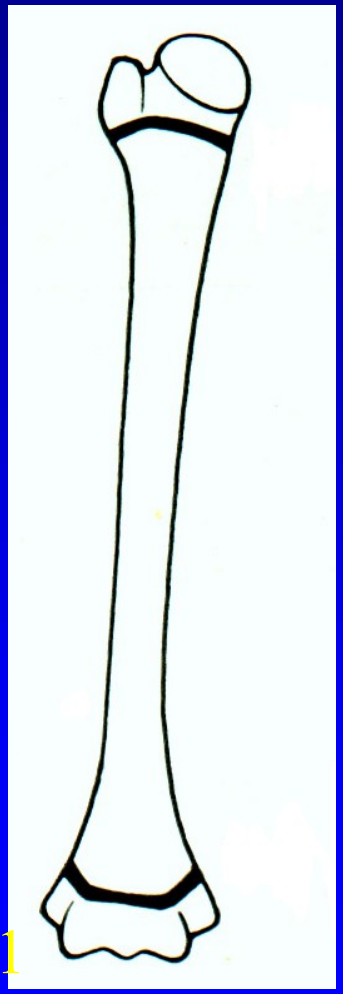
Epiphyseal disorders

Z. Rozkydal

Epiphyseal disorders

Idiopathic avascular necrosis of epiphysis of long bones

Etiology unkown



Obr. 1

Epiphysis

Metaphysis

Diaphysis

Metaphysis

Epihysis

Perthes disease

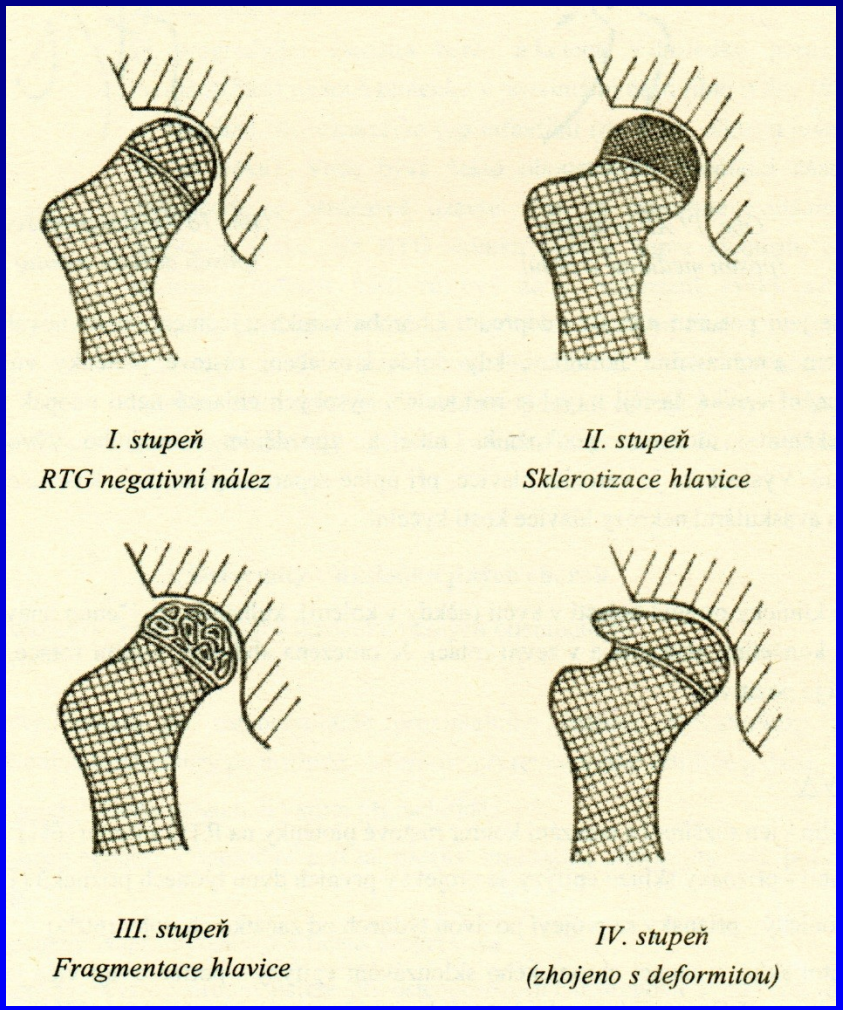
It is a complication of the necrosis of proximal epiphysis of the femur

4 -12 years
10 % bilateral
More often in boys

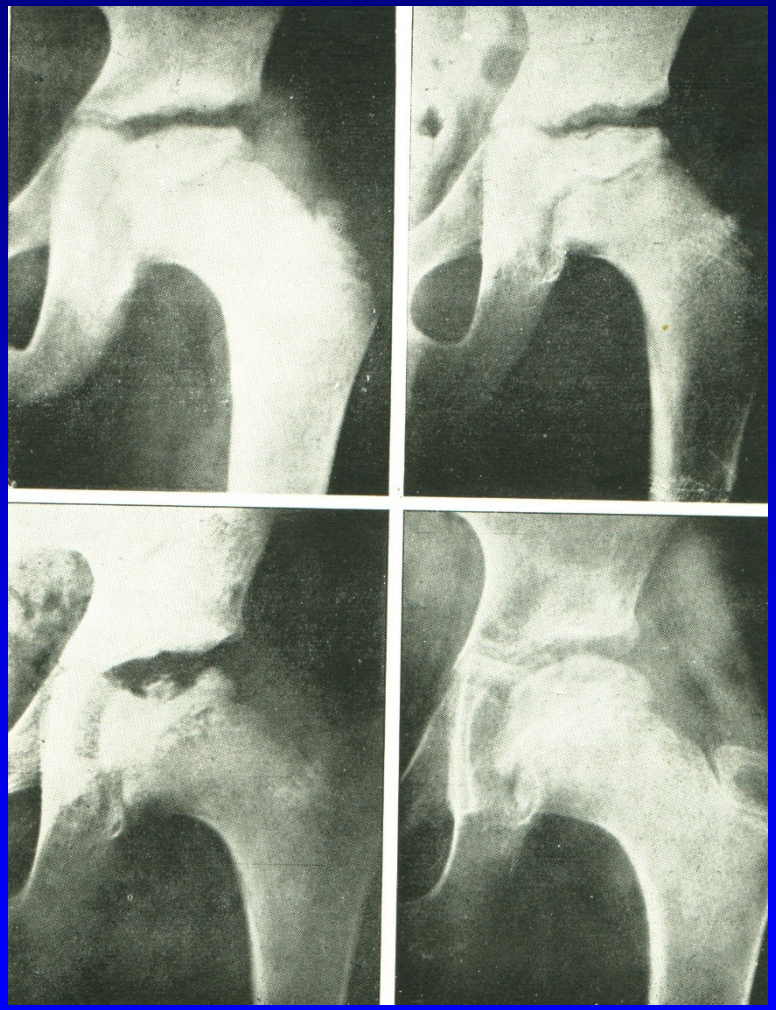
Symptoms: limping, pain
limited ROM (rotation, abduction)

Obr. 2

Perthes disease- stages



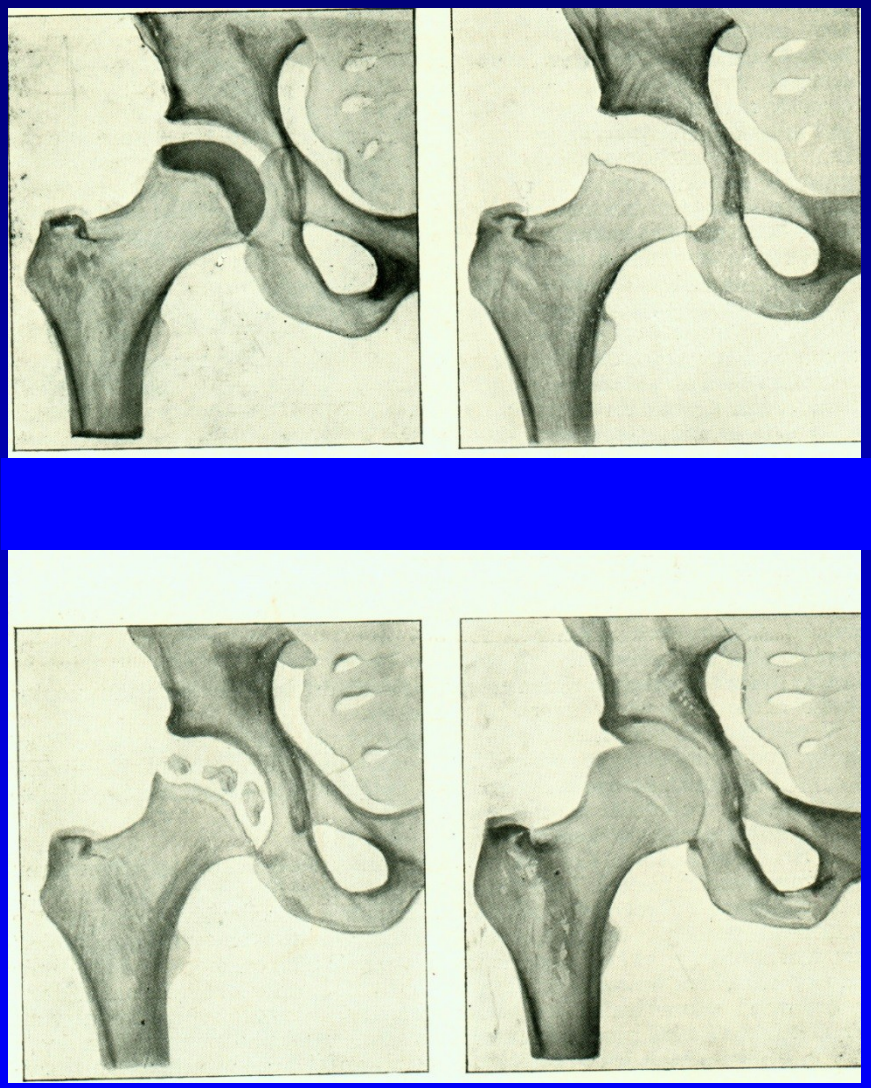
Obr. 4

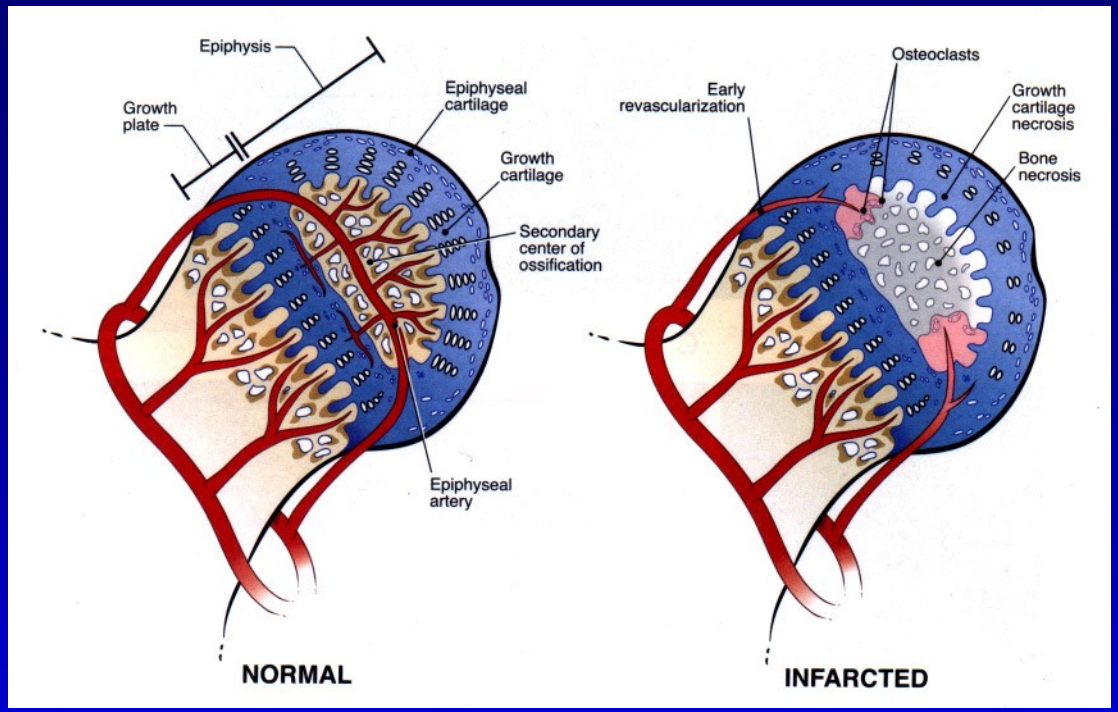


Obr. 5

Frejka classification

1. st. latency 6 - 12 months
2. st. necrosis
3. st. decalcination
4. st. recovery- fragmentation
5. st. consequences

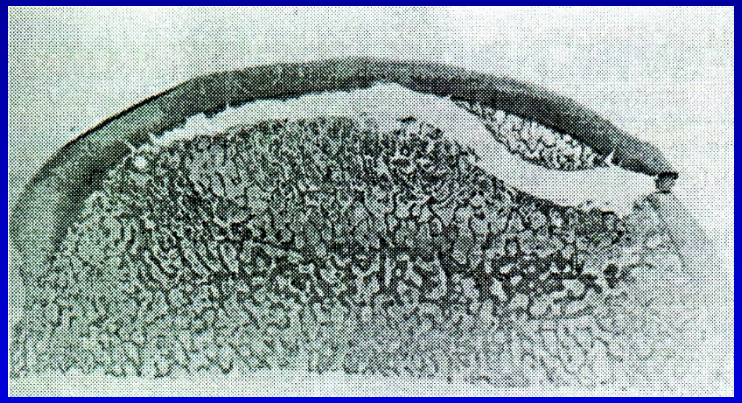




Ischemic necrosis of epiphysis
Loss of vascularity of epiphysis
Necrosis of cartilage
Microdamage in osseus part- resorption
Diminished mechanical strength
Damage of the physeal plate- coxa vara, coxa brevis
Radiolucent lesions in metaphysis

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



Obr. 6
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

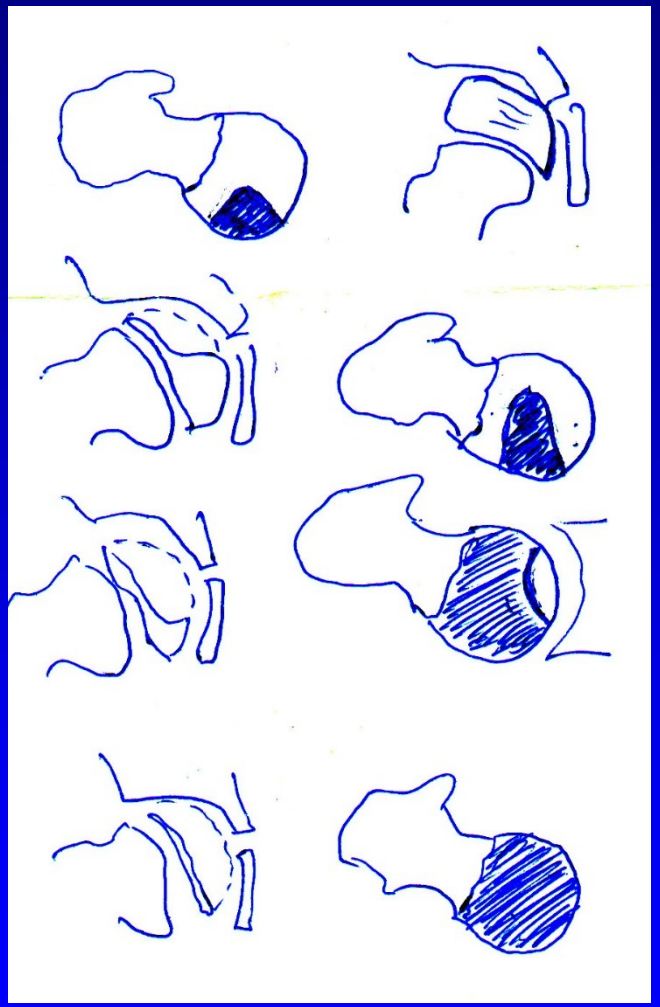
I. 25 %

II. 50 %

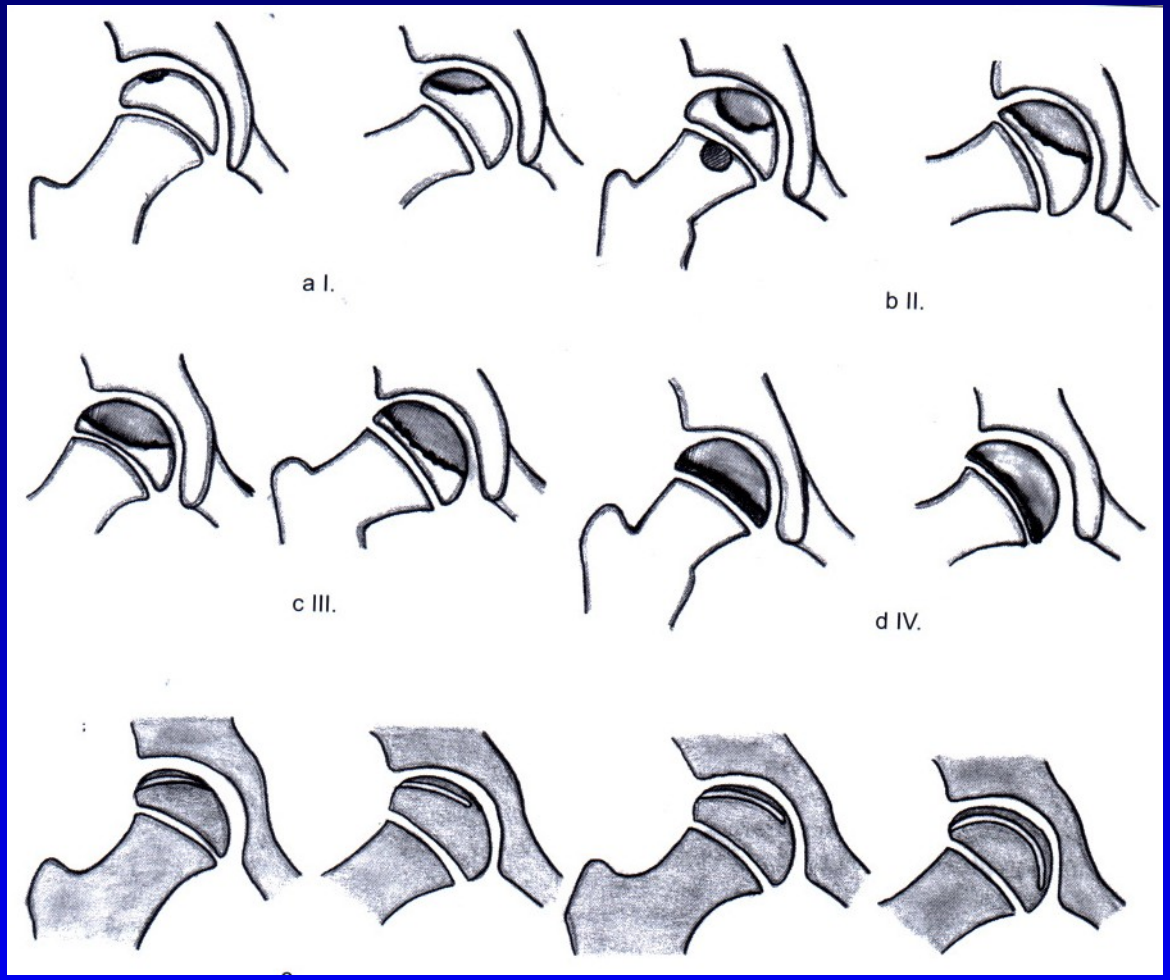
med.- lateral column

III. 75 %

IV. 100 %

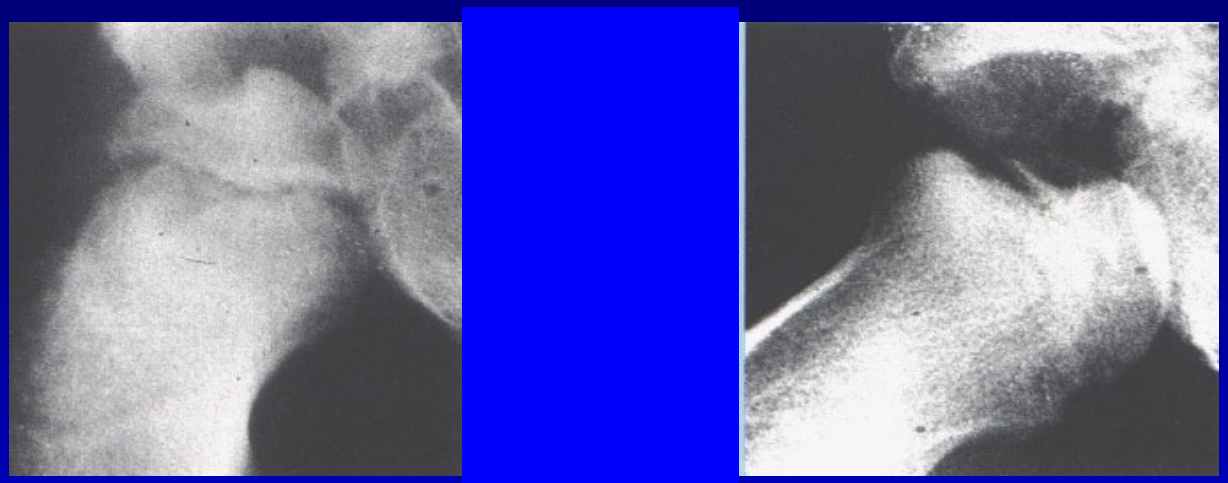


Obr. 7



Subchondral fx
less than one half

Subchondral fx
more than one half

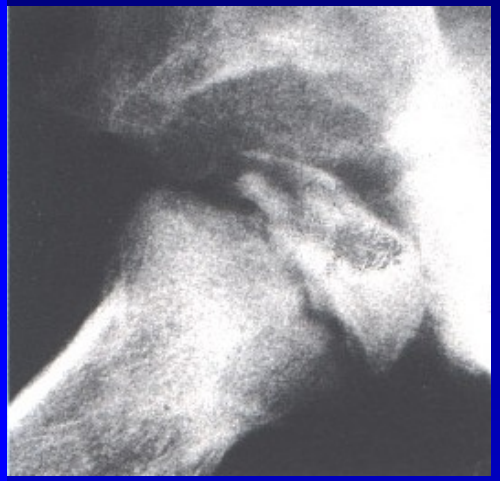


Obr. 8

Catterall I

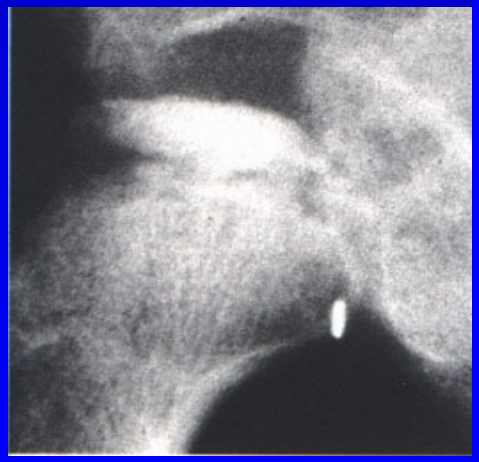
Obr. 9

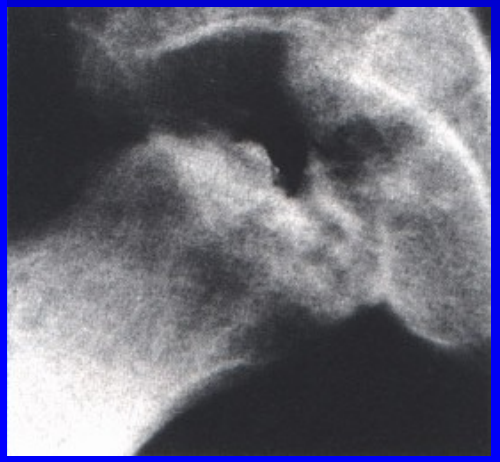
Catterall II



Obr. 10

Catterall III





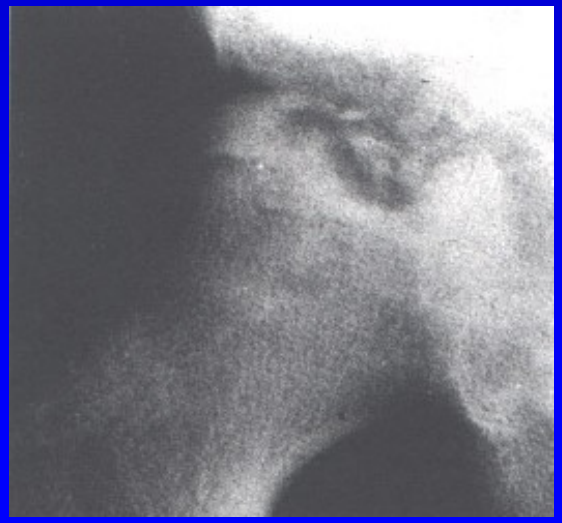
Obr. 11

Catterall IV

Salter classification

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

Obr. 12

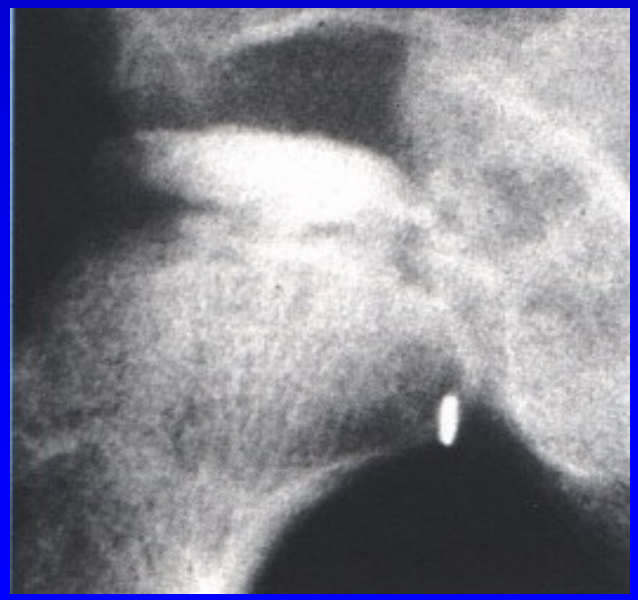


Obr. 13

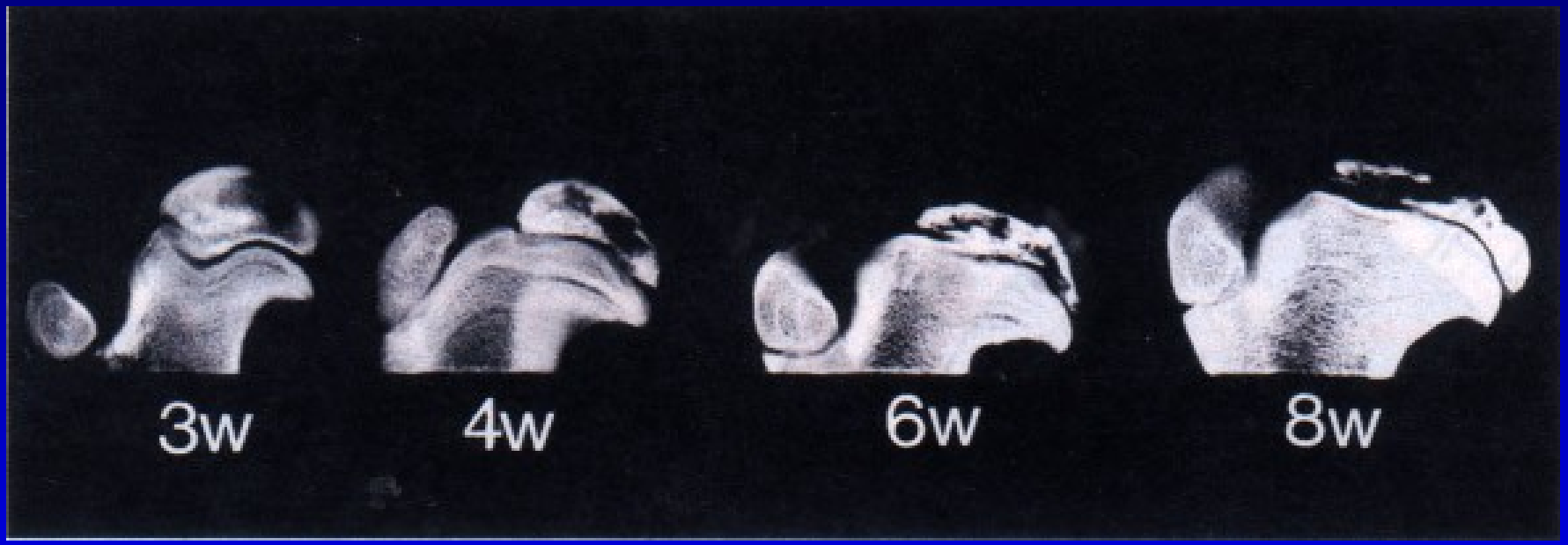
Salter classification

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



Experiment in piglet

Examination

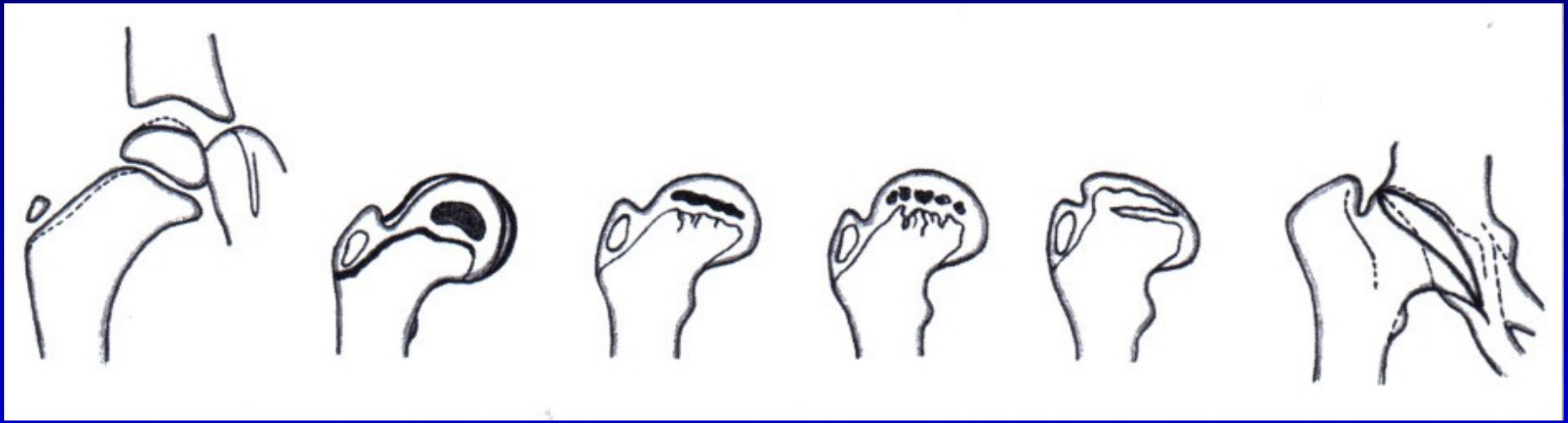
X-ray
Artrography
CT - 3 D reconstruction
MRI
Scintigraphy
Ultrasonography

Prognosis

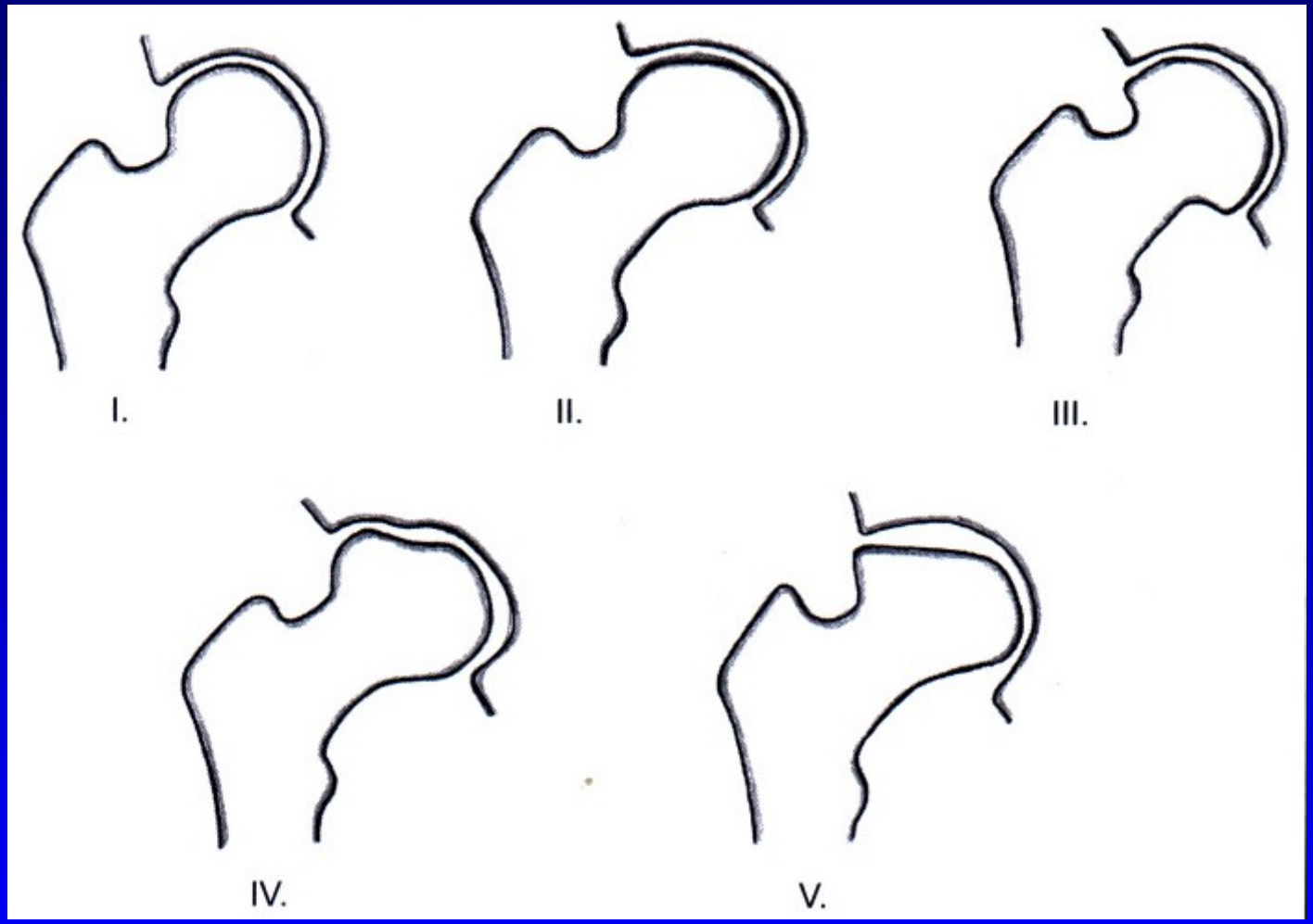
I. and II. stage	good prognosis
III. and IV. stage	wrong prognosis

Risk factors:

Older age
Loss of containment, subluxation
Large extent
Limited movements



Types of deformity in Perthes disesase



Stulberg classification of deformity
of the femoral head in Perthes disease

Management

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

Conservative methods

- Atlanta orthesis, no weightbearing

Operative methods

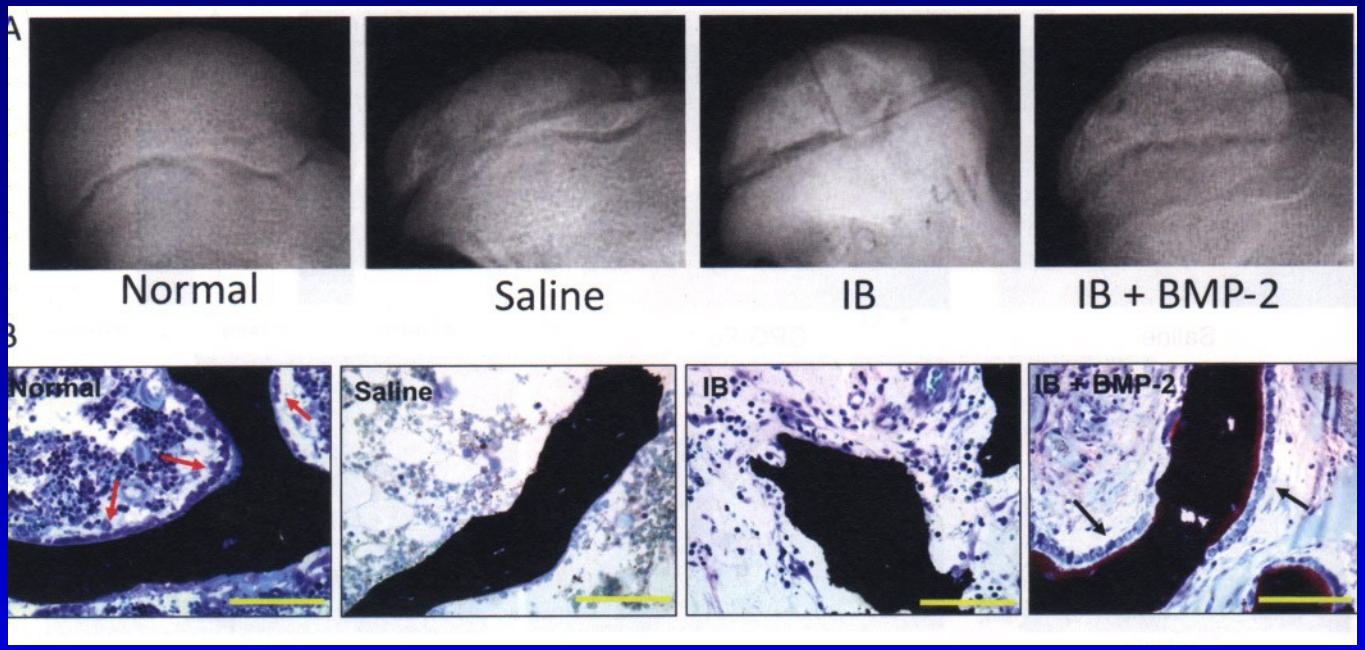
Osteotomy of the pelvis (Salter, Steel, Sutherland, Dungl)

Osteotomy of the femur

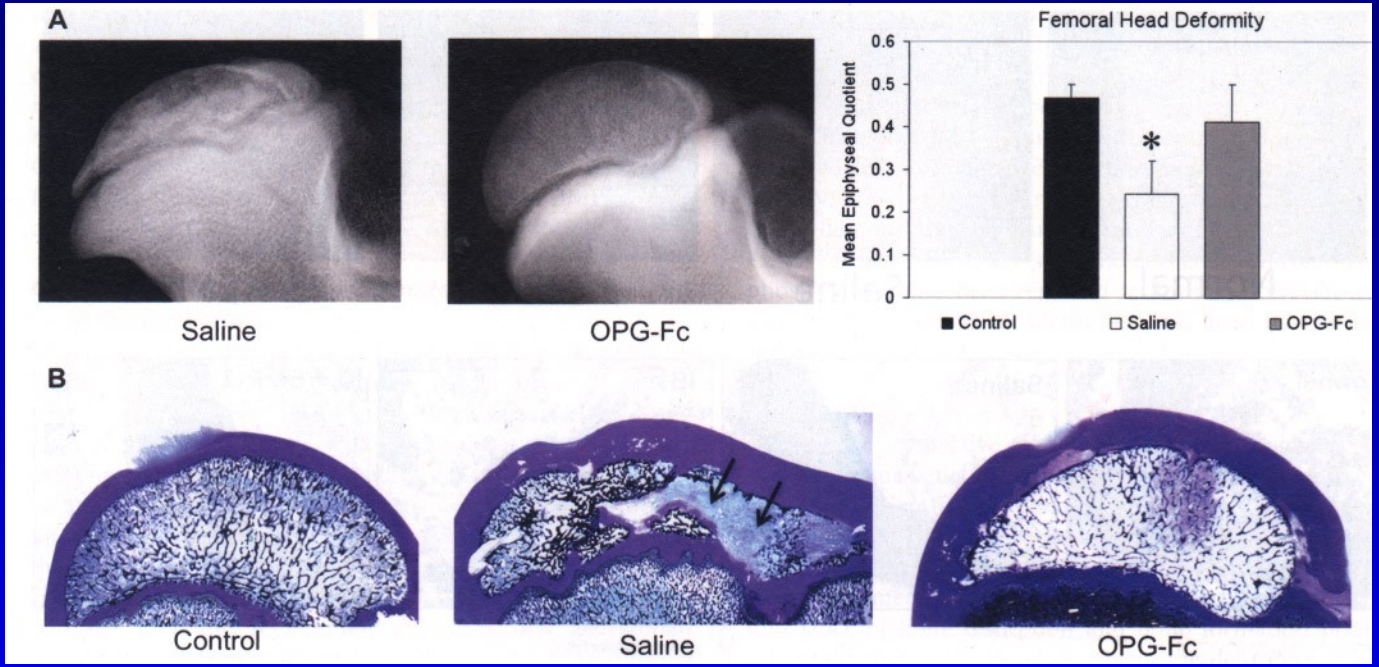
Conservative methods

Rest in bed
Crutches
Atlanta orthesis

Obr. 16
Atlanta orthesis



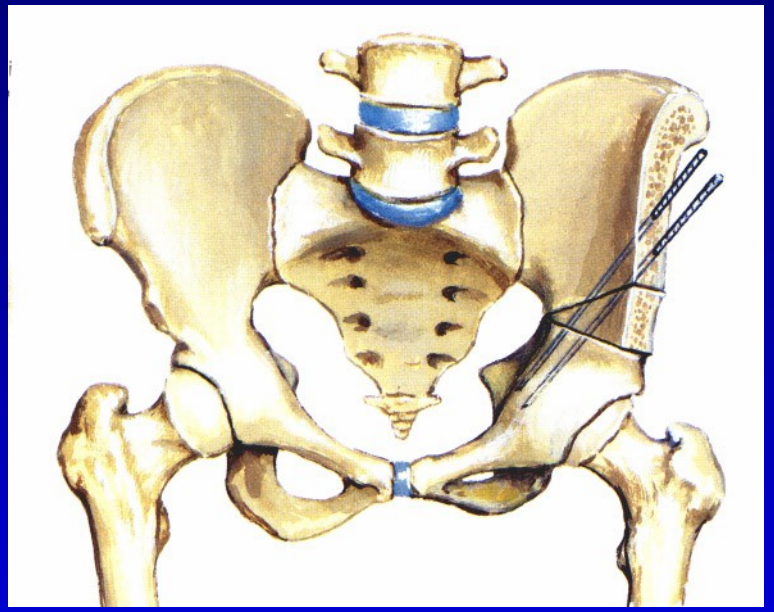
Experiment: Ibandronate + BMP



Experiment: Osteoprotegerin

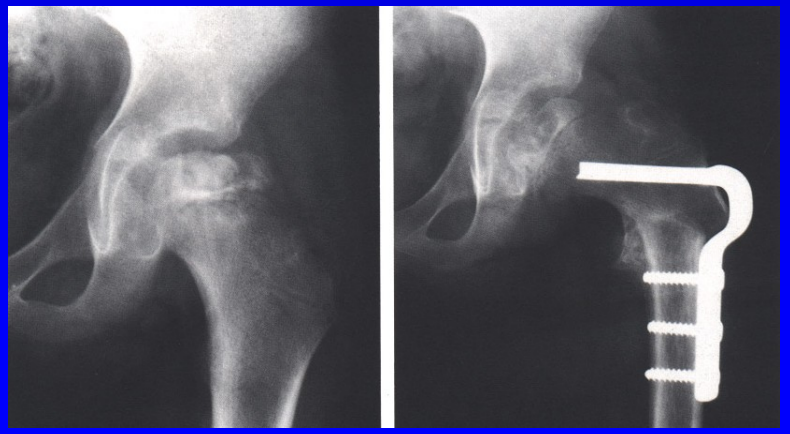
Operative methods

Salter pelvic osteotomy



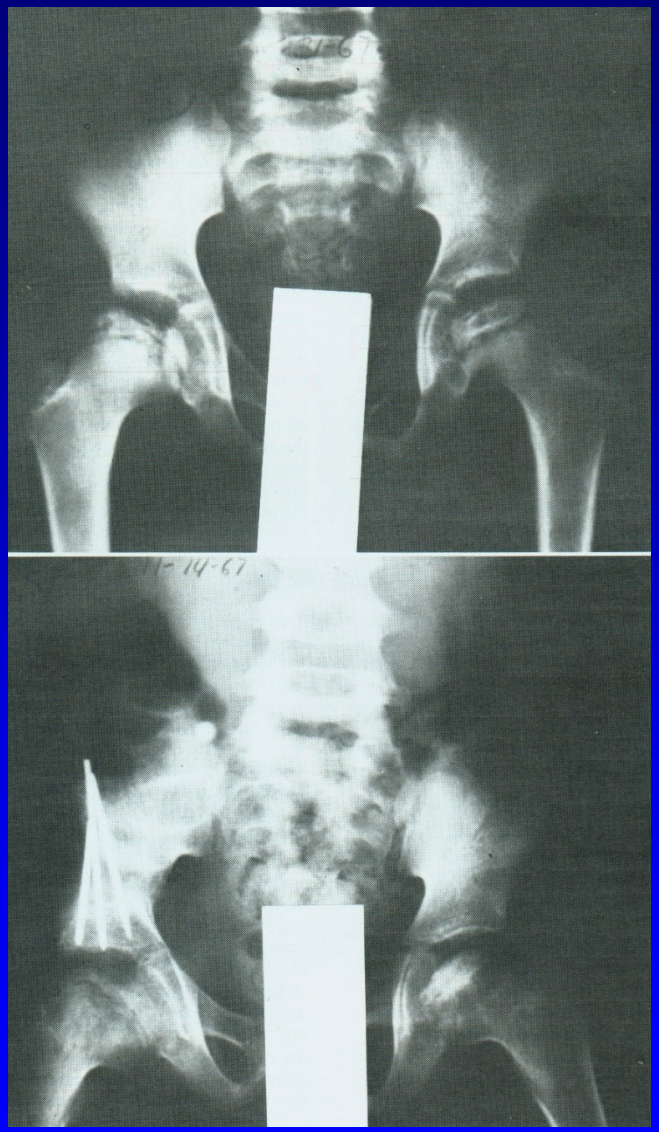
Obr. 17

Varus osteotomy of the femur

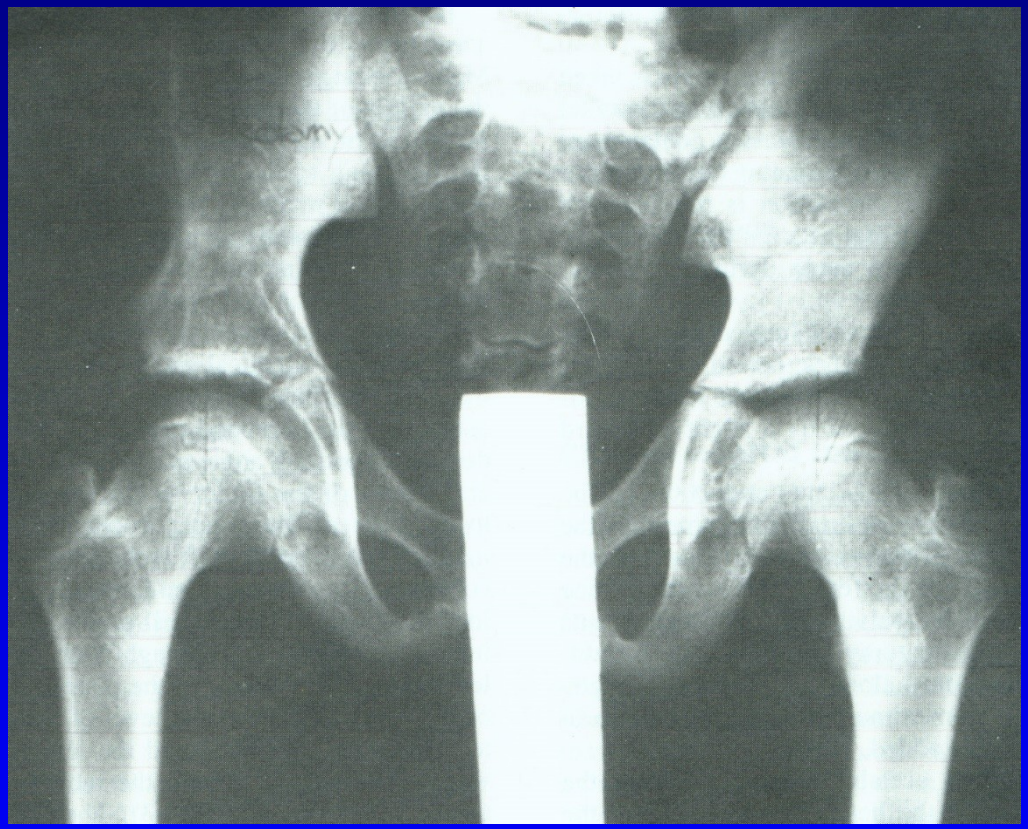


Obr. 18

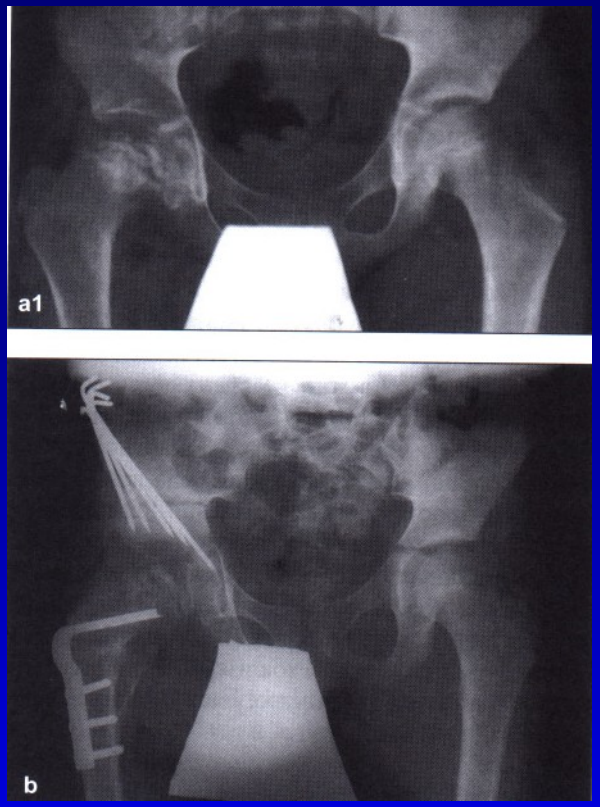
Salter osteotomy

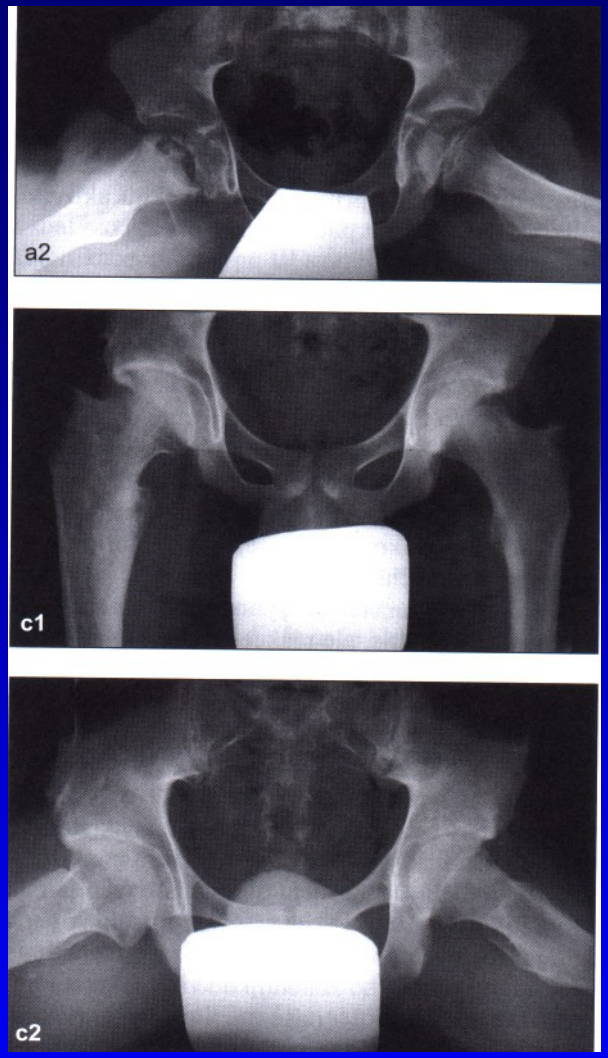


Obr. 19



Obr. 20





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

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

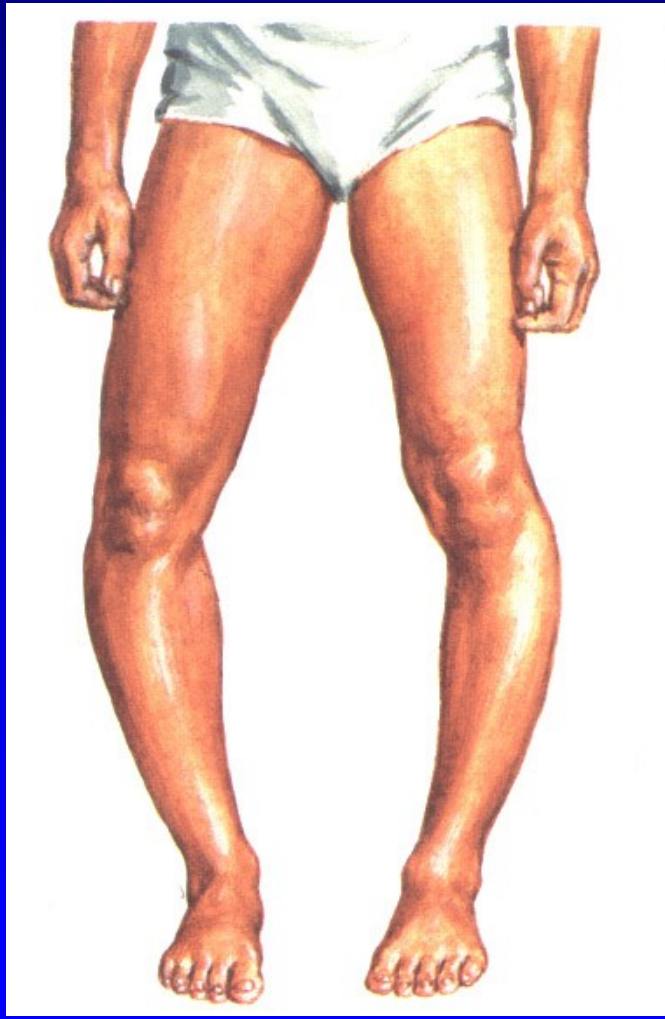
Tibia vara Blount

Disorder of proximal epiphysis of the tibia

Early arrest of growth plate on medial side with smaller epiphysis

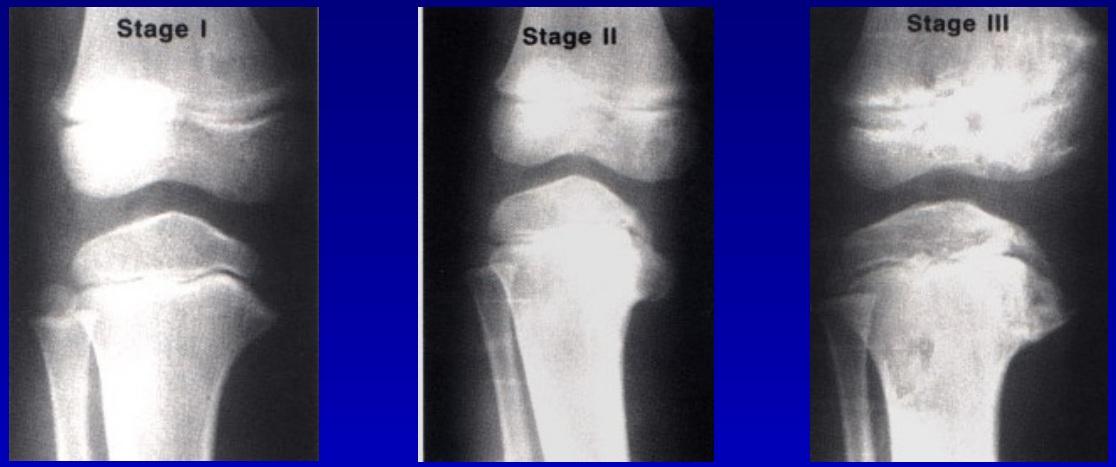
Infantile – up to 3 years
Juvenile - up to 10 years

Th: orthesis, osteotomy

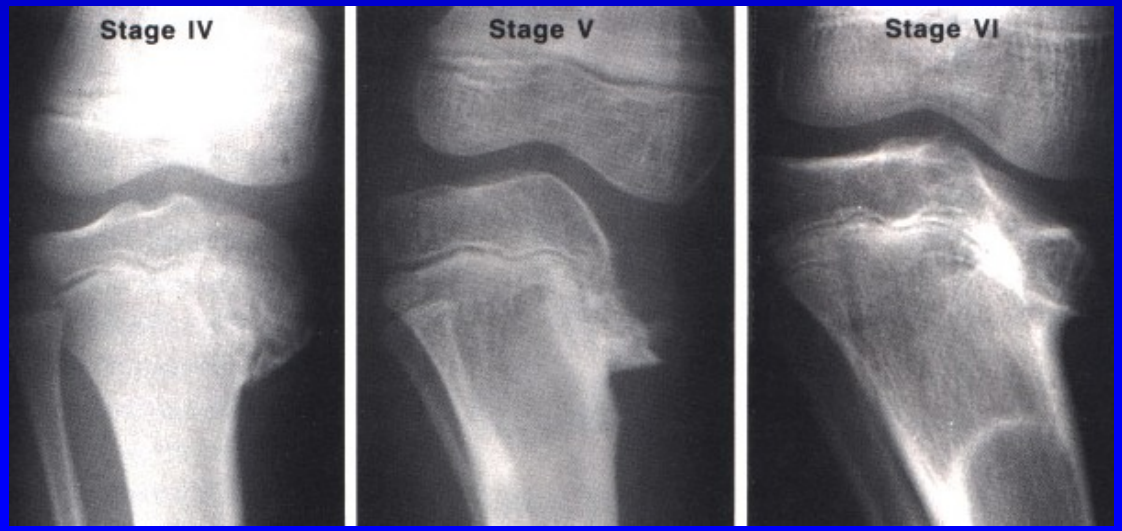


Obr. 22

Tibia vara Blount



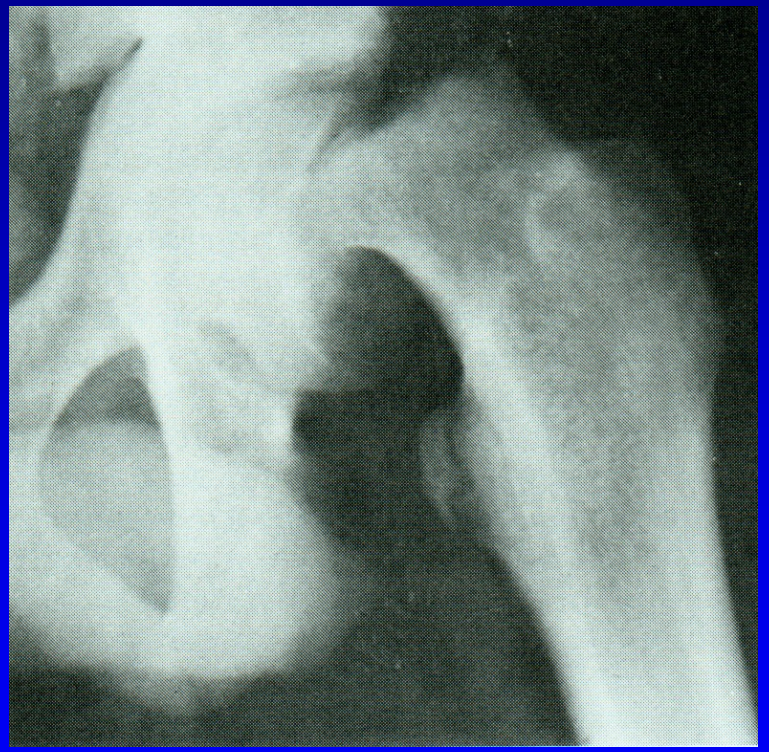
Obr. 24



Obr. 25

Slipped upper femoral epiphysis

Growth plate of proximal epiphysis of the femur is weak and soft
Imbalance of growth hormon and sexual hormons
Obese patients
Fröhlich syndrom
Adiposogenital syndrom
9-15 years
Bilateral in one third

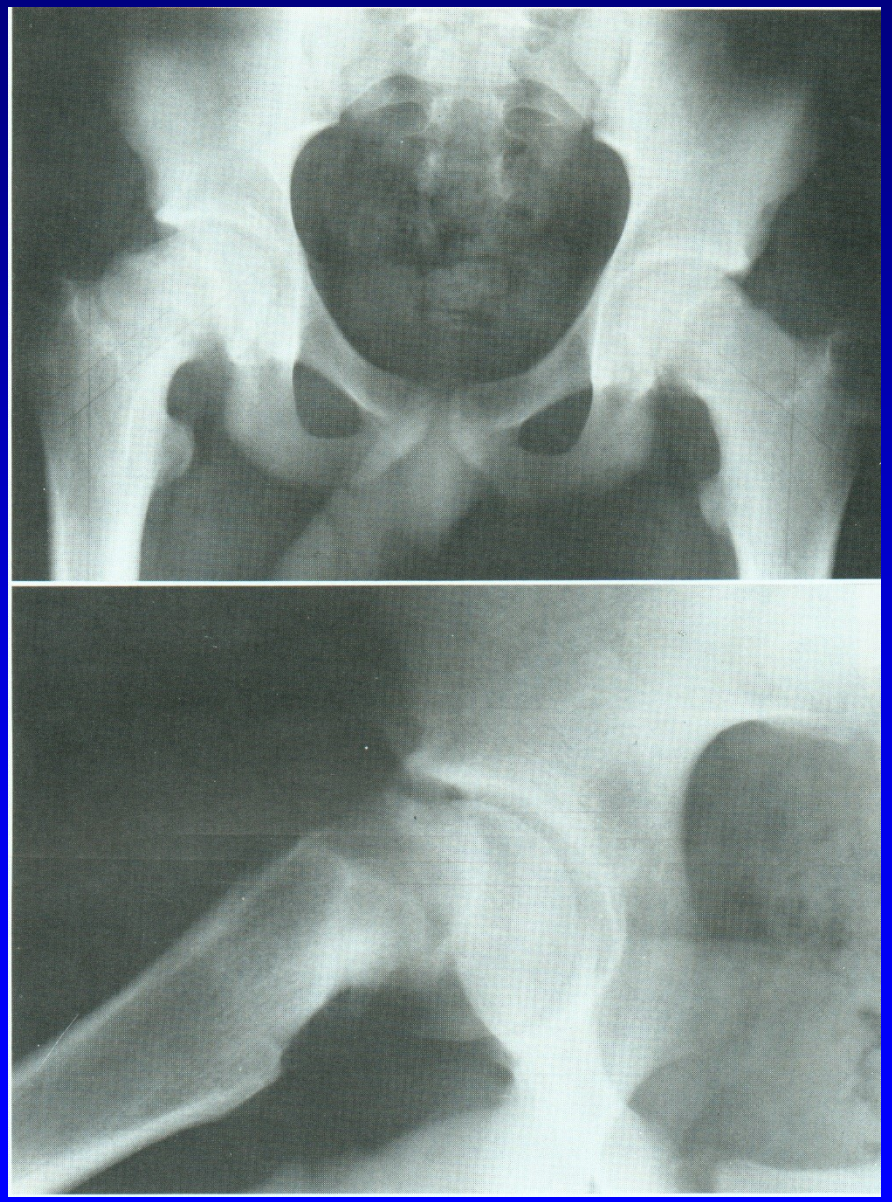


Obr. 26

Slipped upper femoral epiphysis

Slipping of epiphysis
down and backwards
to varus and to retroversion

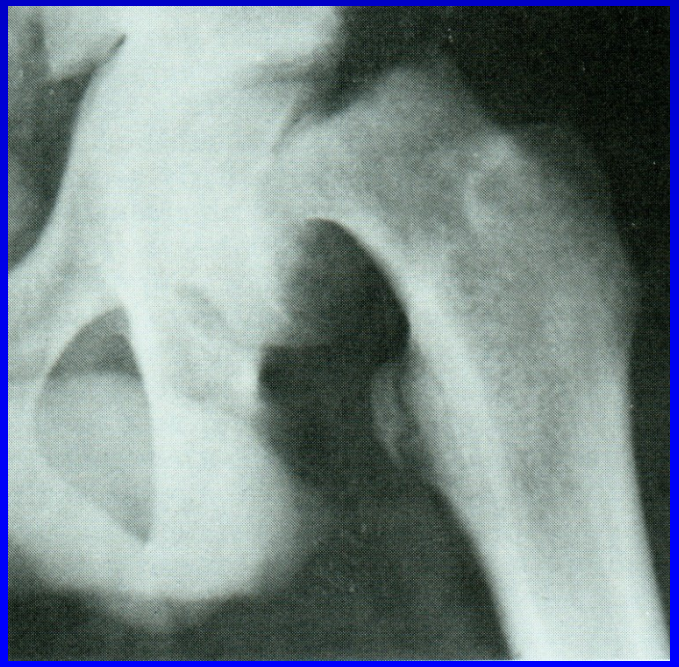
Metaphysis goes proximaly
and to external rotation



Obr. 27

Symptoms

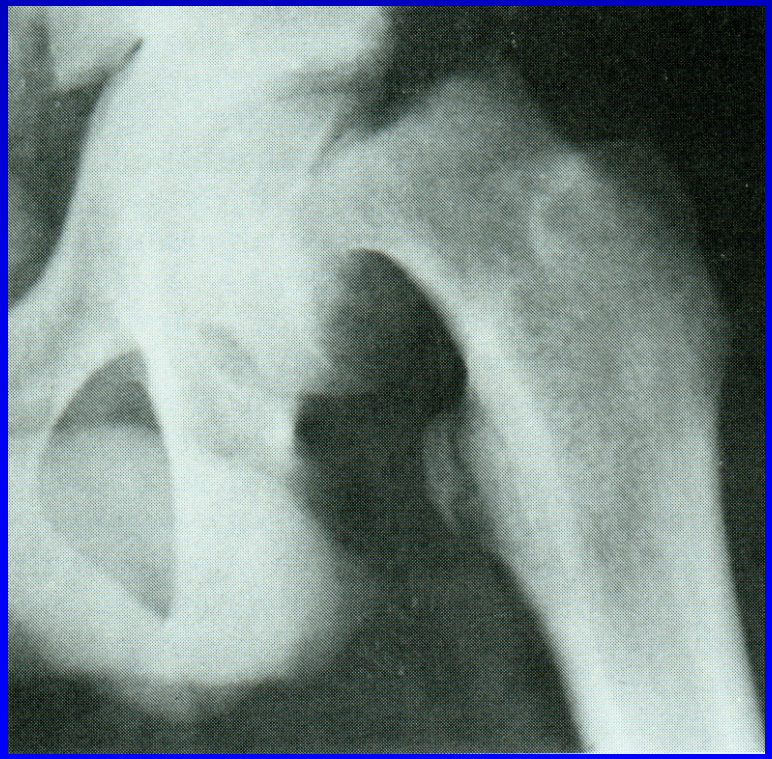
Pain in groin and in the thigh
Limping
Shortening of the leg
Limited abduction and external rotation
Positive Trendelenburg sign



Obr. 28

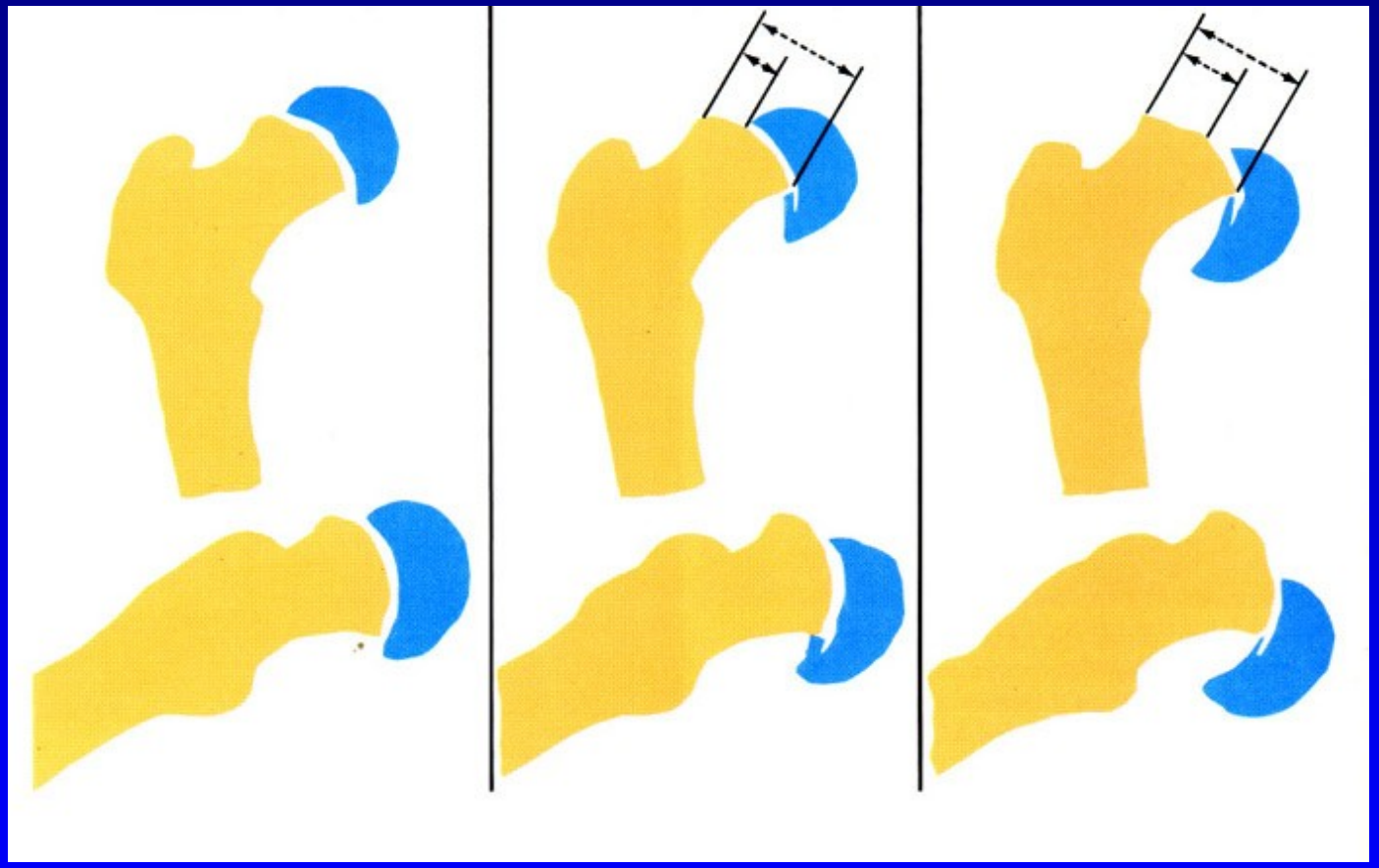
Types

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



Obr. 29

Stages



Obr. 30

1. 2. 3.

Stages

1. Slight: slip up to 30%

2. Moderate : slip 30-60 %

3. Severe: slip above 60 %

Management

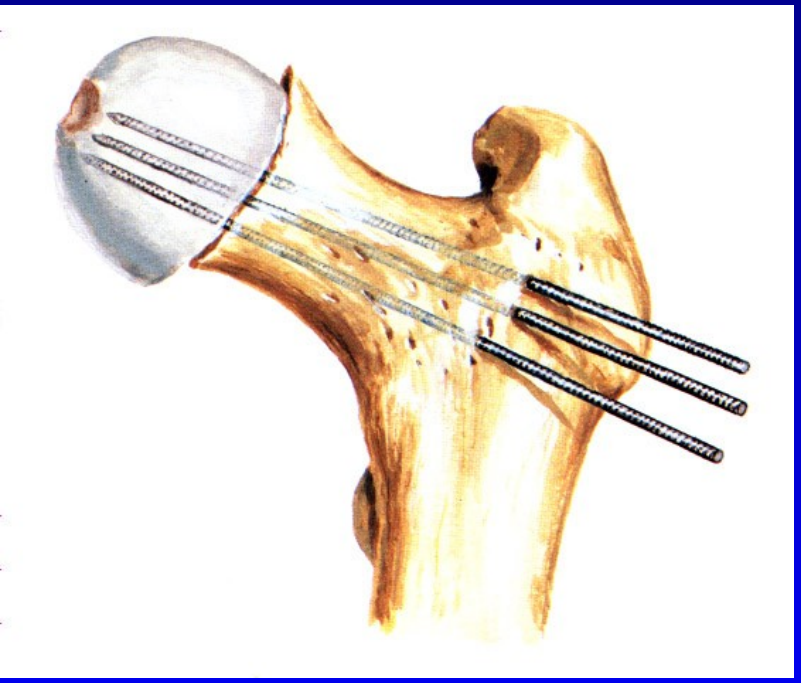
Fixation in situ (K wires, Knowles pins)

Closed reduction and K wires

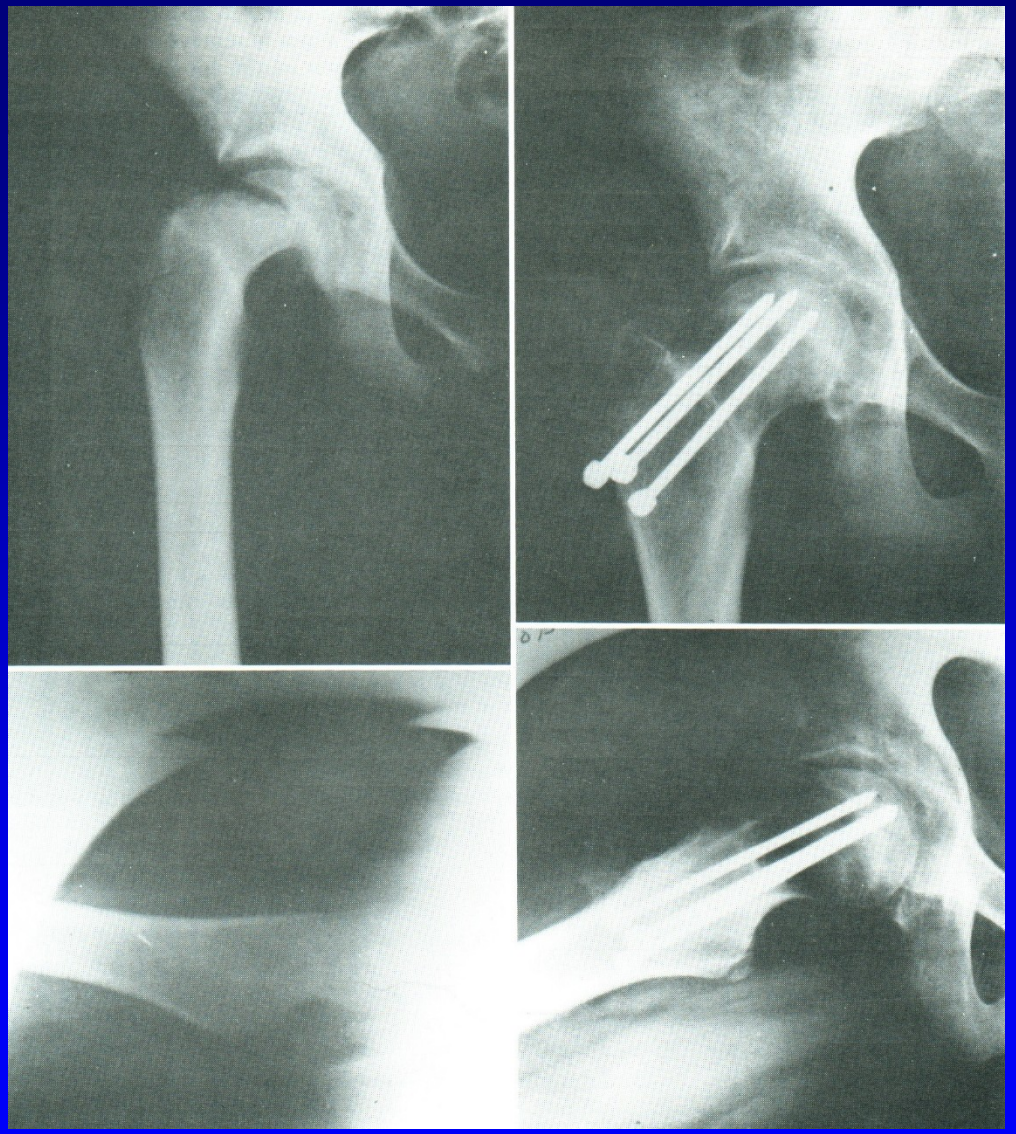
Open reduction

Osteotomy of proximal femur - Southwick, Imhäuser-Weber

Fixation in situ

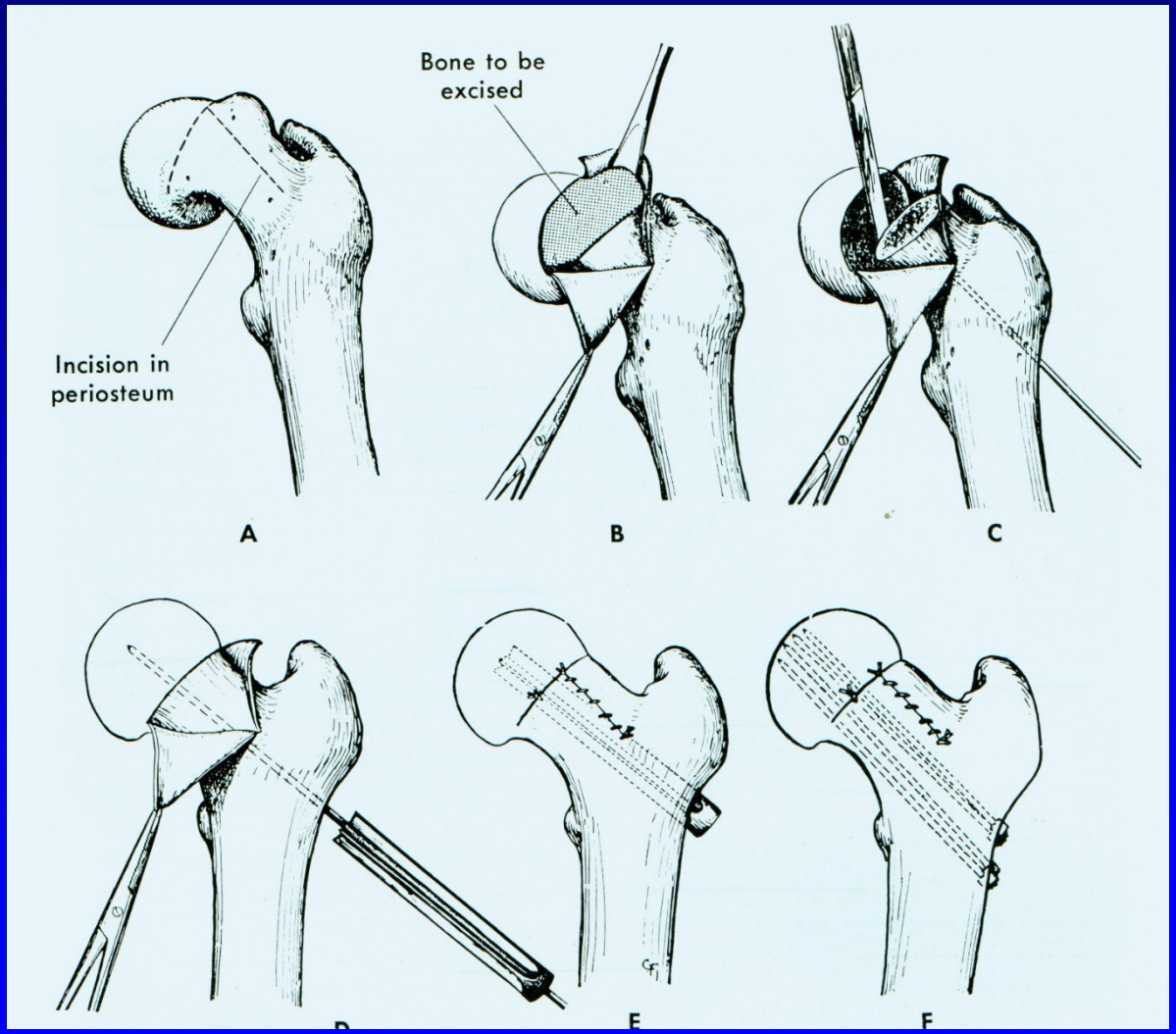


Obr. 31



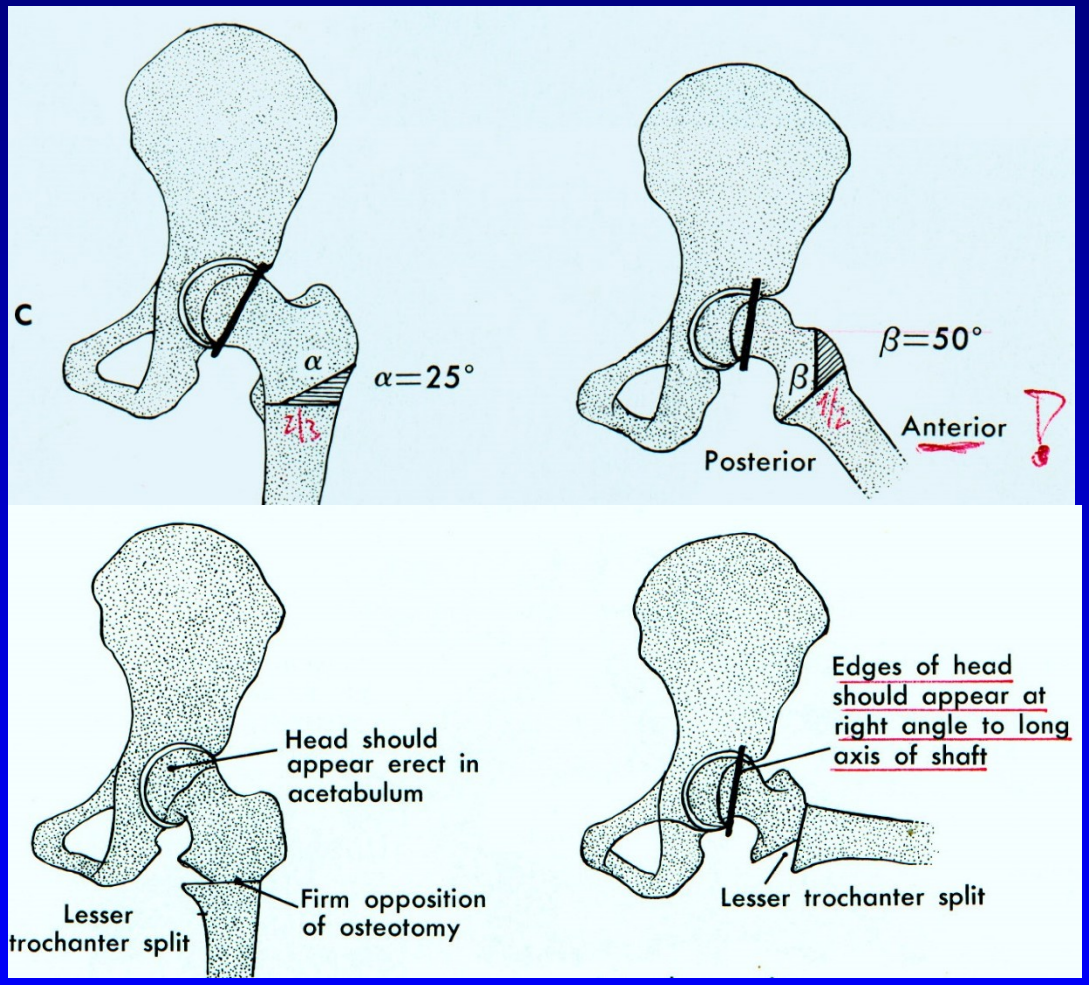
Obr. 32

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

Necrosis of os lunatum m. Kienbőck

Therapy

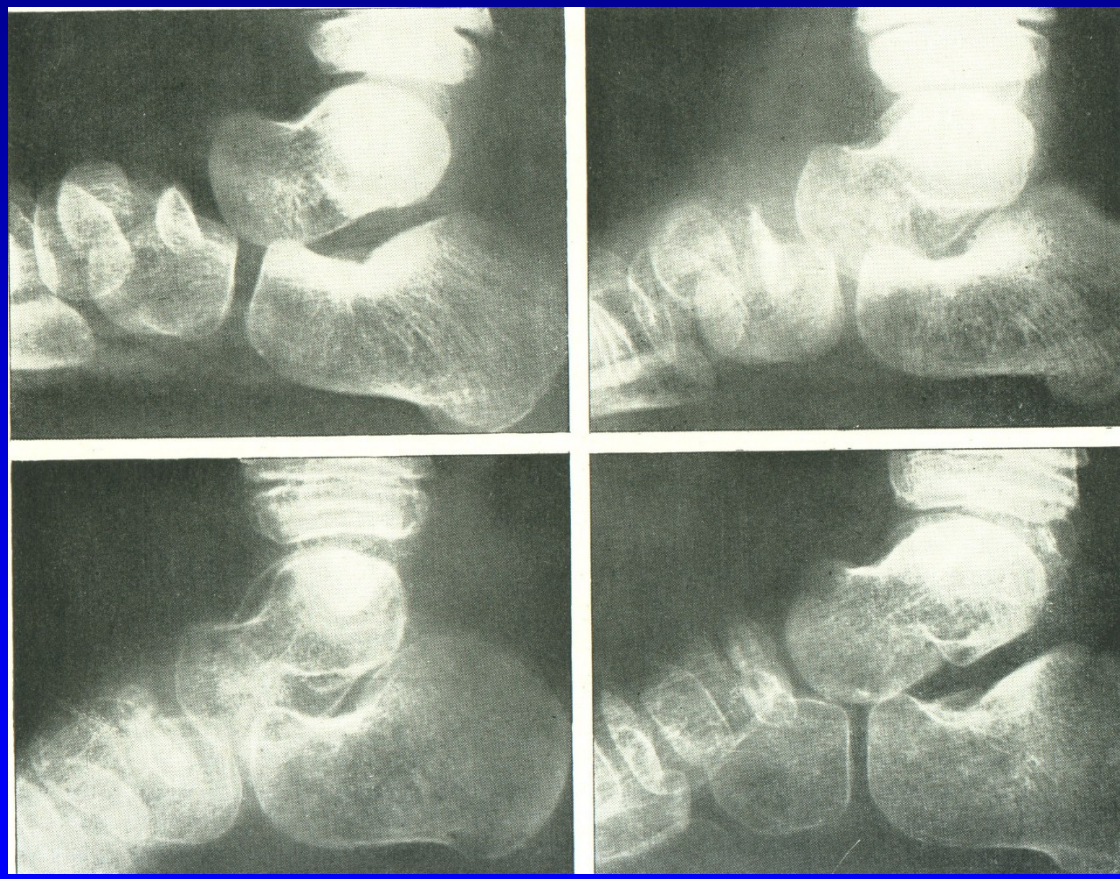
Rest
Immobilisation
Removal and replacement
by tendon, by os pisiforme
or by arteficial material

Obr. 36

M. Köhler I. - necrosis of navicular bone

Therapy

Rest
Immobilisation
Arthrodesis



Obr. 37

M. Köhler II.
M. Freiberg-Köhler
Necrosis of metatarsal head

Therapy

Rest, padding

Surgery:
Removal of necrotic part
Osteotomy

Obr. 38

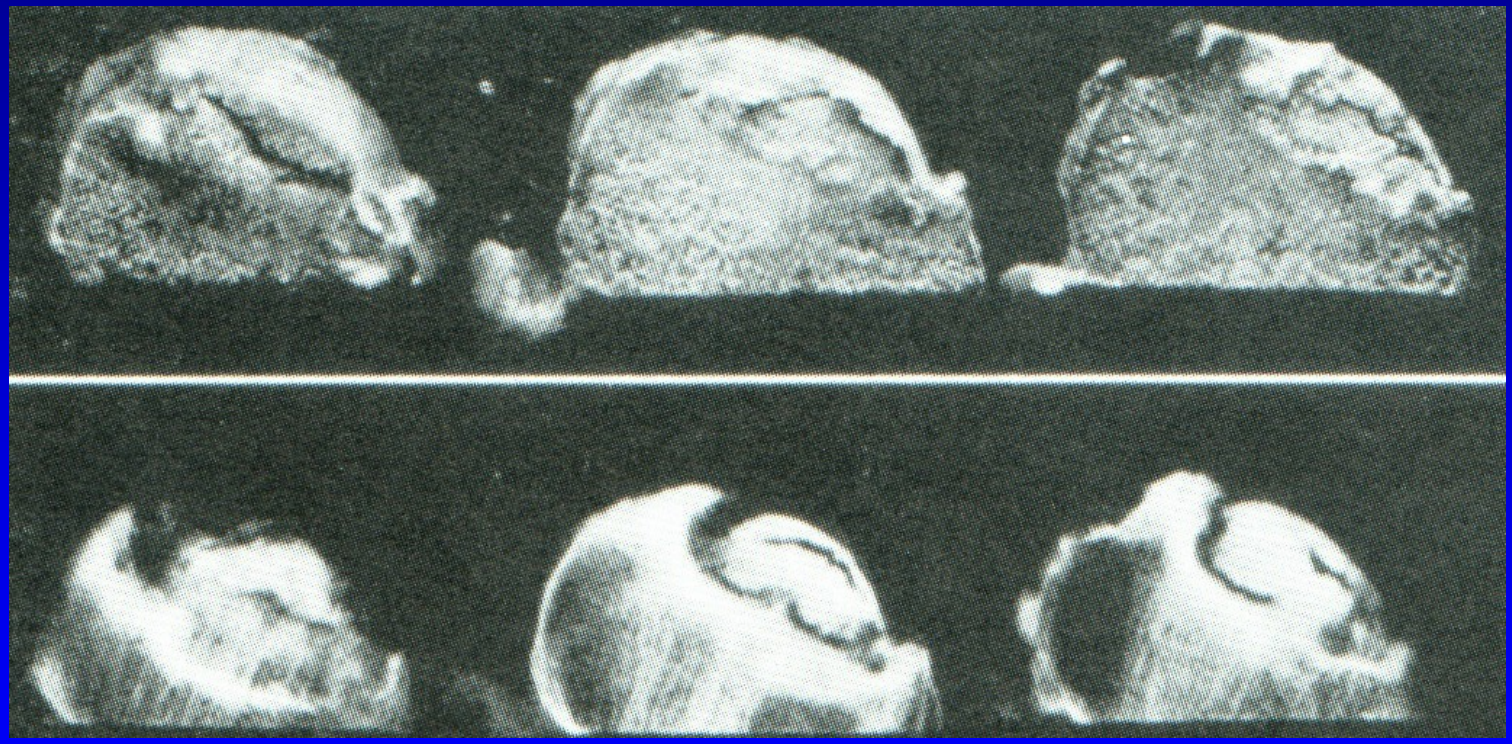
Avascular necrosis of femoral head in adults

Etiology unknown

Pain
Limited movements
Limping

Obr. 39

Avascular necrosis of femoral head



Obr. 40

Etiology unknown

72 % bilateral

Without management- 85 % progress into colaps of the femoral head

5-12 % indications to THA

Genetic background

Risk factors

Table 1 Conditions that may cause or are related to ONFH

Trauma
Femoral neck fracture
Hip dislocation
Extensive burns
Direct vessel trauma
Hypercoagulation
Deficit of antithrombin III
Deficit of protein C
Deficit of protein S
Resistance to activated protein C
Deficit of plasminogen activator inhibitor
Surplus of inhibitor for plasminogen activator
Factor V Leiden mutation
Secondary conditions of hypercoagulation
Corticosteroids
Alcoholism

Hemoglobinopathy
Trombofilia
Corticosteroids

Haemoglobinopathies (sickle-cell disease)

Polycythemia

Metabolic diseases

Hyperparathyroidism

Gout

Cushing's disease

Gaucher's disease

Alimentary system diseases

Pancreatitis

Ulcerative colitis

Chrohn's disease

Other risk factors

Smoking

Decompression disease

Radiation

Chemotherapy

Hemodialysis

HIV infection

Secondary conditions of hypercoagulation
Corticosteroids
Alcoholism
Myelodysplastic syndromes
Pregnancy
Oral contraceptive use
Hyperlipidaemia
Collagen diseases
Ehler–Danlos syndrome
Raynaud's disease
Diabetes mellitus
Antiphospholipidaemic antibodies (APLA)

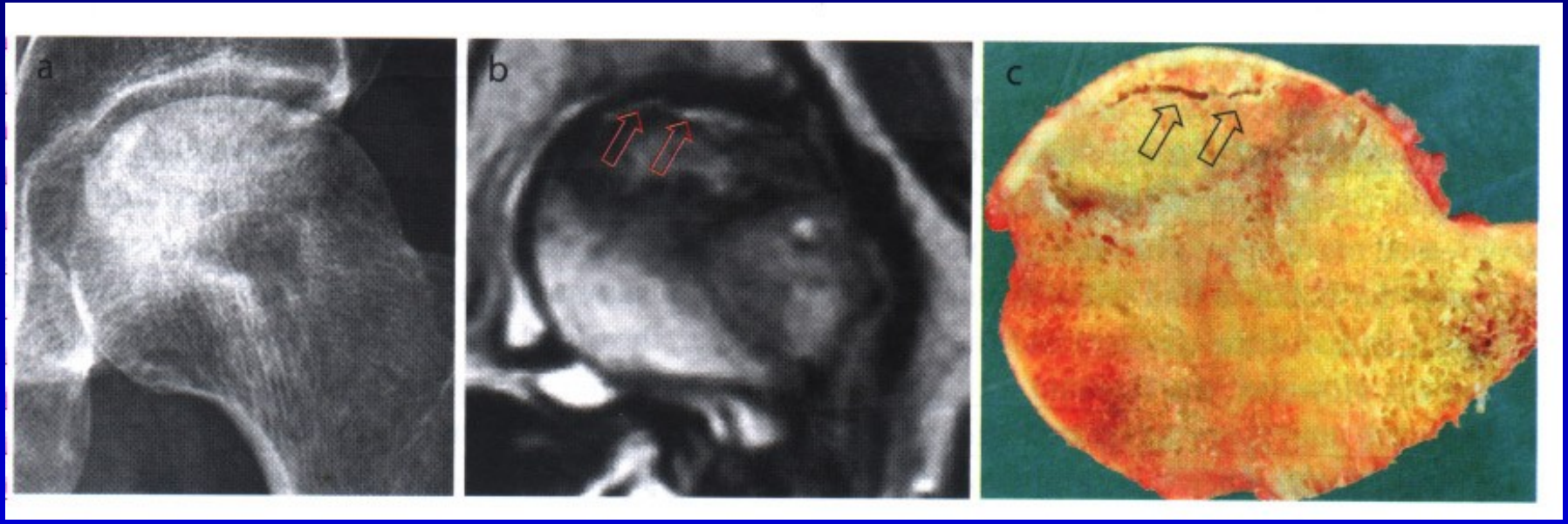
Diagnosis

Bone infarction at the onset is asymptomatic

Groin pain, around the hip, limping

X-ray

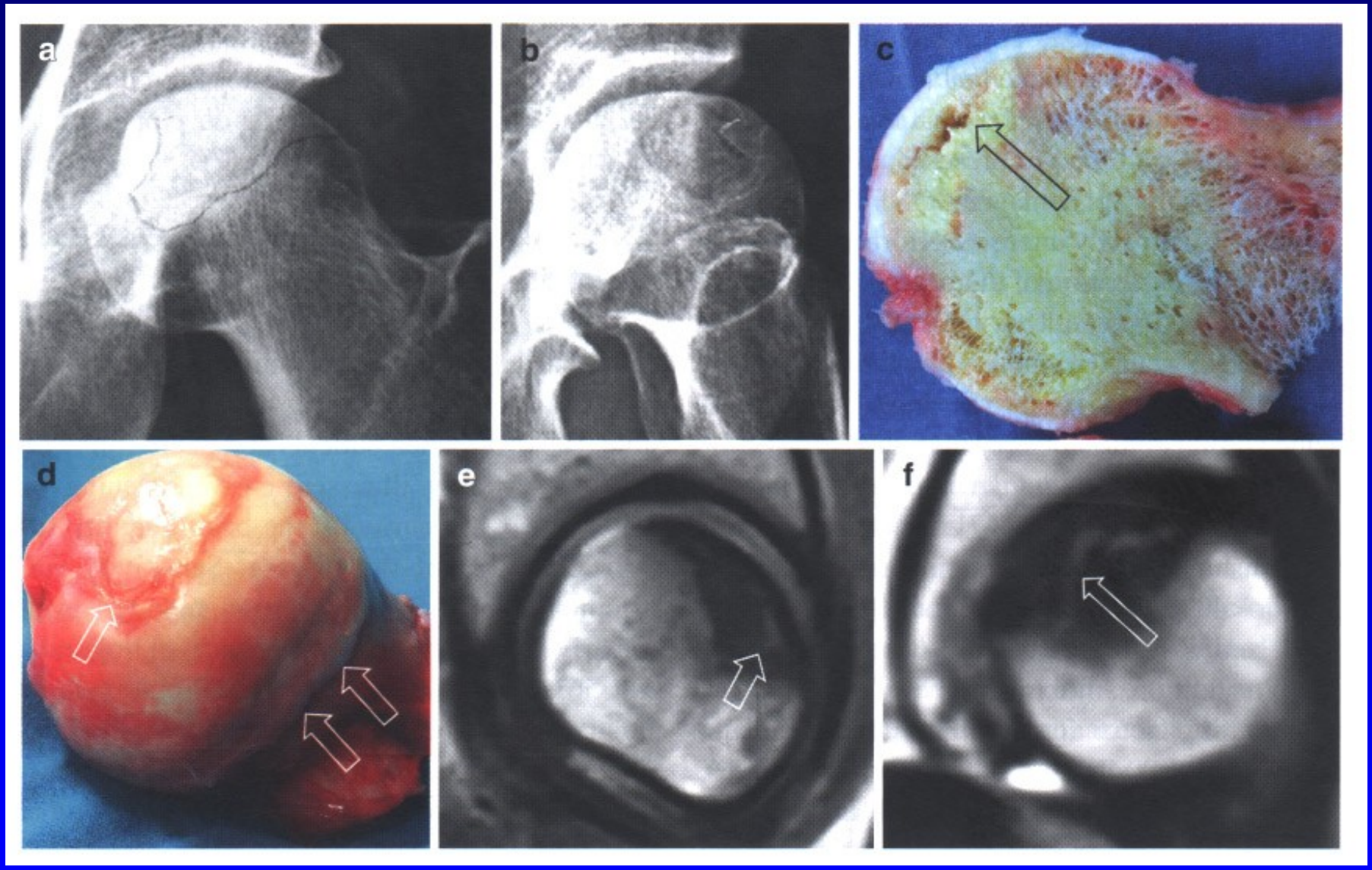
MRI



X-ray
Subchondral changes

MRI

Specimen

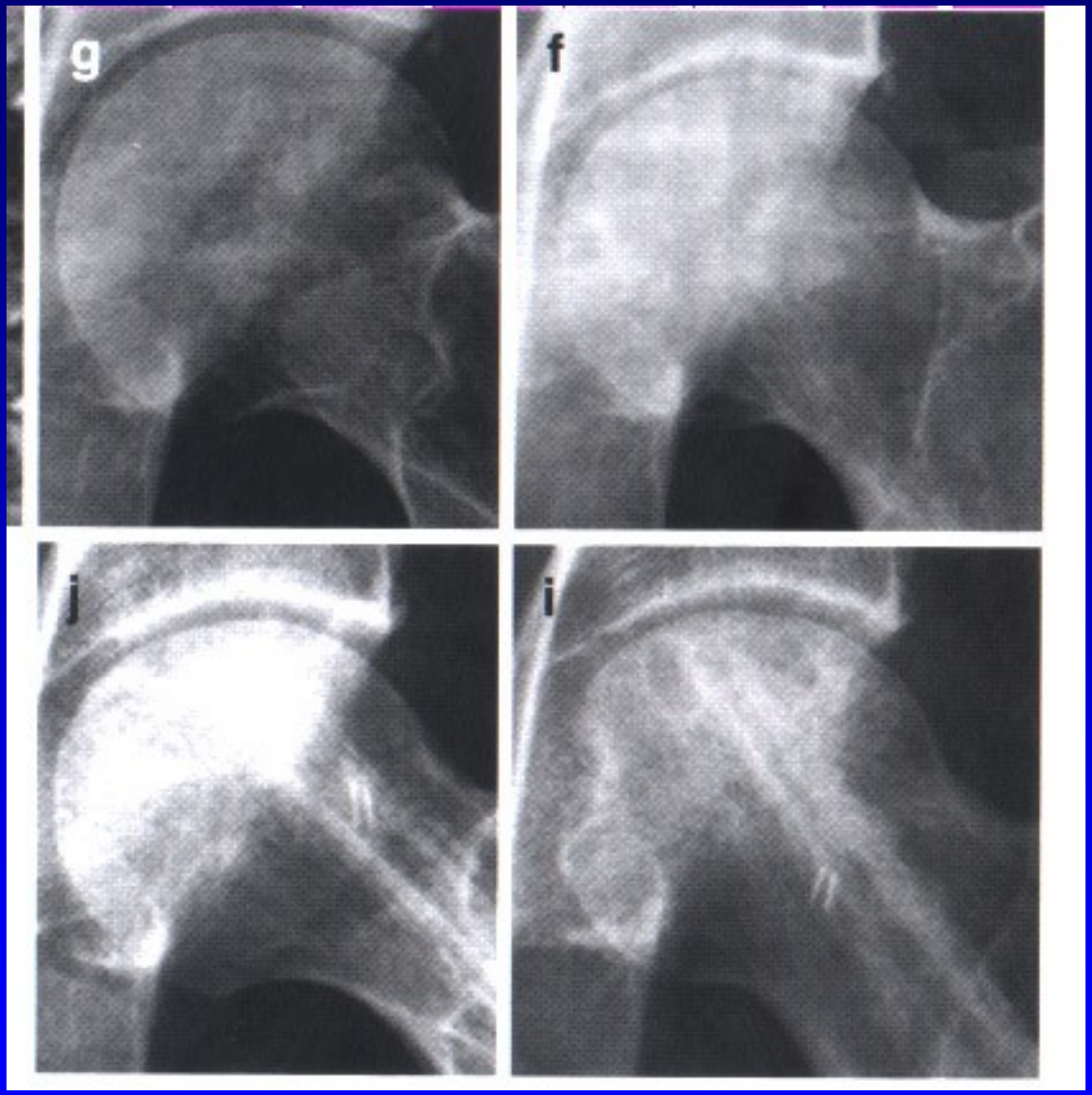


Subchondral fracture

Management

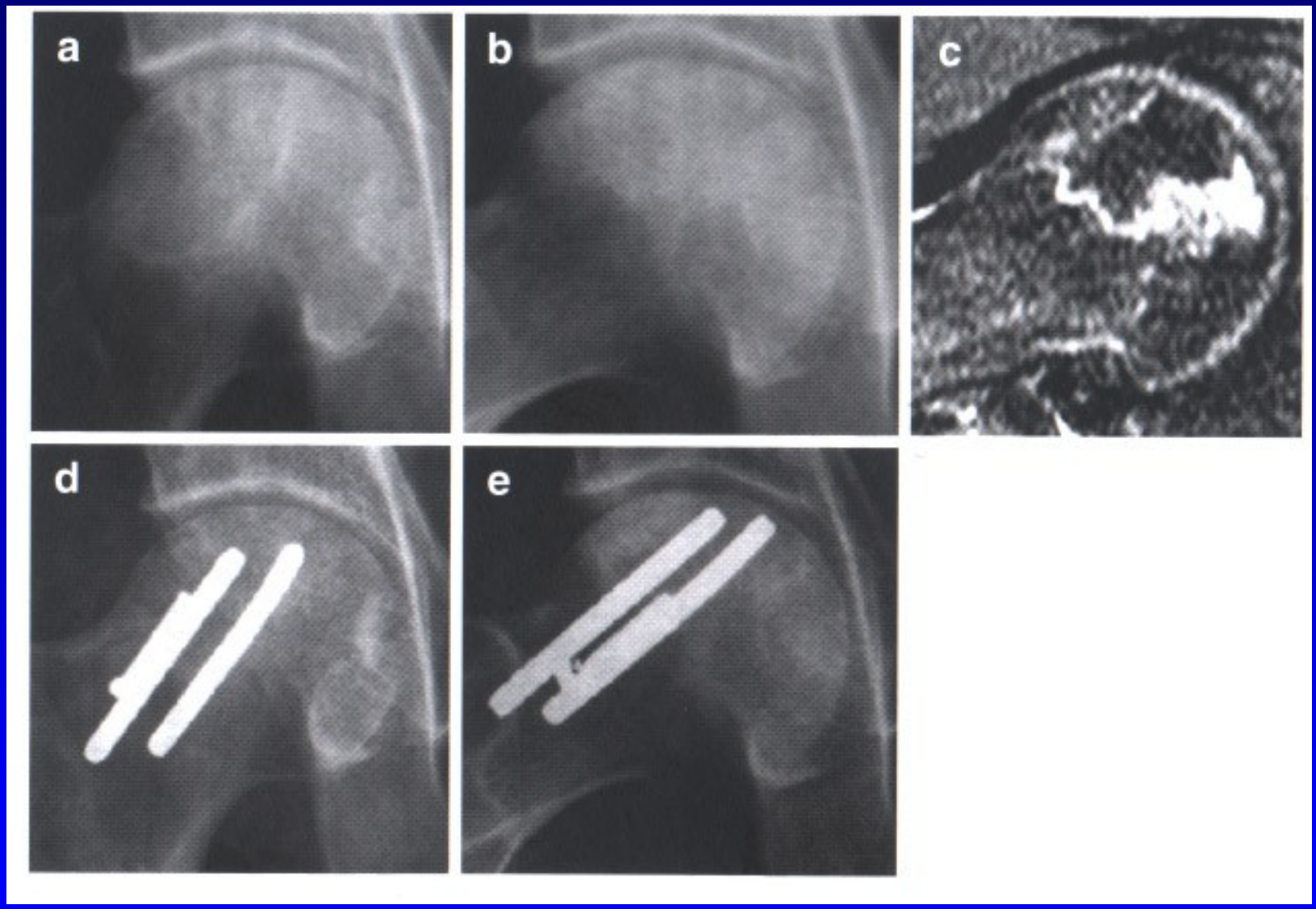
Cons: crutches,bisphosphonates
physiotherapy, drugs for promotion of vascularity

Oper.:
Forrage, decompression, drilling, bone grafting
Long cylindrical bone graft
Osteotomy –varus, valgus, rotation
Free vascularized fibular graft - stage II , III.
Nonvascularised bone grafts
Drilling + stem cells + BMP
THA



Preop.

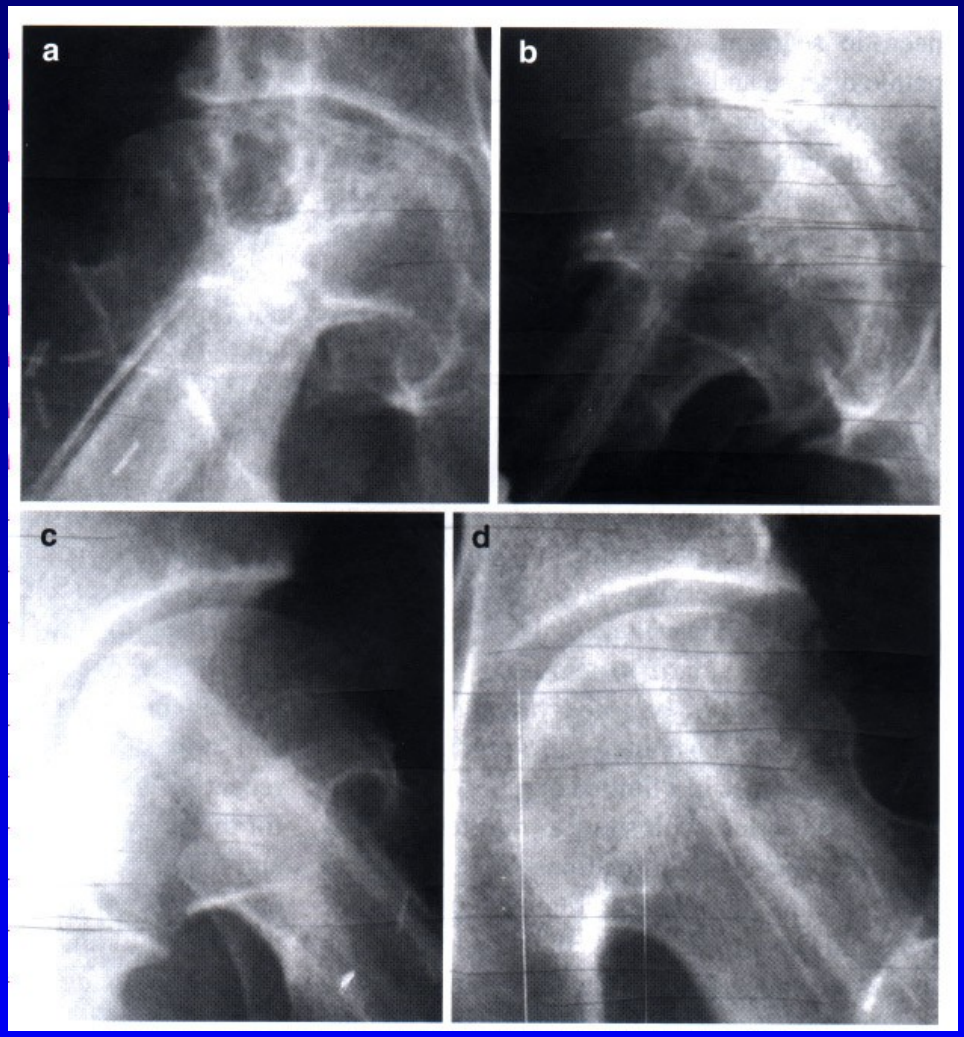
Vascularised fibular graft
5 y.



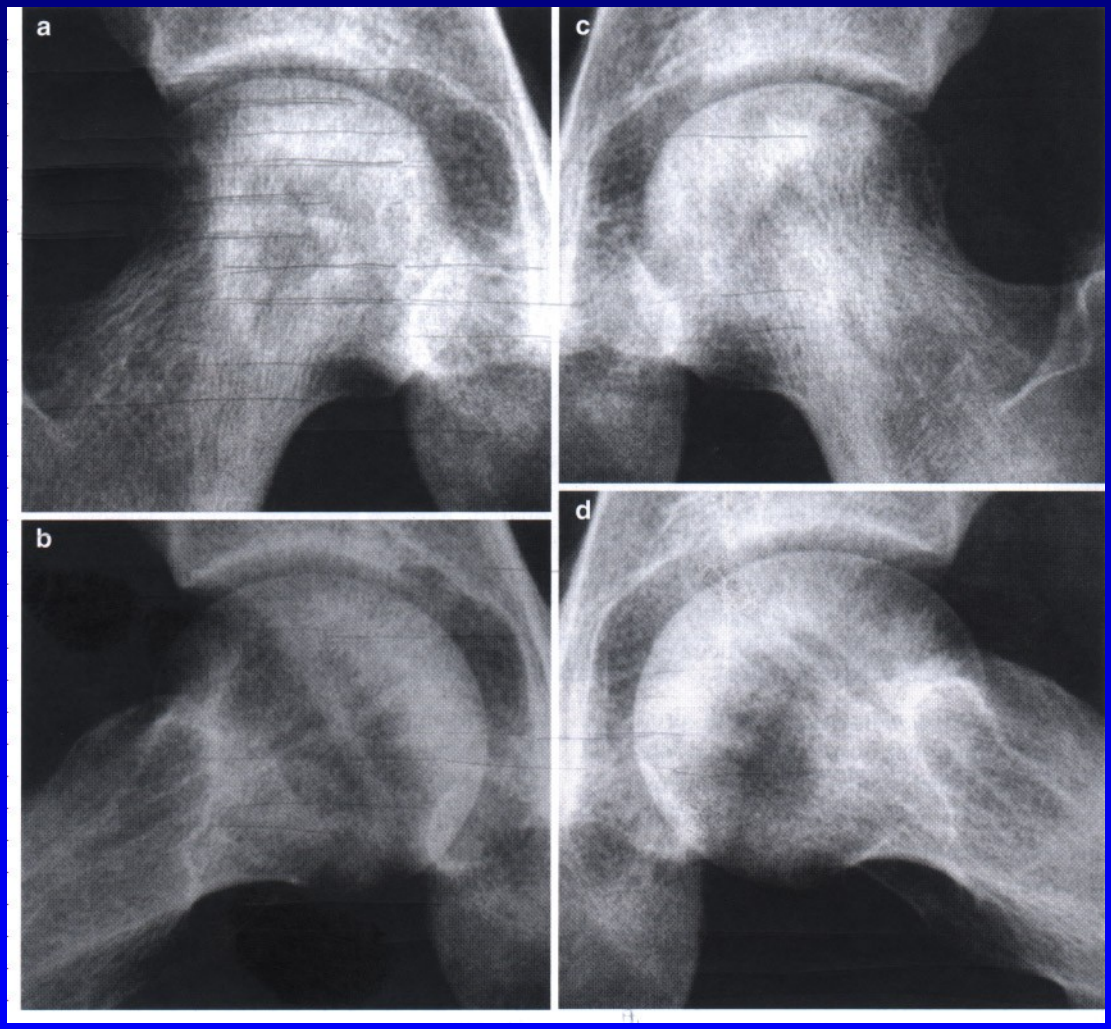
Trabecular metal Tantal rods
4 y. post op

11 y. postop.

10 y postop
Asymptomatic.



Vascularised fibular graft



LED, percutaneous drilling – Steinman pin

Necrosis after fracture of the neck of the femur

Necrosis of the femoral head after coxitis

M. Ahlbäck – necrosis of medial condyle of the femur

m. Osgood- Schlatter – proximal apophysis of the tibia

Necrosis of sesamoid bone

M. Panner – osteonecrosis of humeral head

Vertebra plana Calvé

Necrosis of apophysis of calcaneus

Literature

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