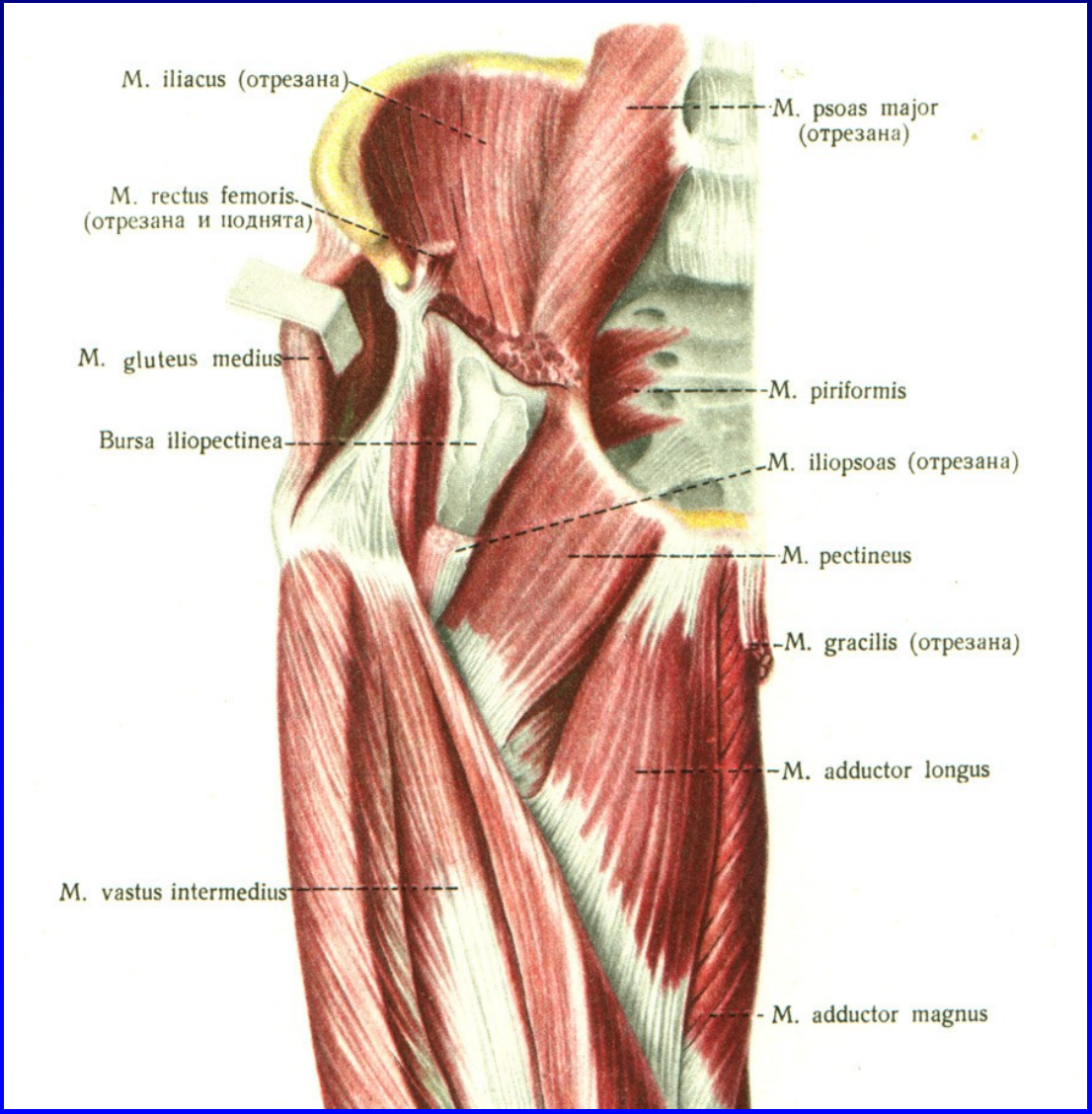




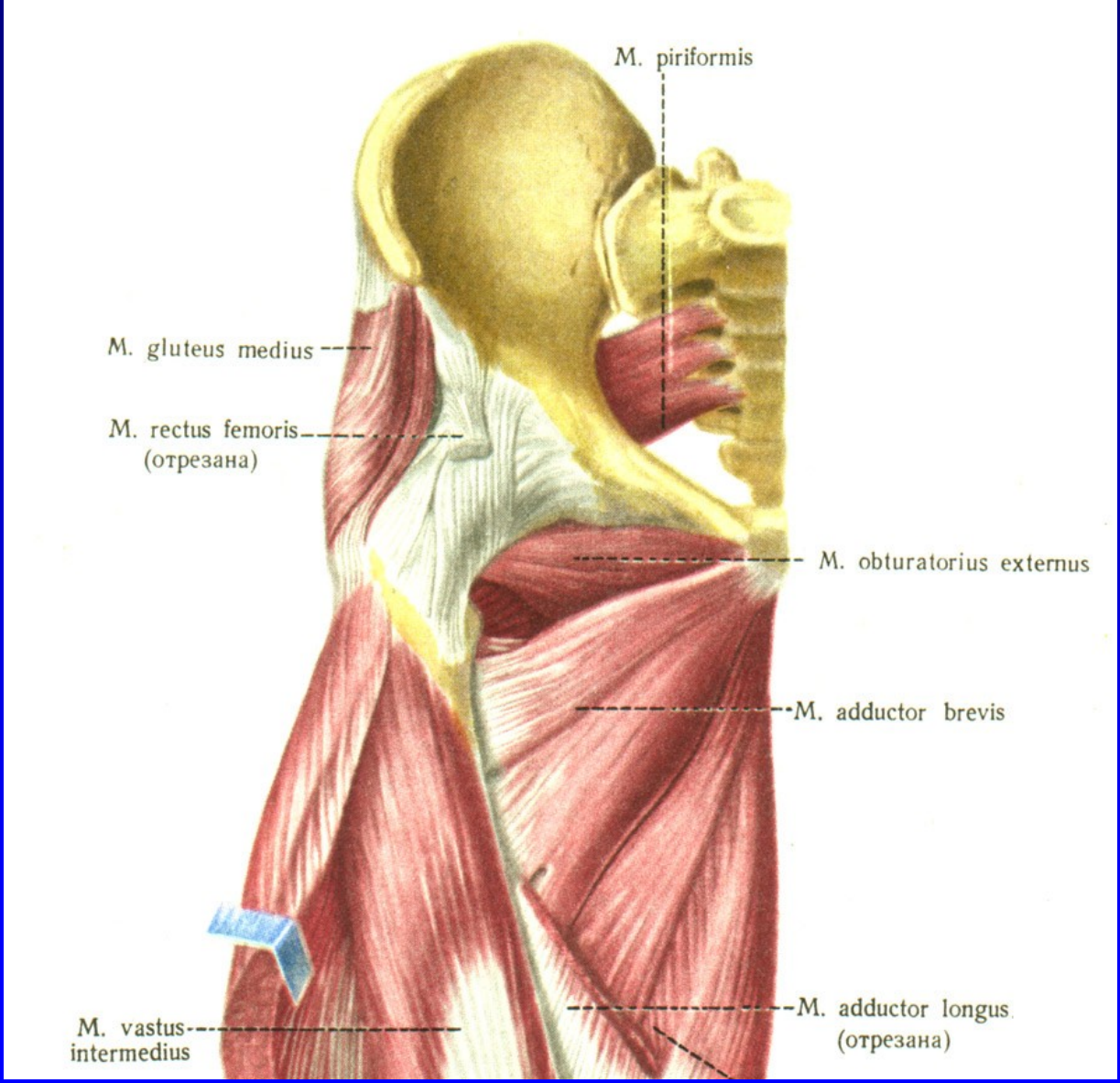
Muscles


M. psoas minor
M. iliacus
M. psoas major
Spina iliaca anterior superior
Lig. inguinale
M. iliopsoas
M. piriformis
Lig. iliopectineum
M. tensor fasciae latae
Lacuna vasorum
M. pectineus
M. adductor longus
M. gracilis
M. sartorius
M. rectus femoris

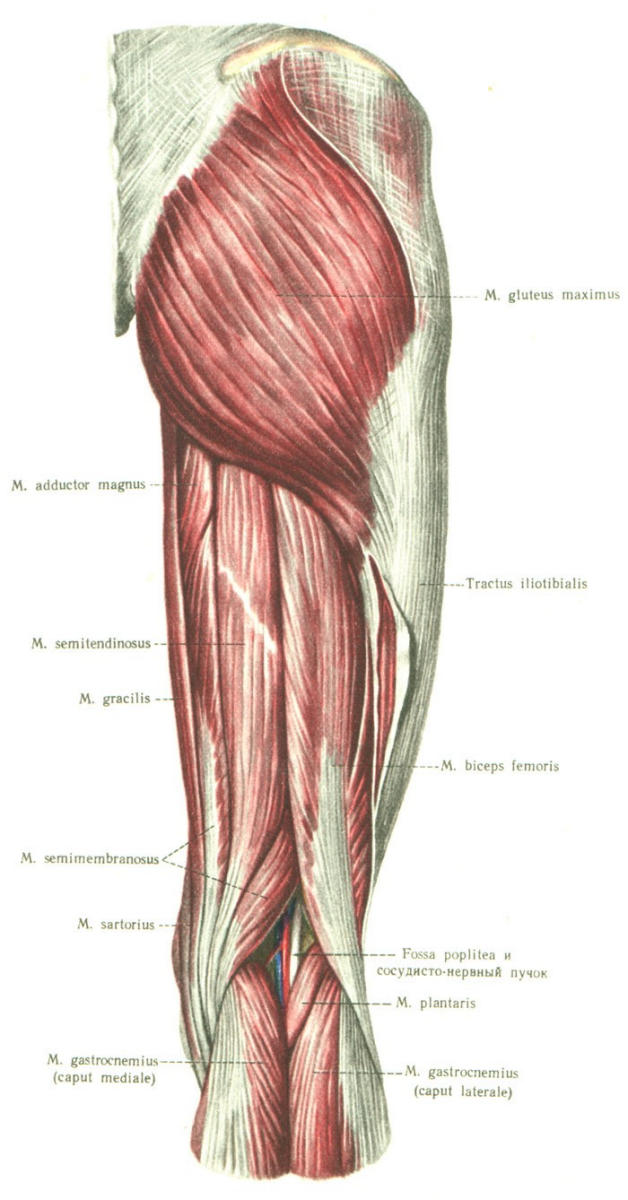
Muscles


M. iliacus (отрезана)
M. psoas major (отрезана)
M. rectus femoris (отрезана и поднята)
M. gluteus medius
M. piriformis
Bursa iliopectinea
M. iliopsoas (отрезана)
M. pectineus
M. gracilis (отрезана)
M. adductor longus
M. vastus intermedius
M. adductor magnus

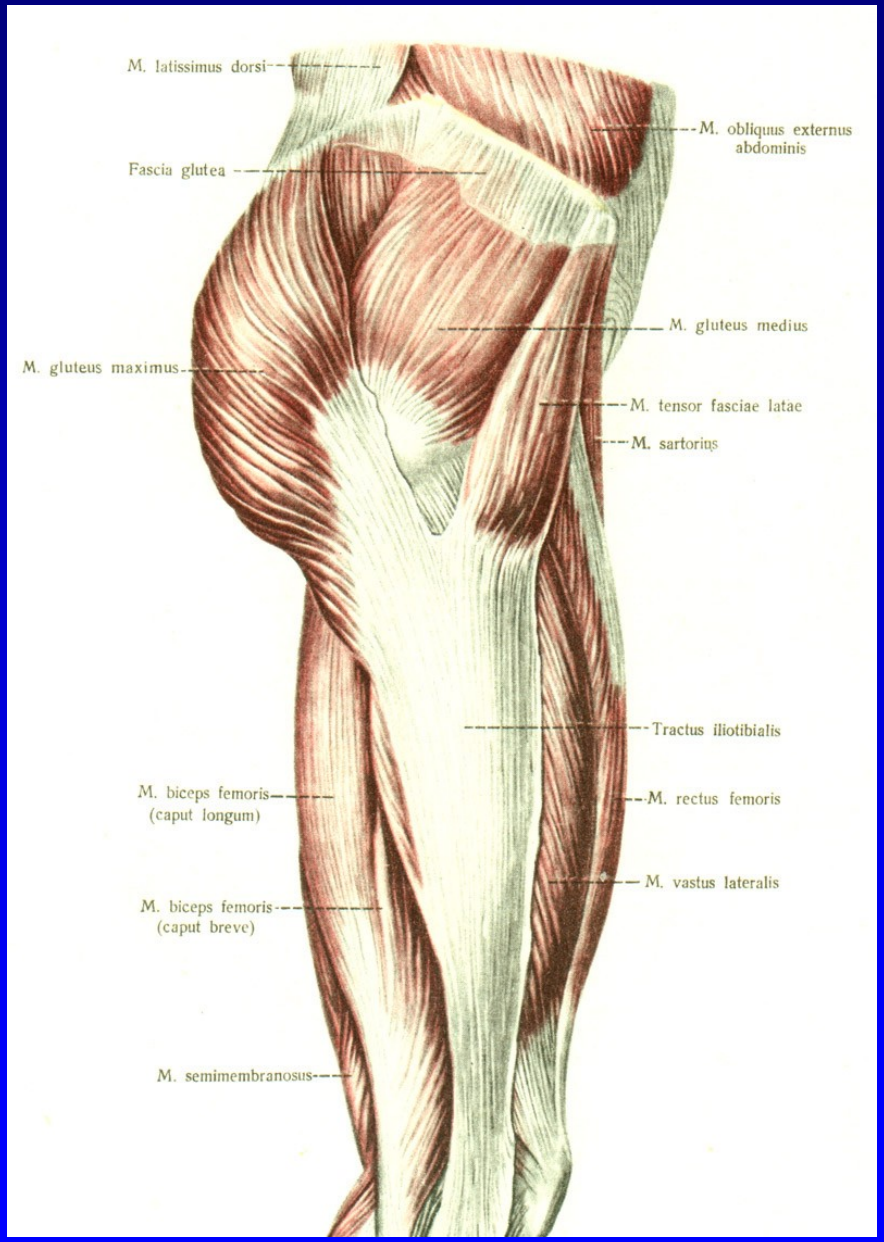
Muscles


M. piriformis
M. gluteus medius
M. rectus femoris
(отрезана)
M. obturatorius externus
M. adductor brevis
M. vastus
intermedius
M. adductor longus
(отрезана)

Muscles


M. gluteus maximus
M. adductor magnus
Tractus iliotibialis
M. semitendinosus
M. gracilis
M. biceps femoris
M. semimembranosus
M. sartorius
Fossa poplitea и
сосудисто-нервный пучок
M. plantaris
M. gastrocnemius
(caput mediale)
M. gastrocnemius
(caput laterale)

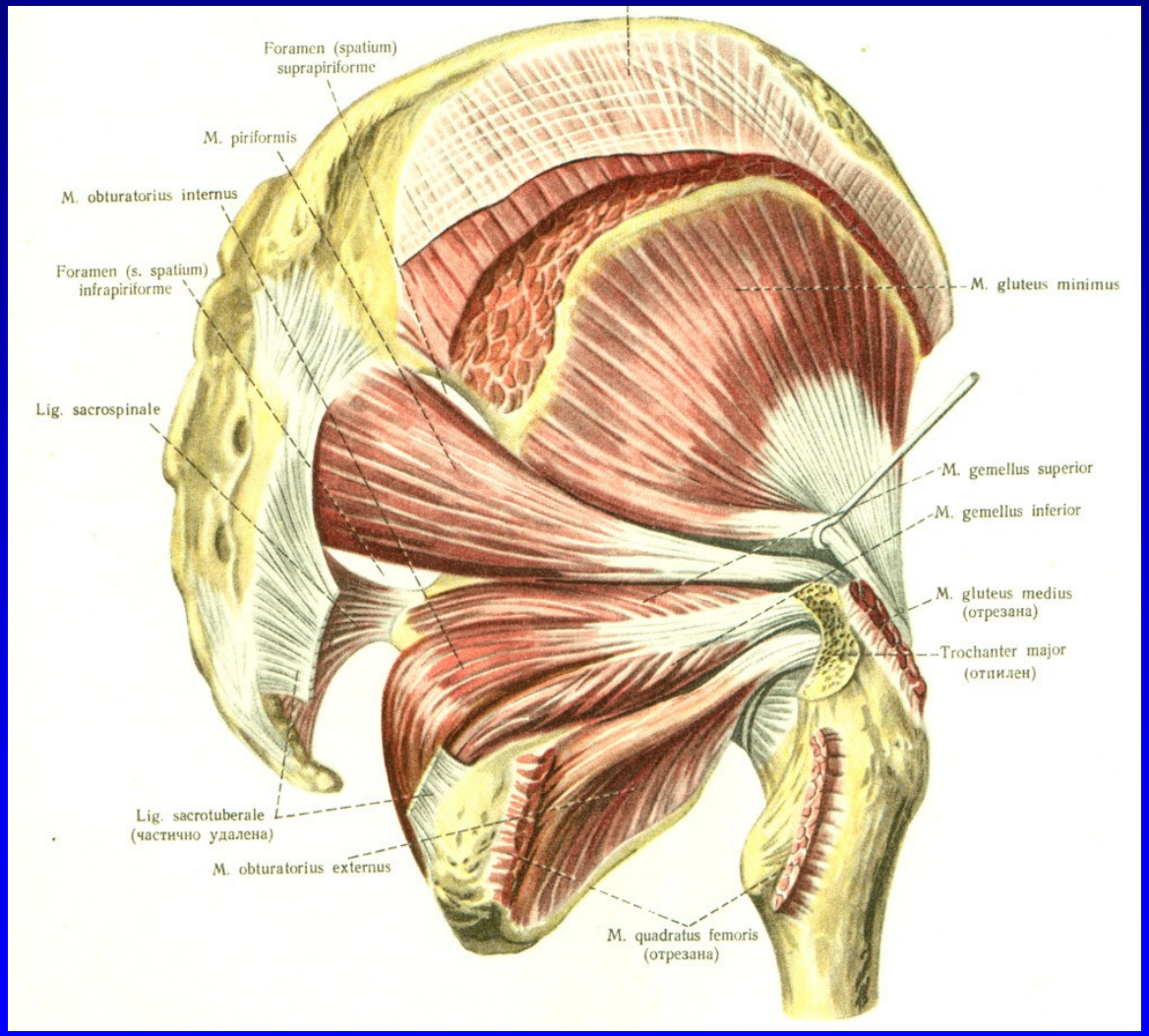
Muscles


M. latissimus dorsi
M. obliquus externus abdominis
Fascia glutea
M. gluteus medius
M. gluteus maximus
M. tensor fasciae latae
M. sartorius
Tractus iliotibialis
M. biceps femoris (caput longum)
M. rectus femoris
M. vastus lateralis
M. biceps femoris (caput breve)
M. semimembranosus

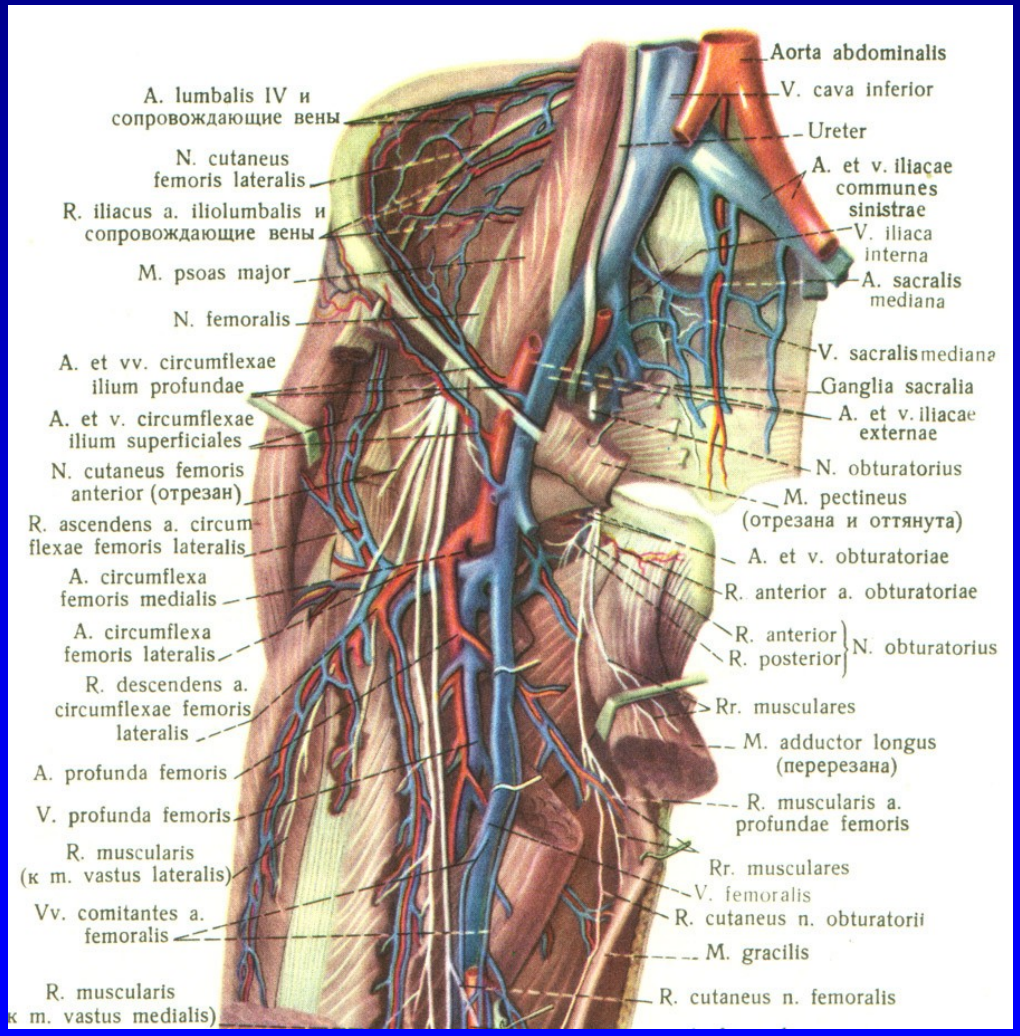
External rotators

M. triceps coxae:

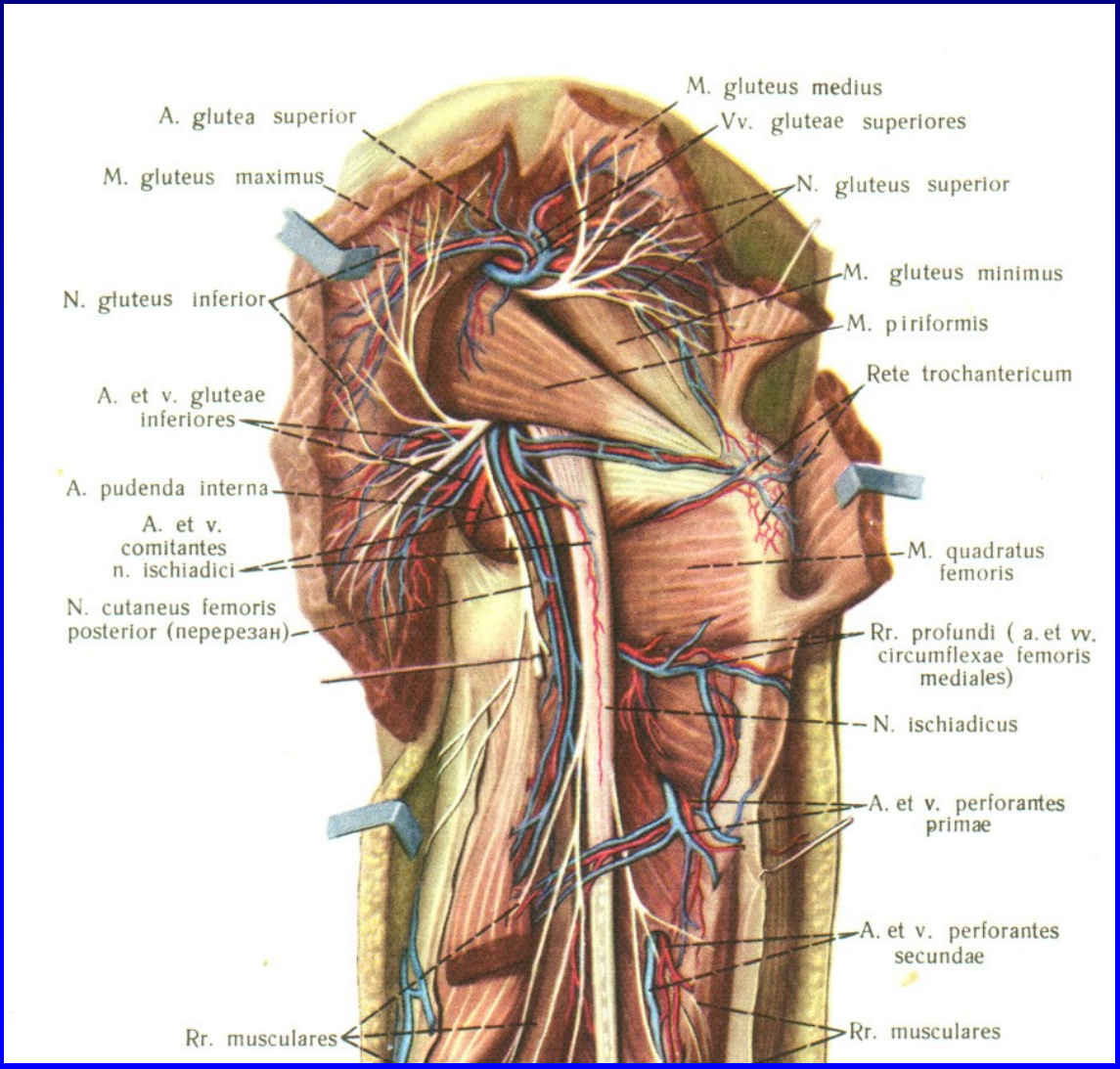
m. obturatorius int.
m. gemelus sup.
m. gemelus inf.



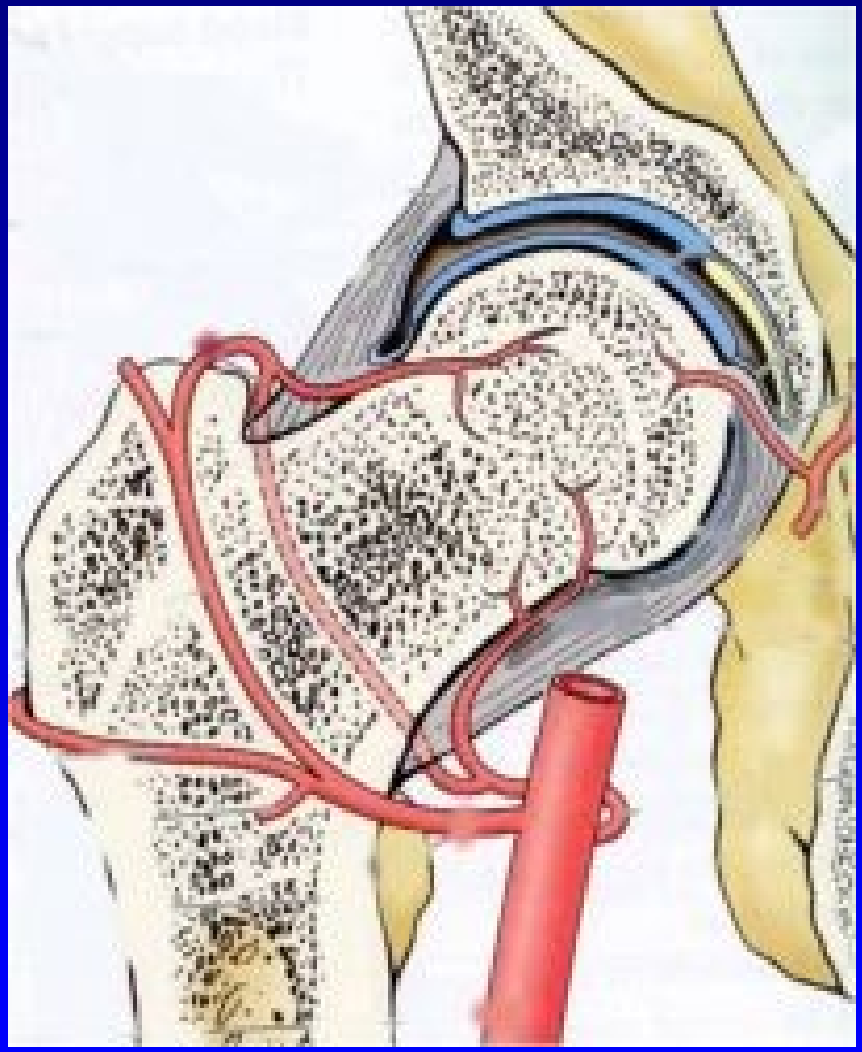
N. femoralis, a. v. femoralis n. obturatorius

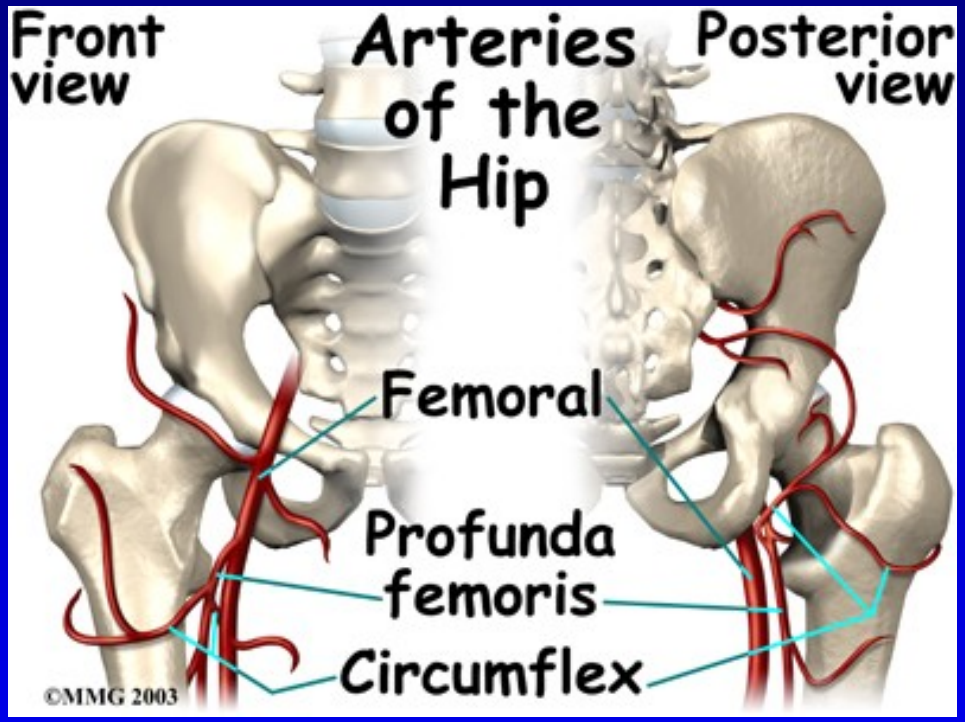


N. ischiadicus- sciatic nerve

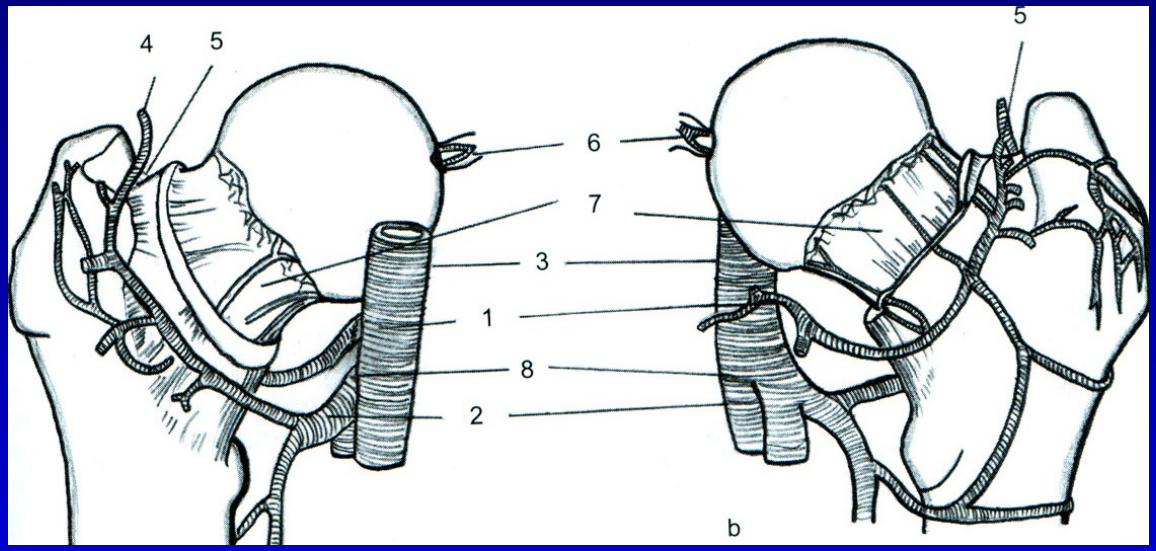


Vessels




Front view
Arteries of the Hip
Posterior view
Femoral
Profunda femoris
Circumflex
©MMG 2003

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

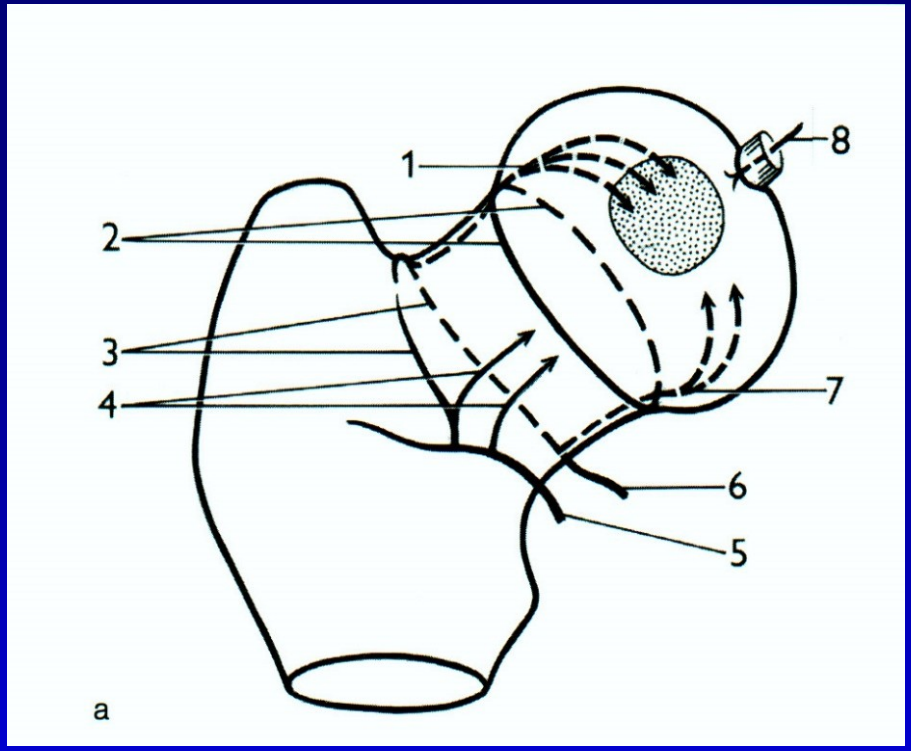
a. capitis femoris

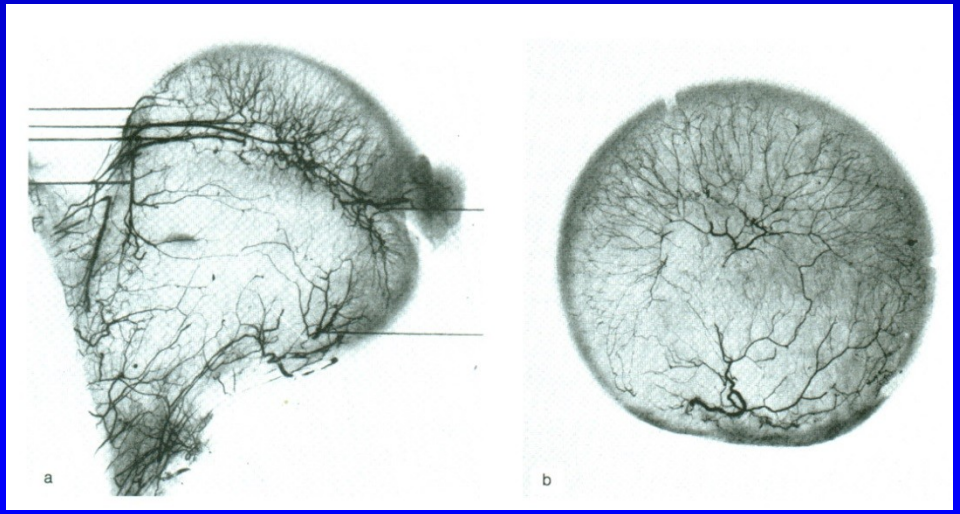
Vessels

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

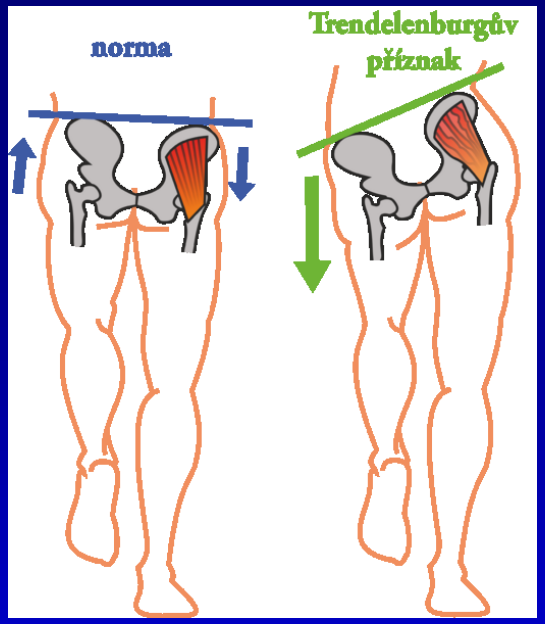
Clinical examination

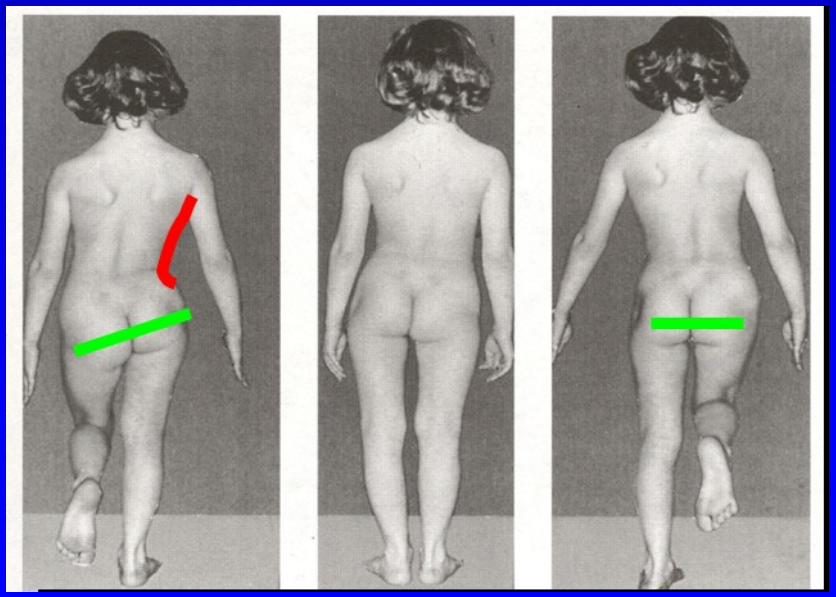
- Gait, limping, sitting
- Kinetic chain- L spine, SI joint, hip, knee, leg

- L spine
  - Hyperlordosis
  - Antalgic position of L spine
  - Scoliosis
  - Tilting of the pelvis

Trendelenburg sign

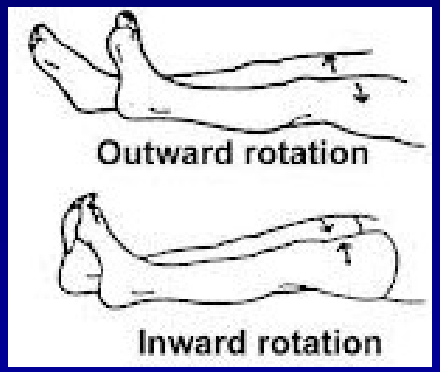
- Stability of the hip
- Strength of abductors
- Negative
- Positive
- Cause
  - Insuficiency of abductors
  - High position of greater trochanter



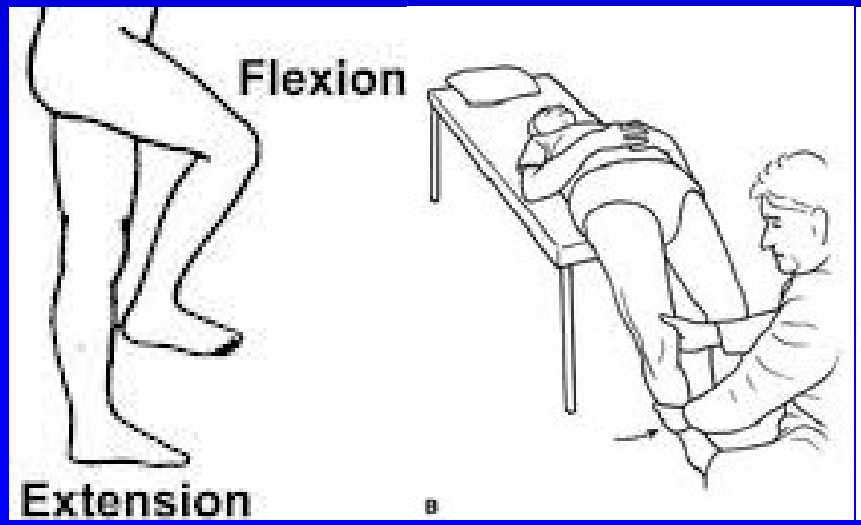


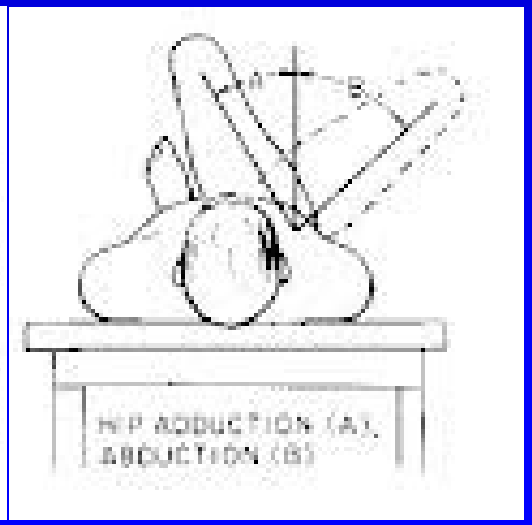
Movements, ROM

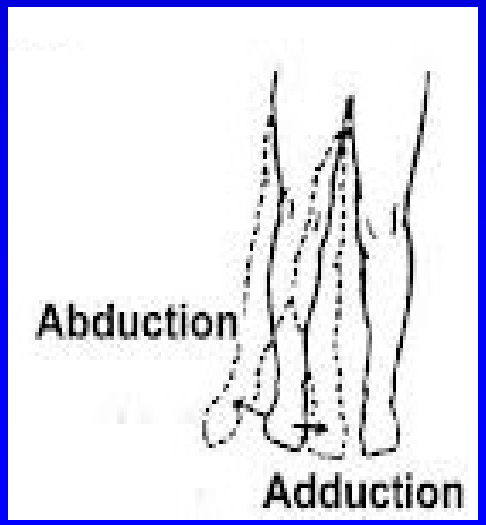
- Active
- Passive



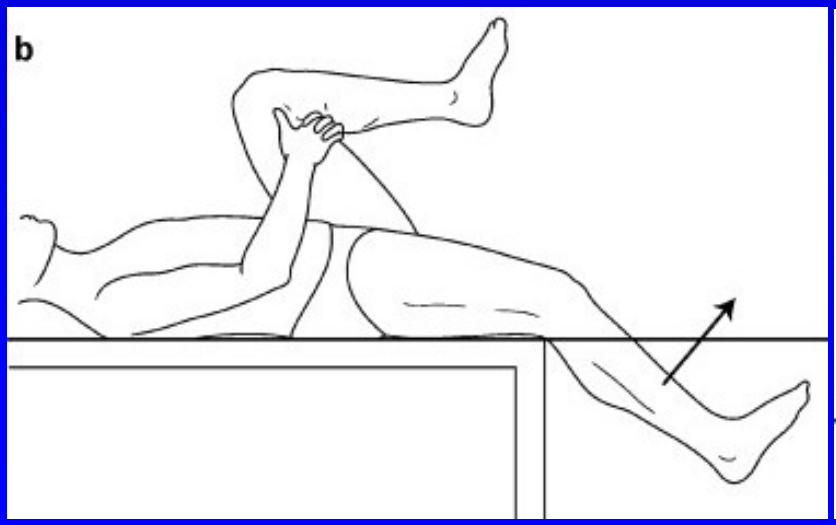
S: extension - 0 - flexion
15 - 0 - 140
F: abduction- 0 - adduction
60 - 0 - 40
T: abduction - 0 - adduction
80 - 0 - 30
R: ER - 0 - IR
50 - 0 - 40

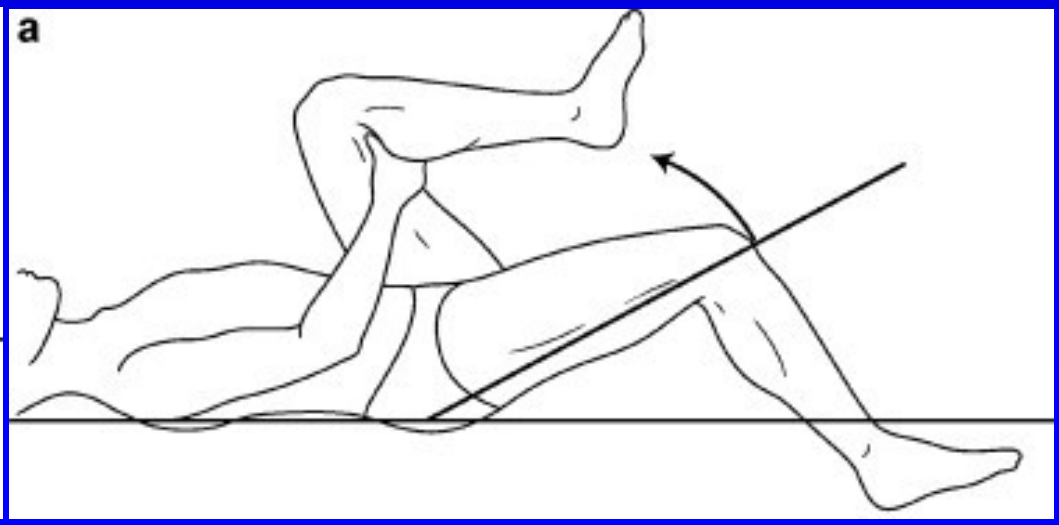






- **Contracture in hip joint**
  - antalgic (semiflexion)
  - typical contracture in cerebral palsy (adduction, flexion, inner rotation – illiopsoas, adductors, rectus femoris.
  - **Thomas sign**
    - Maximal flexion in contralateral hip – balanced hyperlordosis
    - Thigh goes into flexion



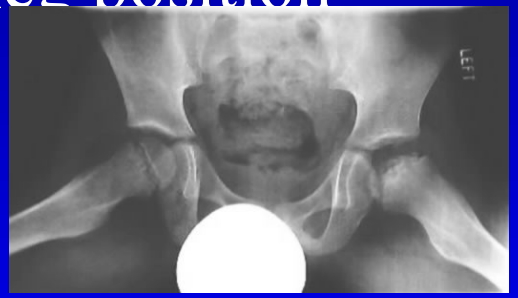


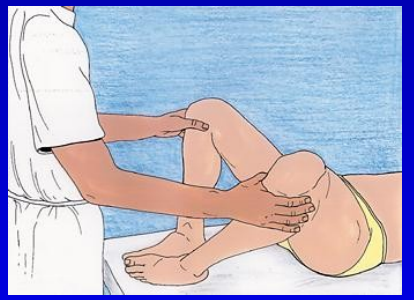
Duncan-Ely test

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

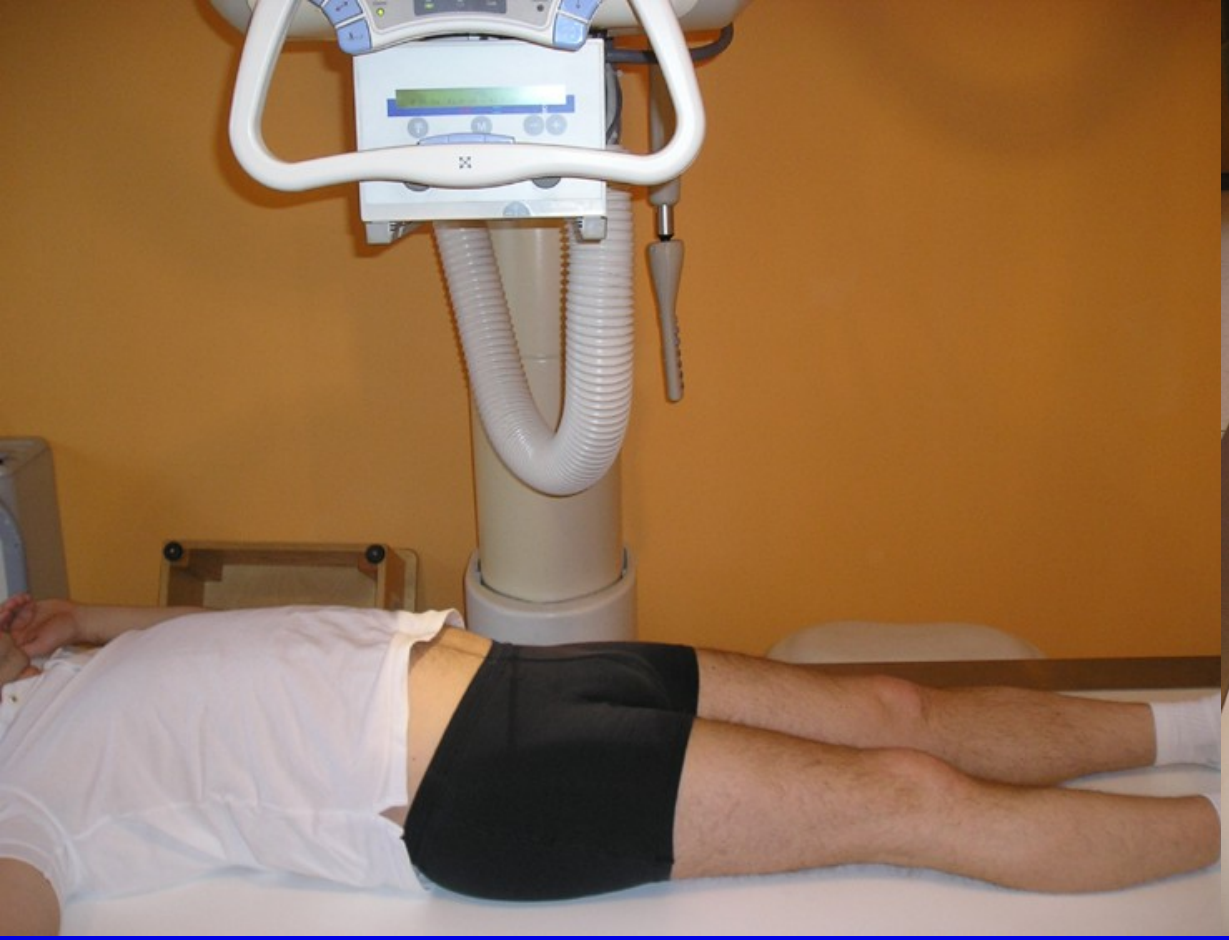
Imaging methods

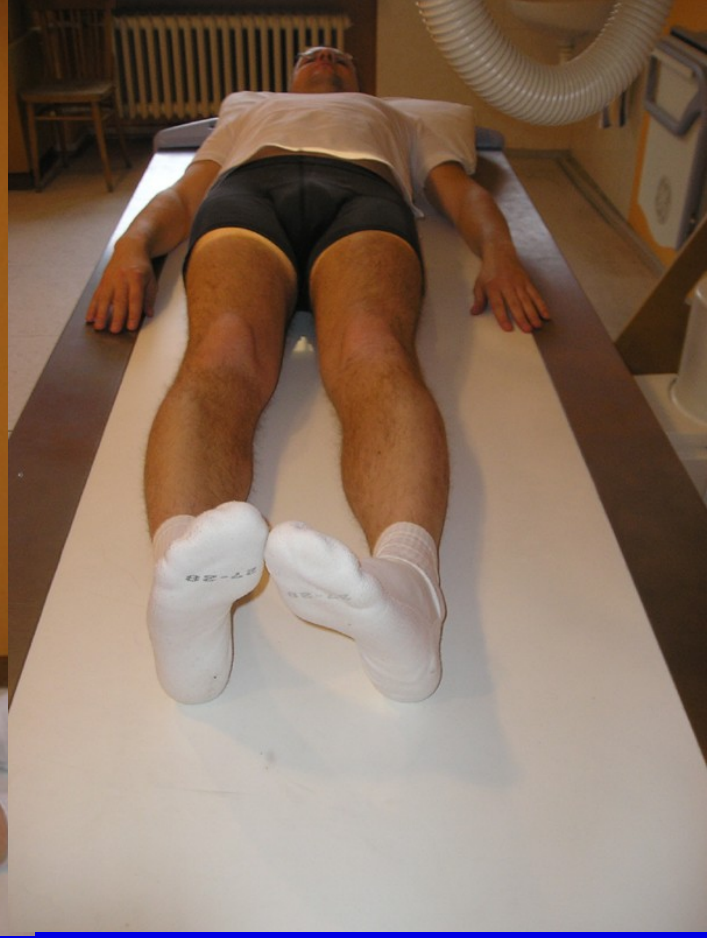
- **X ray**
  - AP
  - Axial
  - Lauenstein, frog leg position



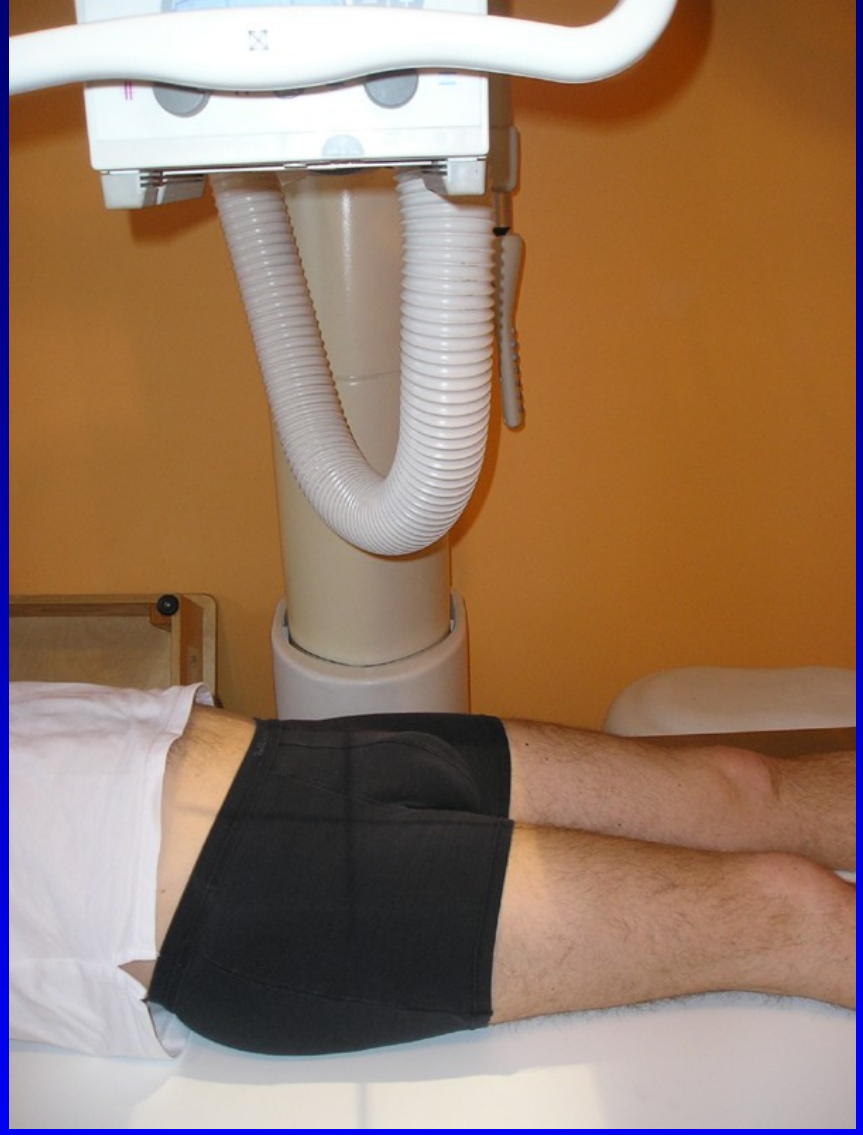


- **USG** (children, effusion, bursitis)
- **Arthrography** (children)
- **CT, MRI**
- **Scintigraphy**

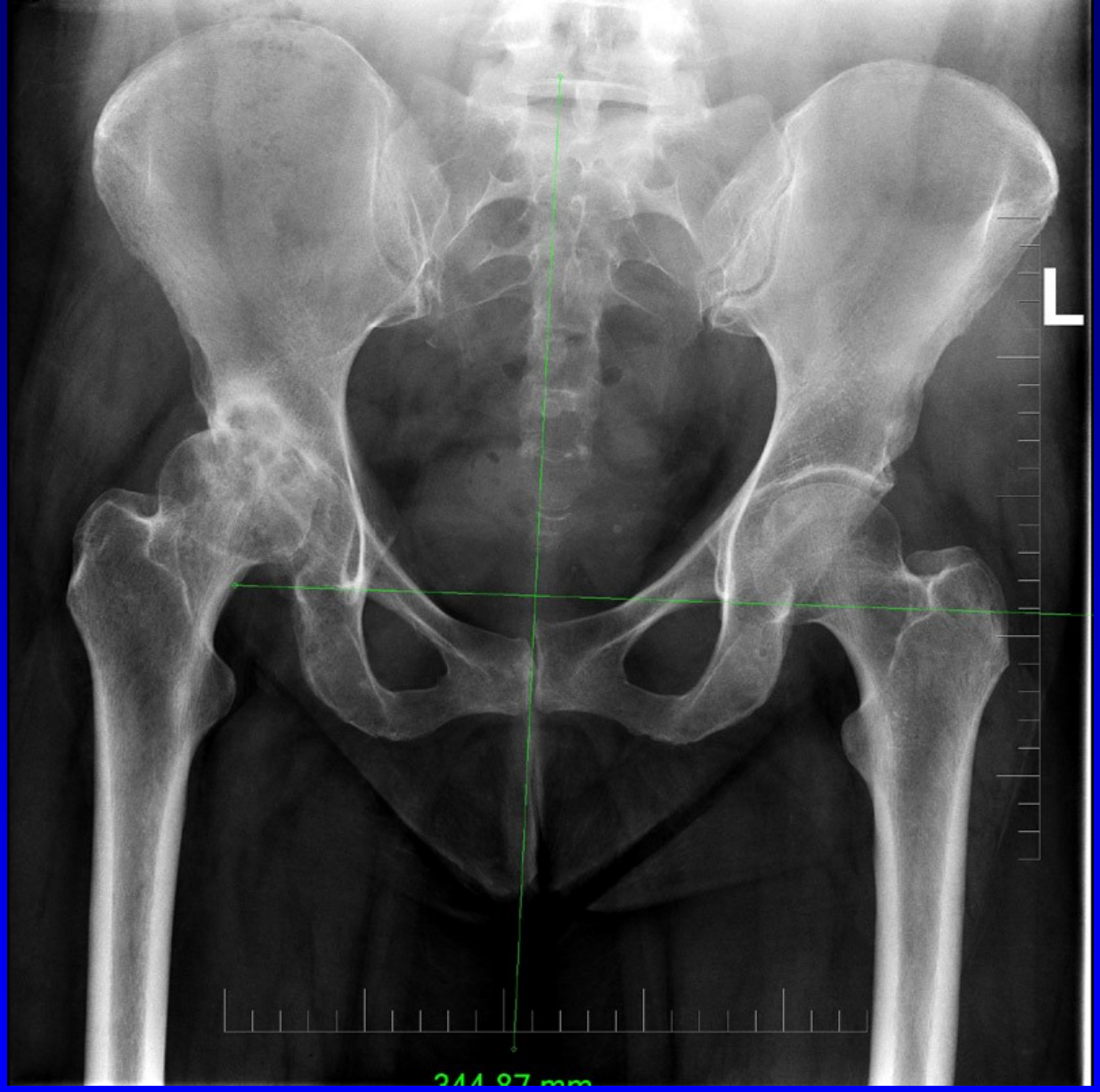




AP view of the pelvis: centre umbiliculus- symphysis
inner rotation



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**

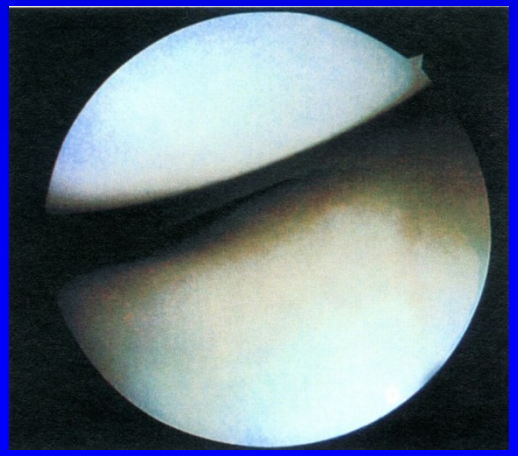
Frequent pathology

- **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



Osteoarthrosis deformans

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

Osteoarthrosis

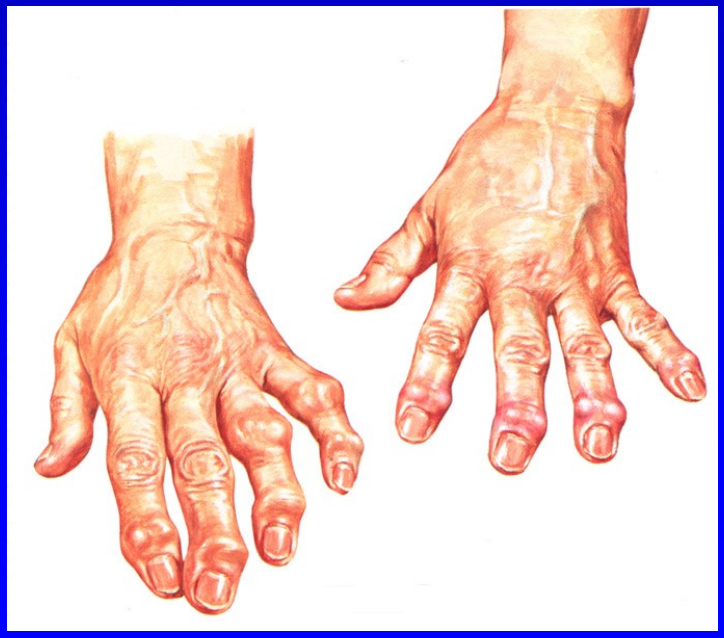
15 percent of the population

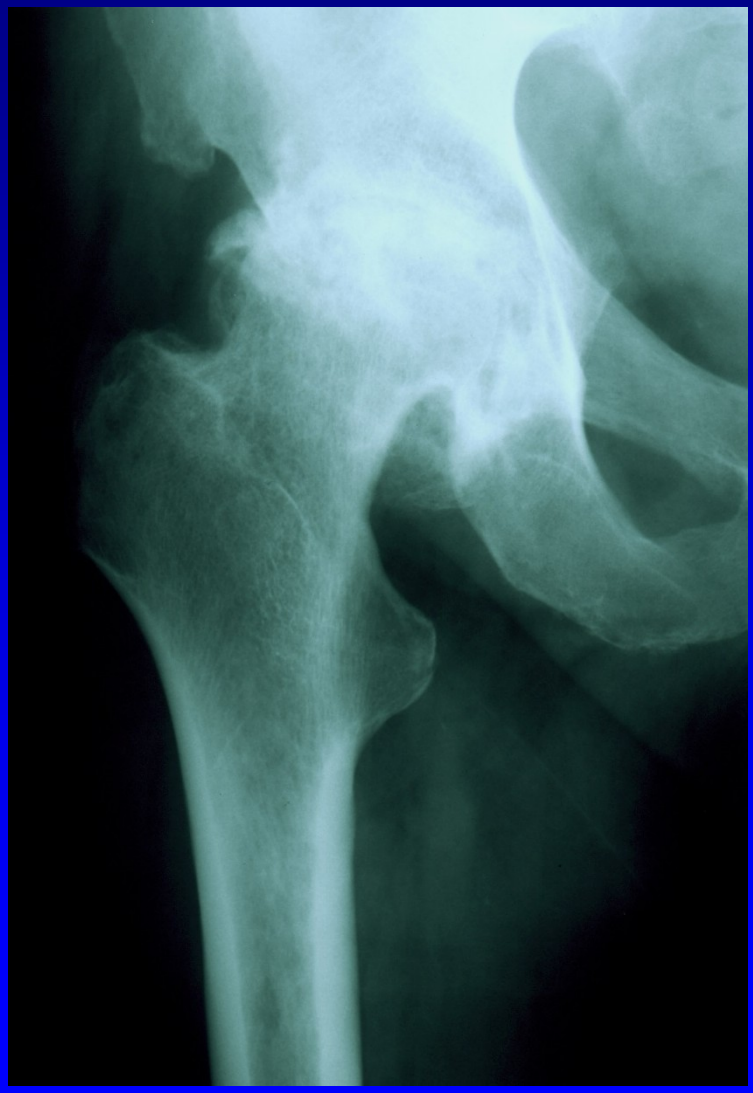
50 percent of people above 65 years

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

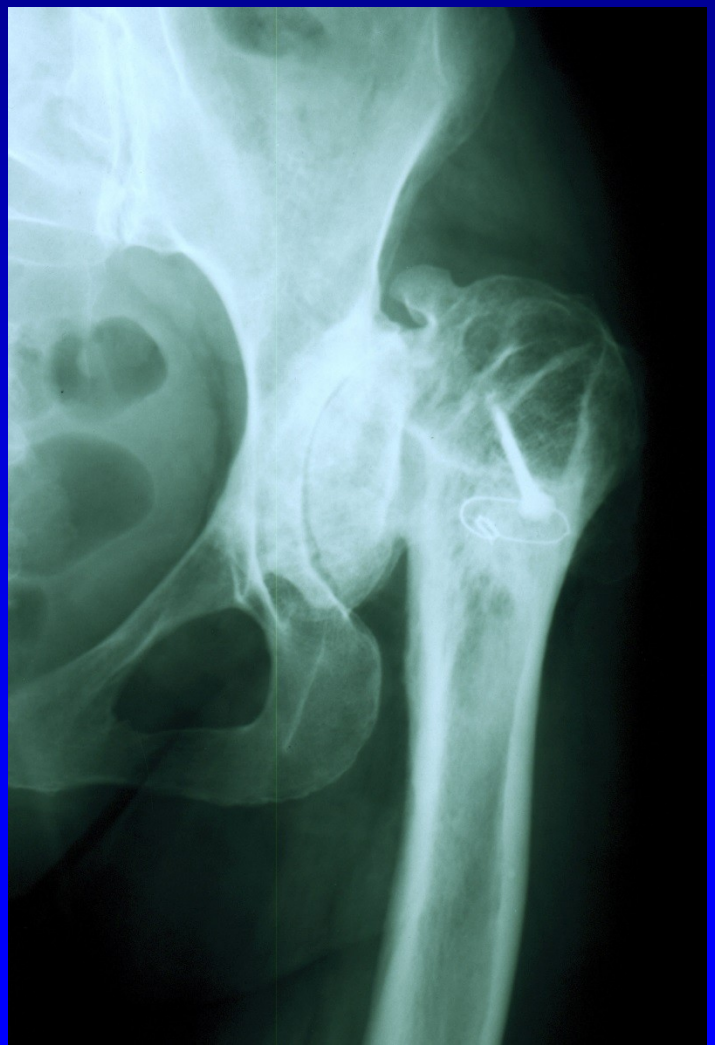




Secondary O.A.

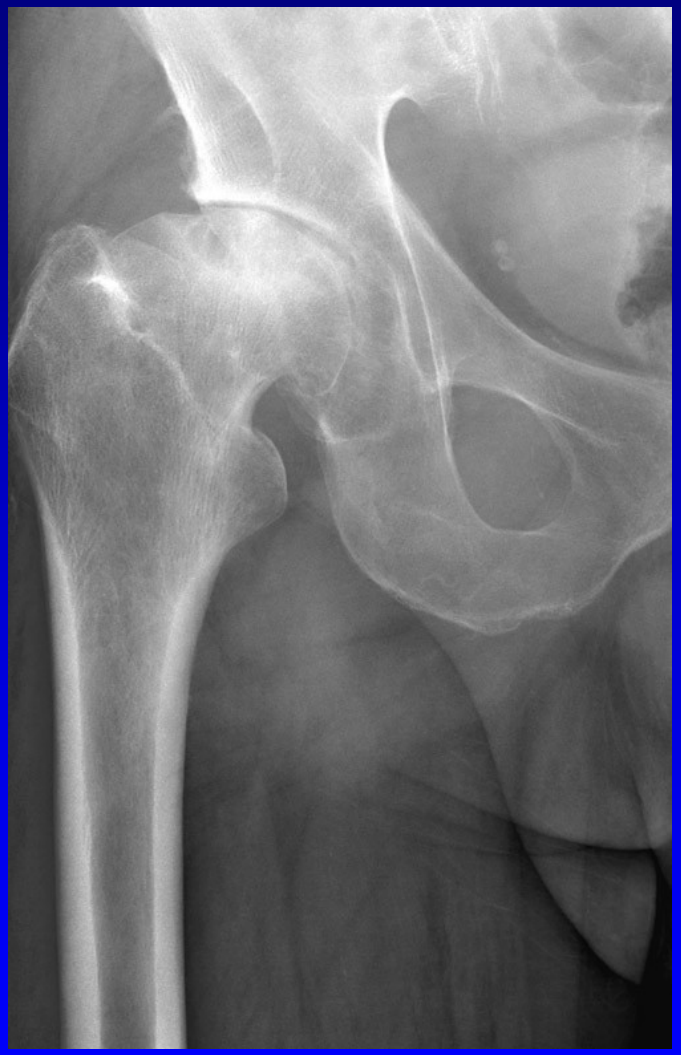
1. Mechanical factors (DDH, Perthes disease, aseptic necrosis, slipped femoral epiphysis, condition after fractures)
2. Metabolic disorders (ochronosis, gout, chondrocalcinosis, Gaucher disease)
3. Hormonal disorders (acromegaly, diabetes m.)
4. Inflamated disorders (septic artritis, R.A.)

DDH- developmental dysplasia of the hip joint



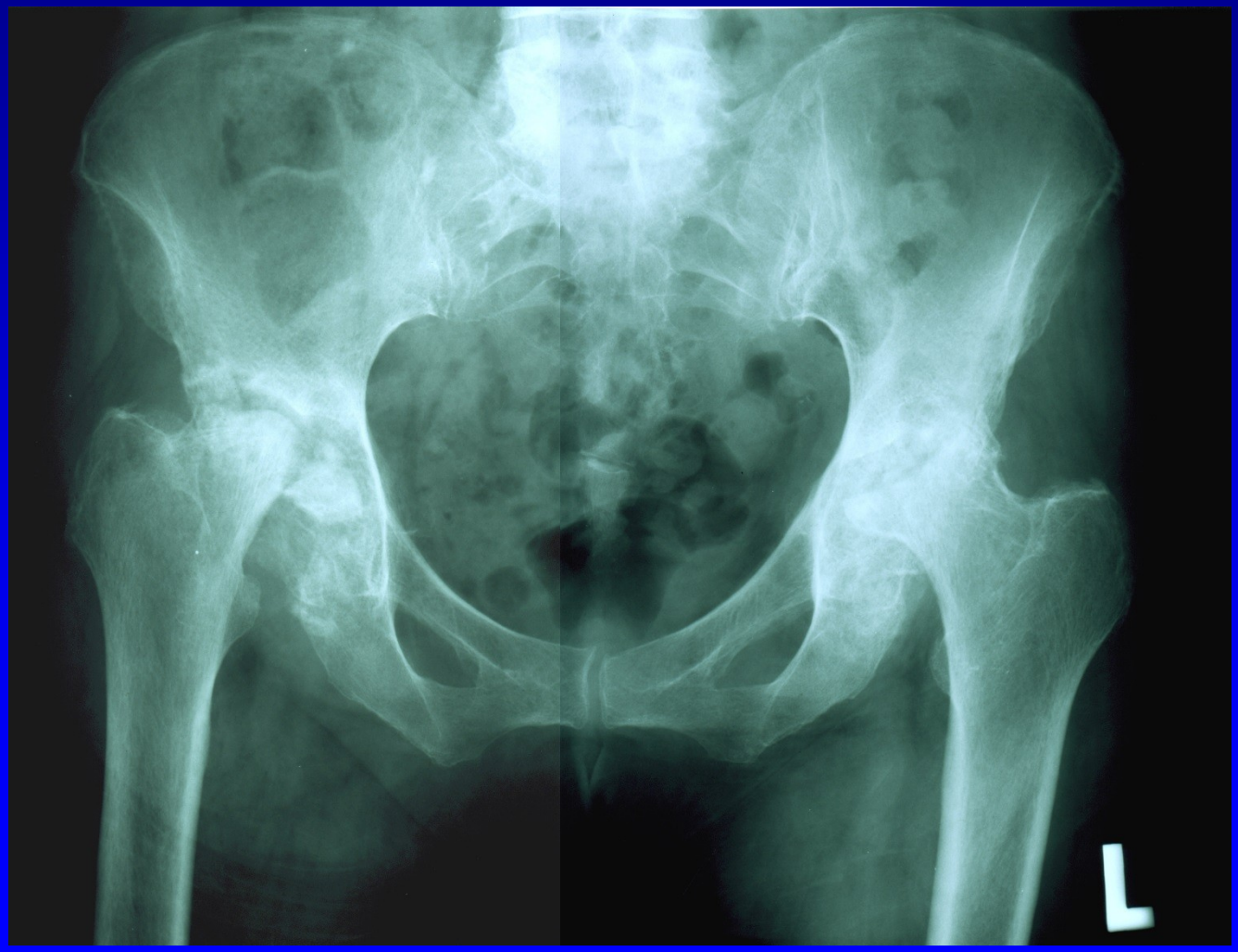
Obr. 6

Condition after Perthes disease



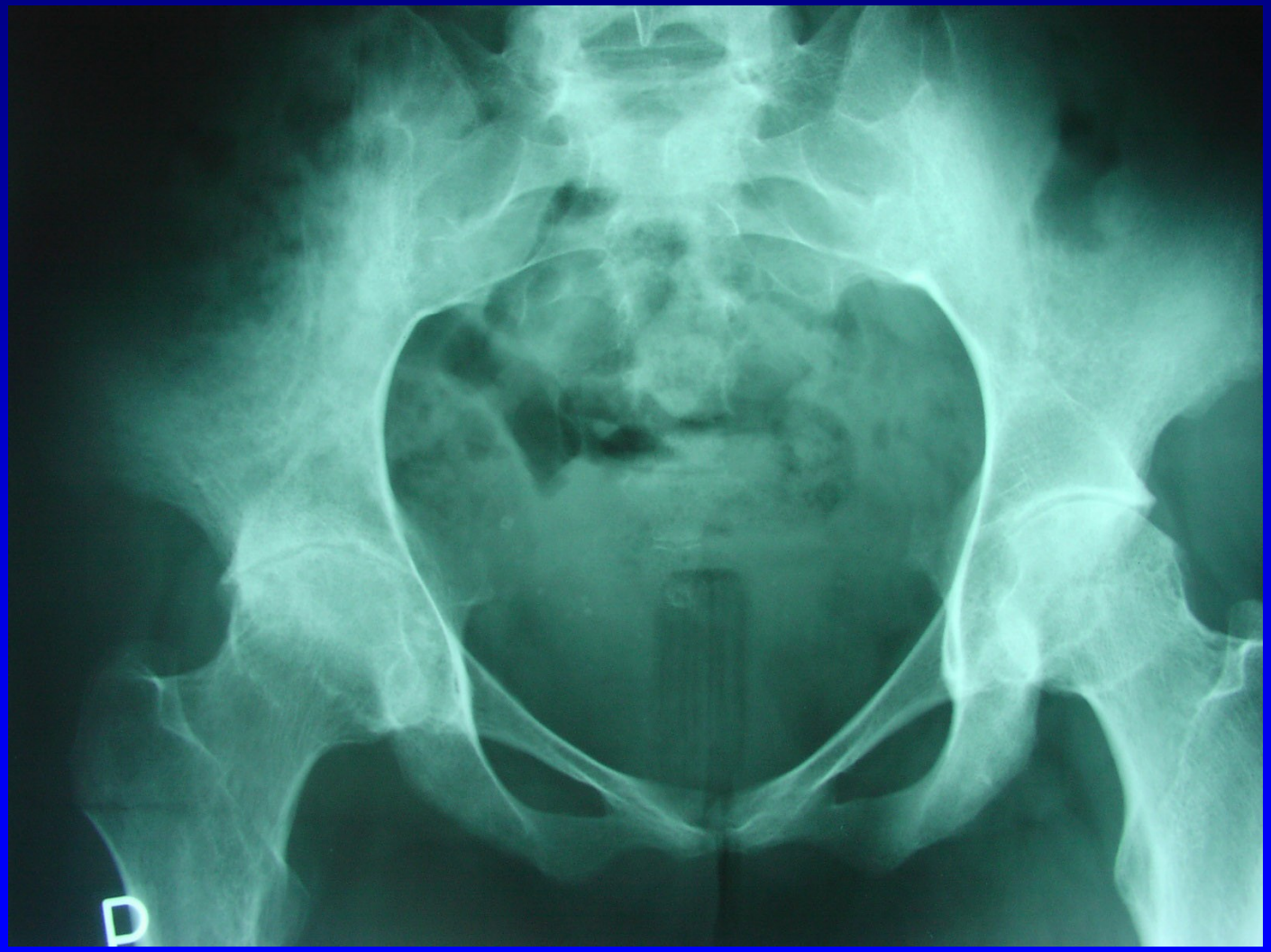
Obr. 8

Rheumatoid artritis



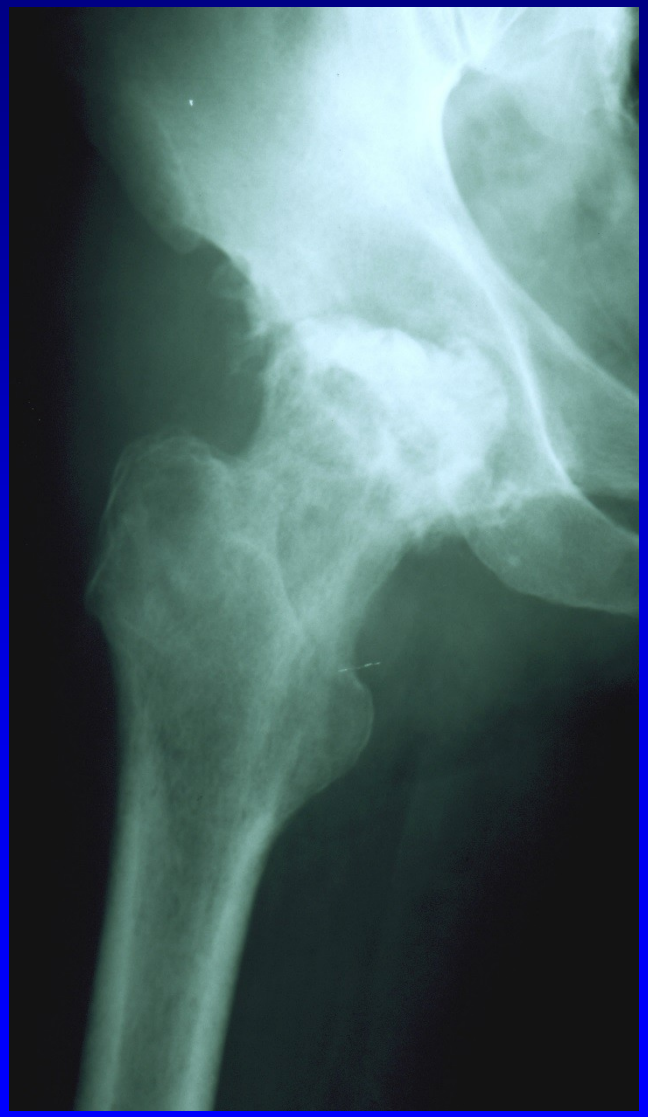
Obr. 10

Ancylosing spondylitis



Obr. 12

Septic arthritis

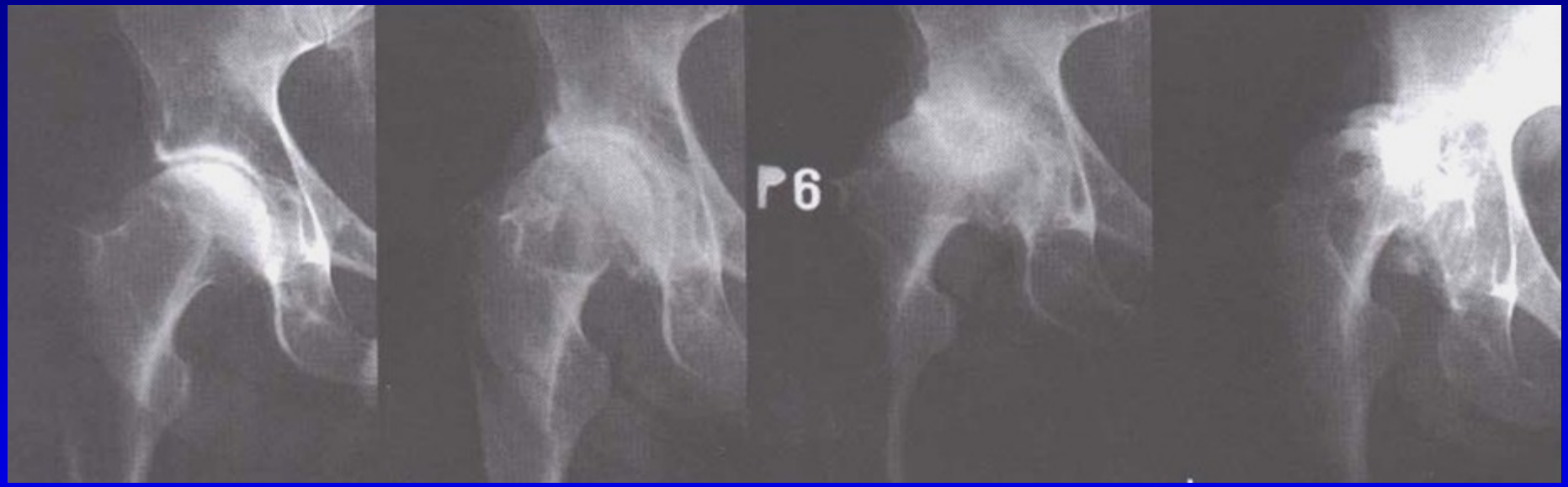


Obr. 13

Osteoarthrosis - 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

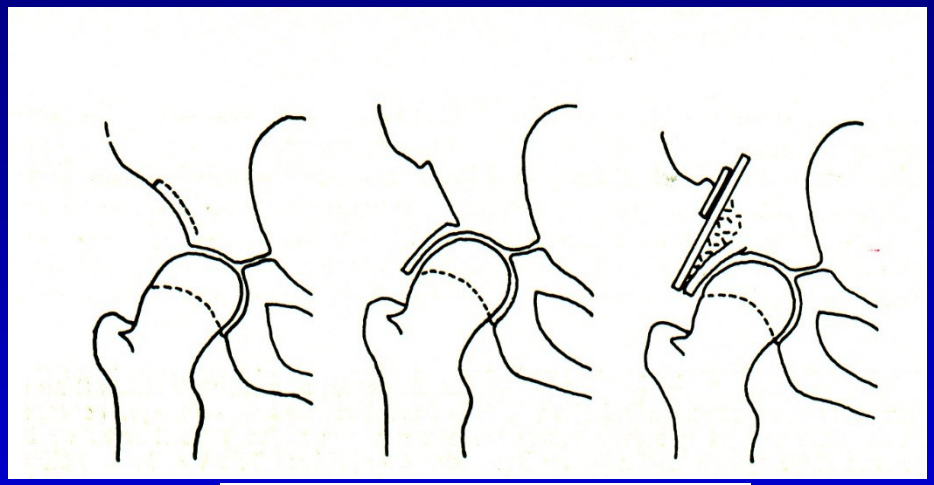
Arthroscopy

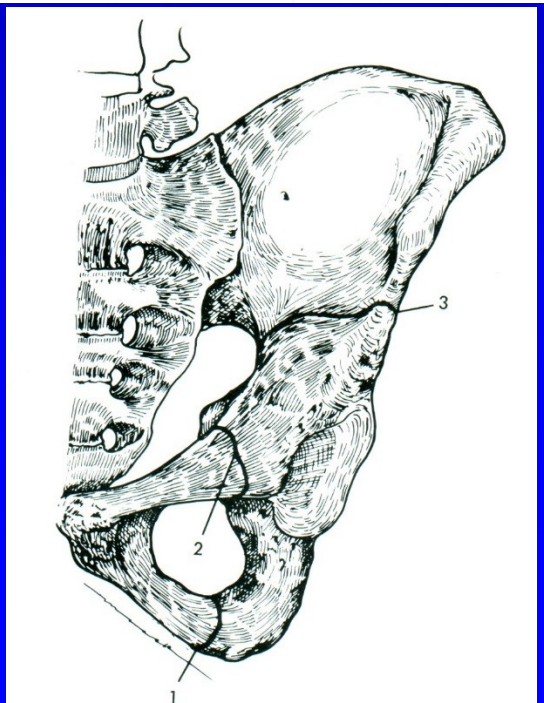
- Labral lesions
- Osteochondral lesion
- Loose bodies
- Synovectomy
- Transchondral fracture

Osteotomy of the pelvis

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

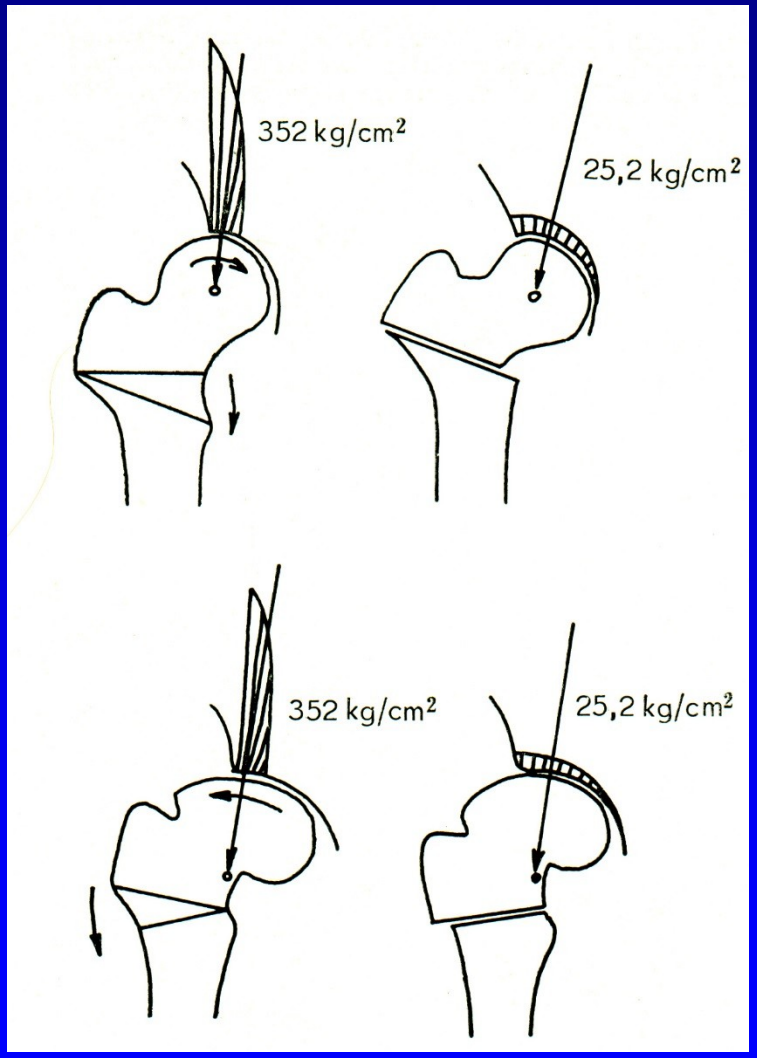
  Bernese



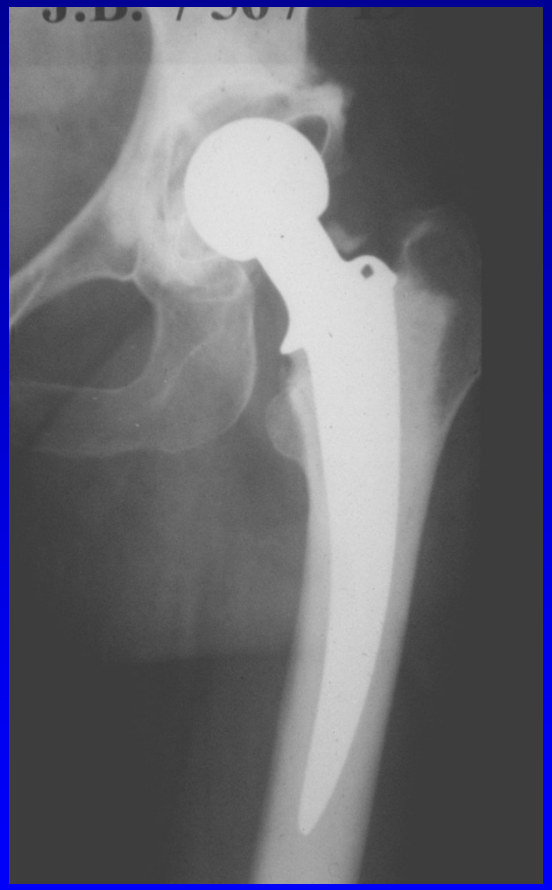


Femoral osteotomy

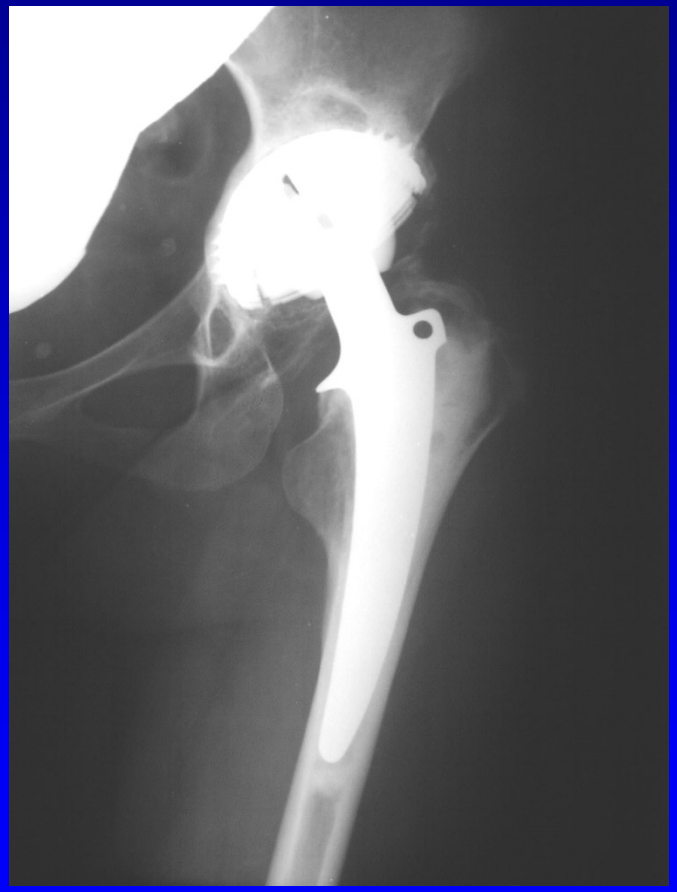
- Varus
- Valgus
- Derotation
- Angulation



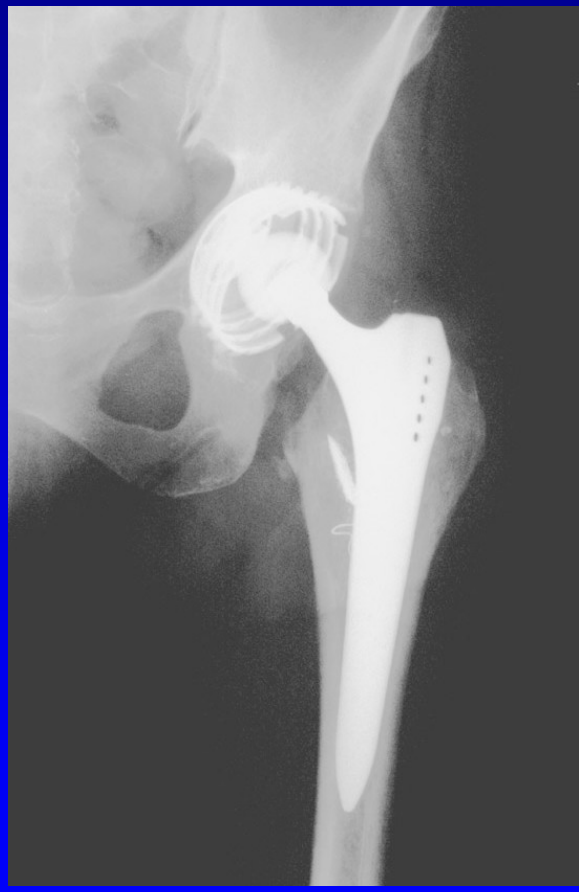
THA



Cemented

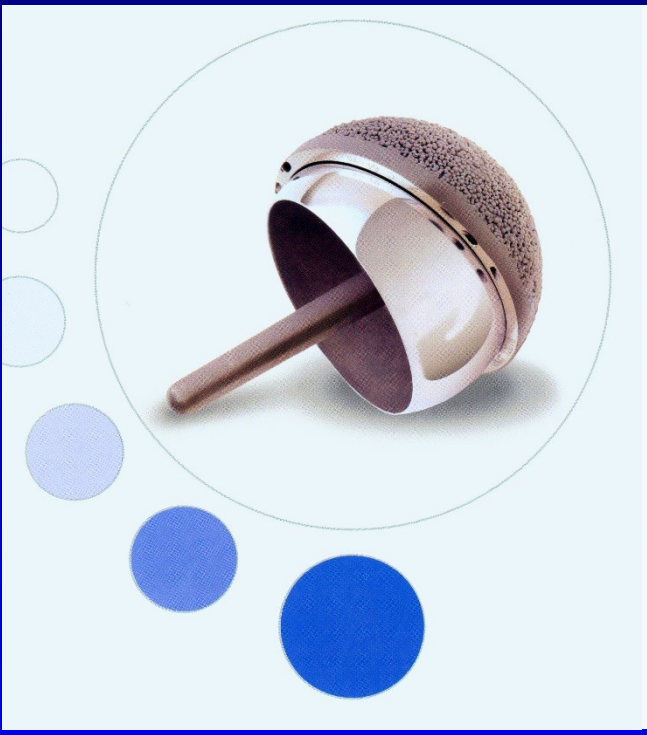


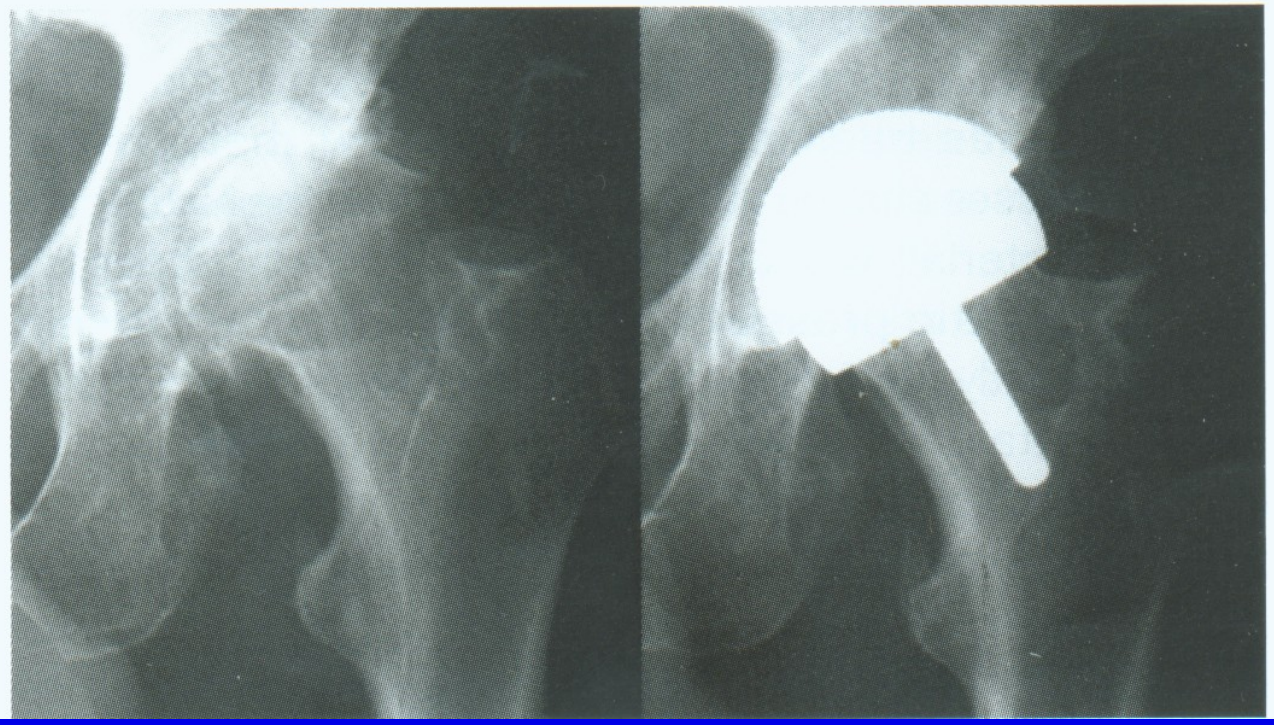
Hybrid



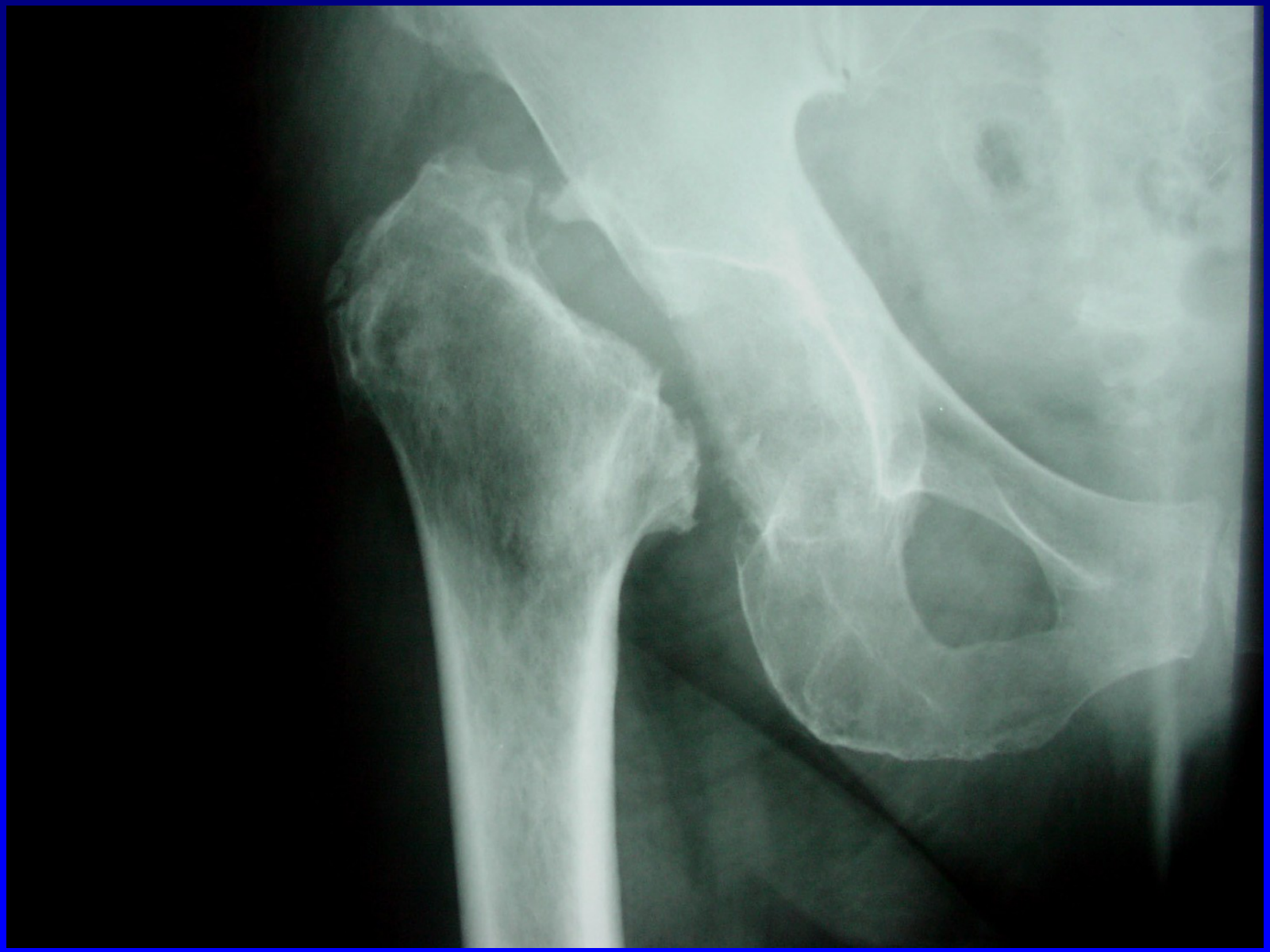
Uncemented

Resurfacing



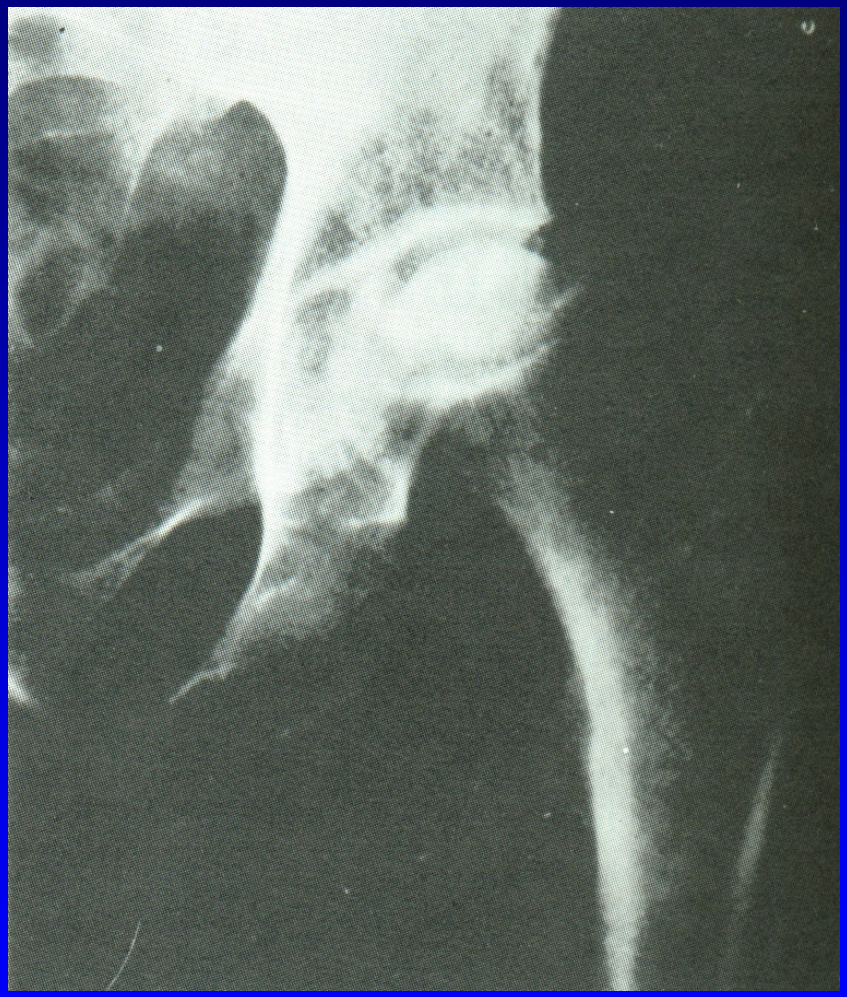


Girdlestone procedure



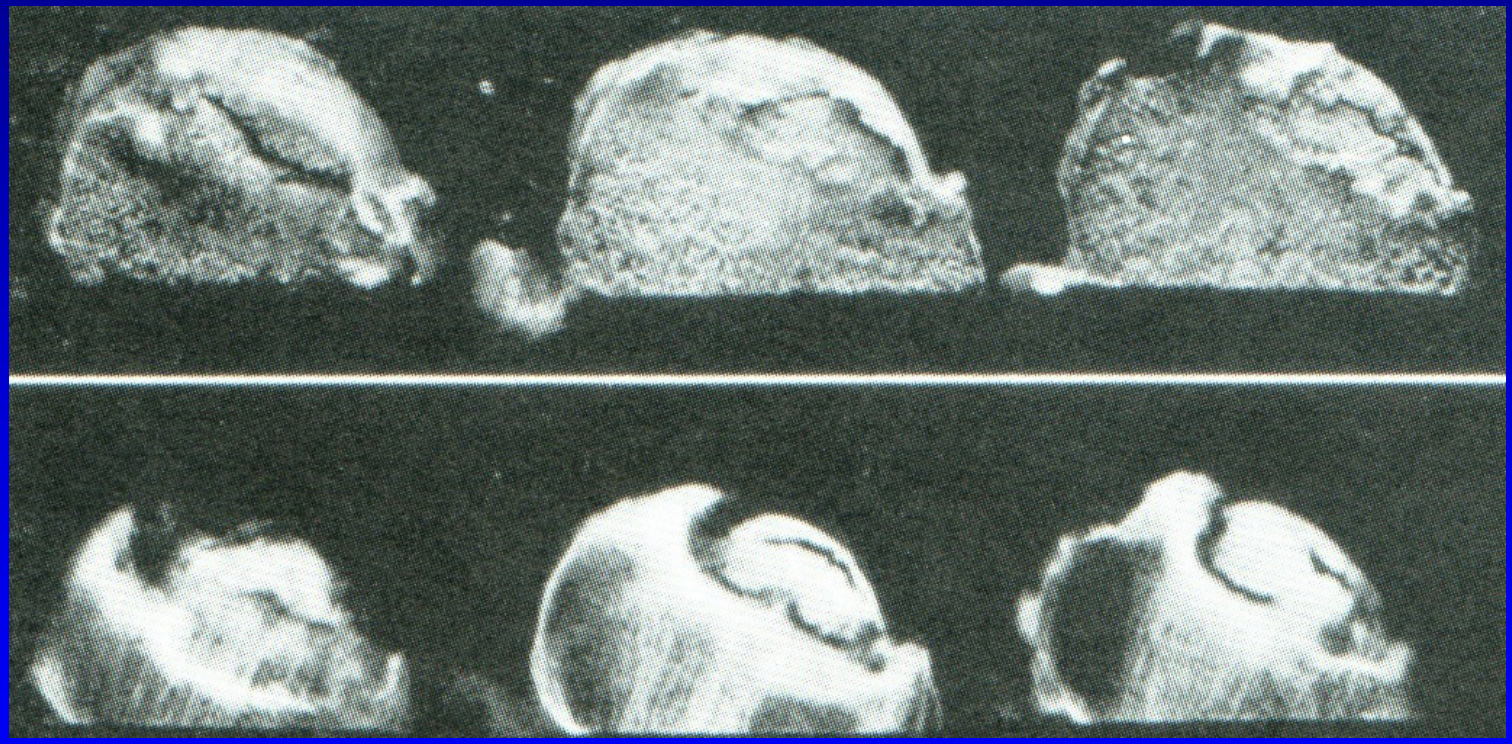
Idiopatic avascular necrosis of femoral head

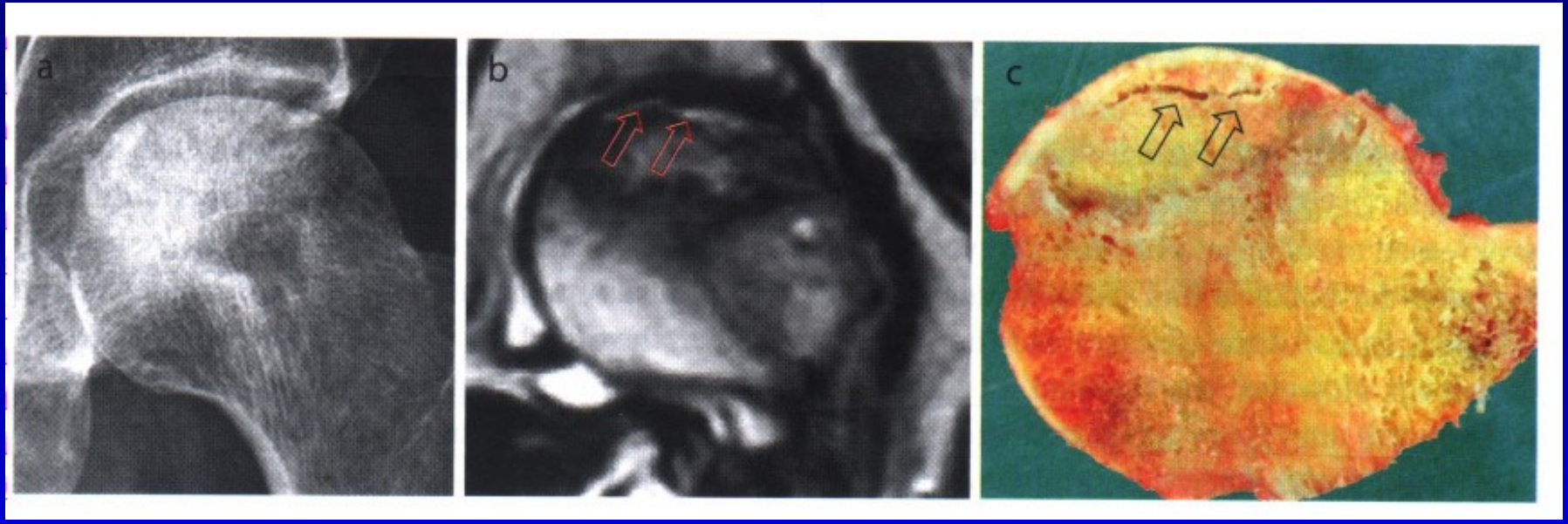
- Male 20-40 years
- Progressive pain
- X-ray CT, MRI, scintigrafie
- **Etiology** – unknown, coagulopathy, radiation, corticoids, alcoholic



Pain
Limited movements
Impaired gait

Idiopatic avascular necrosis of femoral head

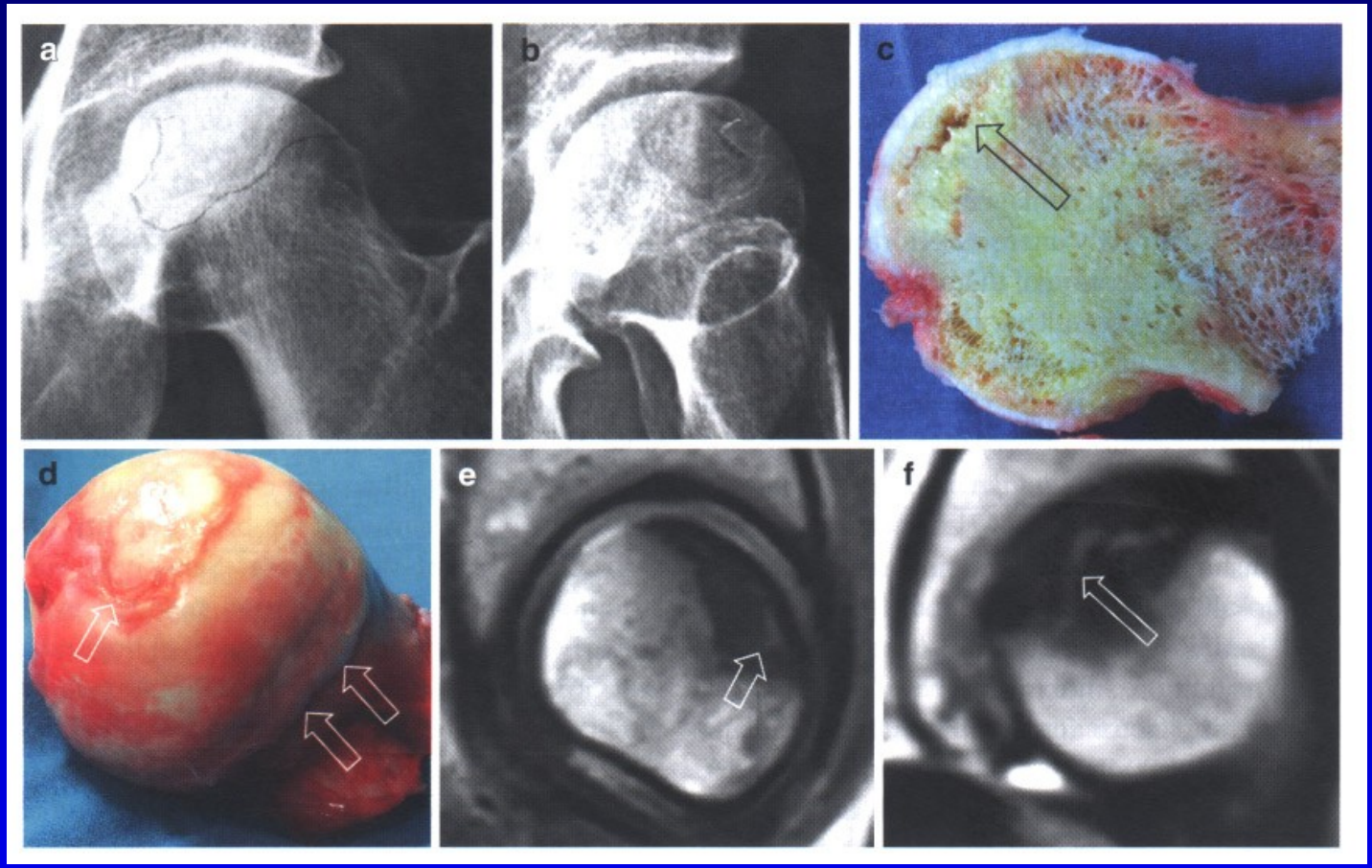




X ray

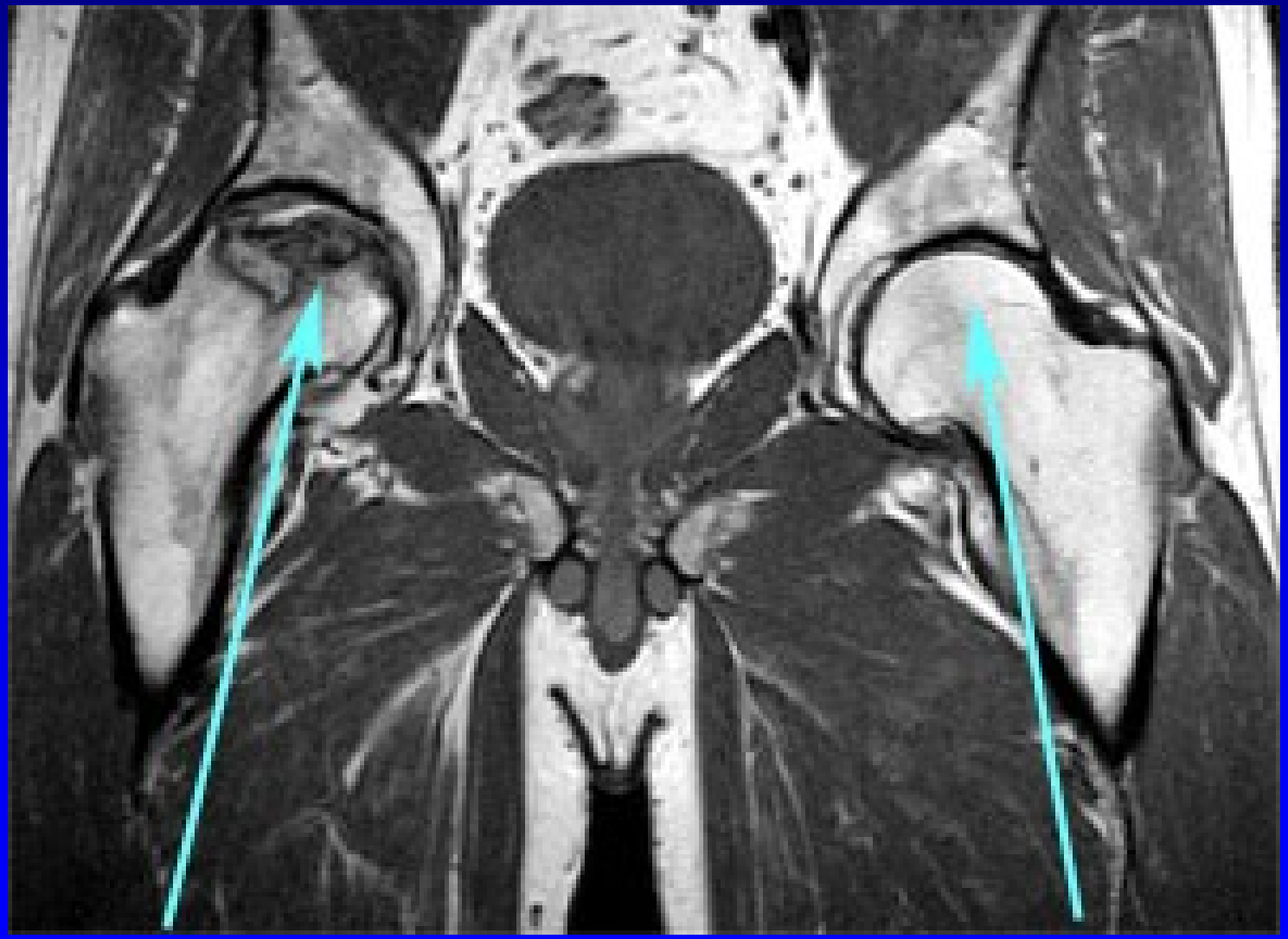
MRI

Excised head

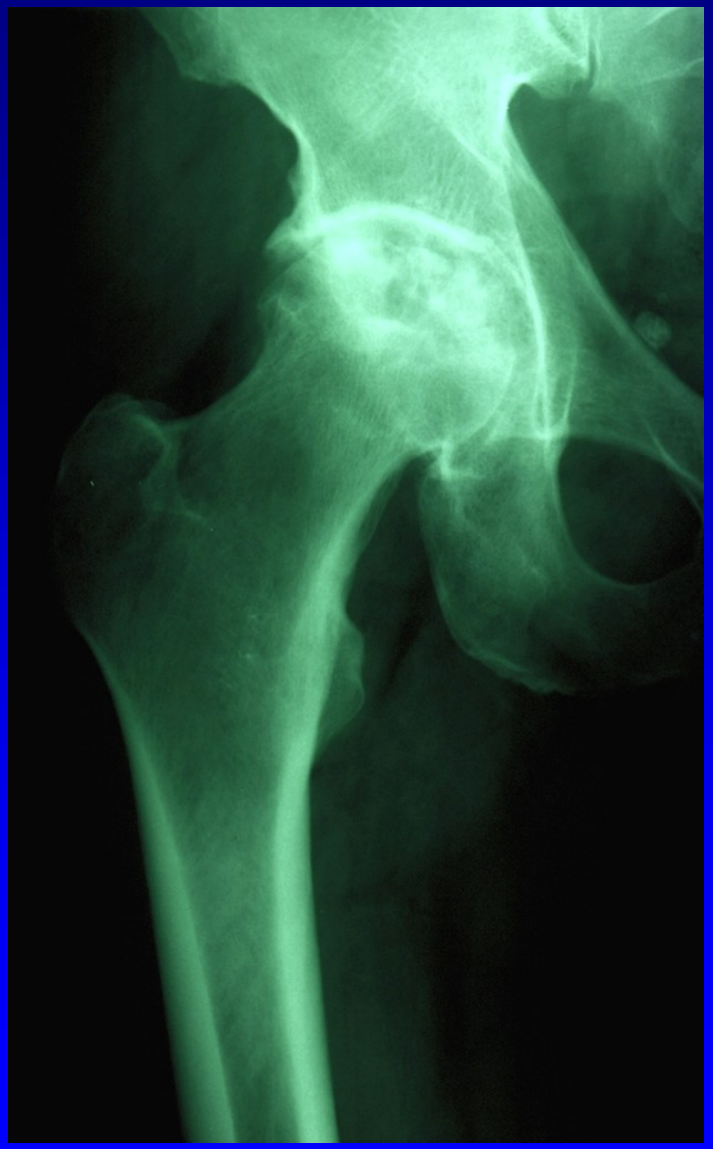


Subchondral fracture

MRI- idiopatic avascular necrosis of femoral head

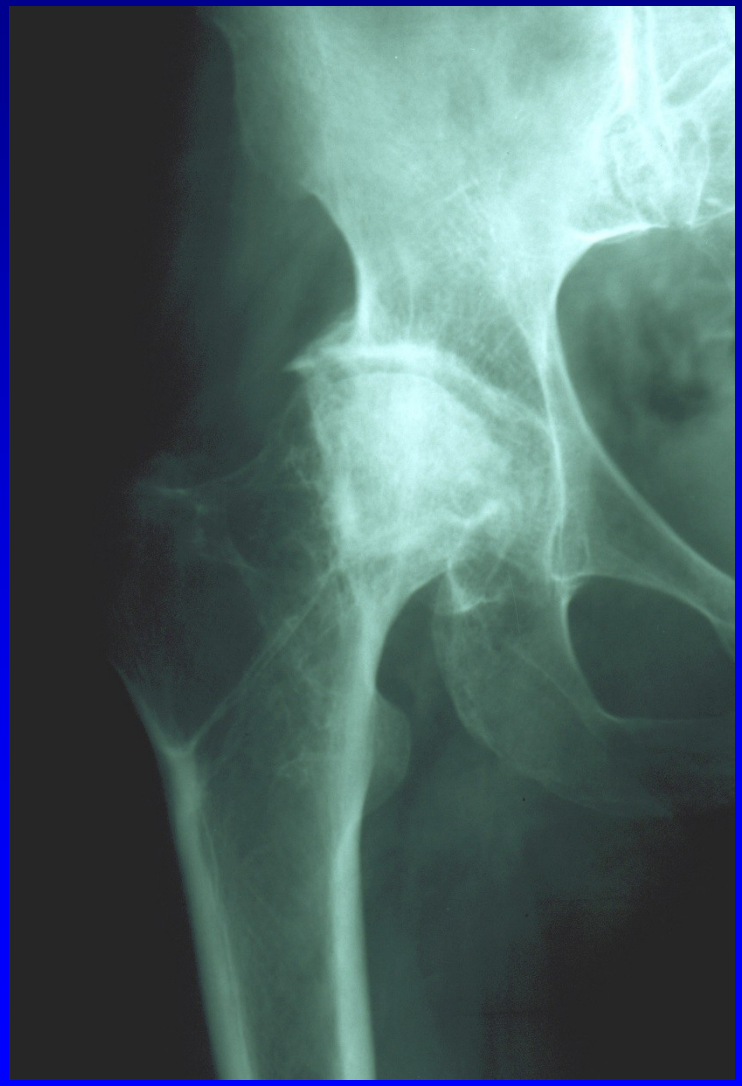


Idiopatic necrosis of the femoral head



Obr. 7

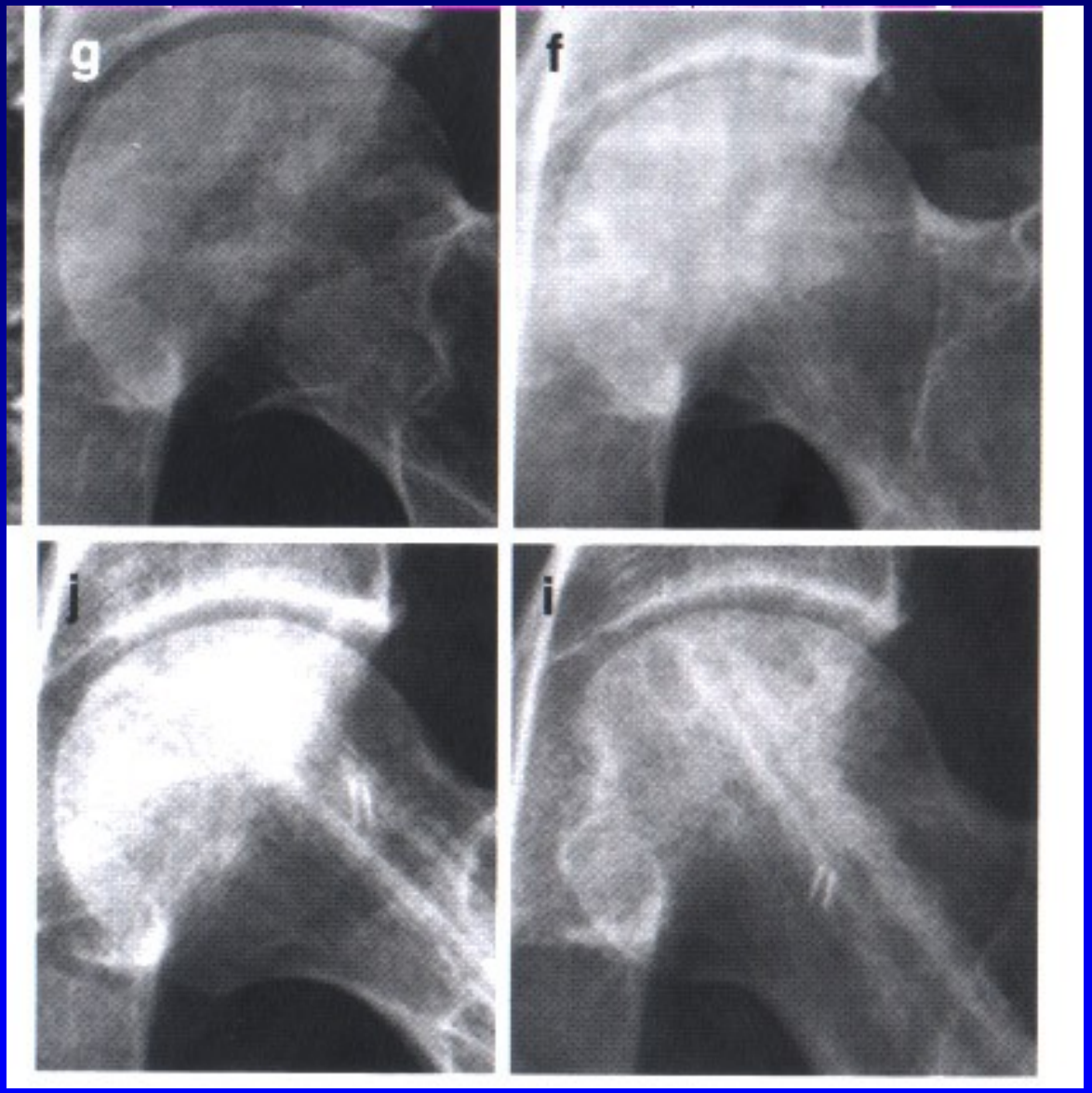
Necrosis after femoral neck fracture

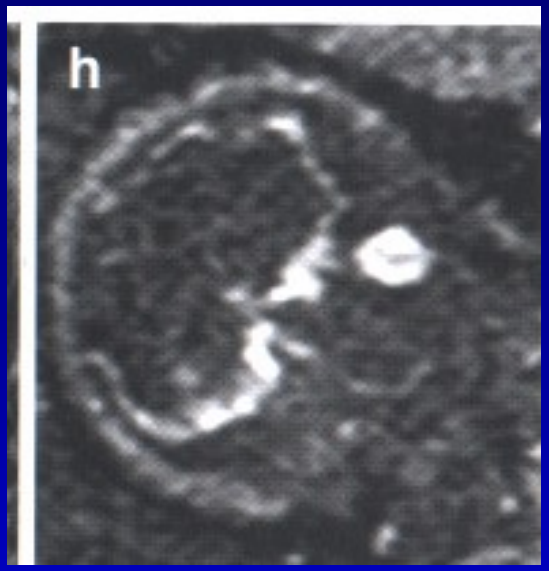


Obr. 9

Management

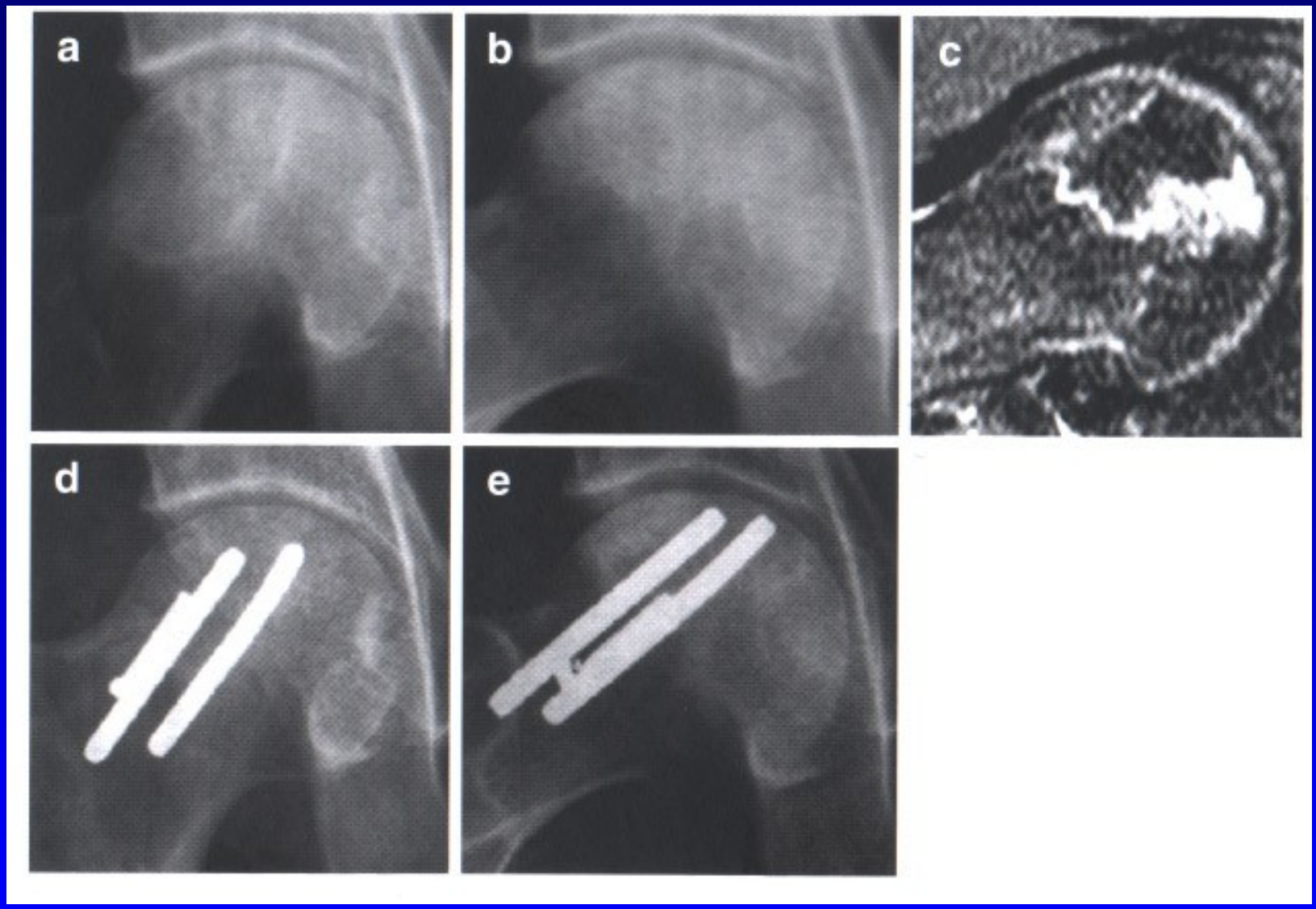
Non weight bearing
Forrage
Curretage , bone grafting
Fibular graft
Graft from greater trochanter
Osteotomy
Tantal rods
Hyperbaric chamber
THR





Preop.

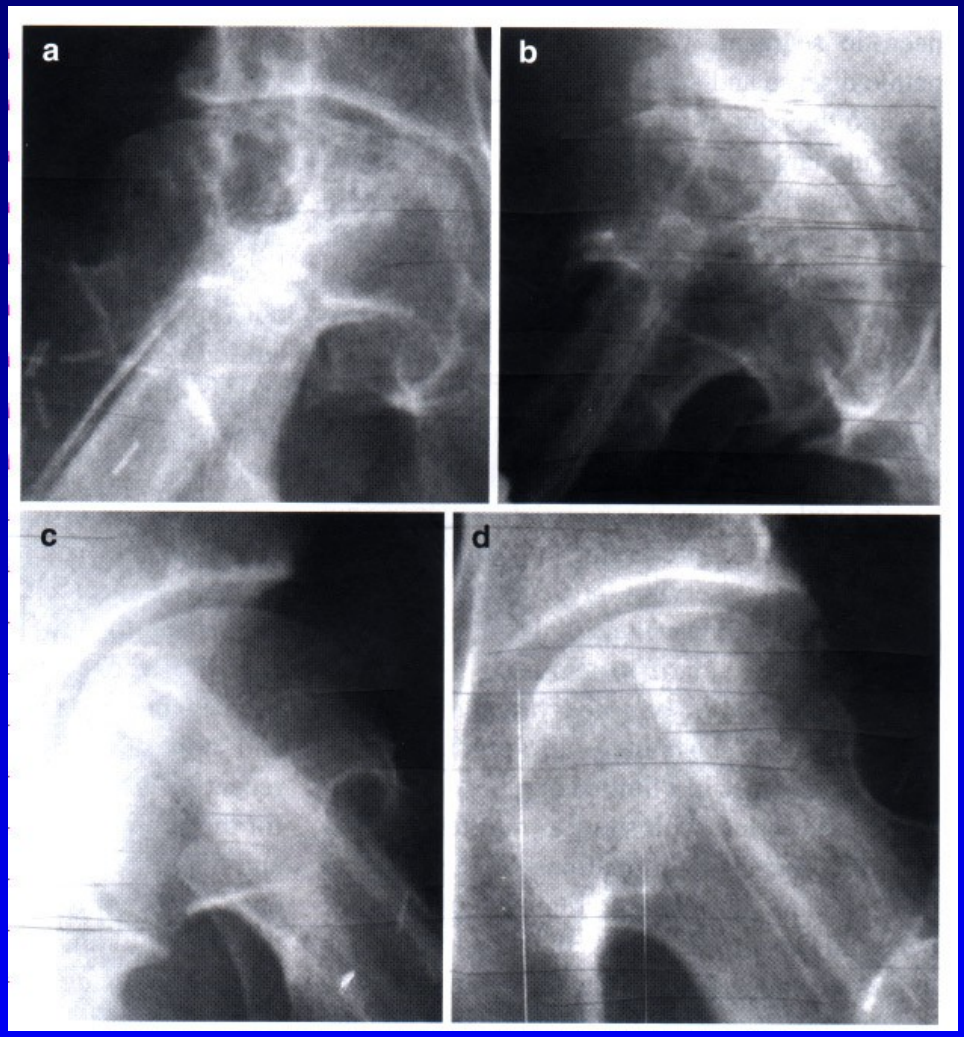
Vascular fibular graft, 5 y. postop.



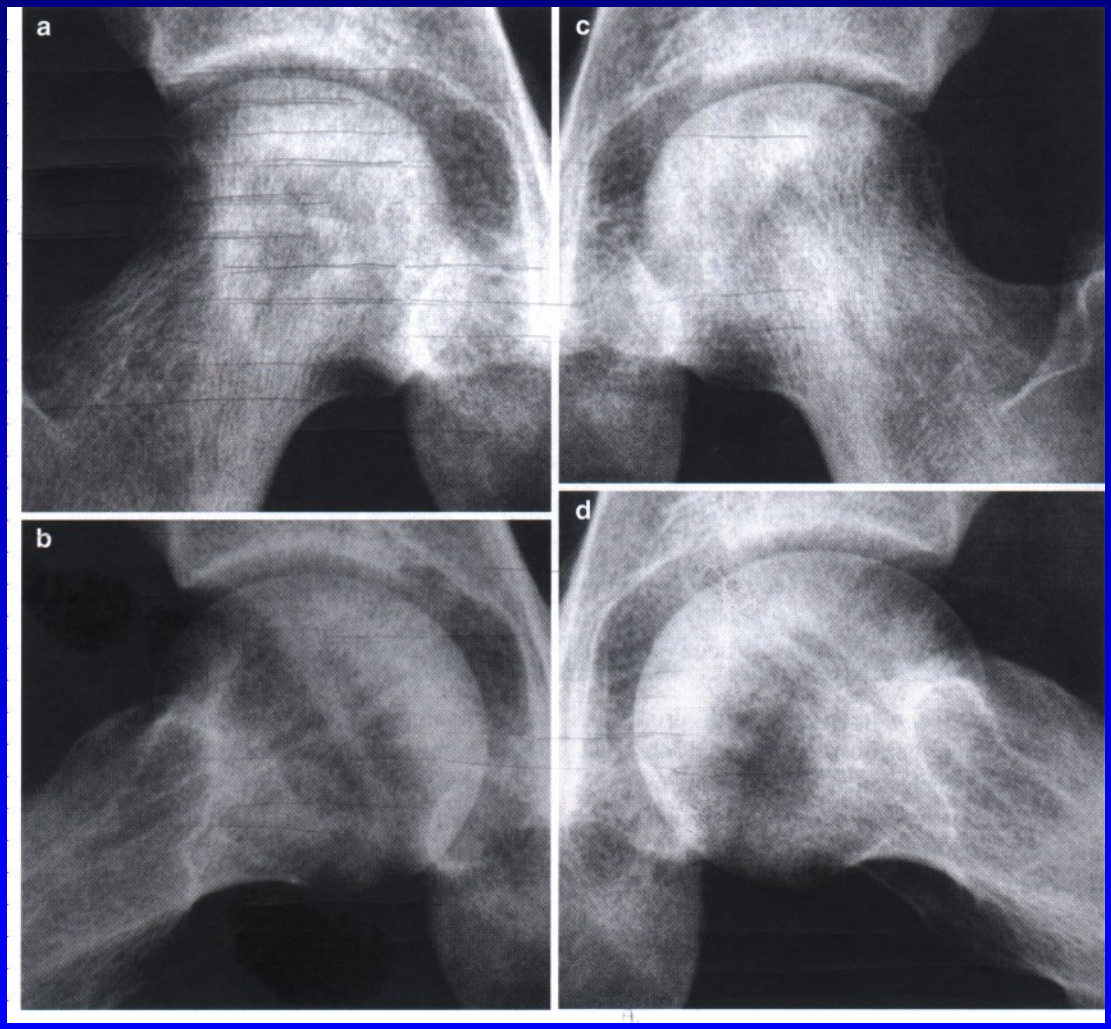
Tantal rods , 4 y. postop.

11 y. postop.
refuses THA

10 y. postop.
Asymptomatic.



Vascular fibular graft



LED, percutaneous drilling with Steinman pin

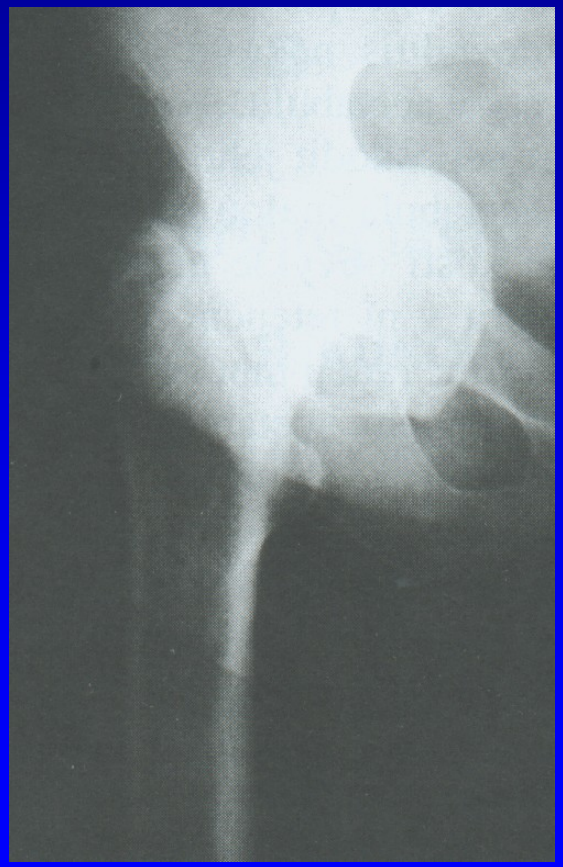
Synovitis

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

Idiopatic protrusion of the acetabulum

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

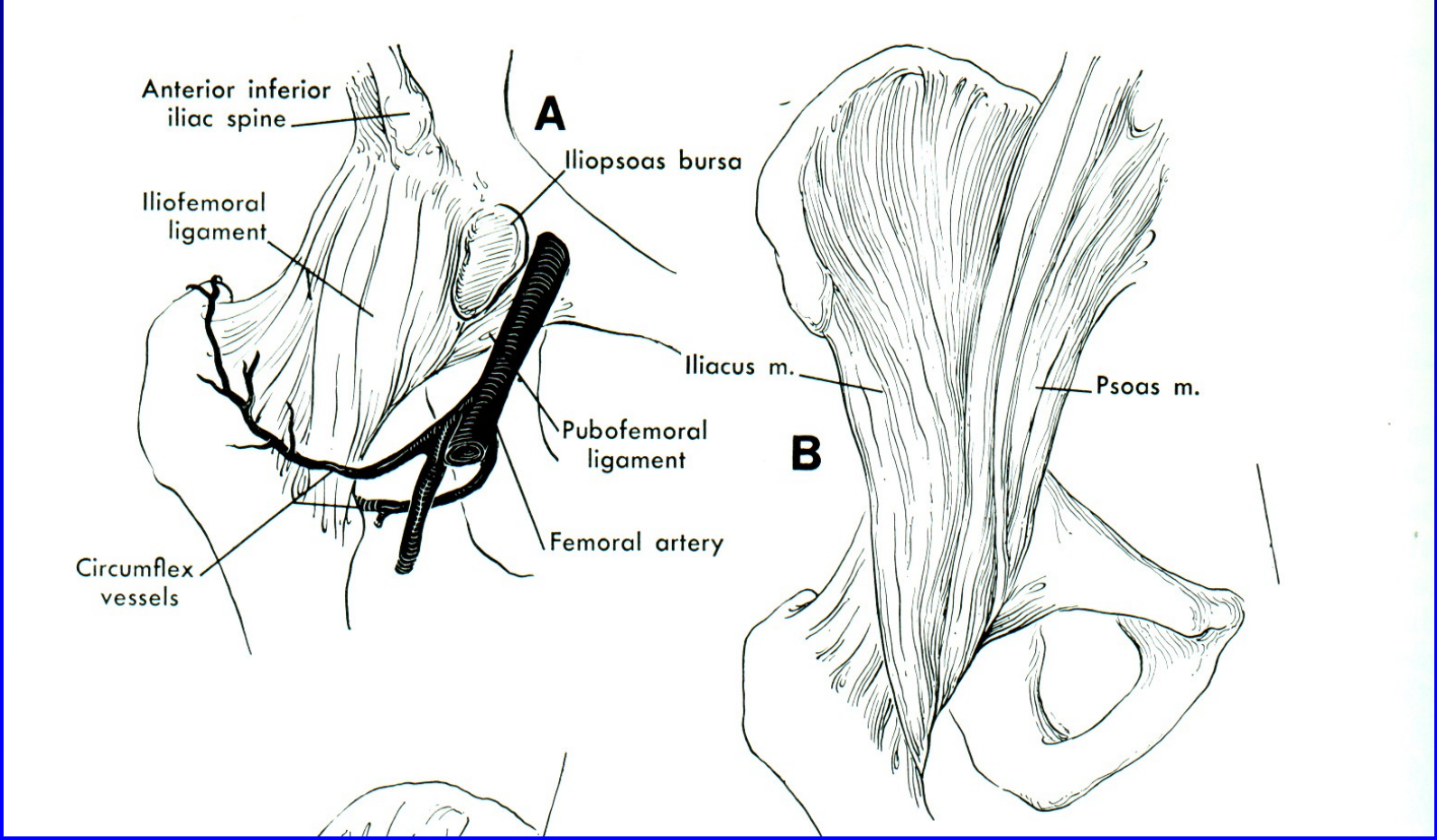
- Therapy: conservative, THR



Bursitis

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

Bursa ileopectinea

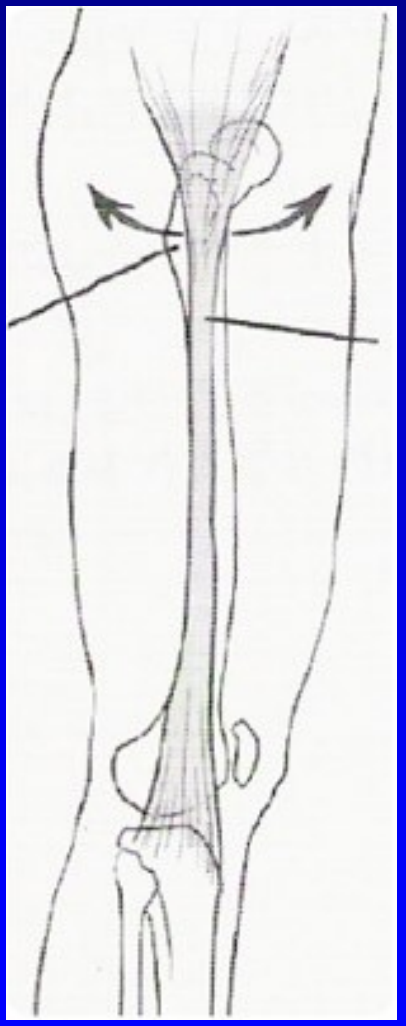


Entesopathies

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

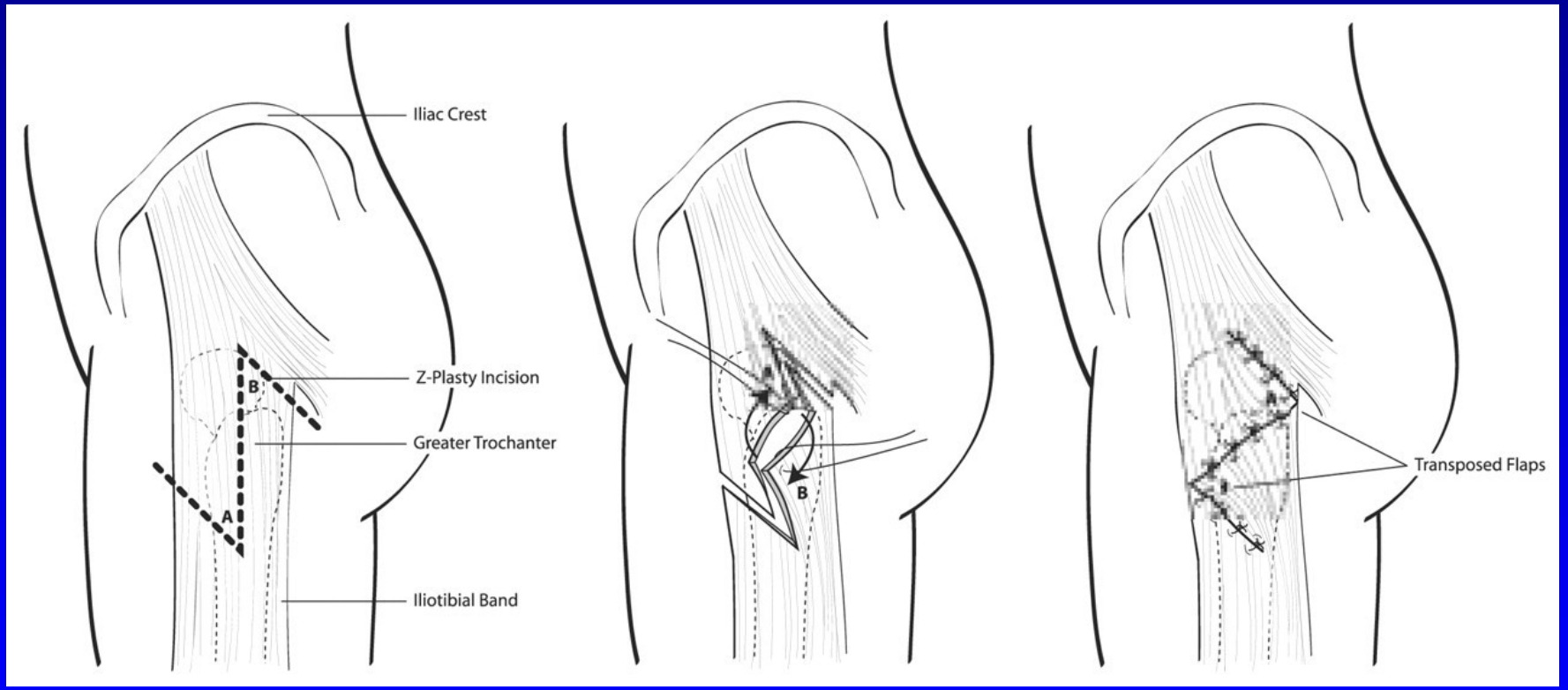
Snapping hip

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



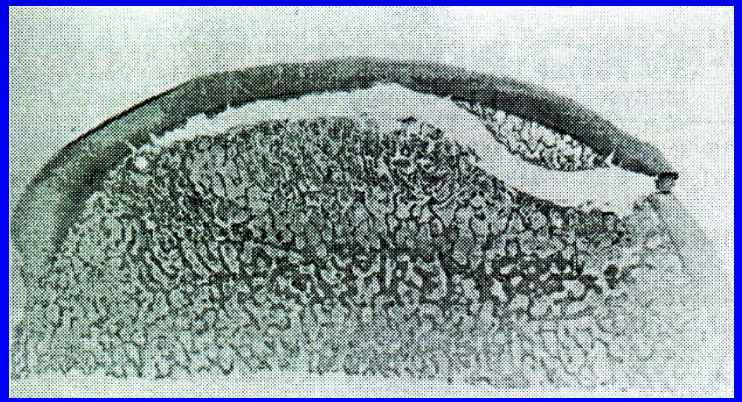
Snapping hip

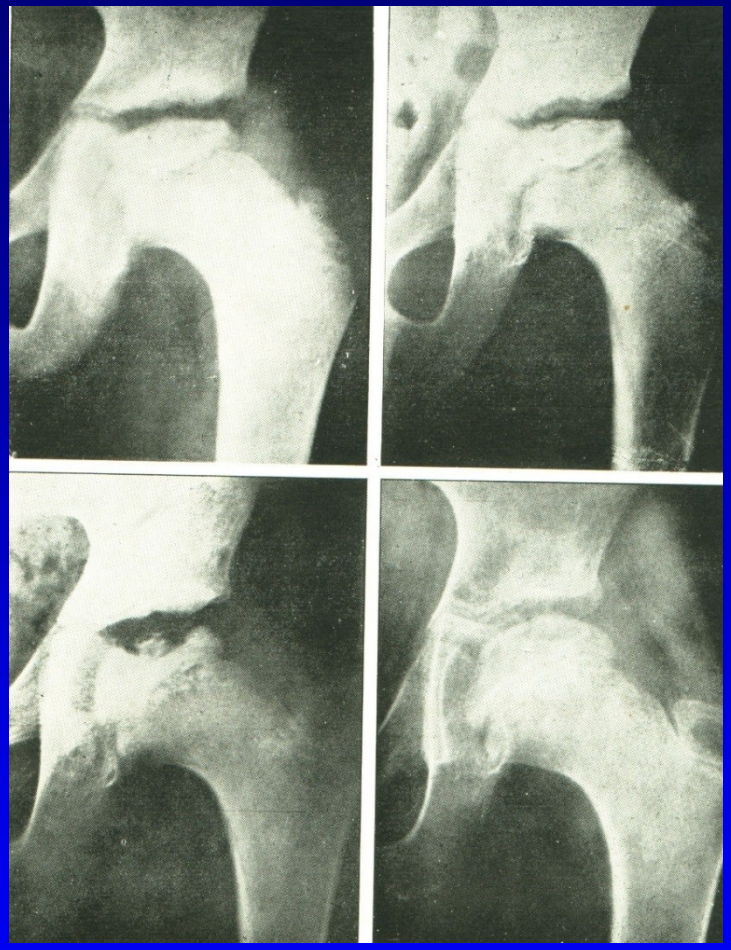
- surgery



Perthes disease

Ischemia of the whole epiphysis
Articular cartilage continues to grow
Bone is resorbed and replaced by wowen bone
The bone is soft and vulnerable
Subchondral fracture
- showes the extent of damage
New bone is gradualy 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

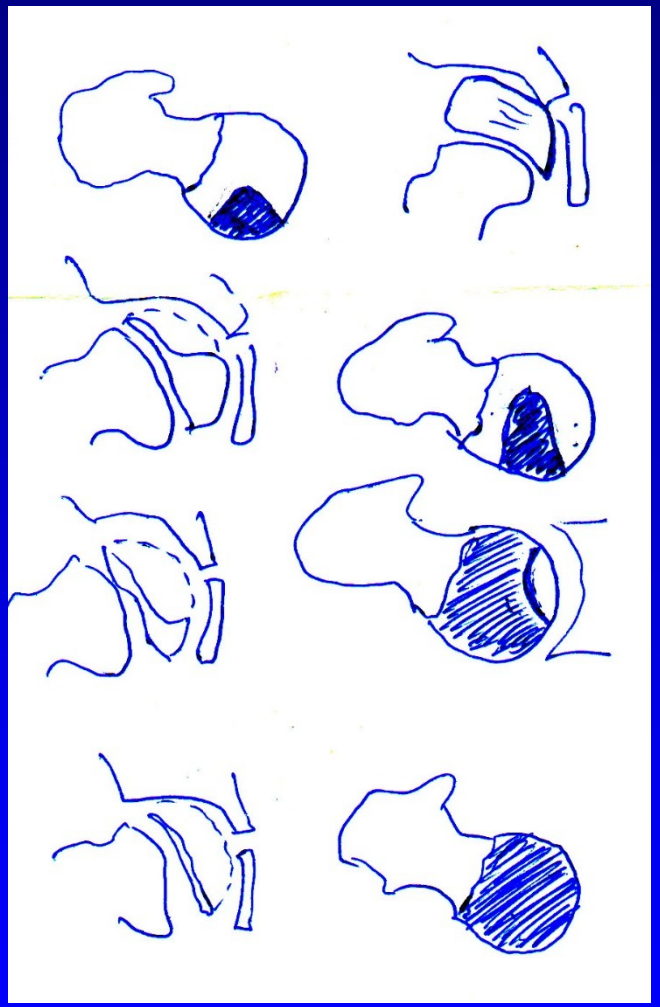
I. 25 %

II. 50 %

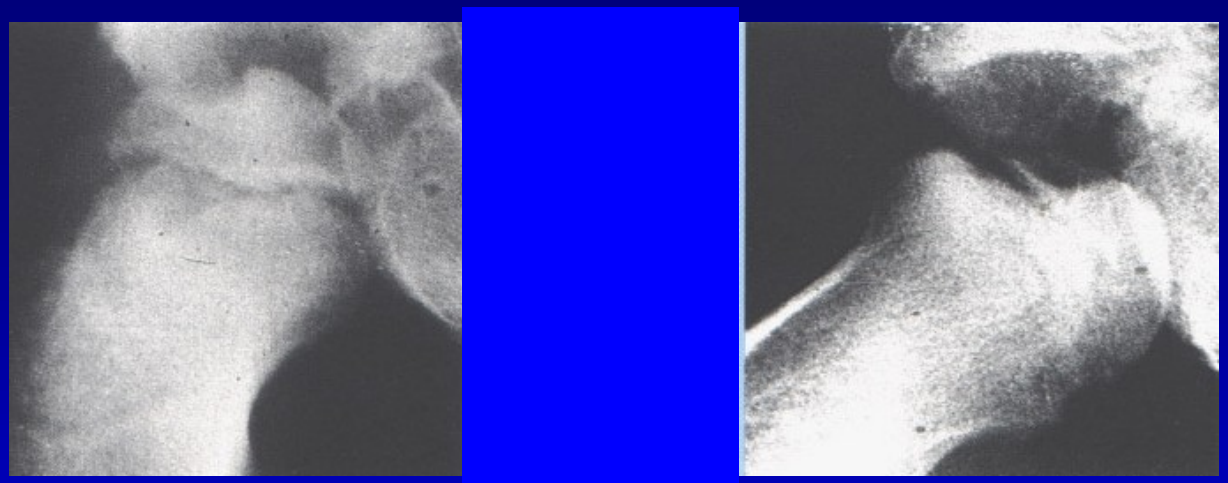
med.- lateral column

III. 75 %

IV. 100 %



Obr. 7

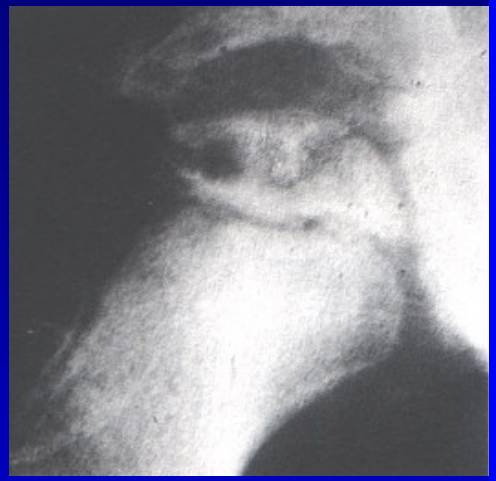


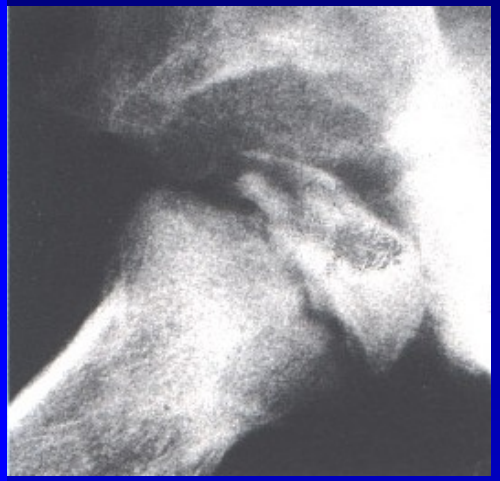
Obr. 8

Catterall I

Obr. 9

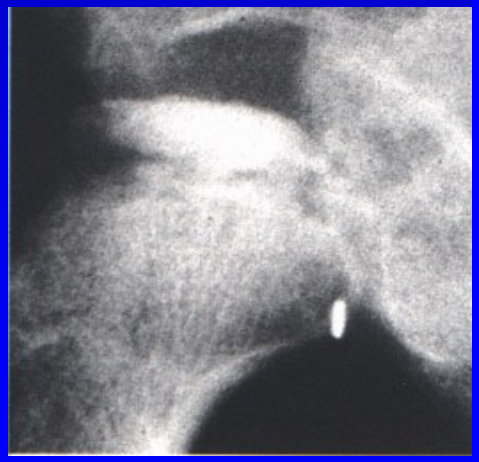
Catterall II

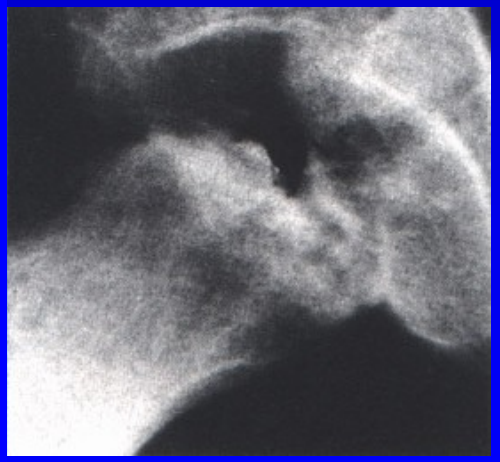




Obr. 10

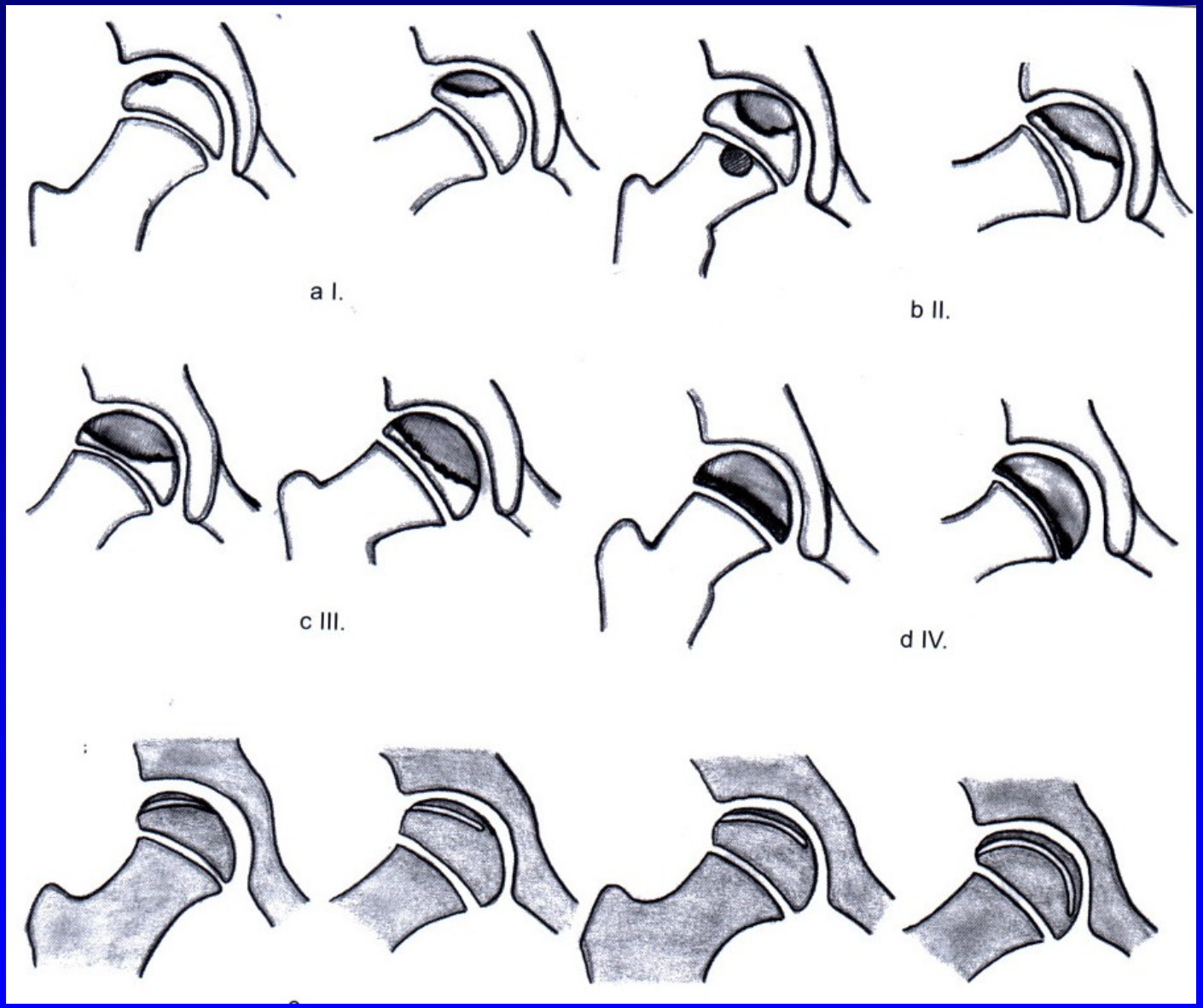
Catterall III





Obr. 11

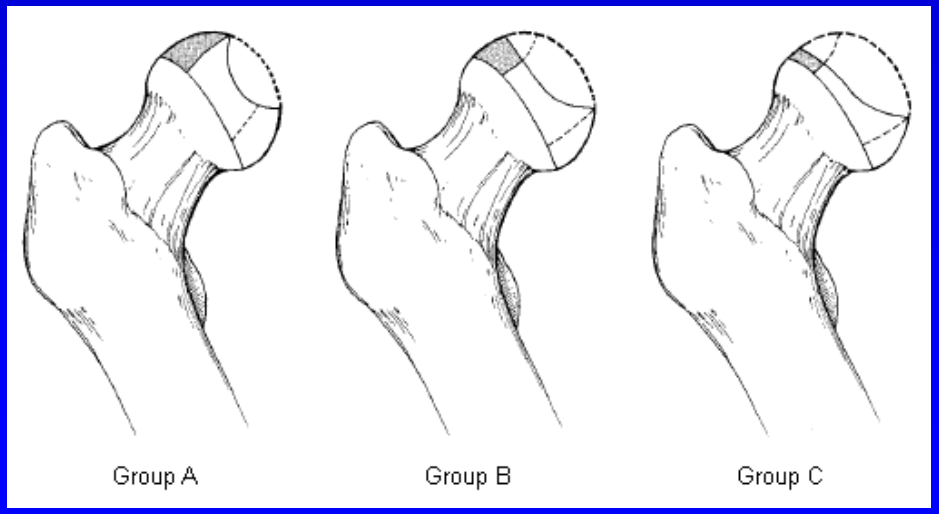
Catterall IV

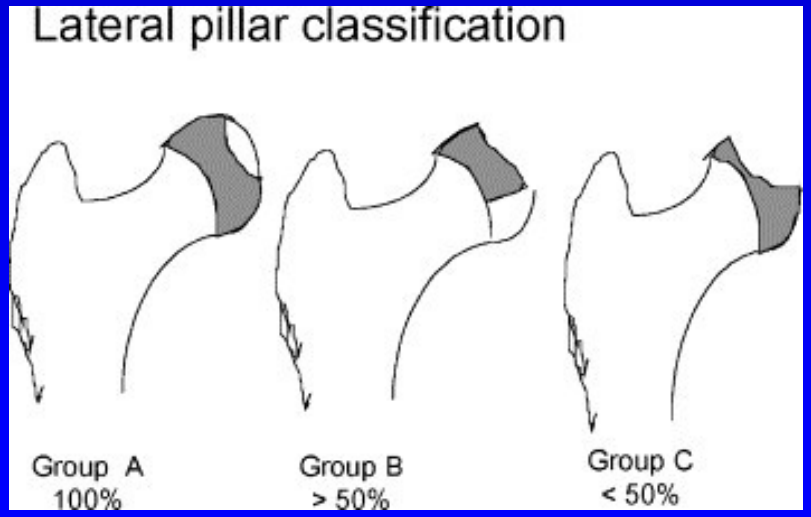


Stage

Subchondral fx

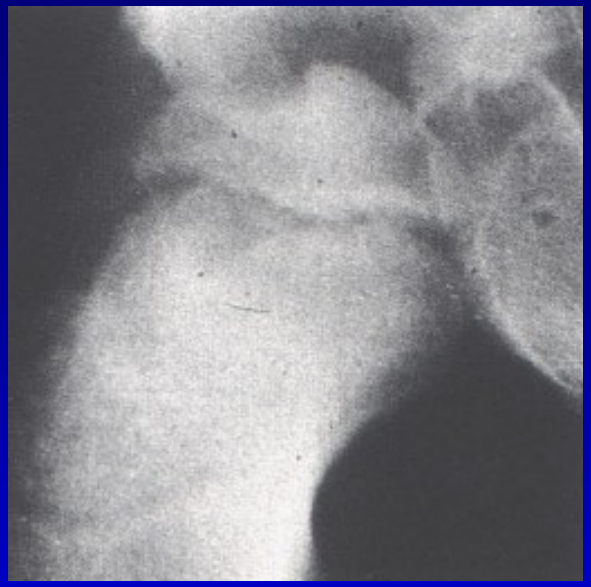
- **Herring classification**
  - Prognosis according lateral column
  - **Typ A** – normal lateral column, 100% good results
  - **Typ B** – more than 50 % of lateral column, 70% good results
  - **Typ C** – less than 50 % of lateral column 30% good results



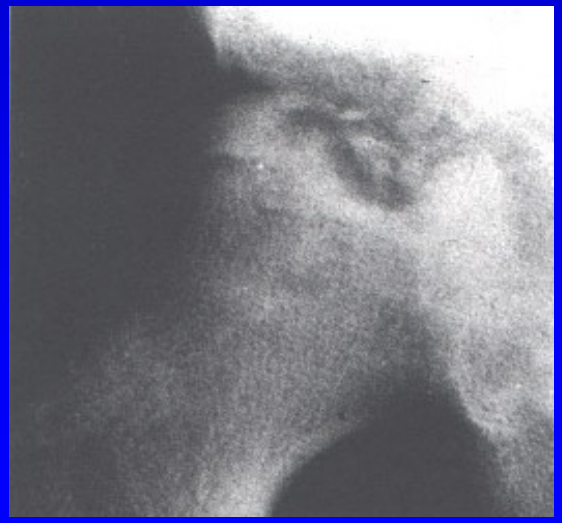


Salter classification

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



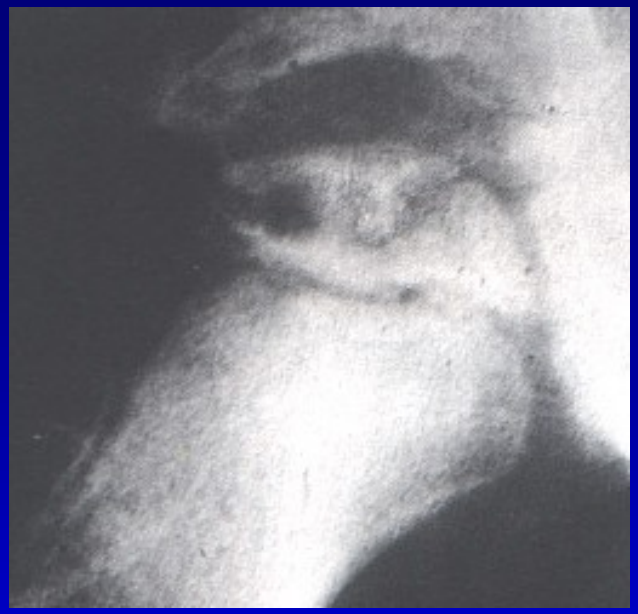
Obr. 12



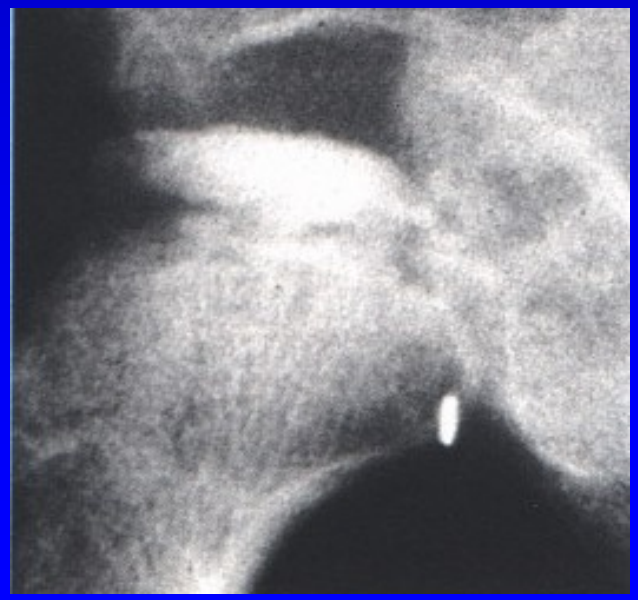
Obr. 13

Salter classification

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

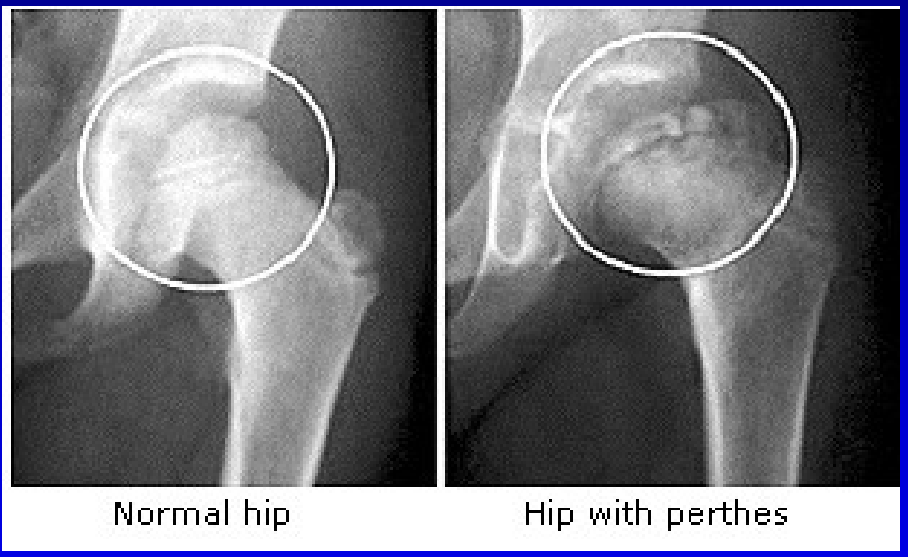


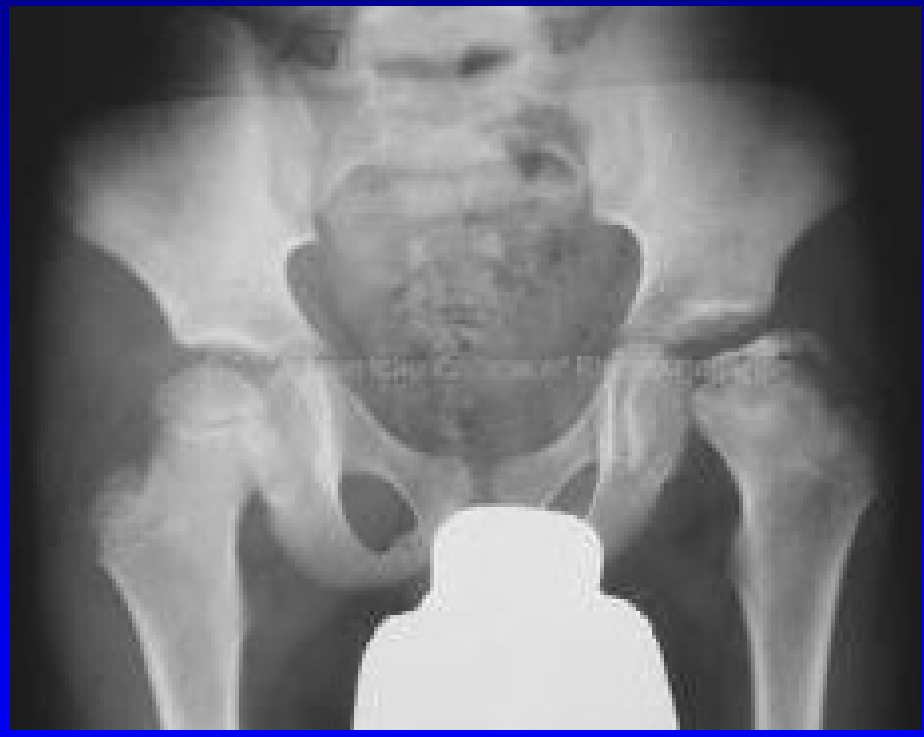
Obr. 14



Obr. 15

- **X-ray**





Examination

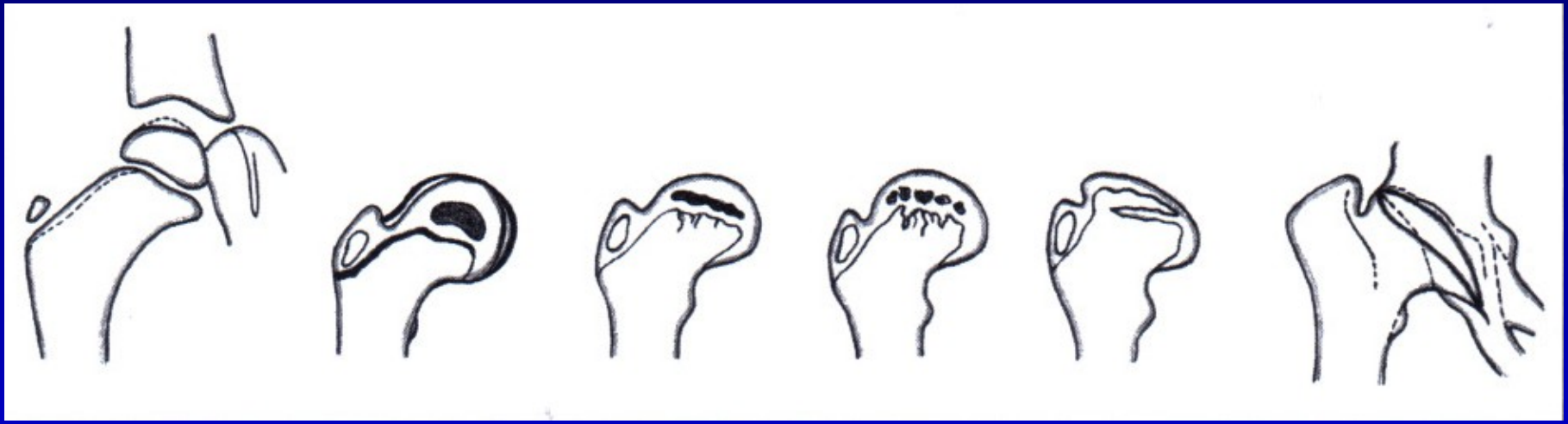
X-ray
Artrography
CT - 3 D reconstruction
MRI
Scintigraphy
Ultrasonography

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 disesase

Management

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

Conservative methods

- Atlanta orthesis

Operative methods

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

Osteotomy of the femur

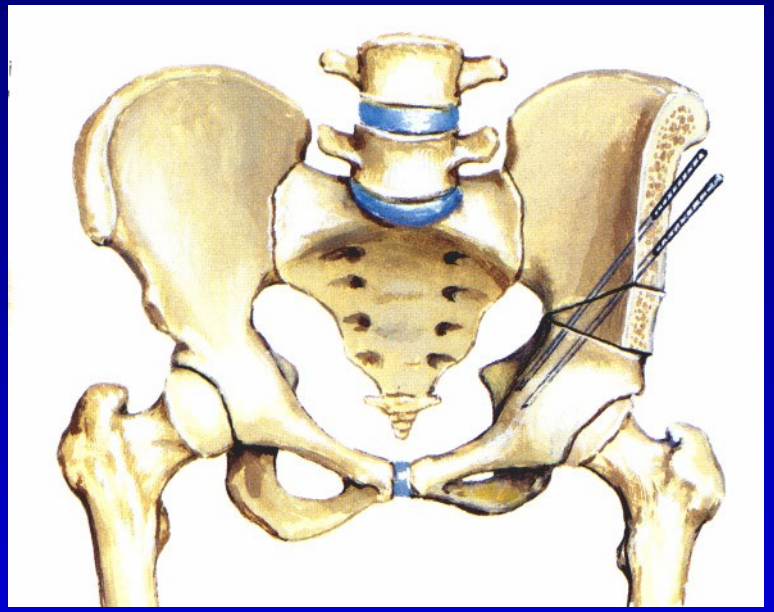
Conservative methods

Rest in bed
Nonweight bearing
Crutches
Atlanta orthesis

Atlanta orthesis

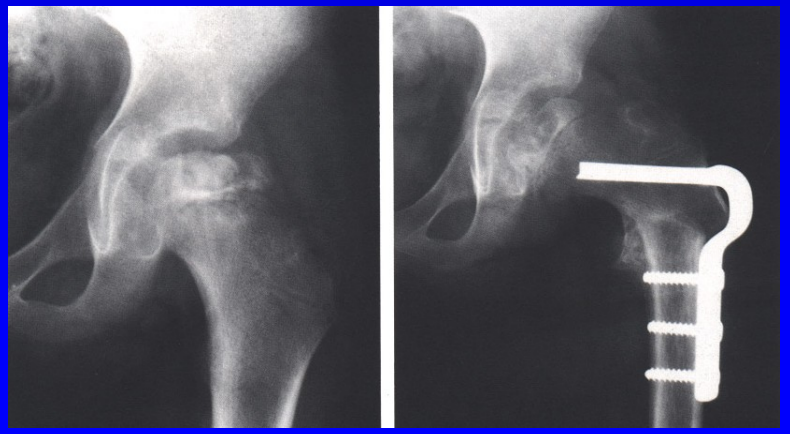
Operative methods

Salter pelvic osteotomy



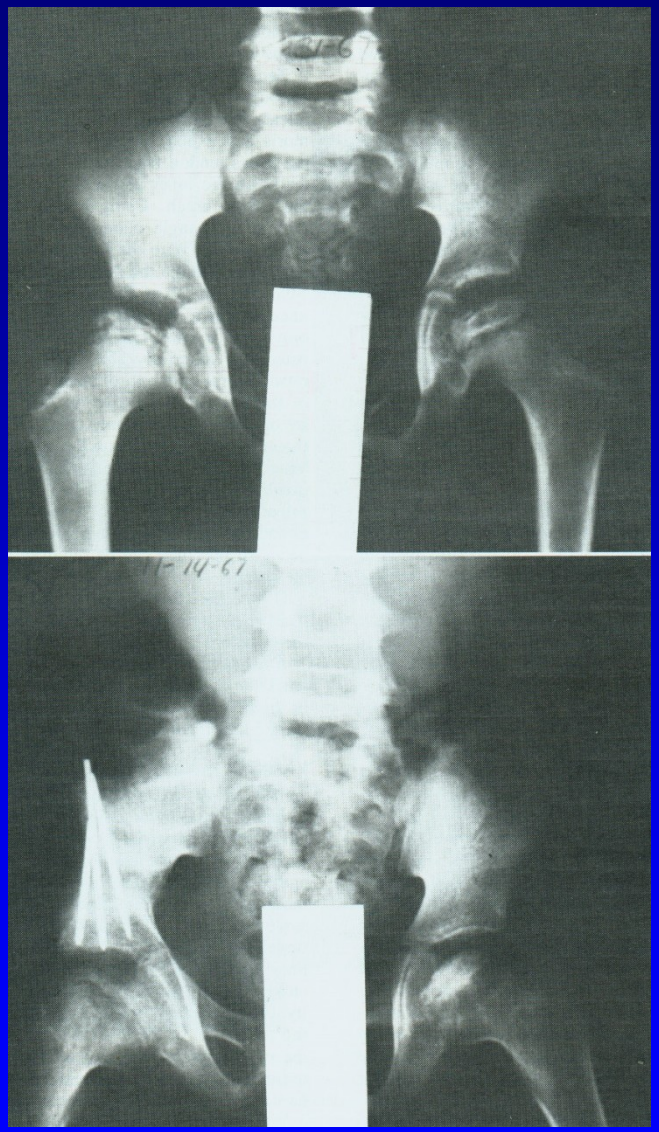
Obr. 17

Varus osteotomy of the femur

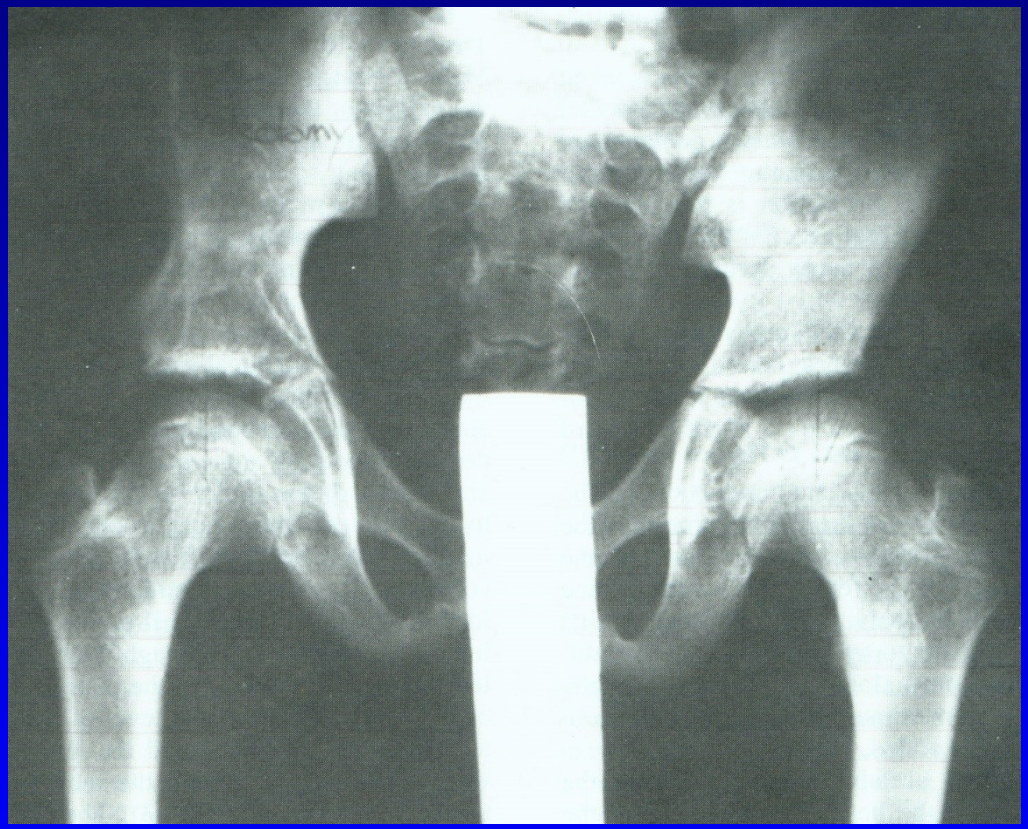


Obr. 18

Salter osteotomy

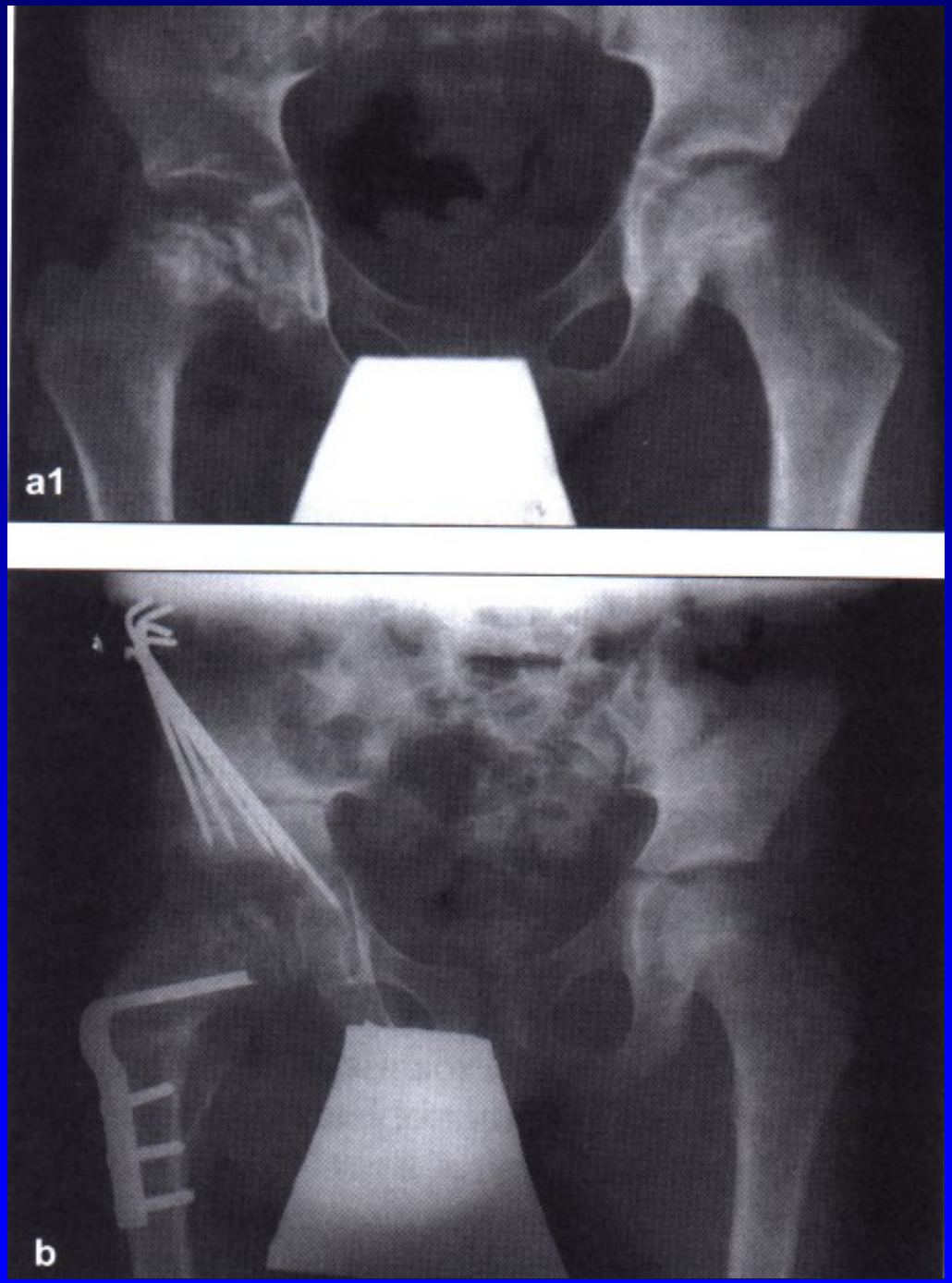


Obr. 19

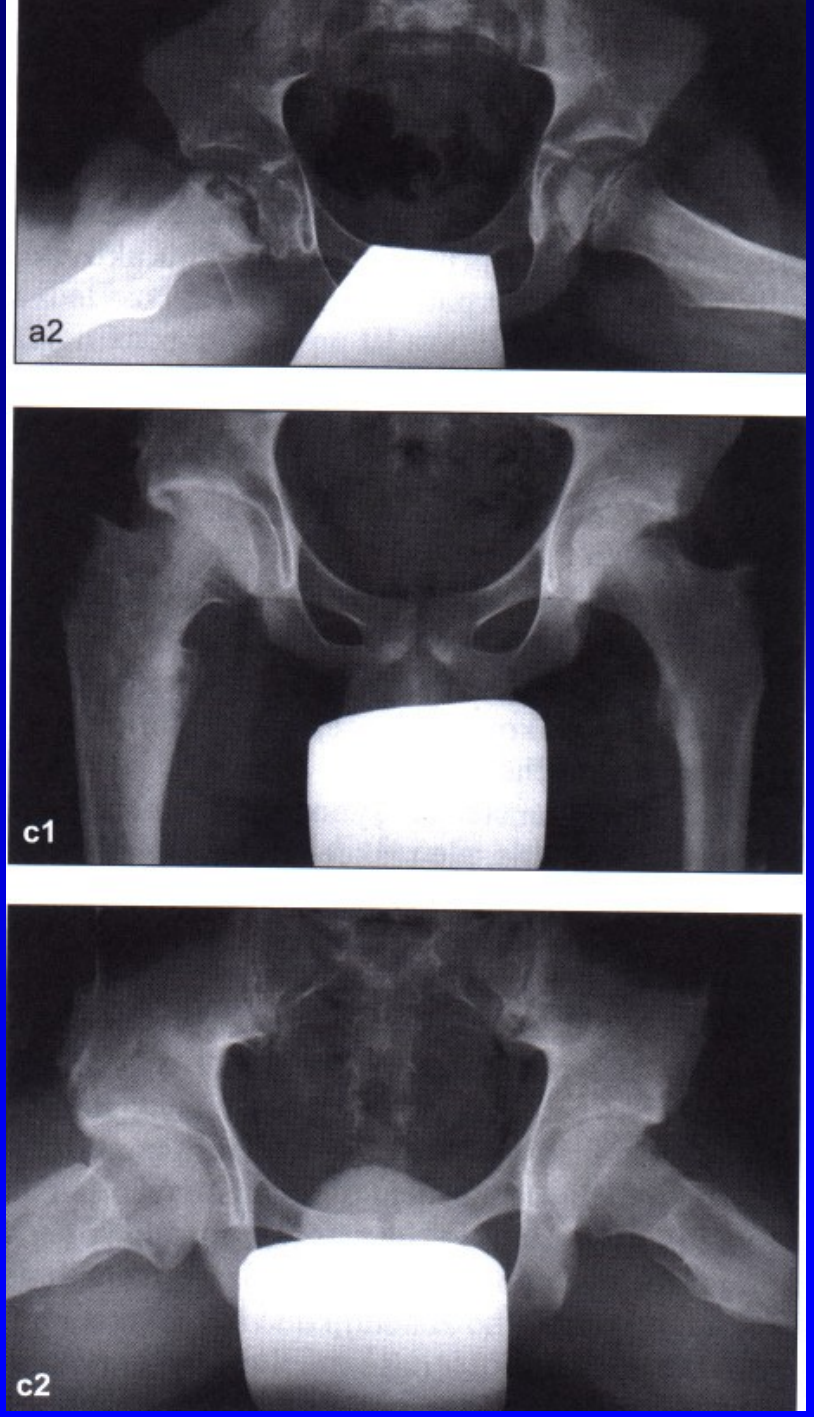


Obr. 20

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



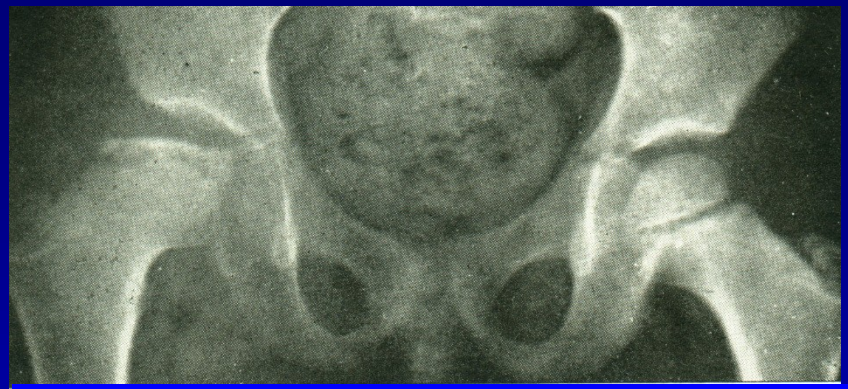
Perthes disease on the right hip
after Salter osteotomy
Almost normal hip
in 18 years of age

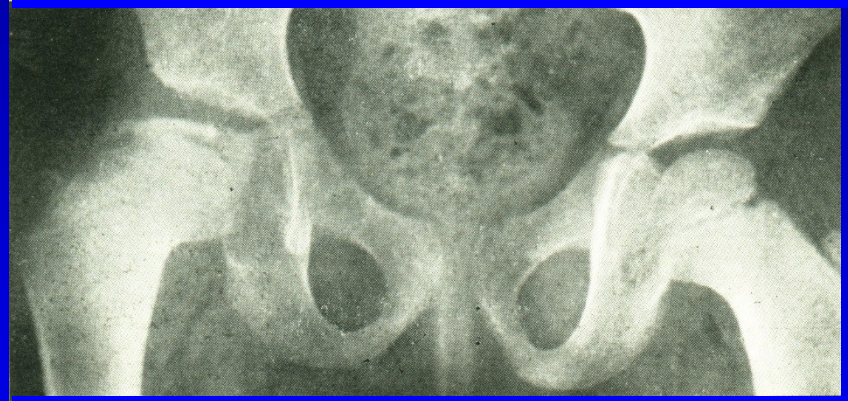


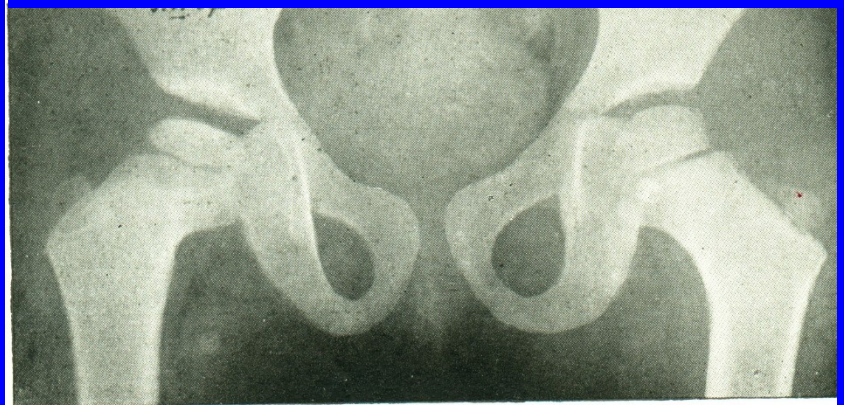
Consequences of Perthes disease

Coxa plana
Shortening of the leg
Limited movements
Early osteoarthritis

Better prognosis
Younger age
Less extent of danage
No subluxation

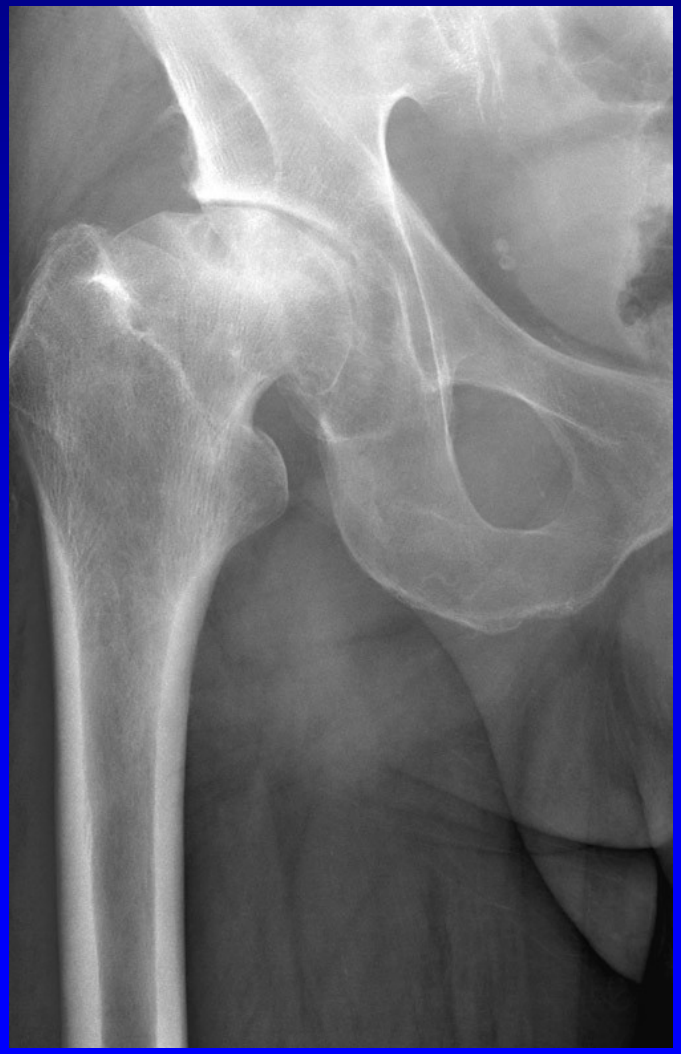




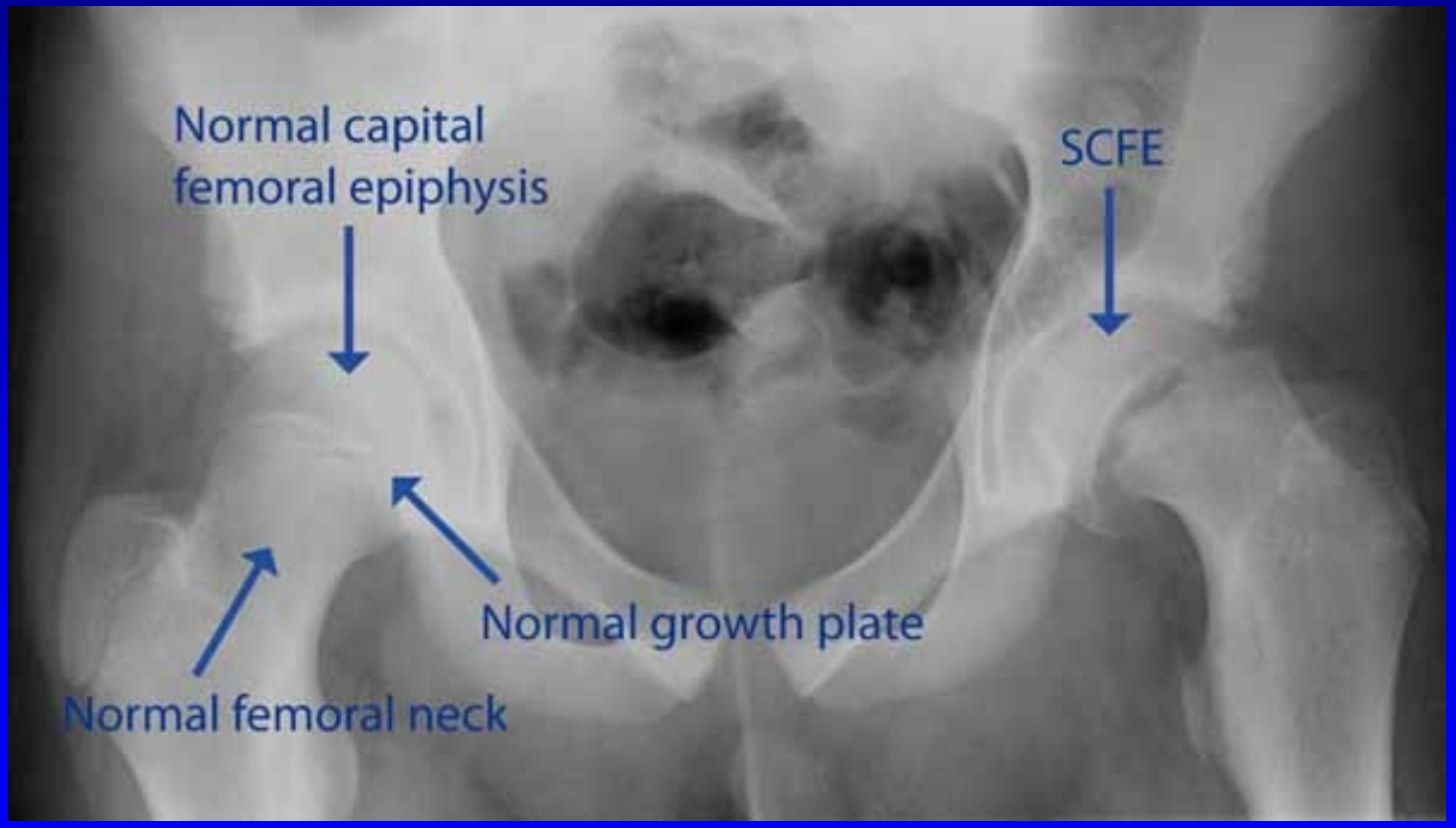


Obr. 21

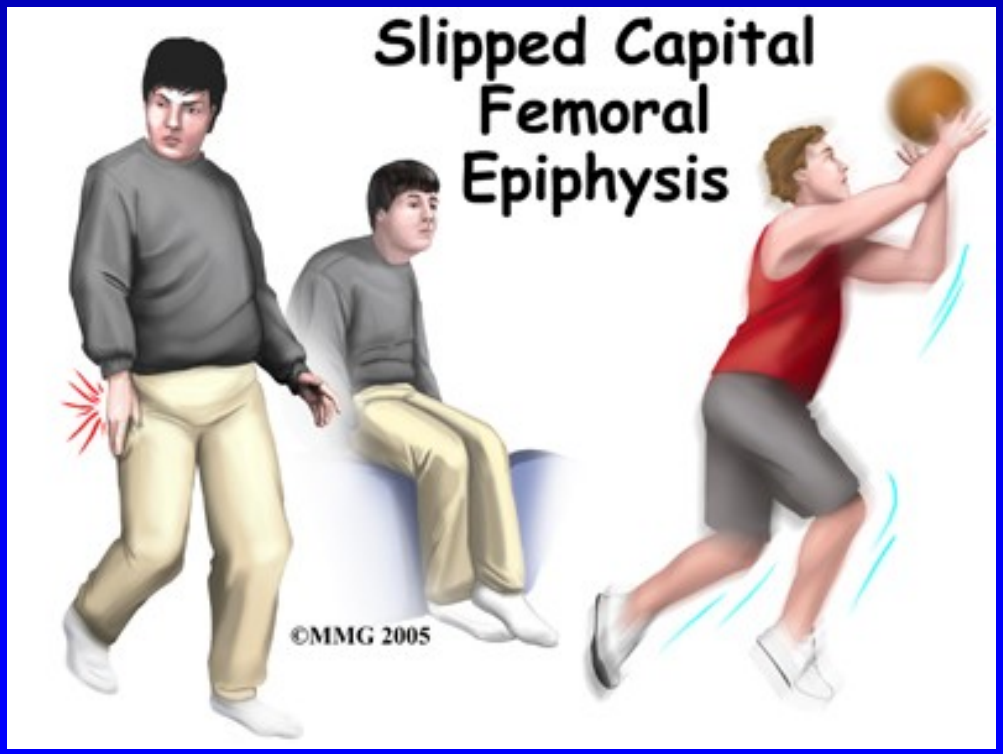
Condition after Perthes disease

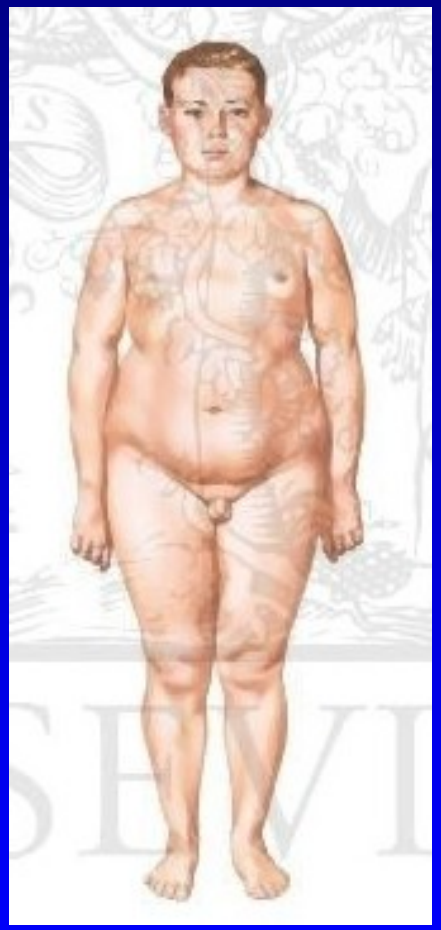


Slipped upper femoral epiphysis



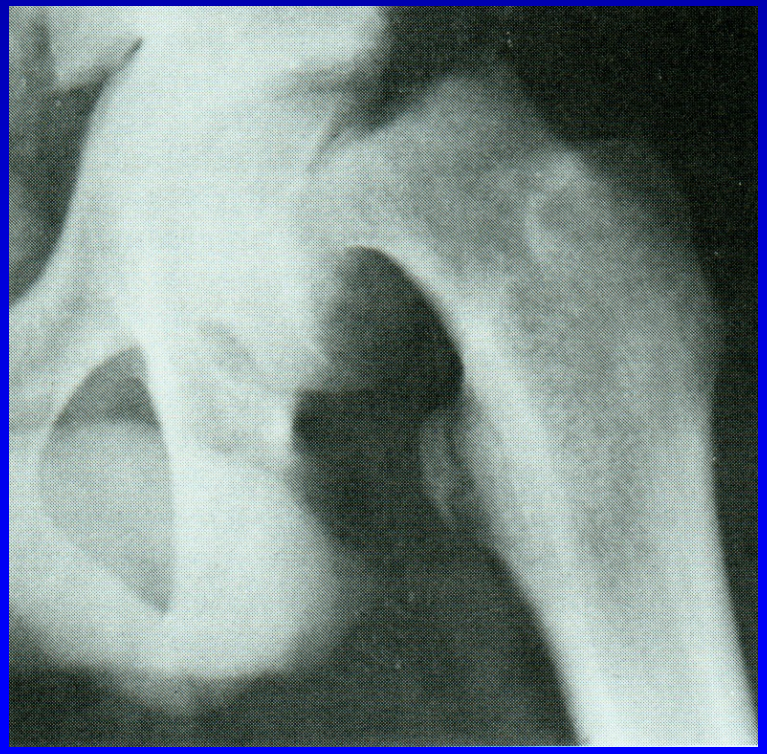
- **Etiology**
  - **Obesity**
  - **Hormonal changes**
  - **Habitus** adiposogenital, eunuchoid





Slipped upper femoral epiphysis

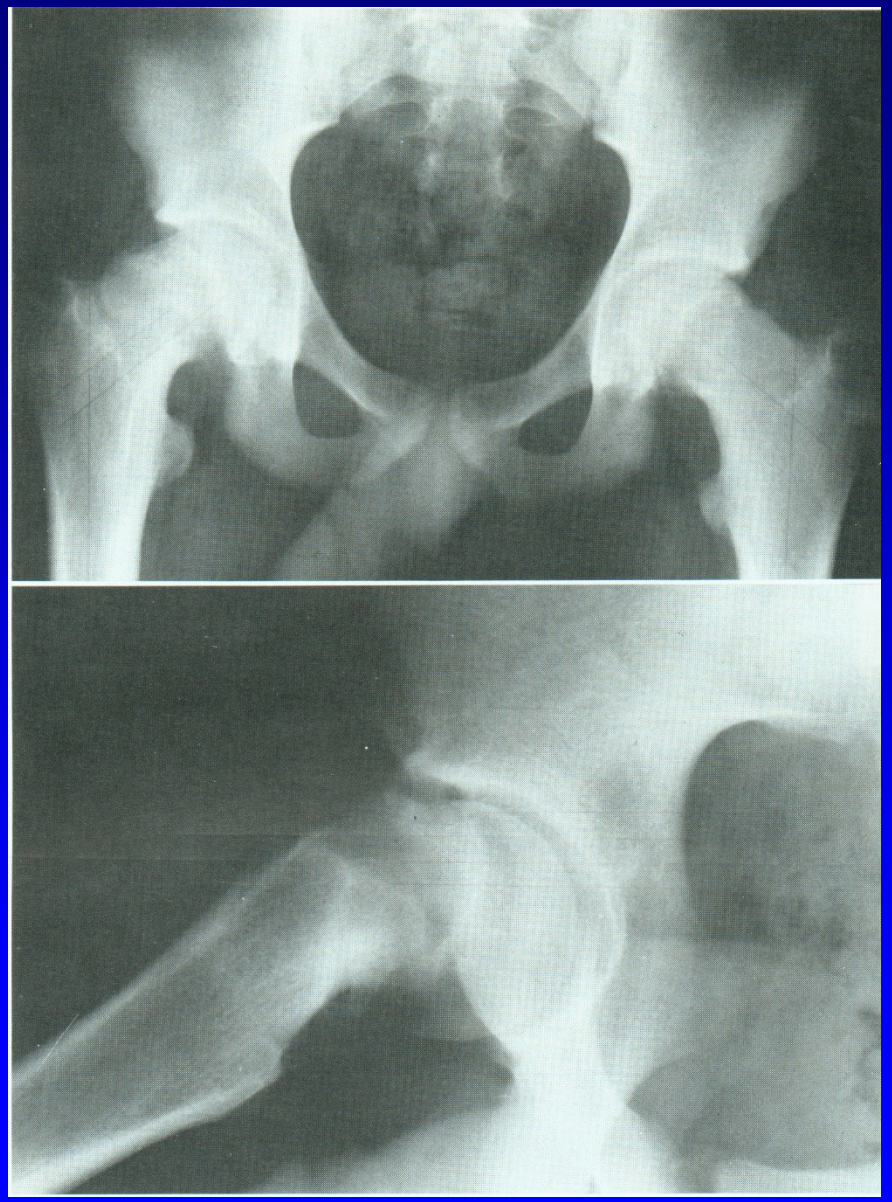
Growth plate of proximal epiphysis
of the femur is weak and soft



Slipped upper femoral epiphysis

Slipping of epiphysis
down and backwards
to varus and to retroversion

Metaphysis goes proximaly
and to external rotation

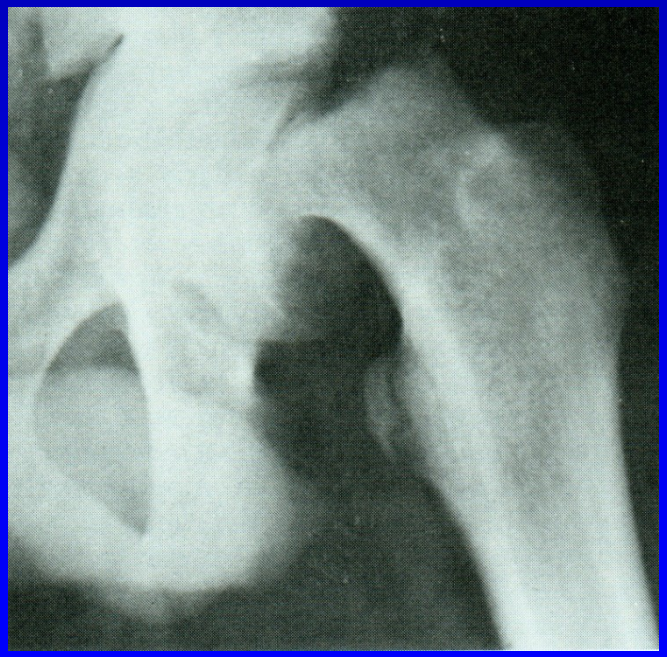


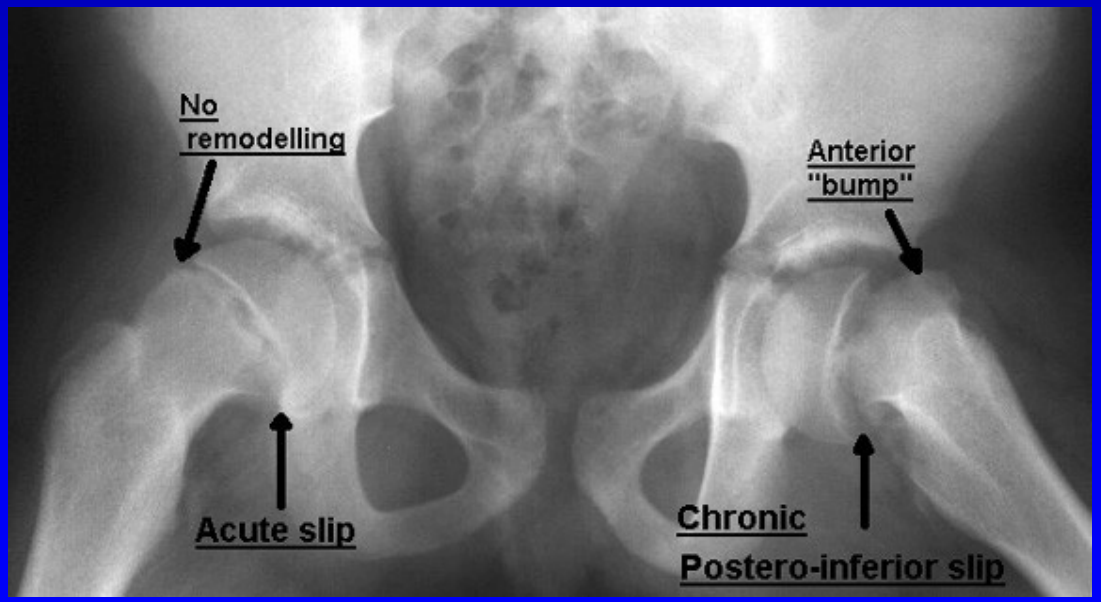
Symptoms

Pain in groin and in the thigh
Limping
Shortening of the leg
Limited abduction and external rotation
Positive Trendelenburg sign

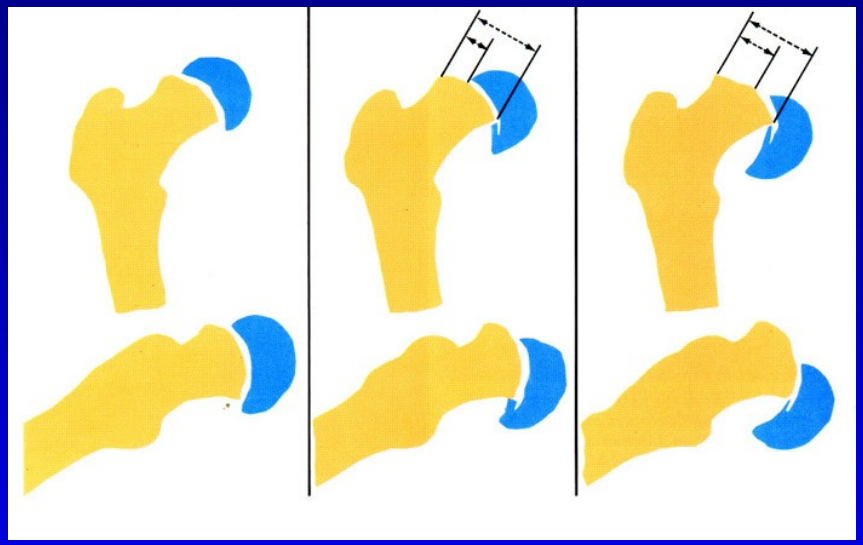
Types

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

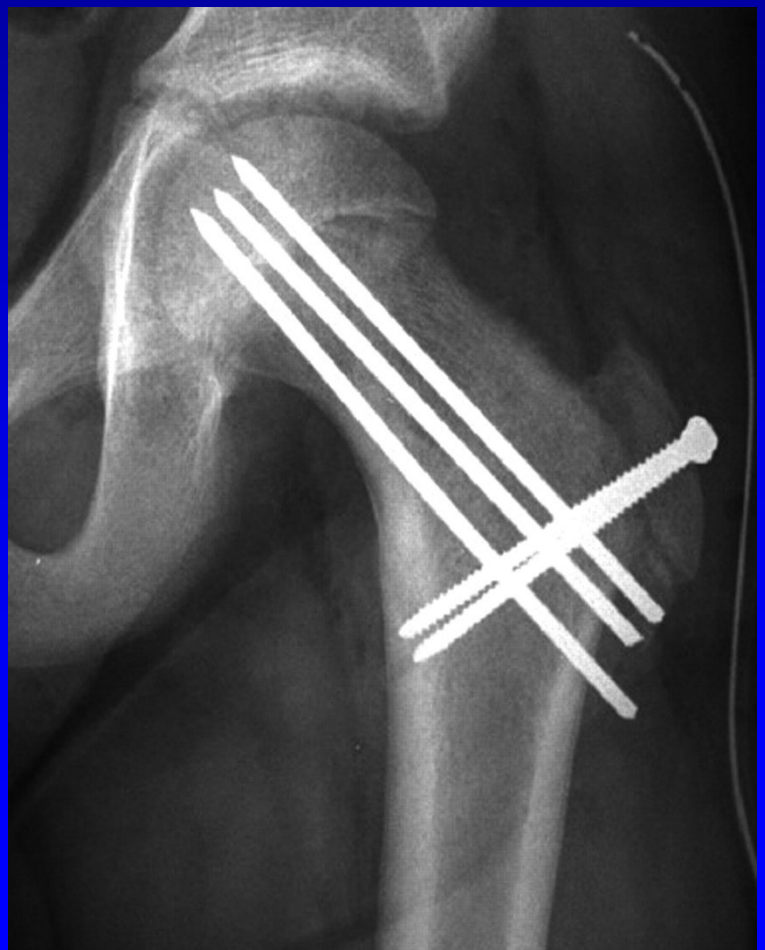
Open reduction

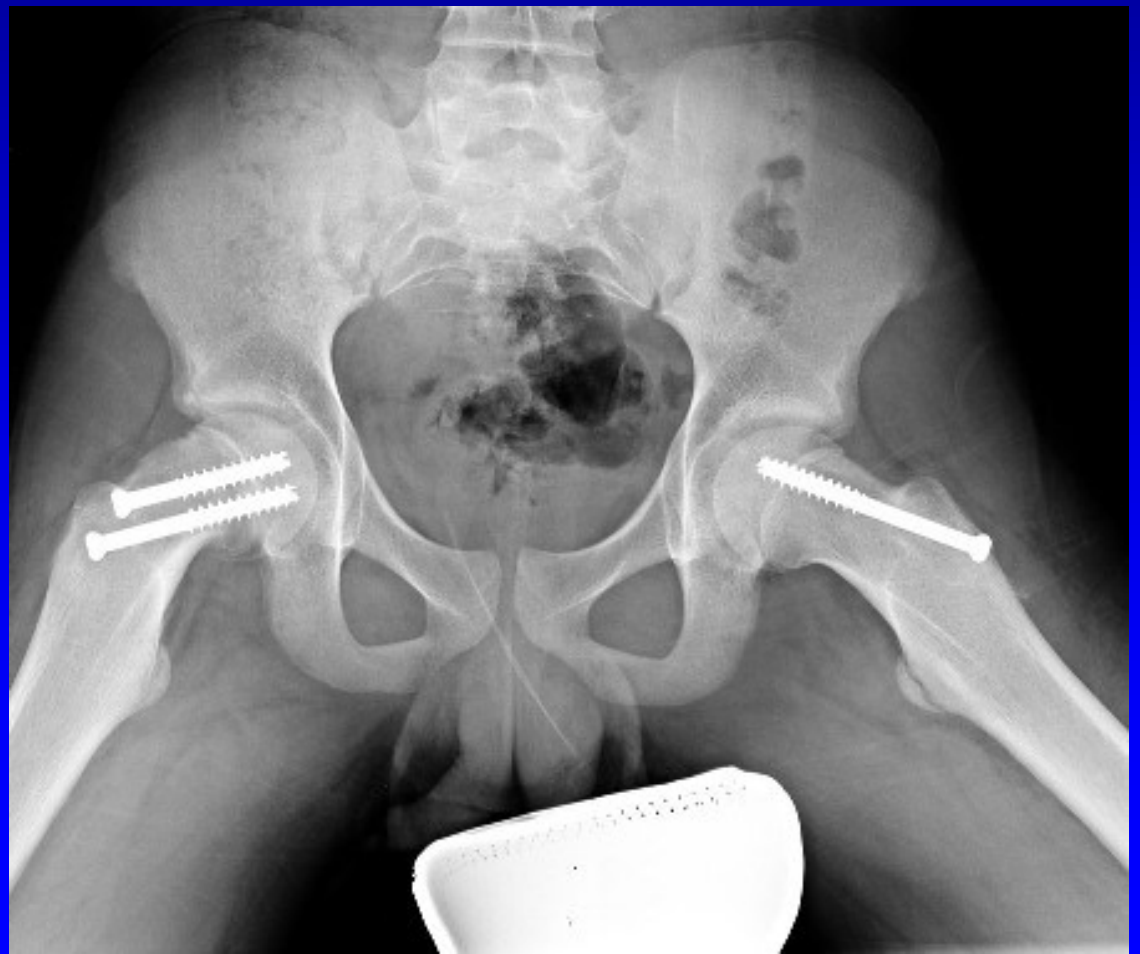
Osteotomy of proximal femur - Southwick, Imhäuser-Weber

Acute slip

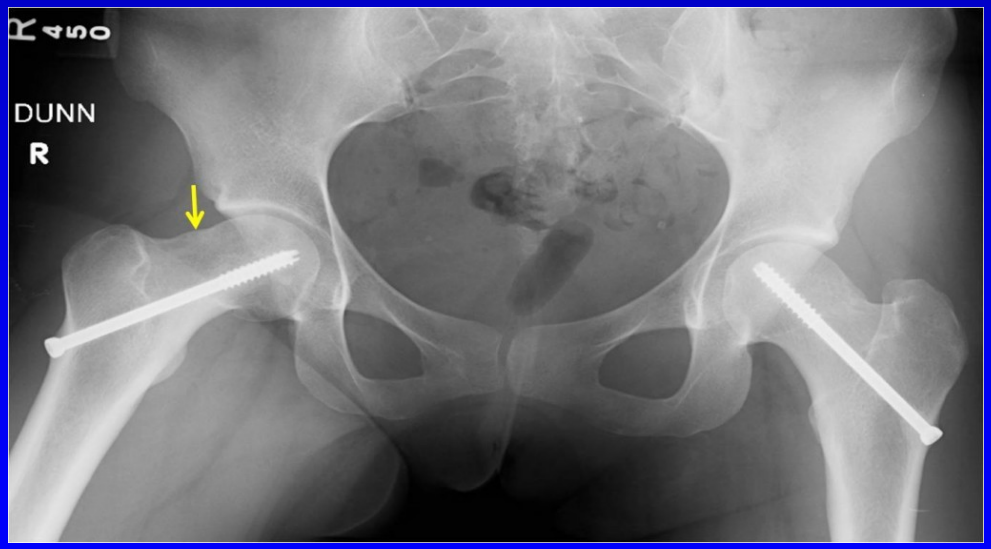
up to 30º– in situ pinning / epiphyseodesis

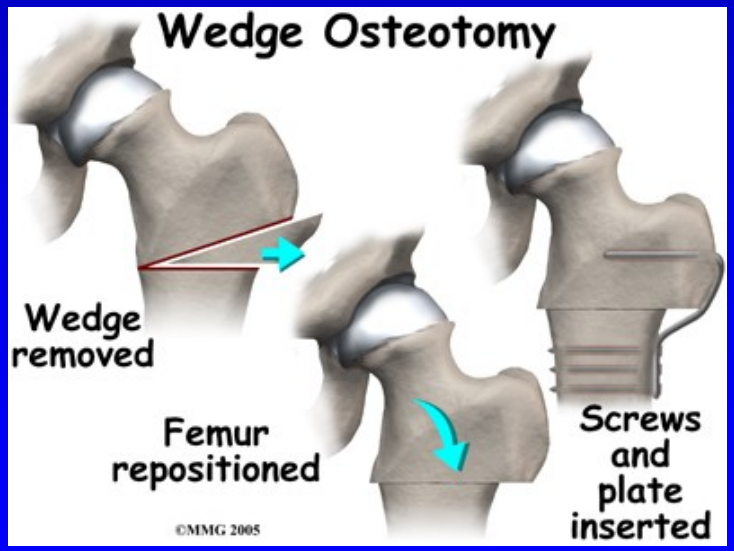
over 30º– reduction, in situ pinning / epiphyseodesis



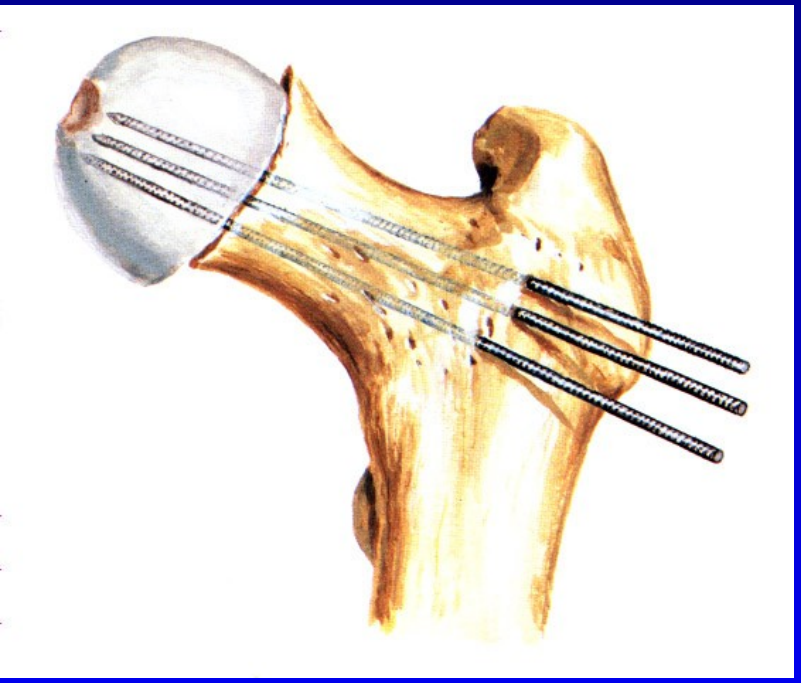


- Chronic slip
  - Up to 30º – epiphyseodesis
  - Over 30º – corrective OT
    - Subcapital (Dunn)
    - Basicervical (Krämer)
    - Intertrochanteric (Immhäuser – Weber)
    - Subtrochanteric (Southwick)

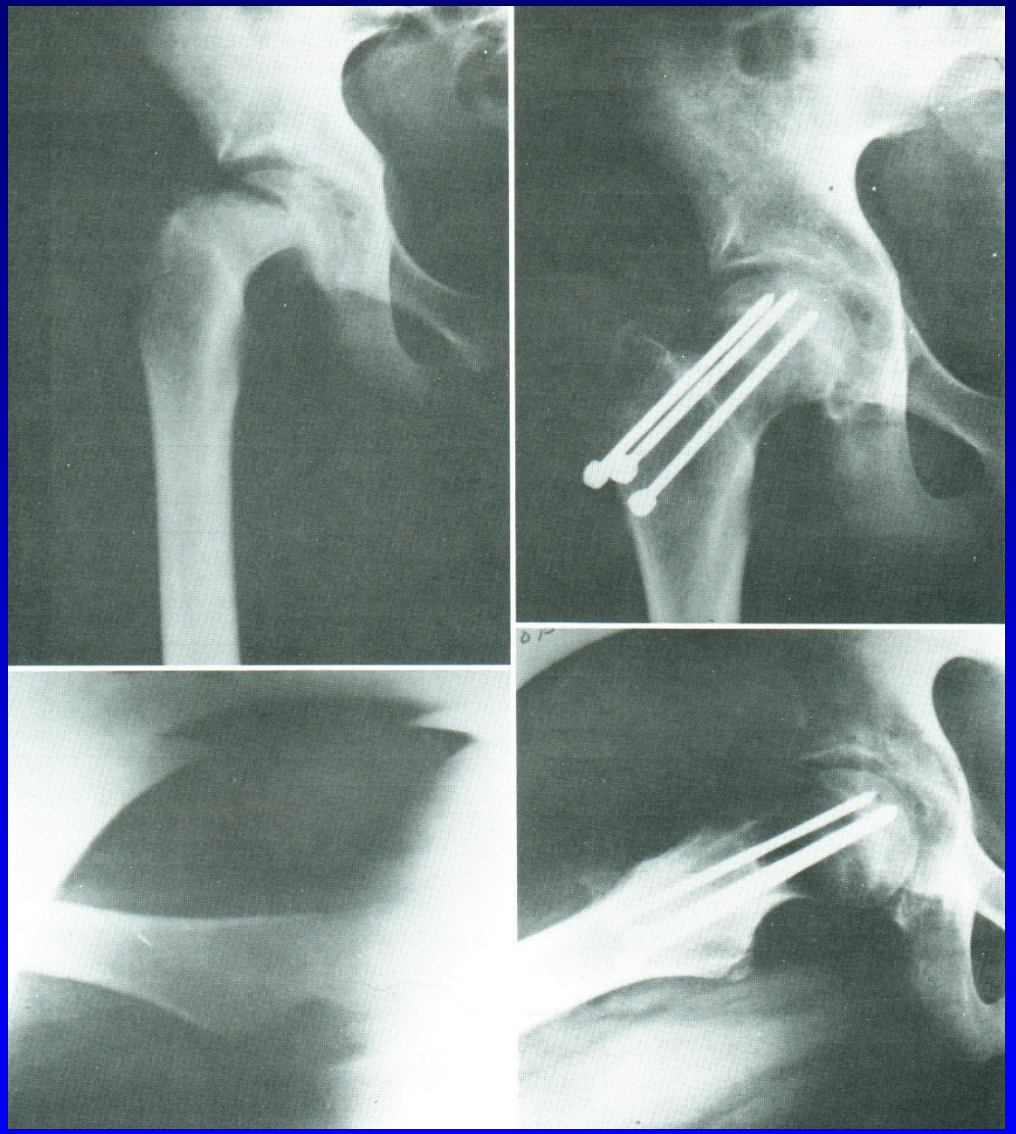




Fixation in situ

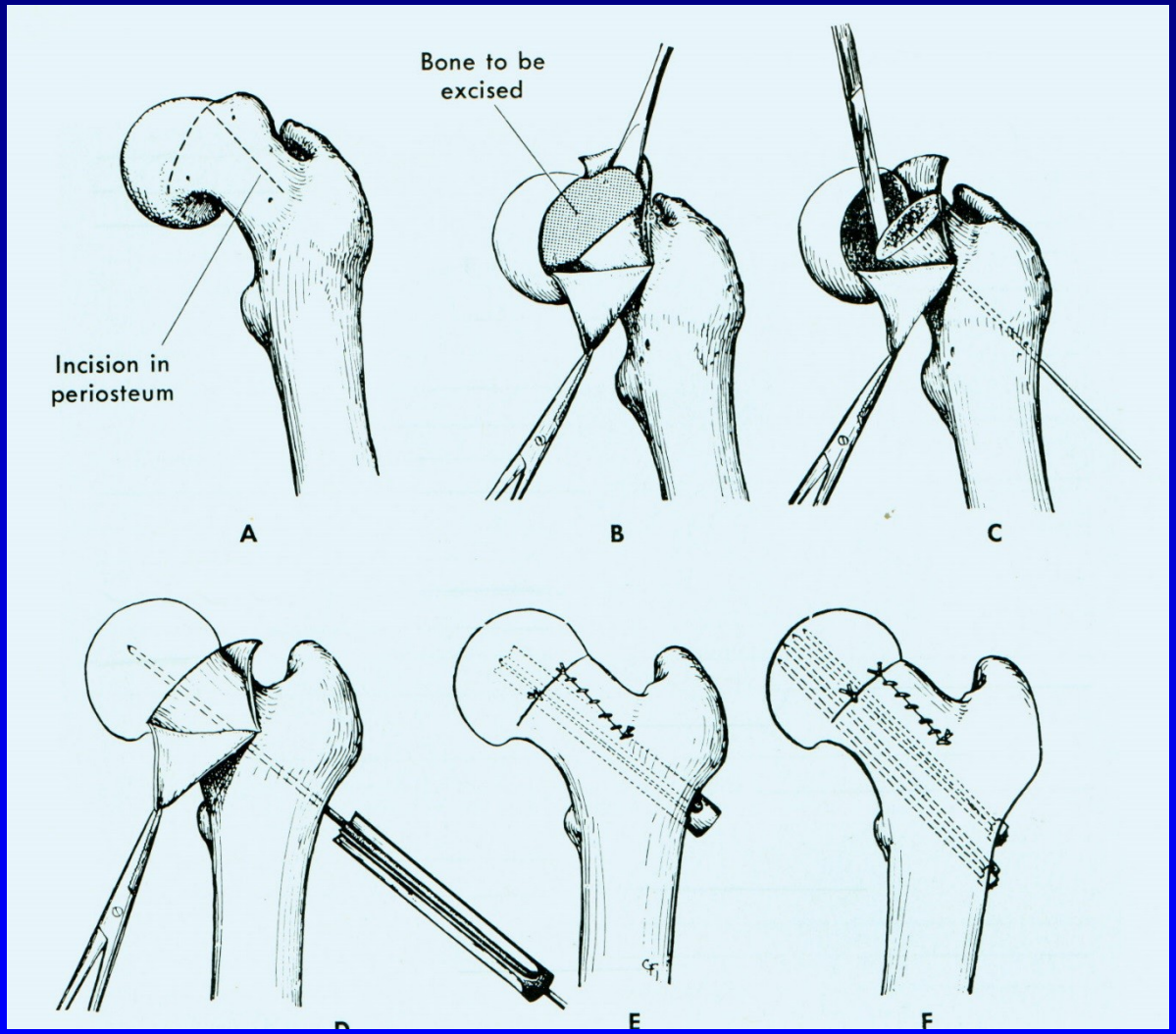


Obr. 31



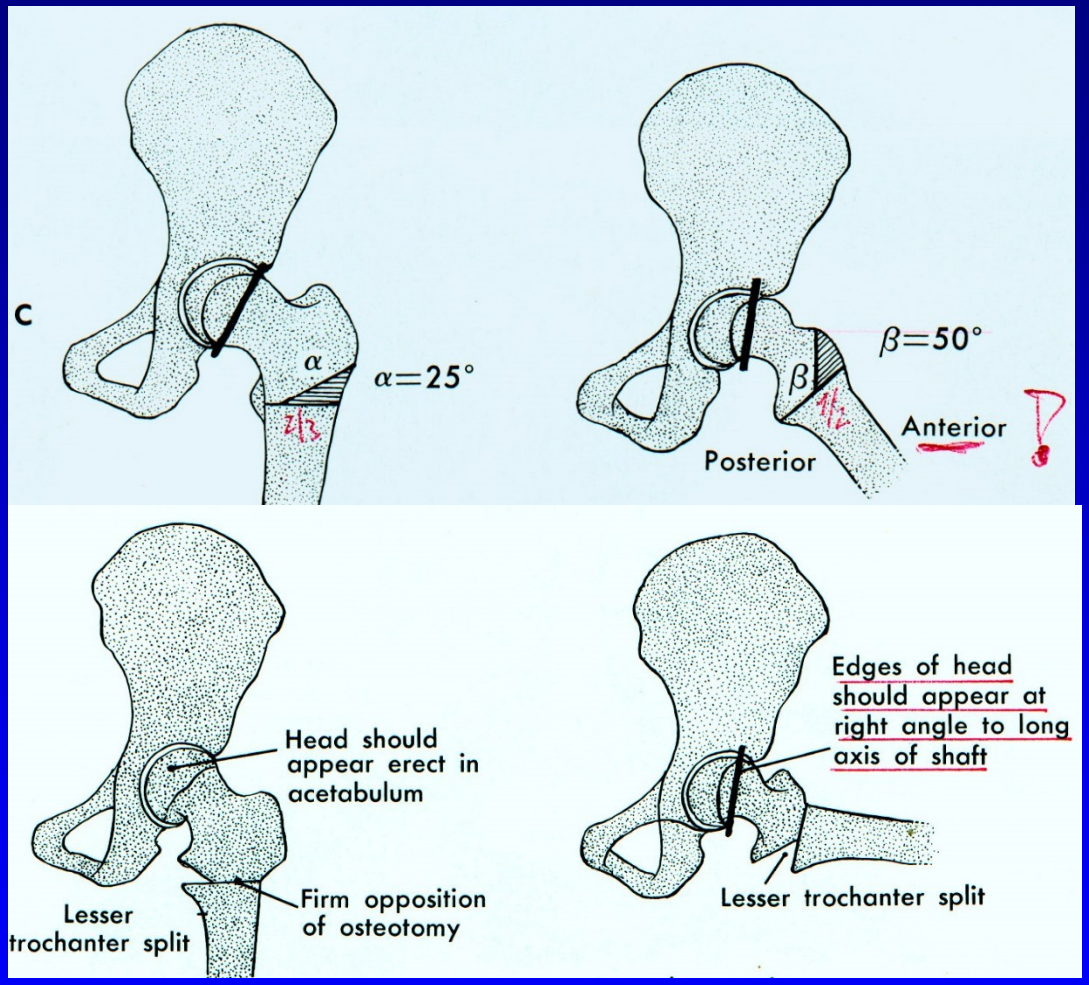
Obr. 32

Open reduction



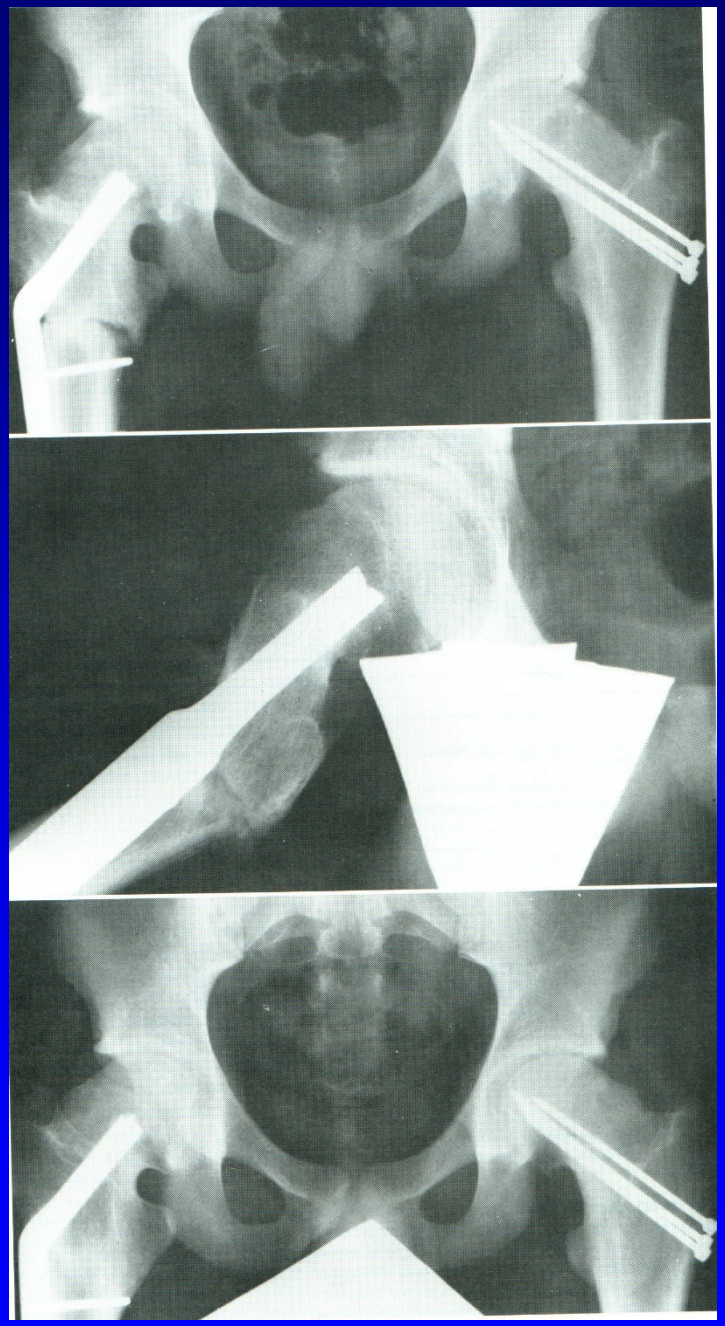
Obr. 33

Southwick osteotomy



Obr. 34

Pertrochanteric osteotomy



Obr. 35

Complication of slipped upper femoral epiphysis

Avascular necrosis of the femoral head

Chondrolysis of the femoral head

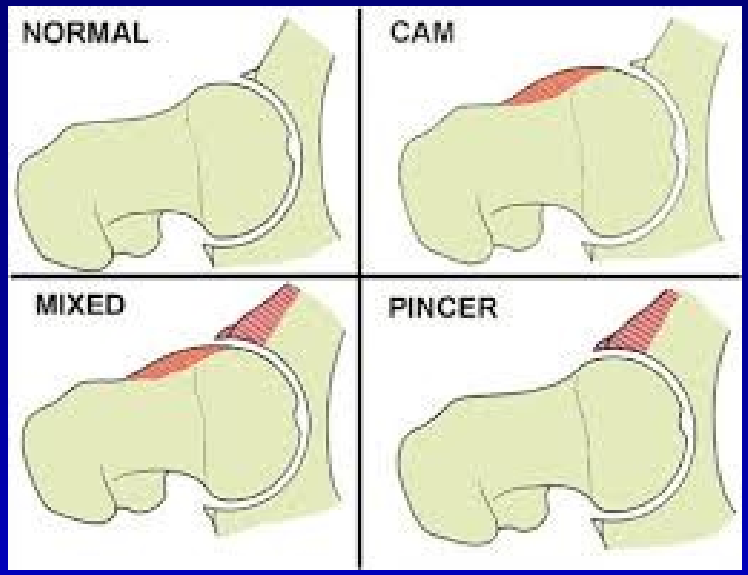
Osteoarthritis of the hip

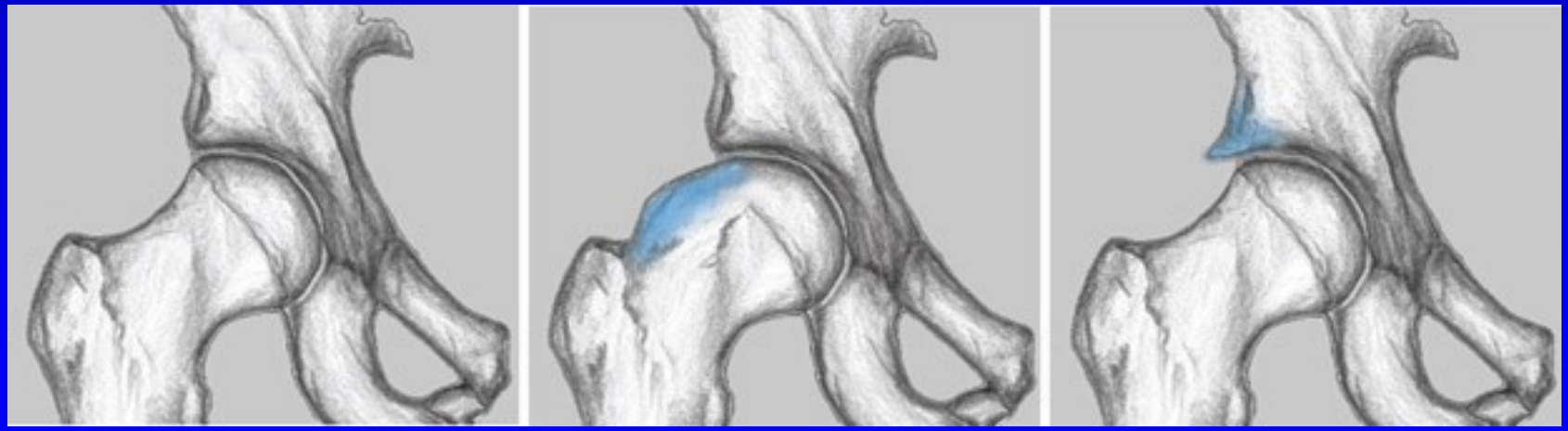
Femoroacetabular impingement
FAI

- 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

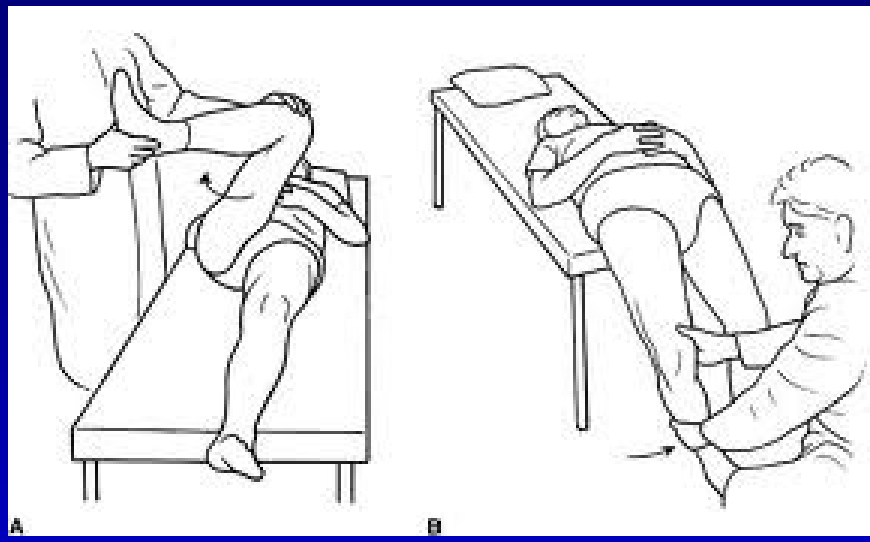


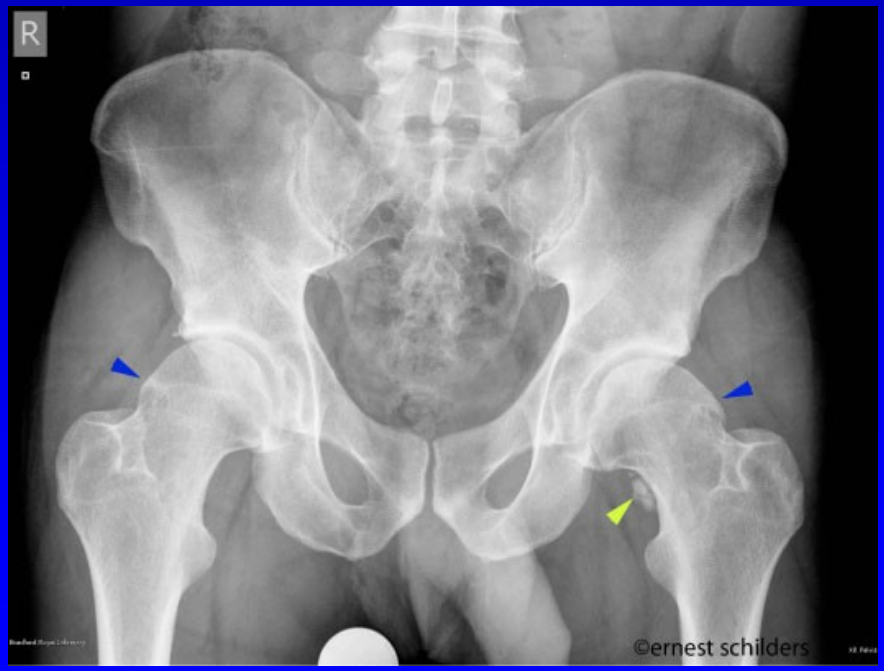


- **Tests**

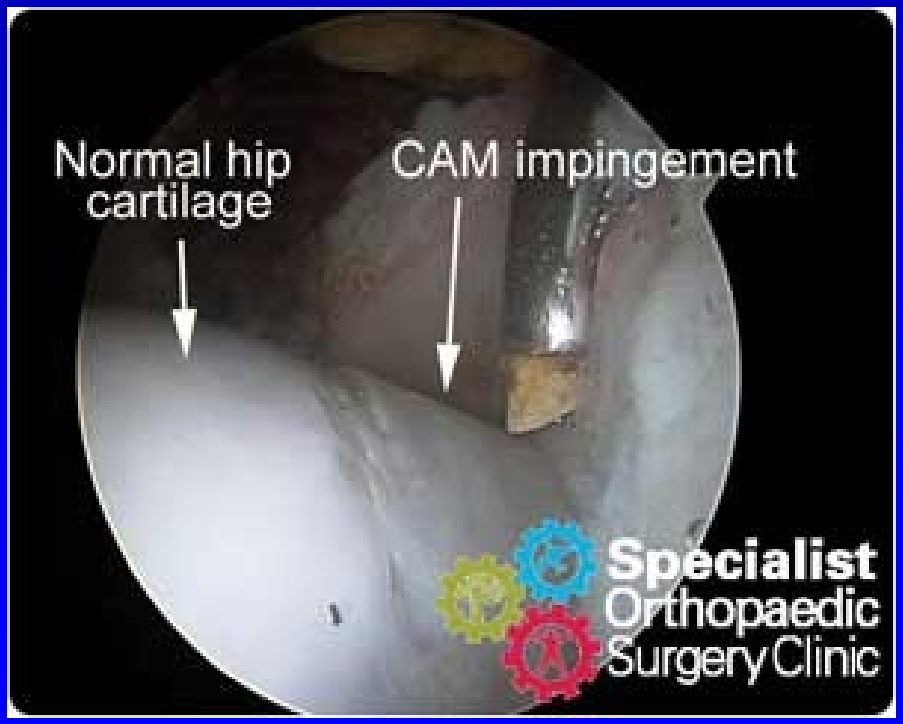
- **Imaging methods**

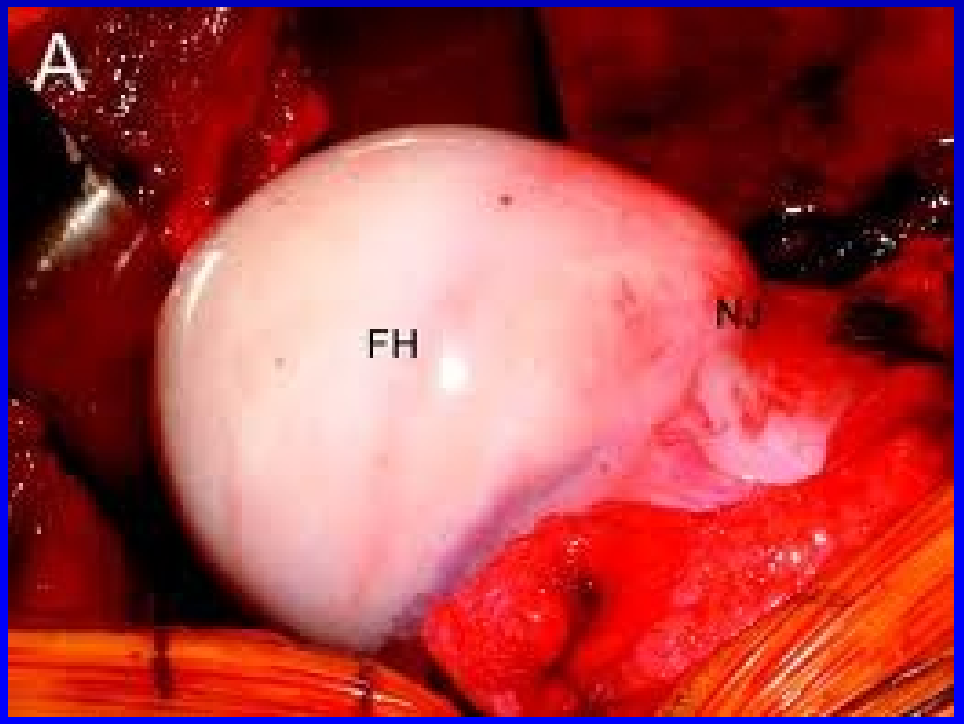
  X ray, CT, MRI





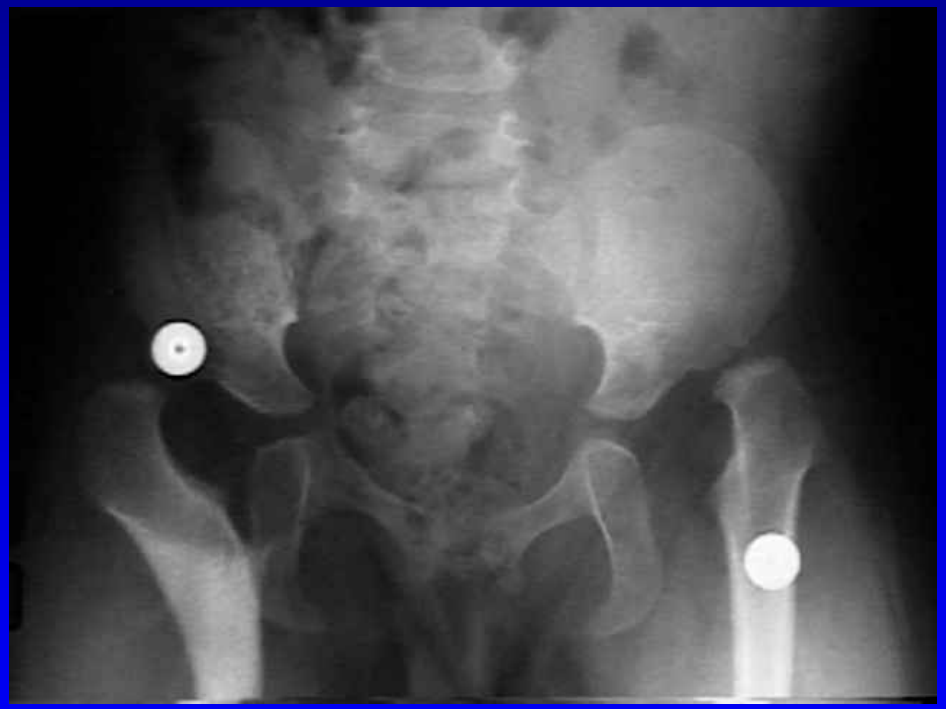
- **Therapy**
  - **Labrum, cartilage, remodelation of the femoral head**
    1. **Open surgery with dislocation of the head**
    2. **Arthroscopy**





Cerebral palsy

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



Hemiparesis

30 % of all cases

½ normal intelligence

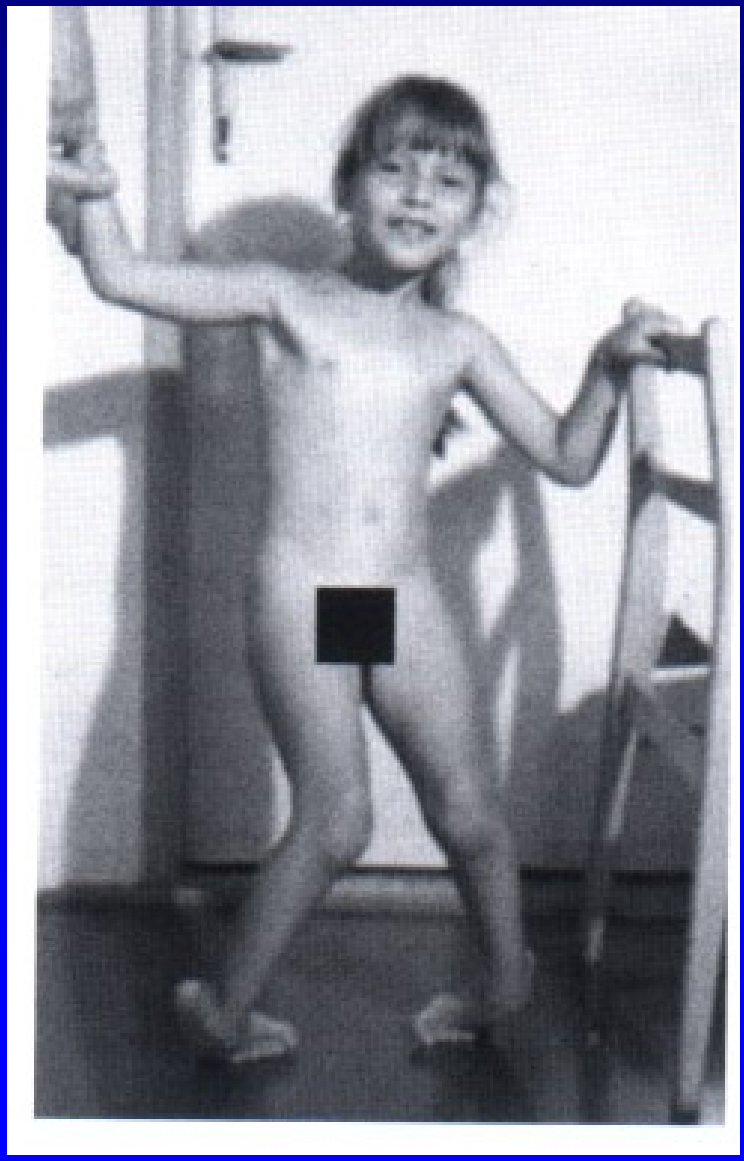
Good walking ability

Diparesis

Both lower extremities are involved more than upper extremities

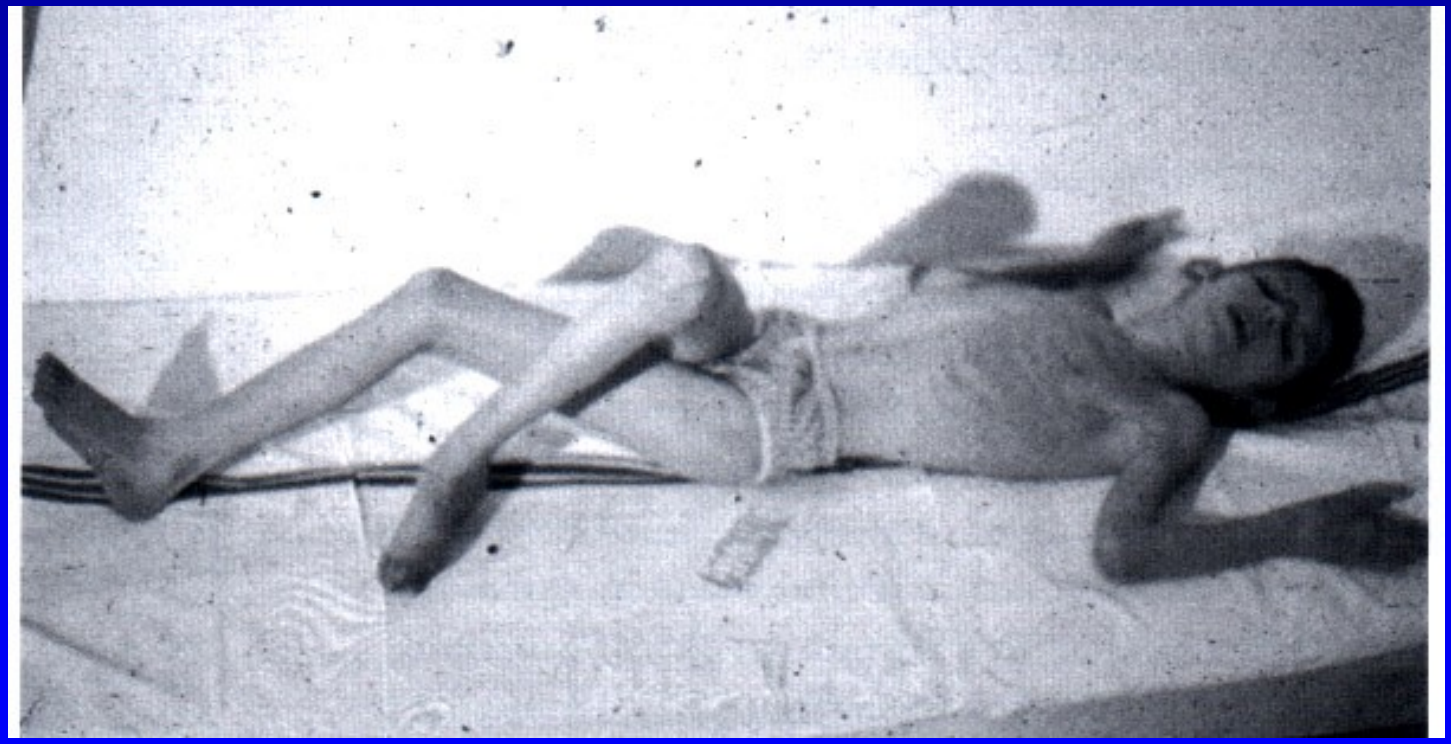
Retarded motoric and psychologic development

Strabismus
Scissors gait
Flexion and adduction contracture in hip
Flexion contraction of the knee
Equinosity of the feet, tip toe walking



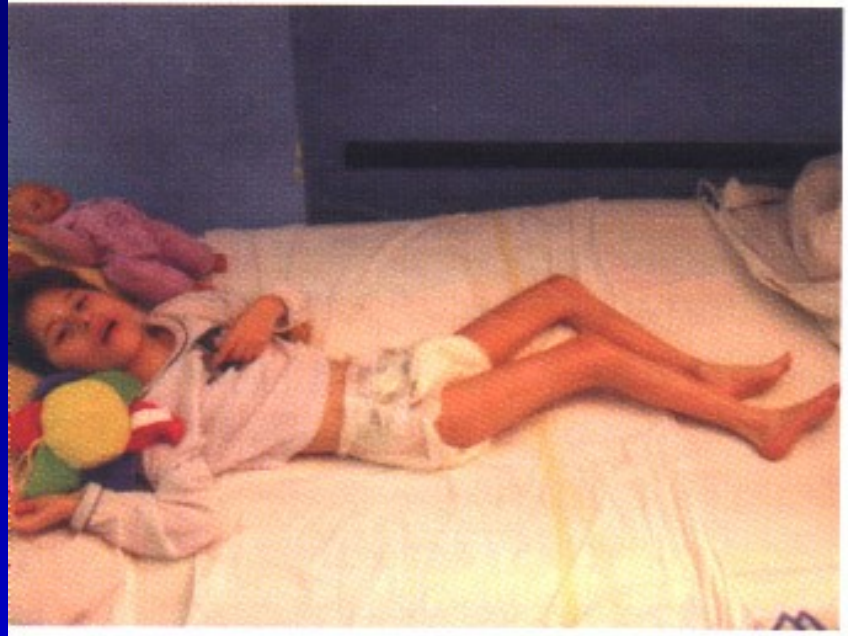
Quadruparesis, triparesis

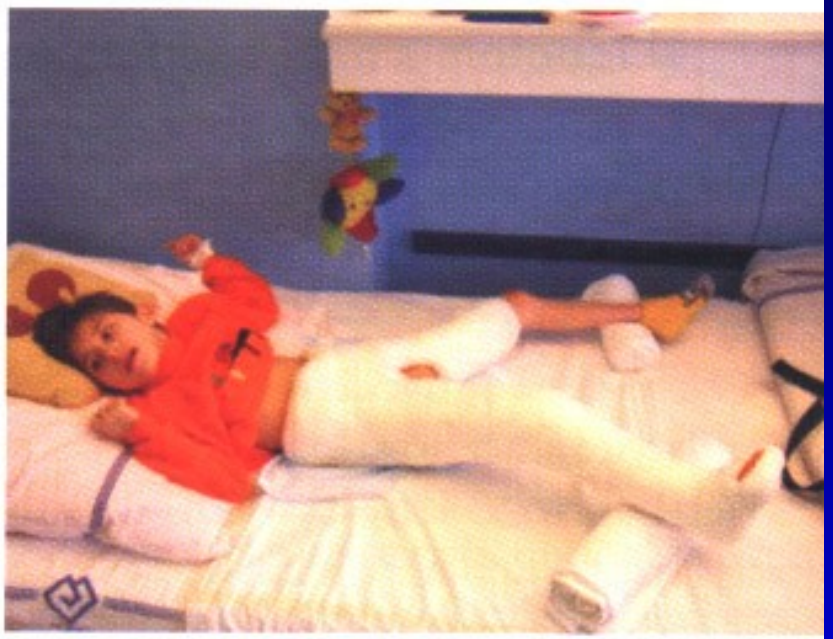
Severe paralysis of both extremities
Head nerves involvement, debilitated patients



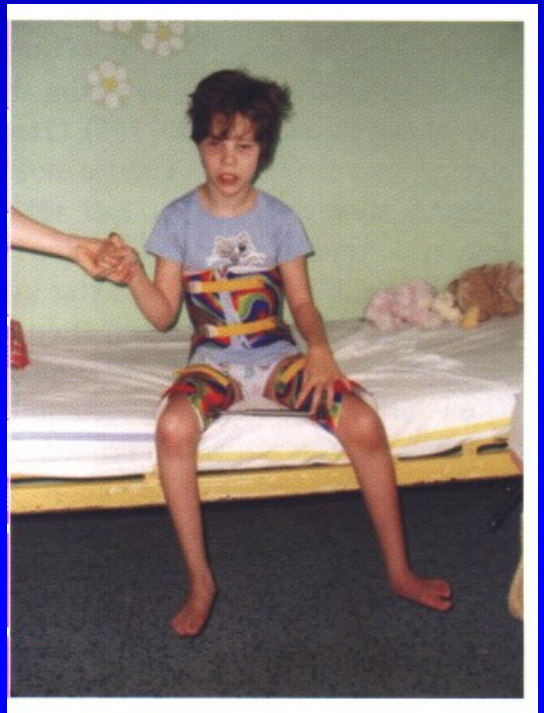
Orthopaedic procedures in the hip joint

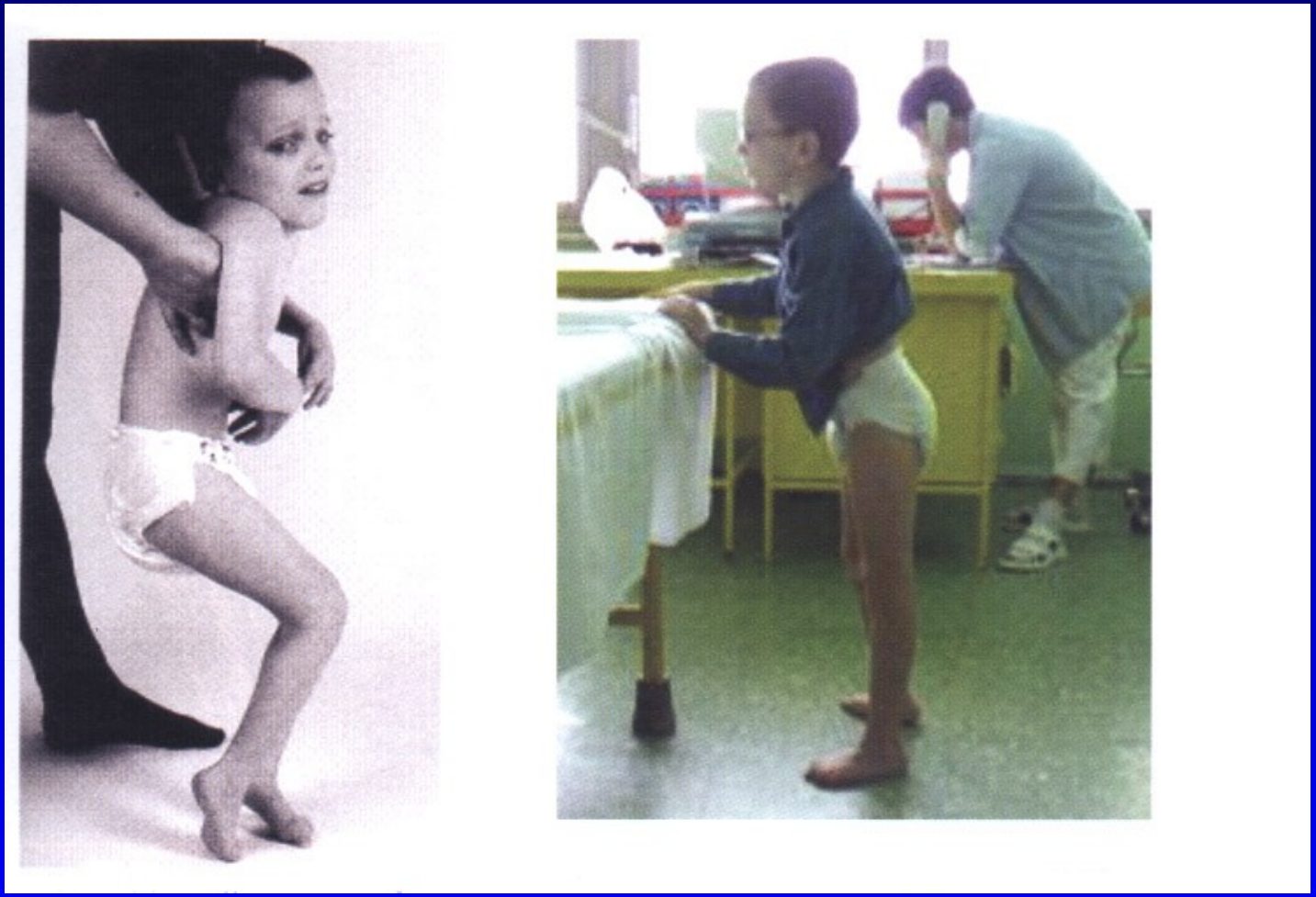
Adductos tenotomy
Transposition of adductor of the hip
Iliopsoas recession
Open reduction of dislocated hip
Varus osteotomy of the femur
Acetabuloplasty, shelf procedures
Osteotomy of the pelvis
Girdlestone
Schanz
THA





Adductor tenotomy





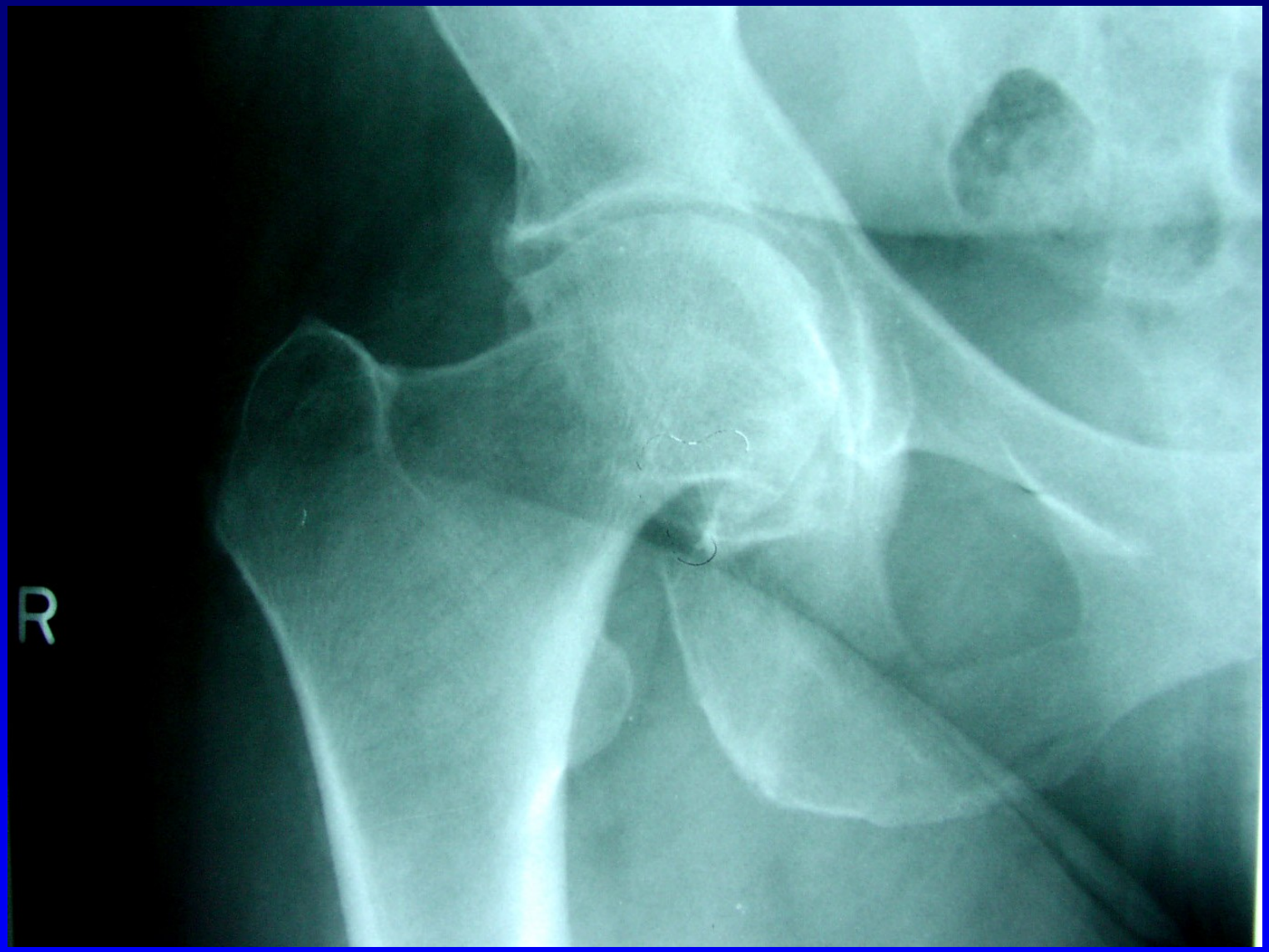
Flexion contracture of the hip and knee joints
Before surgery, after surgery

Pyogenic coxitis

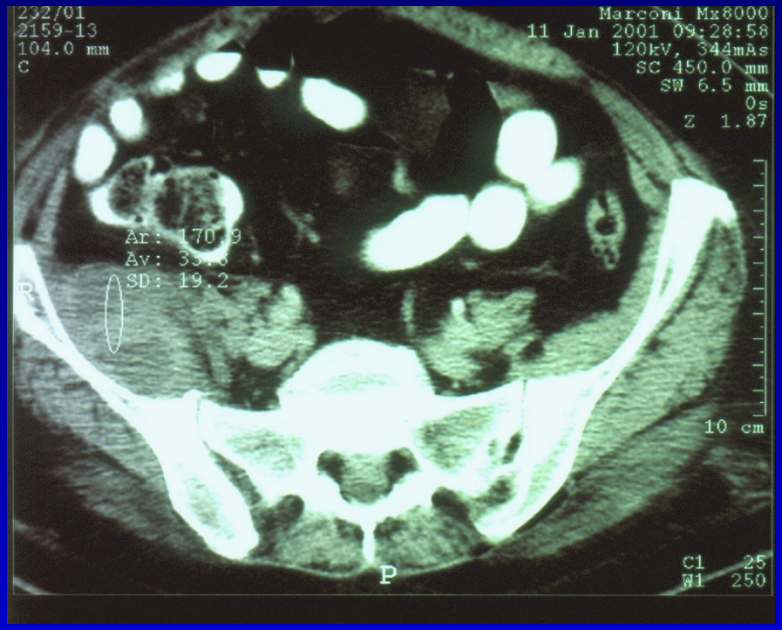
- Clinical symptoms
- Laboratory tests
- Aspiration
- Bacteriology, PCR, cytology

Management

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

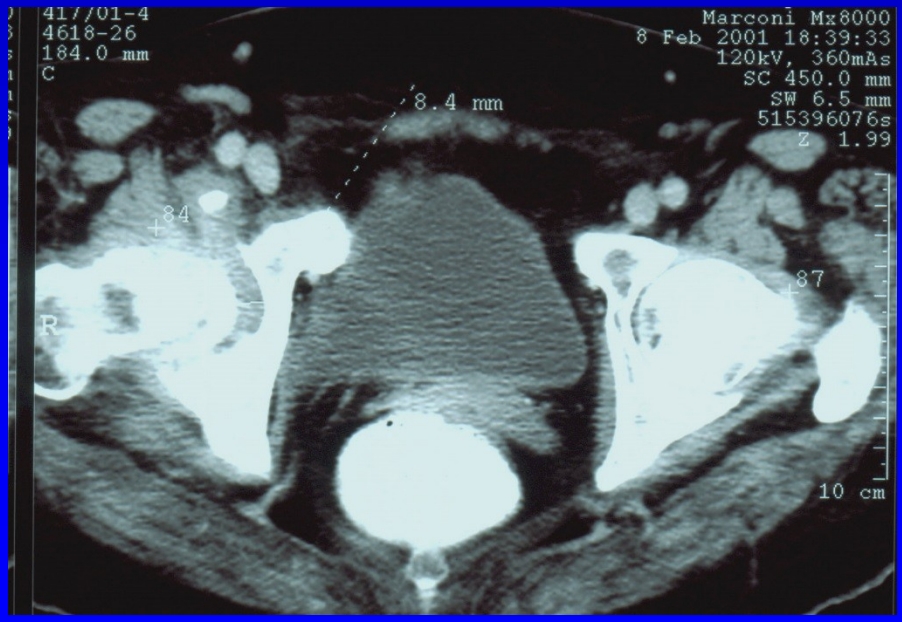


F, 50 y., O.A. of the right hip,
Infection of the big toe

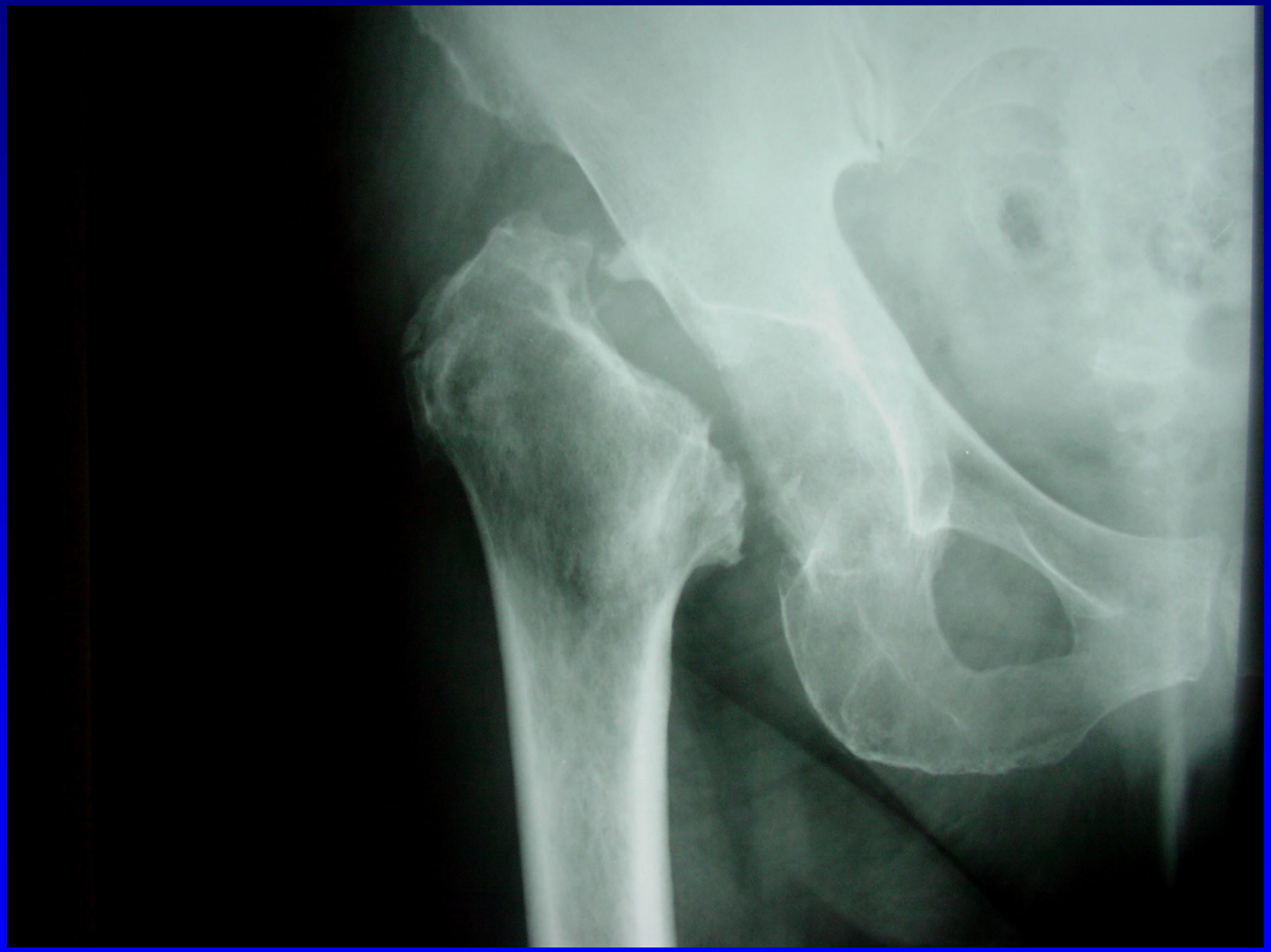


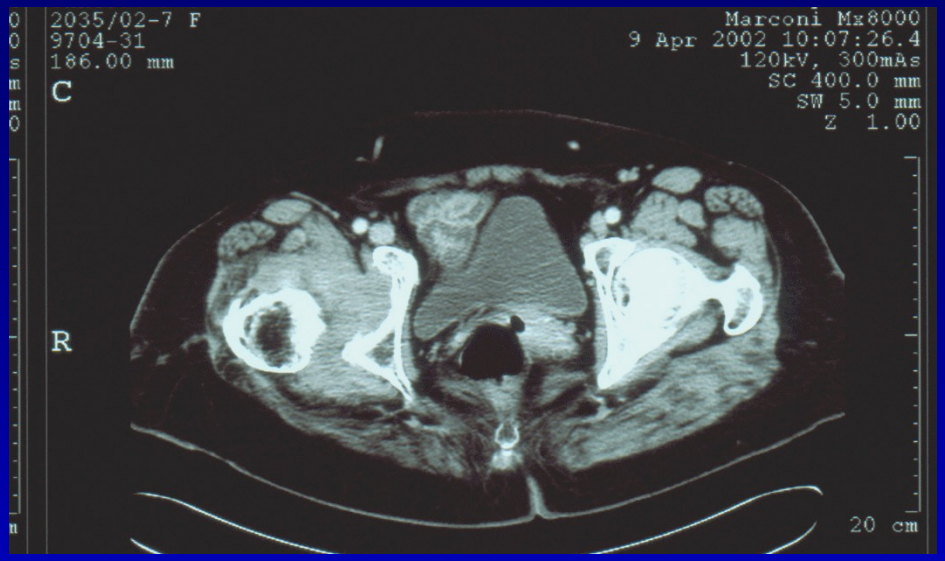
F, 50 y.
Intrapelvic absces
Pyogenic coxitis,
Staphylococcus aureus

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



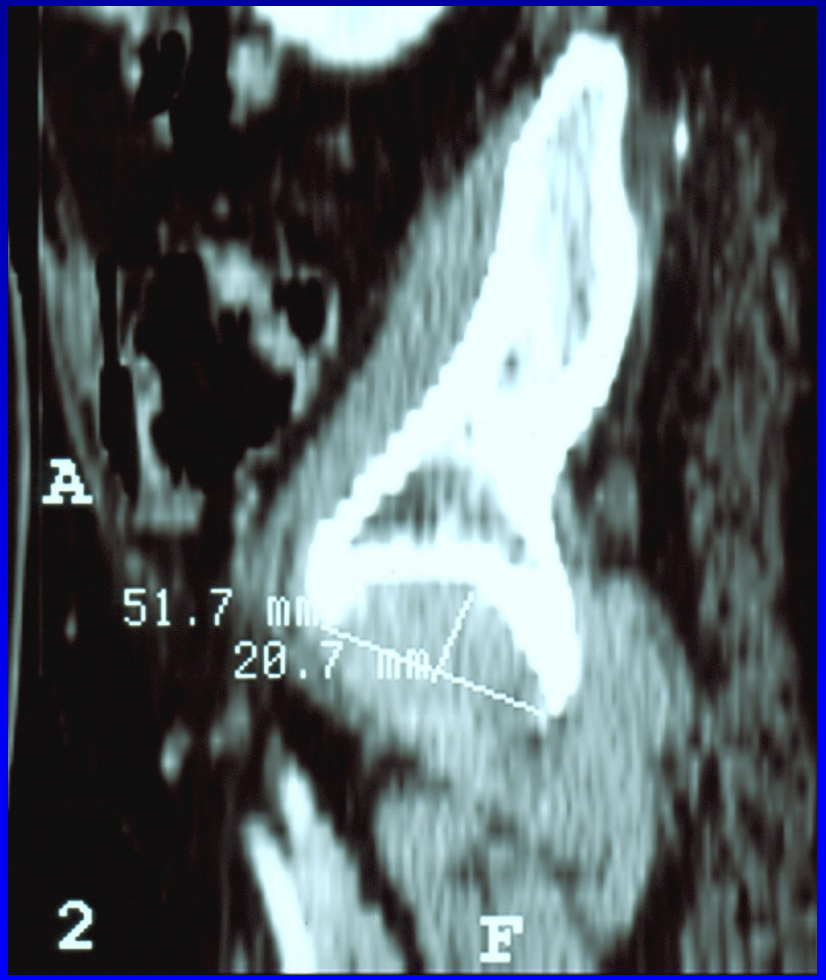
Op. sec. Girdlestone

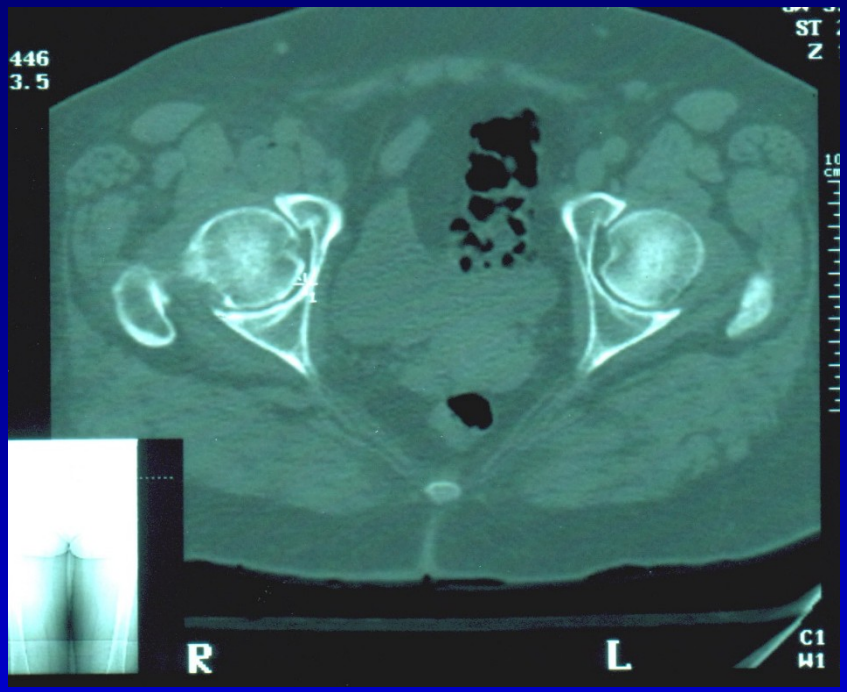




CT reconstruction,
width 51,7 mm

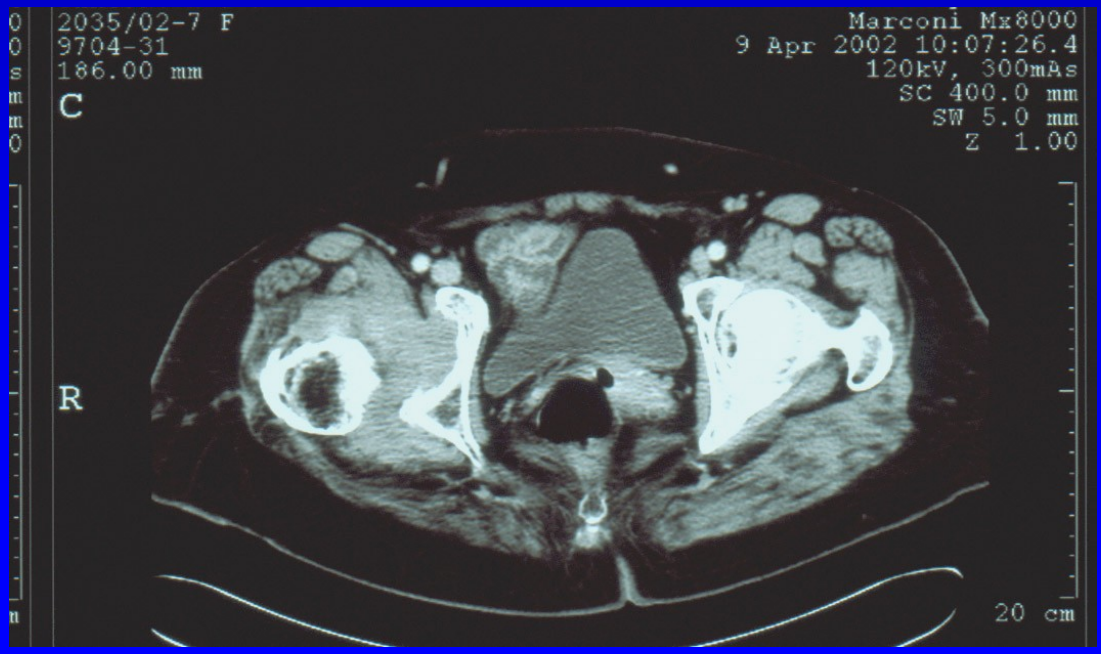
F, 50 y., after one year,
Girdlestone situation,
deep scar tissue,
osteopenia, resorbed edges
of the acetabulum,
thin medial wall.

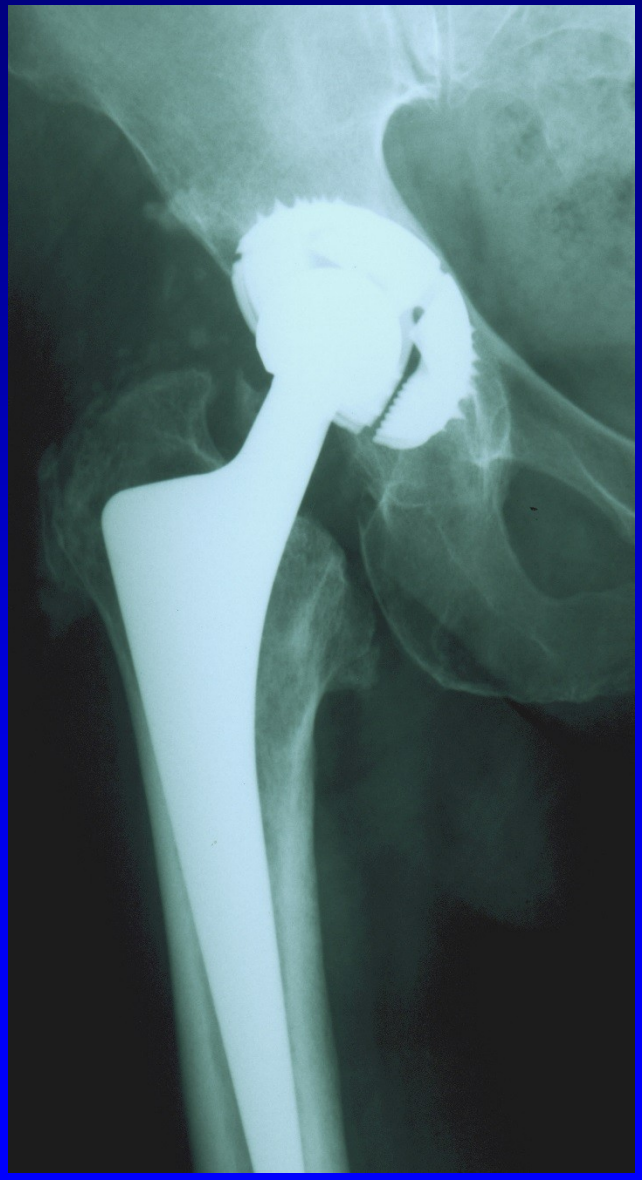




CT scan
at the onset of symptoms,
normal shape of the
edges

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