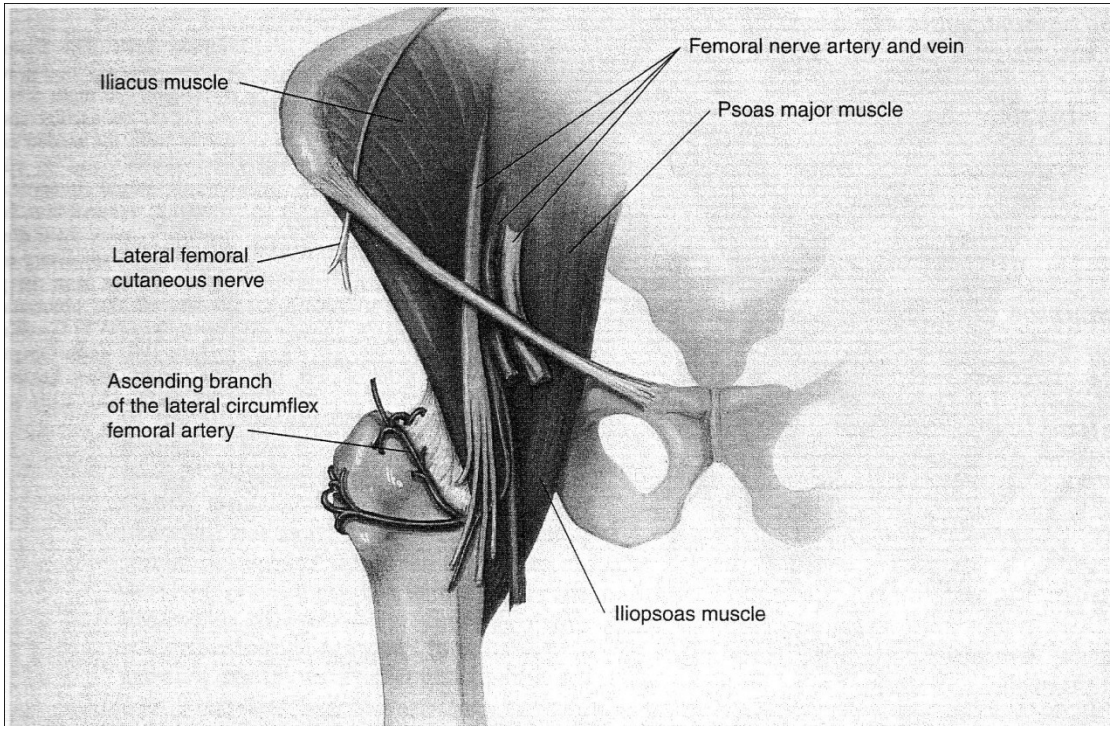
Traumatology of lower limb I.

Hip joint, femur, patella

Hip joint - anatomy



Blood supply of proximal femur

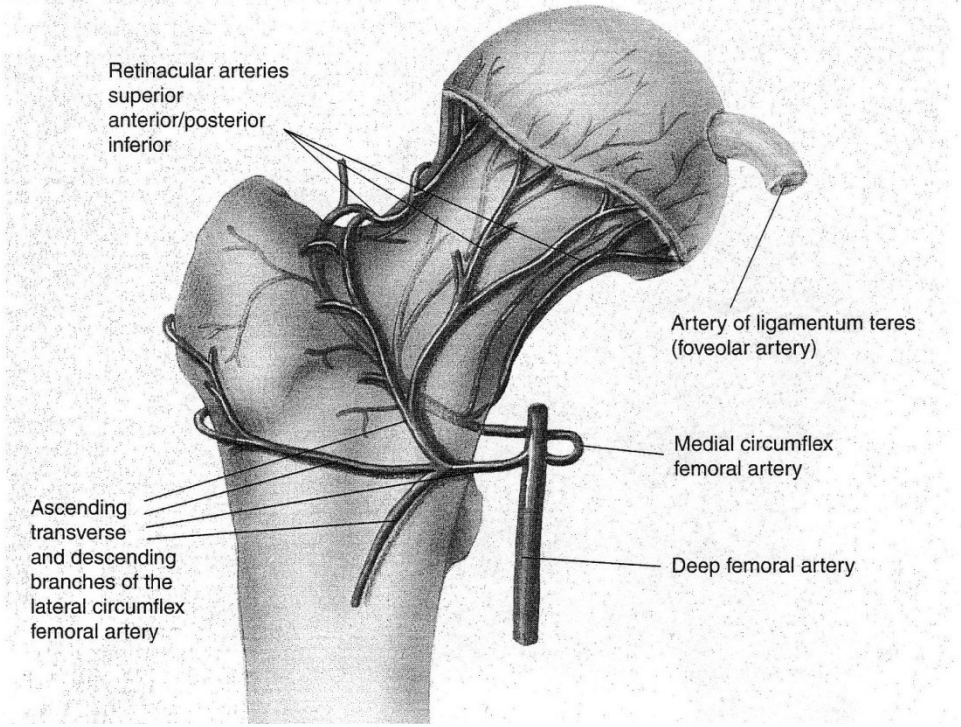
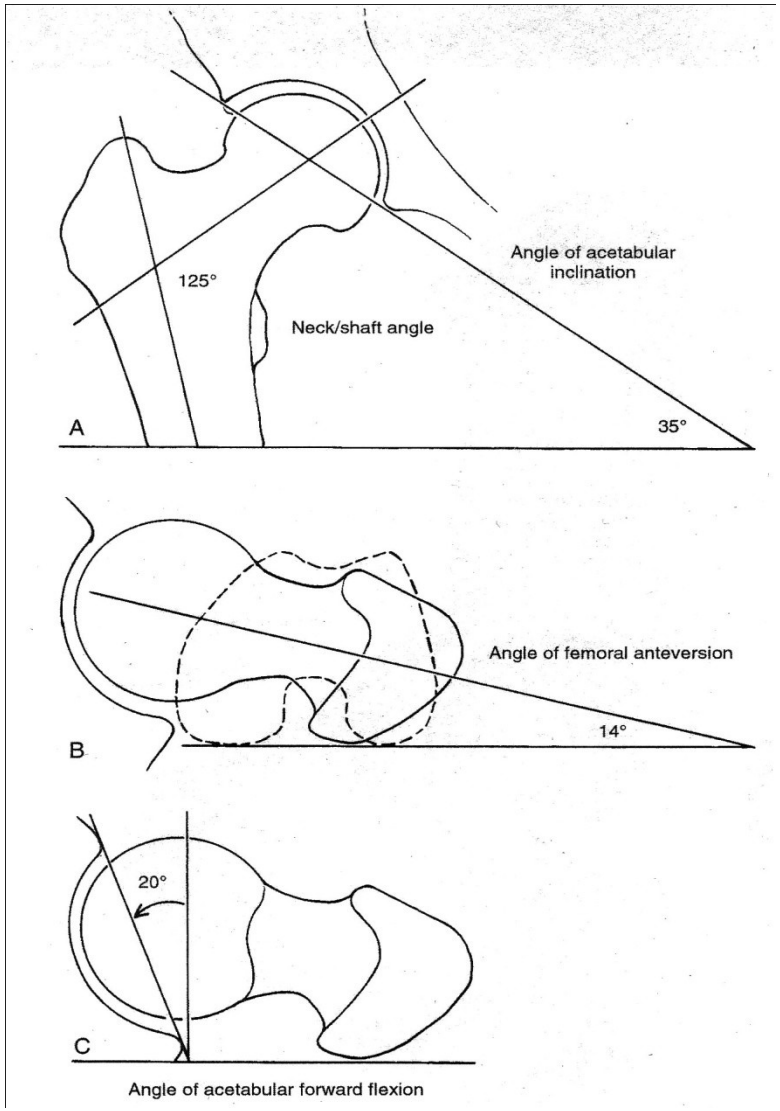


Figure 3–12. The femoral head receives arterial blood flow from an anastomosis of three sets of arteries: (1) the retinacular vessels, primarily from the medial circumflex femoral artery and, to a lesser extent, the lateral circumflex femoral artery; (2) terminal branches of the medullary artery from the shaft of the femur; (3) the artery of the ligamentum teres from the posterior division of the obturator artery. (From Byrd JWT: Gross anatomy. In Byrd JWT (ed): Operative Hip Arthroscopy. New York: Thieme, 1998, pp 69–82.)

Geometry of acetabulum and femur



Luxatio femoris – hip dislocation

- **Mechanism** – high energy trauma, extensive indirect force – car accidents /dash board injury/, falls

- Very often with **fracture of acetabulum or femur**

- **Dg** – intense pain, springy resistance, limb possition depending on luxation type,

  x-ray – both hips, beware undisplaced femoral neck fr., CT.

- **Risks**

  - posterior dislocation - n.ischiadicus,
  - anterior dislocation - n.femoralis and a.femoralis.
  - <u>all cases</u> – vitality of femoral head /avascular necrosis – 20%, after 12hours of dislocation – above 50%/

Hip dislocations

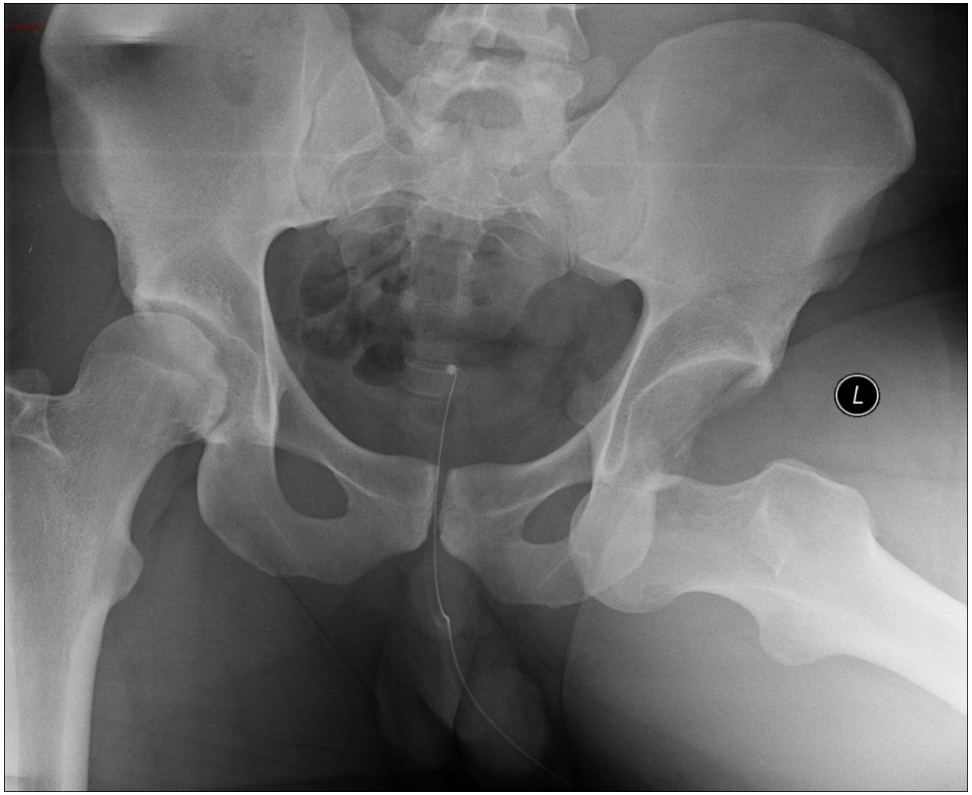
- **Posterior** – more frequent /90%/, mechanism - adduction, limb in internal rotation, shorter

  – upper – luxatio iliaca
  - lower – luxatio ischiadica

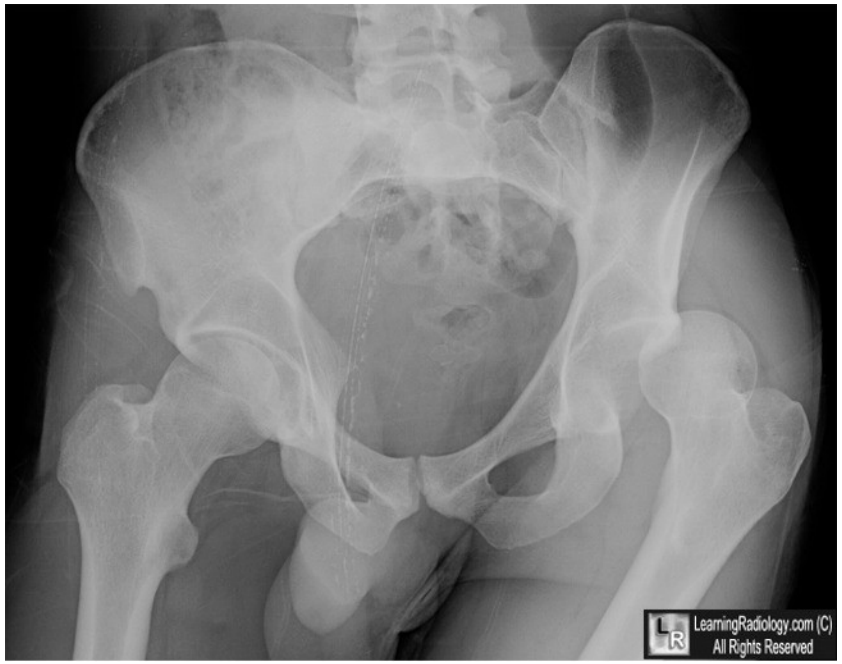
- **Anterior** – /10%/ -mechanism - abduction, limb in external rotation, normal lenght or longer
  – upper – luxatio pubica /iliopectinea/
  - lower – luxatio obturatoria

- **„central dislocation“** - fracture of acetabular centr

Anterior hip dislocation



Posterior hip dislocation



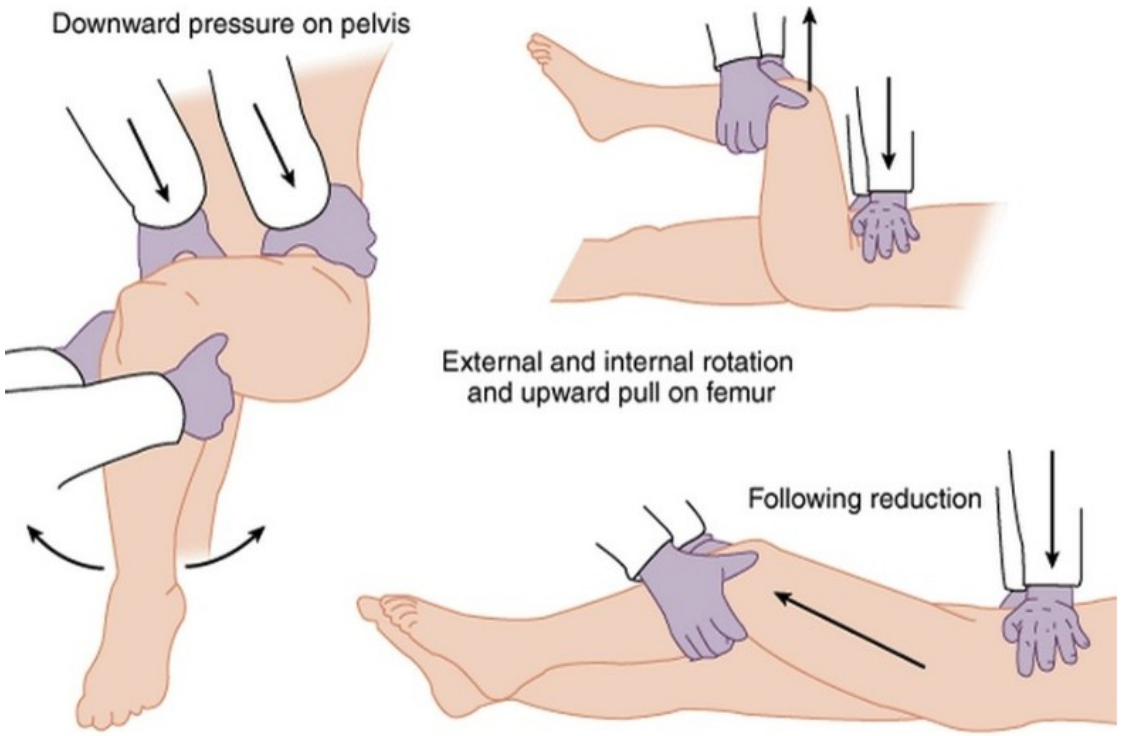
Therapy

Reduction

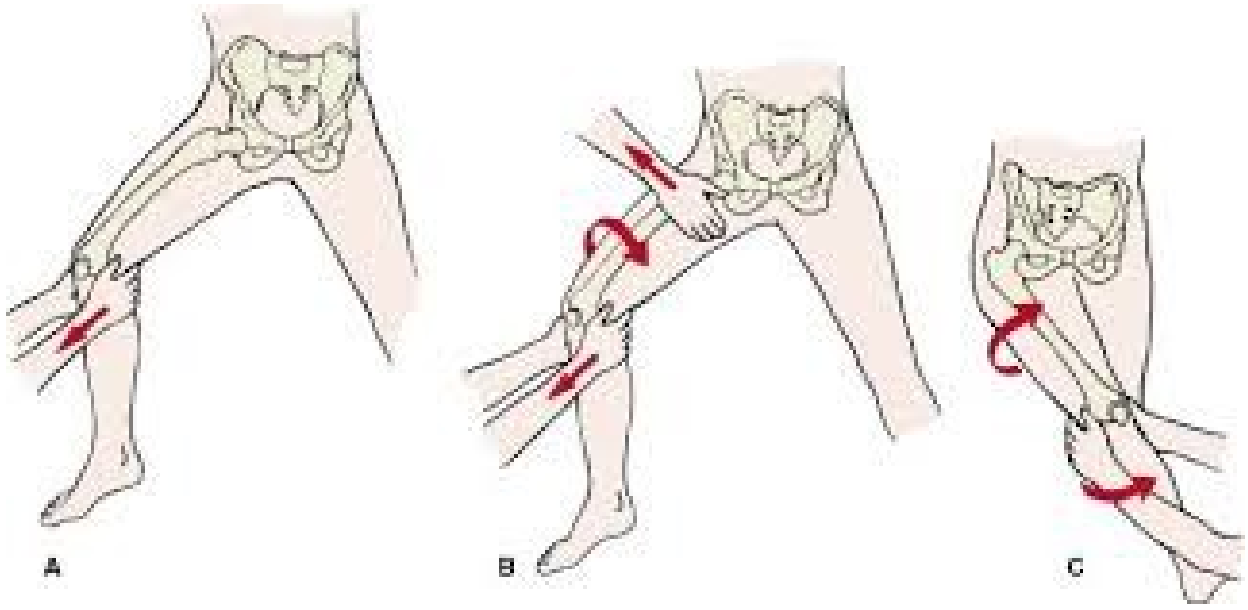
- urgent, under general anesthesia with muscle relaxation,
- x-ray control
- CT – before or after reduction
- neurovascular status – check and document pre and post

Operating treatment – unstabile or nonreducible fractures – advantage – early mobilization, disadvantage – difficult aproach.

Posterior disloc.- reduction - flexion in the knee at 90°, pull, hip flexed, abduction and external rotation, CT in all cases post-reduction



Anterior disloc.- reduction - extension, internal rotation, adduction



After reduction

- **Pure dislocations** - 54% - 2 weeks rest in a bad, progressive mobilization without weight, after 6 weeks step by step weight
- **With fracture of acetabulum** /except central dislocation/ 36%, the most frequently fr. of posterior wall – osteosyntesis, or traction 2-3w, gradual weight with crutches after 8-12w.
- **With fracture of femur** -10% - depends on type of fracture

Prognosis

- Threat of **avascular necrosis** of femoral head - 20%, after 12h 50%
- Risk of posttraumatic **coxartrosis**
- **Paraarticular** calcifications, osifications.
- Risk of **injury of n**.ischiadicus and n.femoralis.

Fractures of proximal femur

- Head fractures
- Neck fractures

  -mediocervical (subcapital - intracapsular)

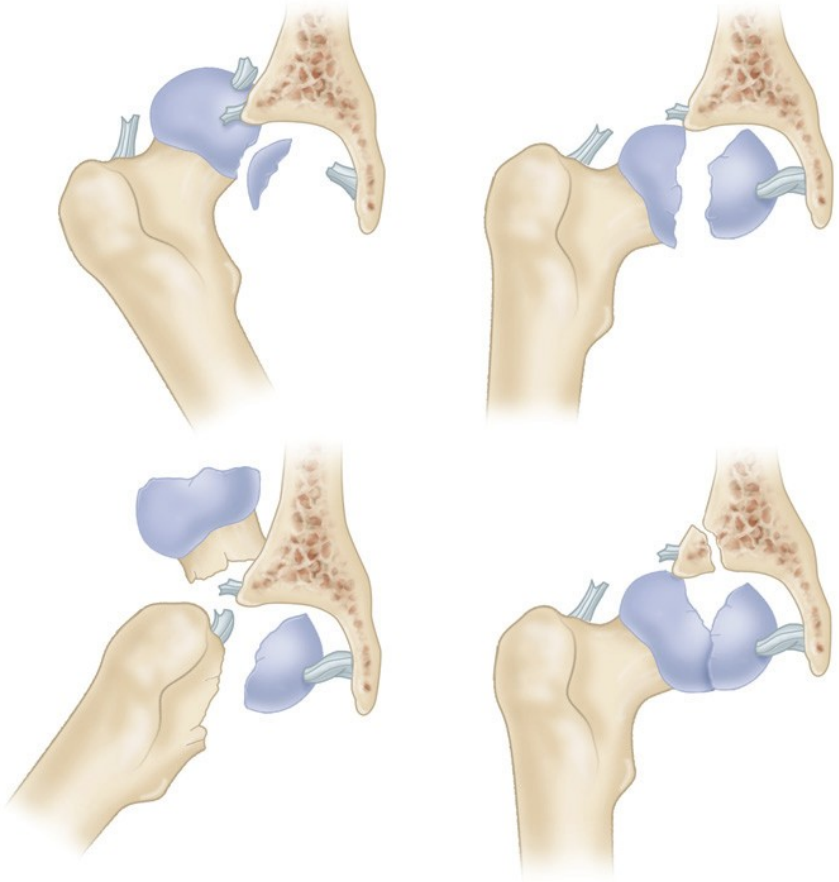
  -laterocervical (basicervical - extracapsular)
- Trochanteric /pertrochanteric, intertrochanteric/ fractures
- Subtrochanteric fractures
- Isolated fractures of trochanters

Head fractures

- Separate group of prox. femor. fr.
- **Tangencial** – flake-fracture, with posterior hip dislocation, without dislocation rare.
- Pipkin – 4 types /„Pipkin‘s fracture“/ - location.
- DG – x-ray, CT.

Pipkin‘s classification

Type I—femoral head fracture caudad to fovea capitis.
Type II—femoral head fracture cephalad to fovea capitis.
Type III—type I or II fracture with associated femoral neck fracture.
Type IV—type I, II, or II fracture with associated acetabular fracture.



Therapy

- aim – anatomical restoration of joint surface
- 1. closed reduction of femur dislocation
- 2. operation th. – depending on large of fragment /1cm2/ and location of defect
  - fragment removal /open or artroscopy/,
  - osteosyntesis /reduction and fixation of fragment/ using absorbable screws or glue,
  - THA can be implanted in case of elderly.

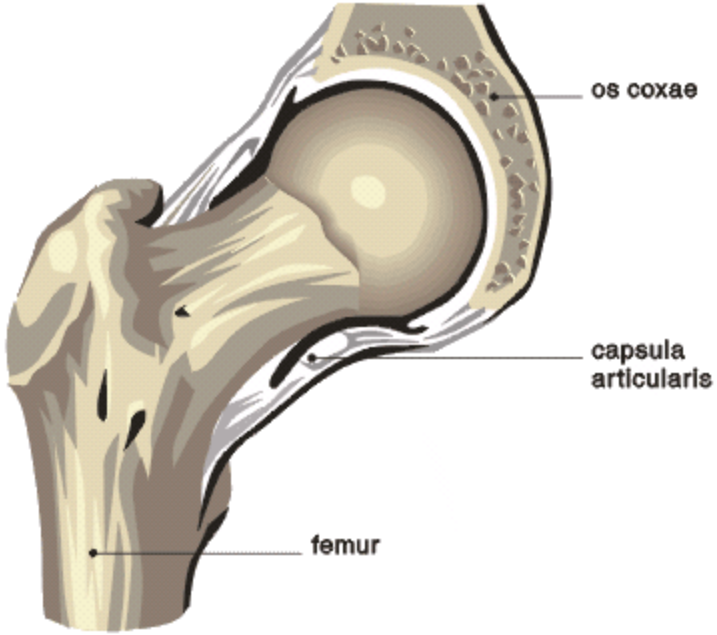
Proximal femoral fractures – neck, per/intertrochanteric, subtrochanteric

- Osteoporosis, pathological, minimal injury
- Clin. – pain – hip /knee, hip possition – antalg. - external rotation, anteflexion, contraction,
- Check neurovascular status
- X ray – pelvis - whole /fr. Pelvis, other hip/,
  - whole femur incl. Knee,
  - CT ?

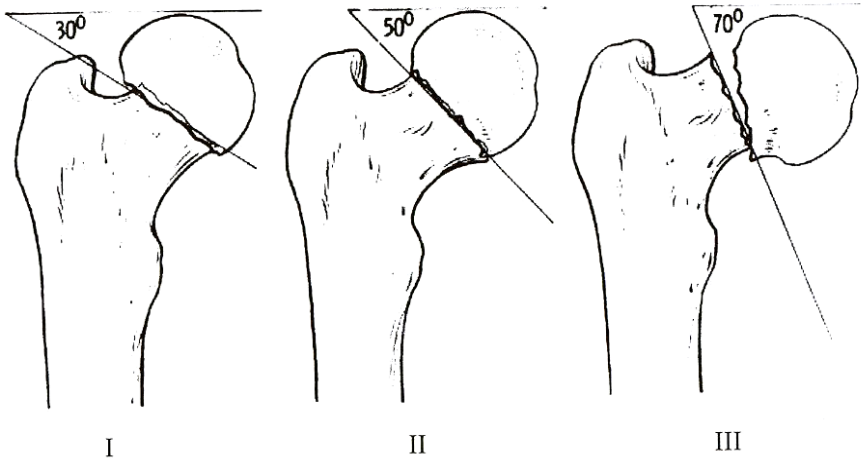
Fractures of femoral neck

- **mediocervical** (subcapital - intracapsular) – vitality of femoral head – interruption of vessels, compression – hematom, dislocation.

- **laterocervical** (basicervical - extracapsular)



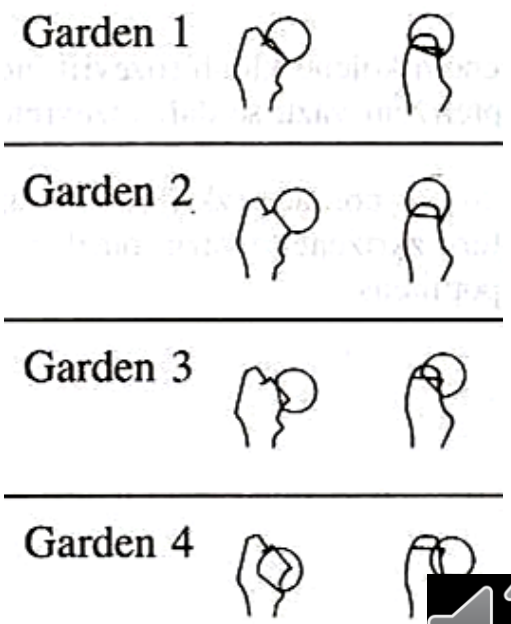
Femoral neck fractures - – classifications



Pauwels - I. – less than 30st., II. 30-70st, III. More than 70st.

- mechanické poměry - abdukční – valgozní 10%, addukční - 90%

Garden – vitality of head



Treatment of mediocervical fractures

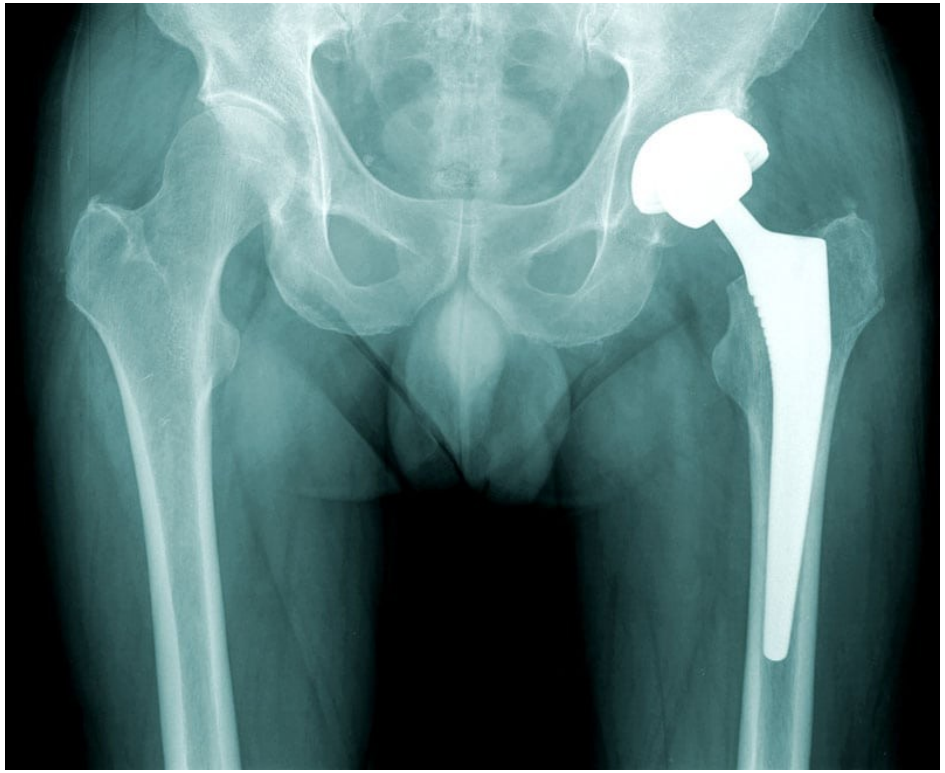
- Conservative - Garden I – valgus impacted
- Osteosyntesis - DHS, spongios screws, alternativly – PF – young /50y/ all types, older Garden II.
- Alloplastic – Garden III. a IV., depending on age total hip replacement - THA or hemiartroplasty - CKP /lifetime TEP 15y, CKP 5y/

Osteosyntesis – optimal time 6 - 12h /releasing of vessels – reduction, decompression of intracapsular haematoma/ Practice?

- Risk of head necrosis - up to 30%

Hemiartroplasty

THA



Treatment of laterocervical – basicervical fractures

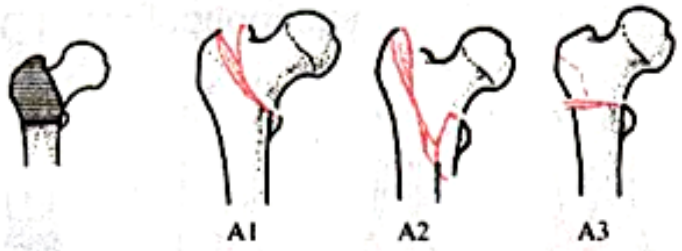
- Extracapsular fr.– minimal risk of head necrosis, like per/intertrochatneric fractures
- Osteosyntesis - PFN, DHS, rarely THA.

Inter-trochanteric fractures

- Stabil X instabil - the most important is thick medial cortex (Adams‘s arch)

31- Femur, proximální segment

31-A femur prox., zlomenina v trochanterické oblasti



A1 . . . , pertrochanterická, jednoduchá
A2 . . . , pertrochanterická s více úlomky
A3 . . . , intertrochanterická

Treatment of per/intertrochanteric fractures

- PFN
- Gama nail
- DHS – compresion hip screw

- Blade plates (95 st., 130 st.)
- Enders rods /rarely/

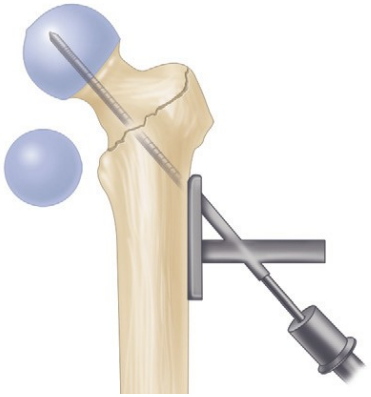
-corect reduction

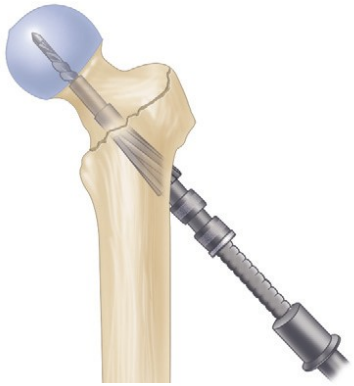
-restoration of lenth and axis of limb

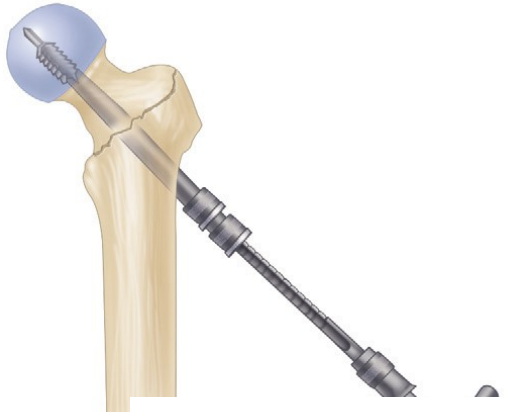
-reduction of external rotation deformity

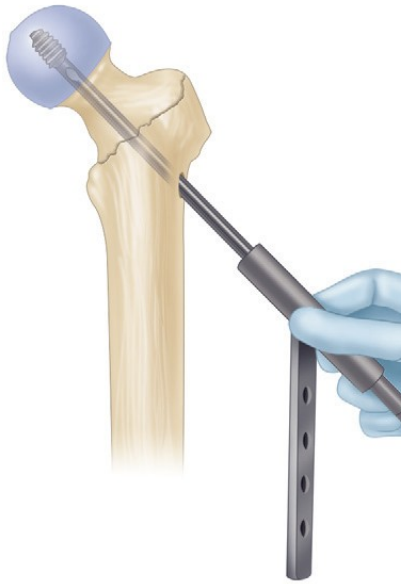
-stabile osteosyntesis and early mobility of patient

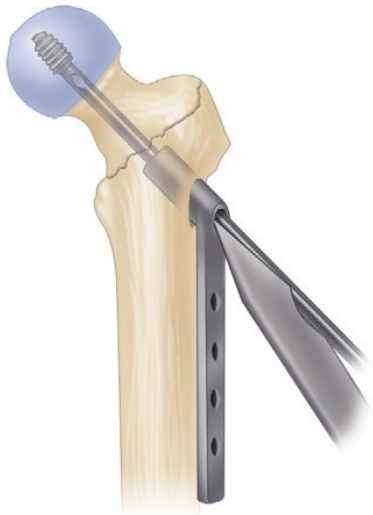
Fixation of intertrochanteric fracture with Dynamic (compression) Hip Screw

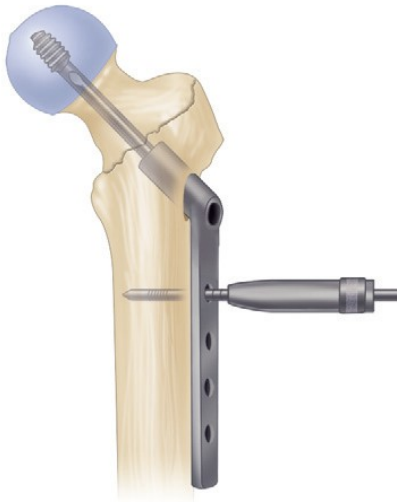


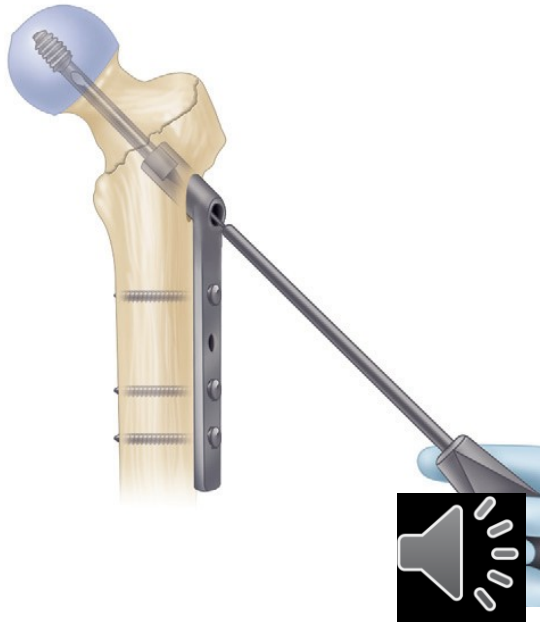




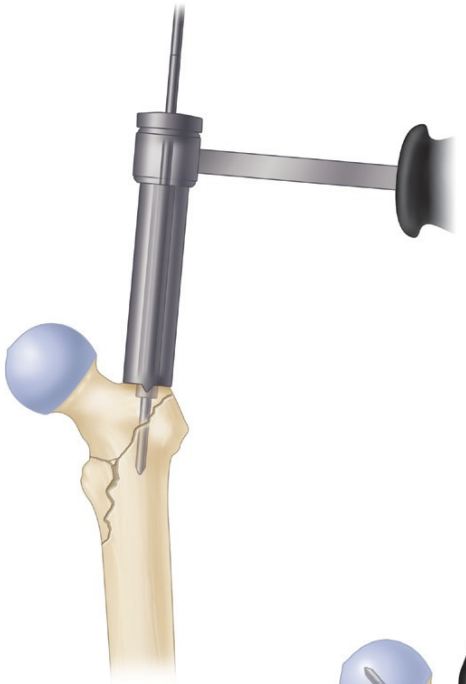


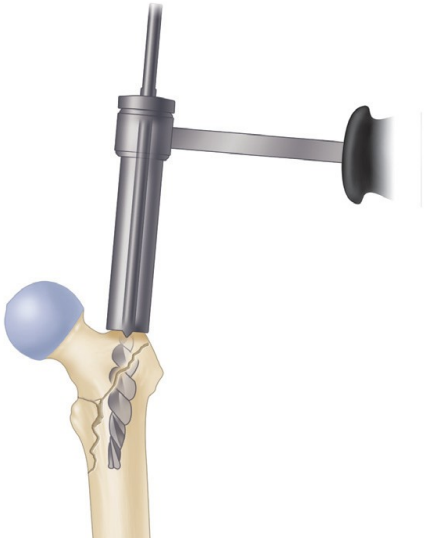


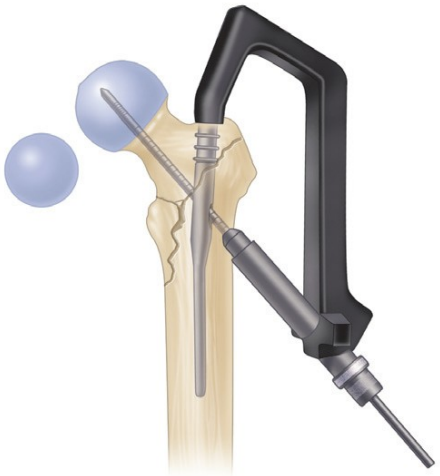


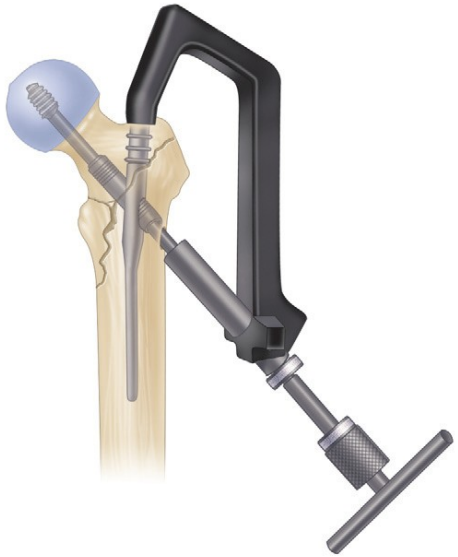


Fixation of introchanteric fracture with PFN / Gamma nail







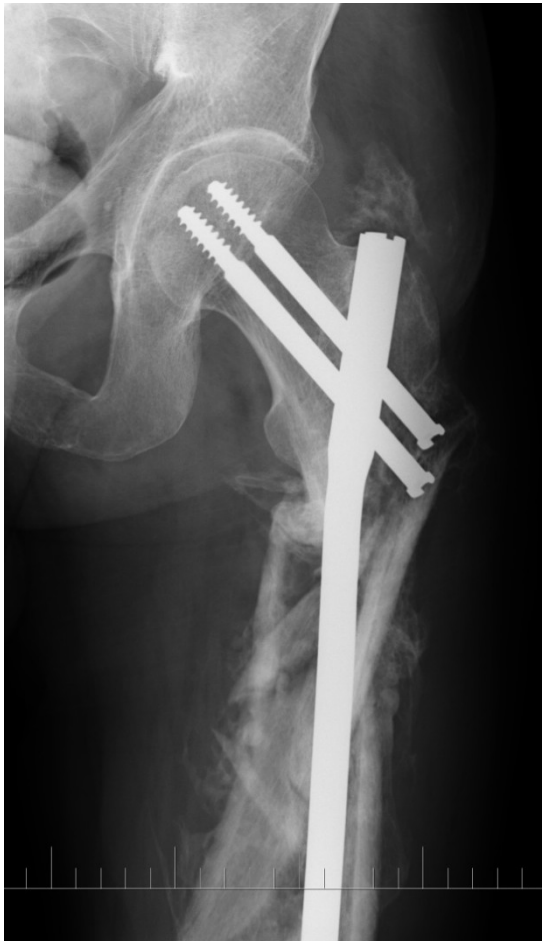


DHS osteosyntesis of pertrochanteric fracture

Subtrochanteric fractures

- Between the lesser trochanter and isthmus of the femoral canal
- within 5 cm of the distal extent of the lesser trochanter
- difficult reduction
- Plating – open reduction, DHS, DCS
- Nailing – more stabile, closed/open reduction,

  - PFN
  - gama nail
  - antegrade nail proximaly locked in reconstruction mode (Reconstruction nail)

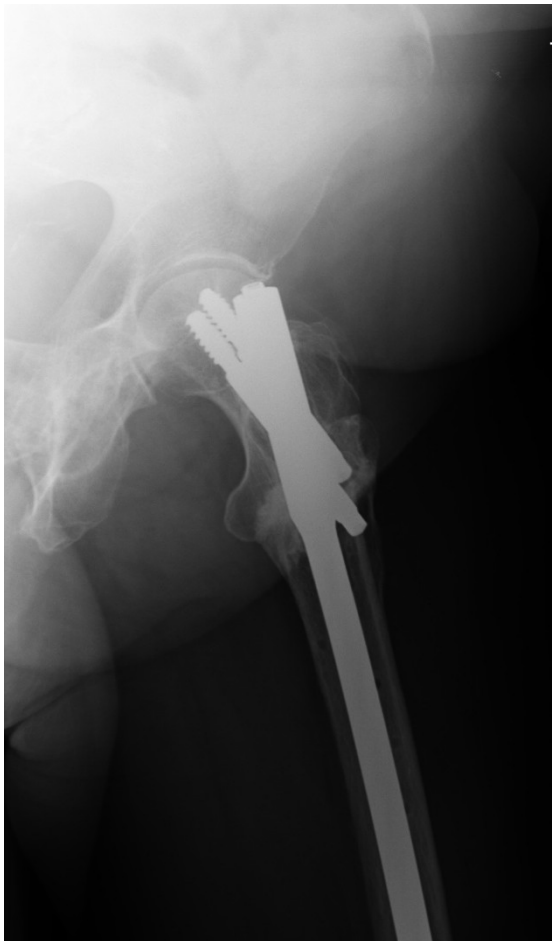


- Nailing / Plating

Open reduction and nailing

Failure of DHS plate

After change of DHS osteosynthesis to nail



Proximal femoral fractures

- Reduction (traction) - analgezie, prevent of head ischemie,
- prevention of thrombembolism
- Acute operation /„vital indication“/
- Antibiotic profylaxis (one dose/24h)
- Physiotherapy from 1st pooperative day

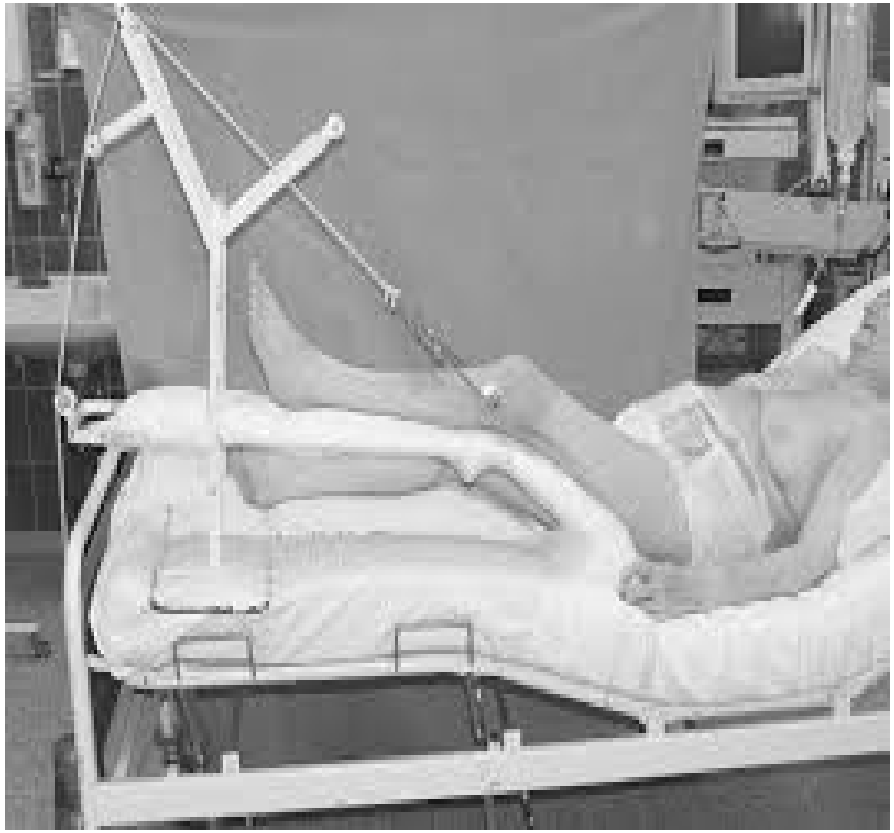
Femoral shaft fracture

- Usually are associated with considerable **soft-tissue damage.**
- **Blood loss** of 2 to 3 units /1000-2000ml/
- high incidence of **associated injury in the same extremity** - fractures of the femoral neck, posterior fracture-dislocations of the hip, tears of the collateral ligaments of the knee, and osteochondral fractures involving the distal femur or patella and fractures of the tibia.

- X – ray – to view **the joint above and the joint below** the fracture
- Treatment – operative **- closed antegrade interlocking nailing** - with or without reaming of the canal using flexible reamers

  - plates (LCP), external fixator

Temporary immobilization



Nailing

Complications

- **Associated vascular and nerve damage**, especially a transient peroneal or pudendal nerve palsy, is not uncommon - generally associated with excessive or prolonged traction.
- **Shortening and malrotation** of the extremity frequently occur , even with intramedullary nailing. Slight shortening is associated with earlier fracture union, and shortening up to 0.5 inch should be accepted without hesitation.
- **Skin breakdown** over bony prominences and pin track infections are complications of traction.
- **Infection is extremely rare** with the closed nailing technique .
- **Nonunion occurs in approximately 1% of fractures treated with nailing.** This problem is easily managed with nail removal, reaming, and repeat nailing. Healing complications are more common when small-diameter nails are used.
- **Rotational malunion** occurs in 10% to 20% of patients; the deformity is generally external rotation .
- Weakness of the abductor muscles and hip pain can occur in one third of patients.
- **Knee injuries** are common after femoral shaft fractures .

Distal femoral fractures

- about 7% of all femur fractures.
- If hip fractures are excluded, one-third of femur fractures involve the distal portion.
- high incidence in **young adults** from high-energy trauma, in the **elderly** from minor falls.
- In 5% to 10% - Open fractures

Distal femoral fracture

- Associated with osteoporosis
- Dislocation - dorsal angulation – m.triceps surae
- Sharp bony spike
- Vascular damage 2%

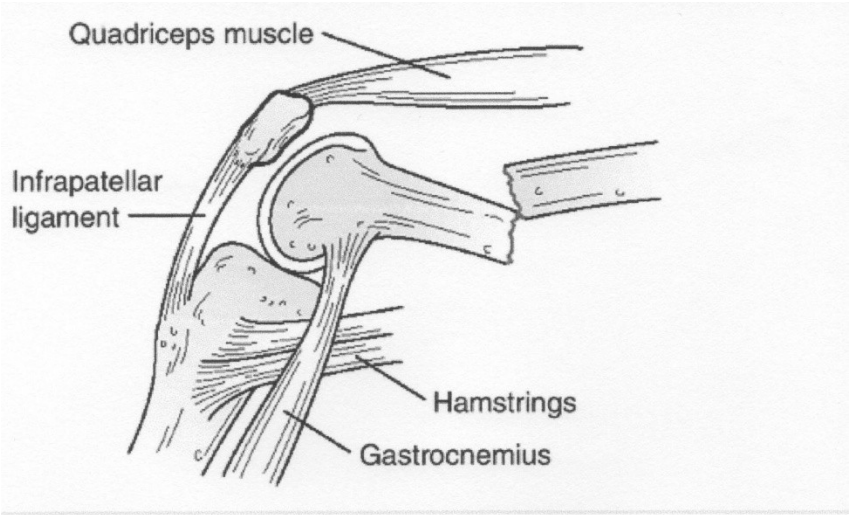
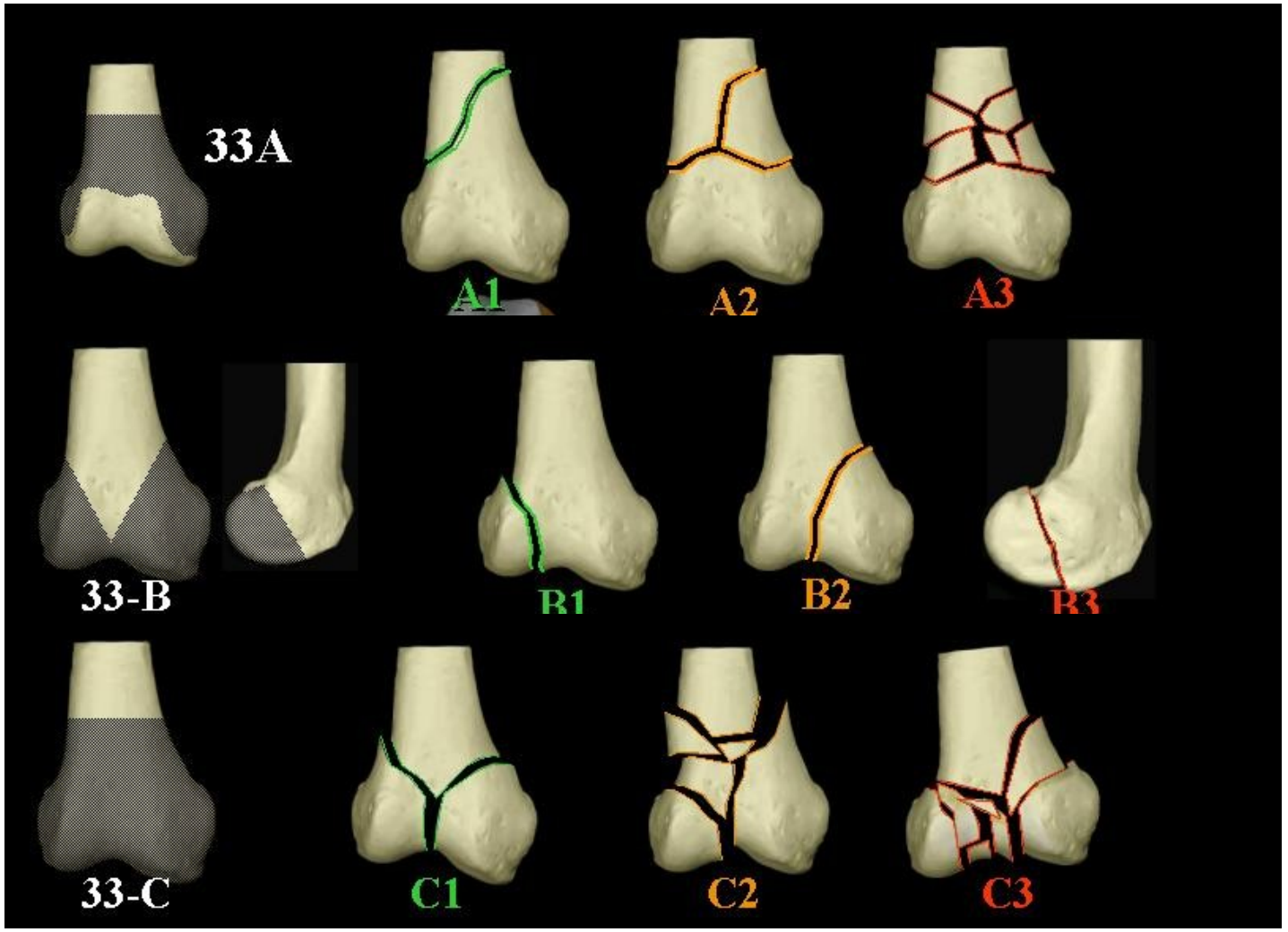


Figure 33.4. Lateral view showing muscle attachments and resulting deforming forces. These result in posterior displacement and angulation at the fracture site. (Adapted

Distal femoral fractures



Examine

- Clin. – neurovascular status, skin and soft tissues
- X – ray
- CT

Nonoperative treatment

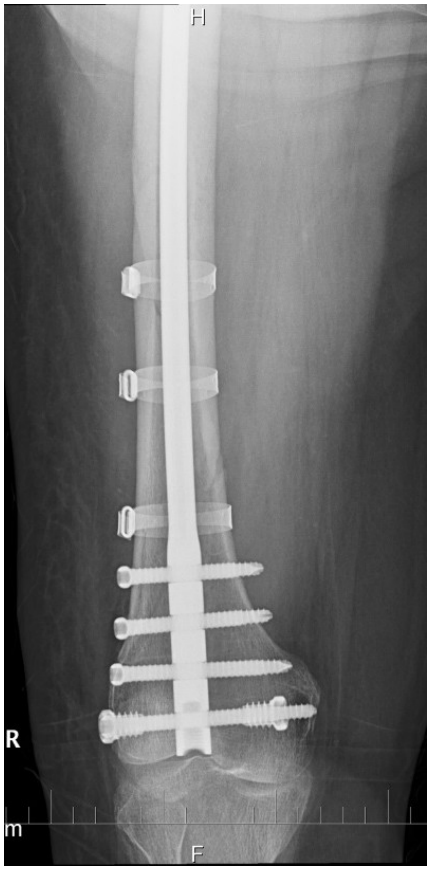
- **rarely**
- **nondisplaced** or incomplete fractures, impacted stable fractures in elderly patients – fixation
- **displaced** - 6- to 12-week period of skeletal traction followed by bracing – risk of varus and internal rotation **deformity, knee stiffness, long bed rest**

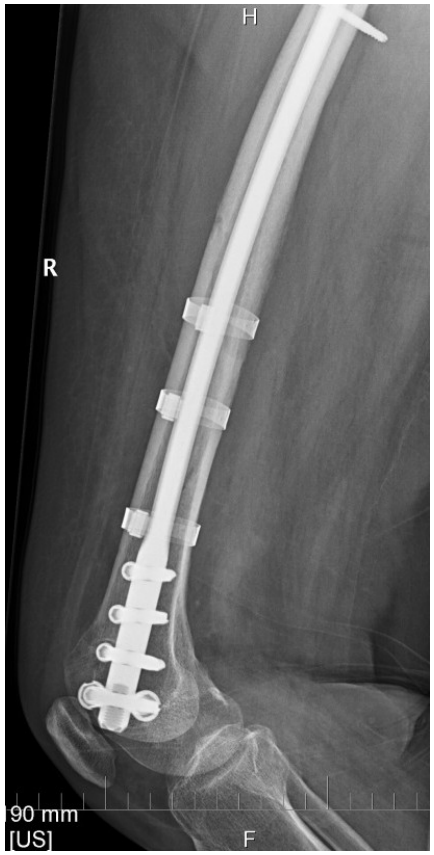
Operative treatment

- Screws
- DCS plate
- Distal femoral nail
- LCP – LISS
- External fixation

Osteosyntesis LCP LISS

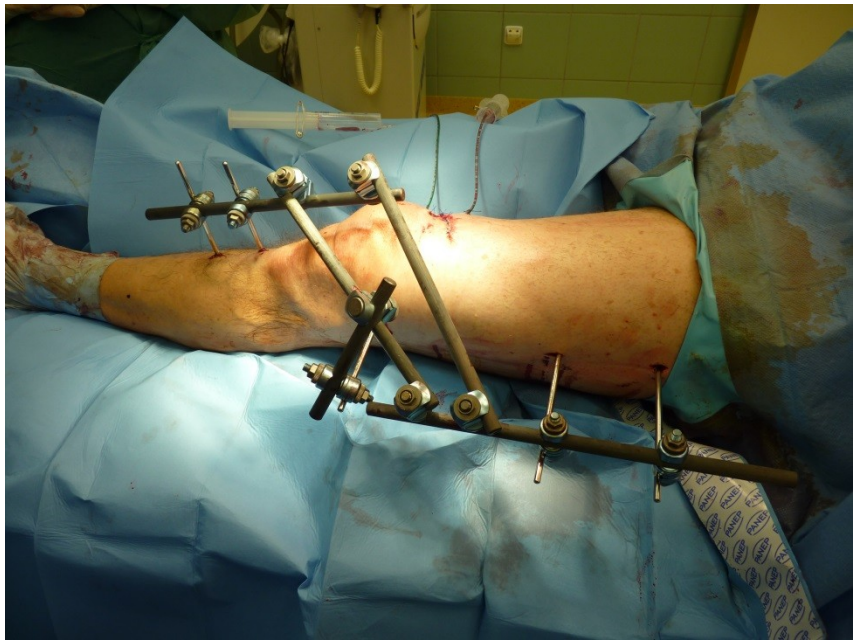
Retrograde nailing – **O**pen **R**eduction **I**nternal **F**ixation /ORIF/

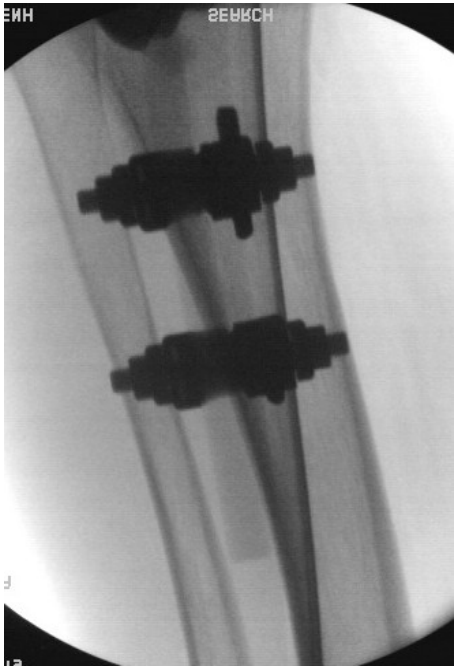




DFN – periprostetic fr., after 6m

Open fracture of distal femur, external fixation

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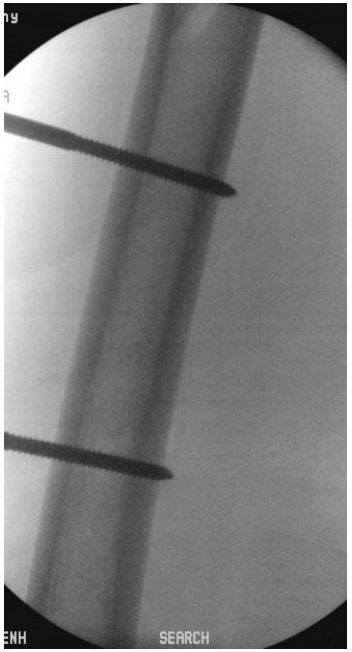
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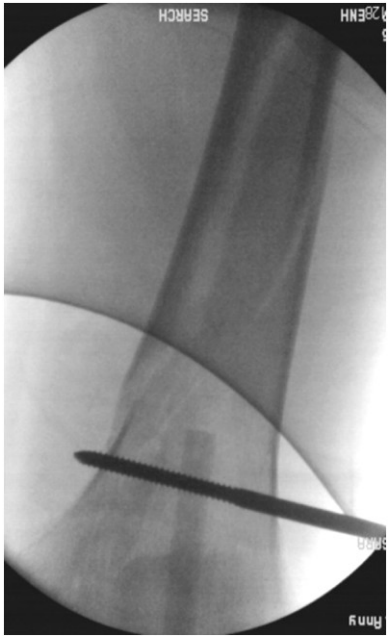
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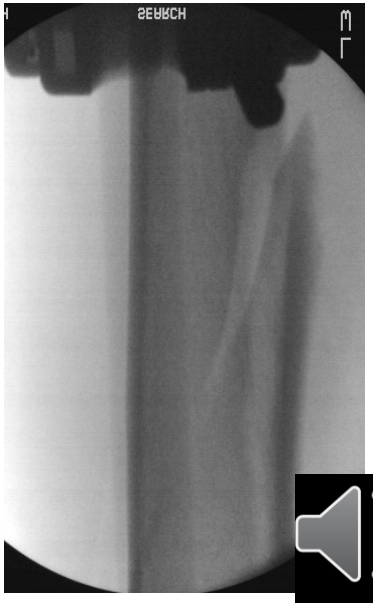
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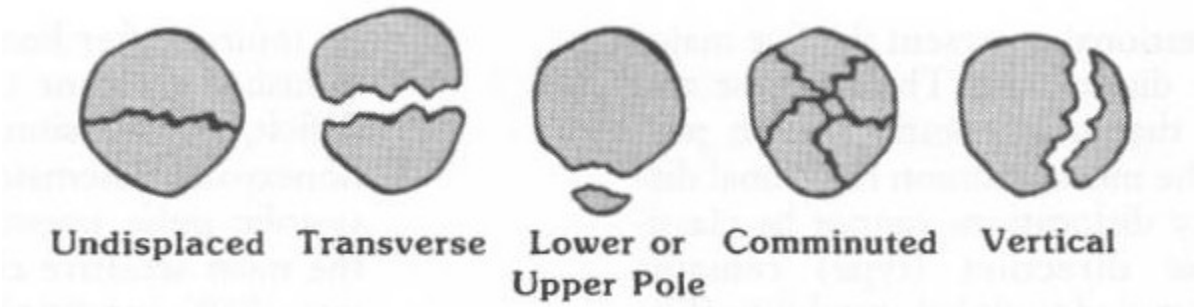
Distal femoral fracture Associated Vascular Injury

- The incidence **about 2%.**
- If **arterial reconstruction** is necessary, it should be done **before definitive skeletal stabilization**.
- Reduction of the fracture and temporary fixation with an **external fixator or femoral distractor before vascular repair** should be considered.
- **Definitive fracture management can proceed after the vascular** procedure if the patients condition allows.
- **Fasciotomy** of the lower leg should be performed **in all cases.**

Patellar fractures



Mechanism of injury

- **Direct: Displacement is typically minimal** - preservation of the medial and lateral retinacular expansions. Abrasions or open injuries are common. Active knee extension may be preserved.

- **Indirect (most common)**: This is secondary to forcible quadriceps contraction while the knee is in a **semiflexed position** The degree of **displacement** of the fragments suggests the **degree of retinacular disruption**. Active knee extension is usually lost.

- **Combined direct/indirect** mechanisms: These may be caused by trauma in which the patient experiences direct and indirect trauma to the knee, such as in a fall from a height.

Clinical evaluation

- **Active knee extension** should be evaluated to determine injury to the retinacular expansions. This may be aided by decompression of hemarthrosis or intraarticular lidocaine injection.

- **Associated lower extremity injuries** may be present in the setting of high-energy trauma. The physician must carefully evaluate the **ipsilateral hip**, femur, tibia, and ankle, with appropriate radiographic evaluation, if indicated.

Nonoperative treatment

- **Nondisplaced or minimally displaced** (2- to 3-mm) fractures with minimal articular disruption (1 to 2 mm). This requires an **intact extensor** mechanism.

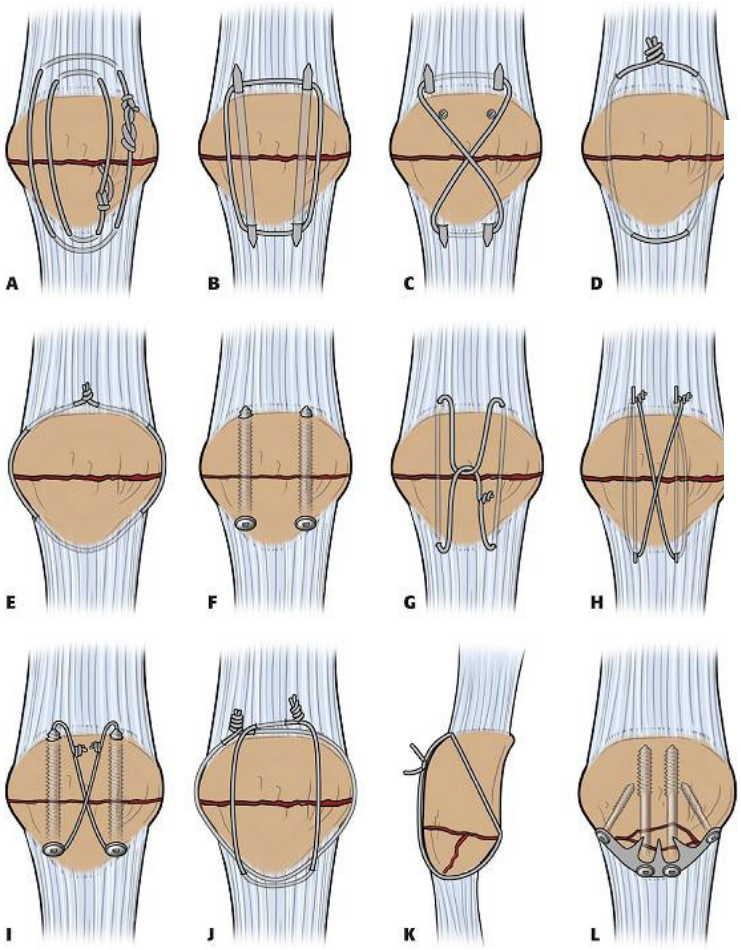
- A cylinder cast or **knee immobilizer** is used for 4 to 6 weeks. Early straight leg raising and isometric quadriceps strengthening exercises should be started within a few days. Weight bearing after 3-4 weeks, active flexion 4+w /x-ray/

Operative treatment

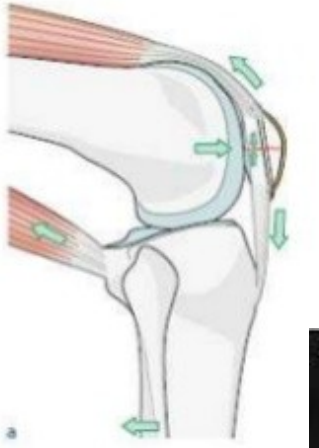
- **ORIF** - open reduction and internal fixation include >2-mm articular incongruity, >3-mm fragment displacement, or open fracture.
- There are multiple methods of **operative fixation**, including **tension banding** (using parallel longitudinal Kirschner wires or cannulated screws) as well as **circumferential cerclage wiring**. Retinacular disruption should be repaired at the time of surgery.
- Postoperatively, the patient should be placed in a splint for 3 to 6 days until skin healing, with **early institution of knee motion**. The patient should perform active assisted range-of-motion exercises, progressing to partial and full weight bearing by 6 weeks.
- Severely comminuted or marginally repaired fractures, particularly in older individuals, may necessitate **immobilization for 3 to 6 weeks.**
- **Patellectomy** – partial / total - comminutive fractures, Reattachment of the quadriceps or patellar tendon, Repair of medial and lateral retinacular injuries , long leg cast at 10 degrees of flexion for 3 to 6 weeks.

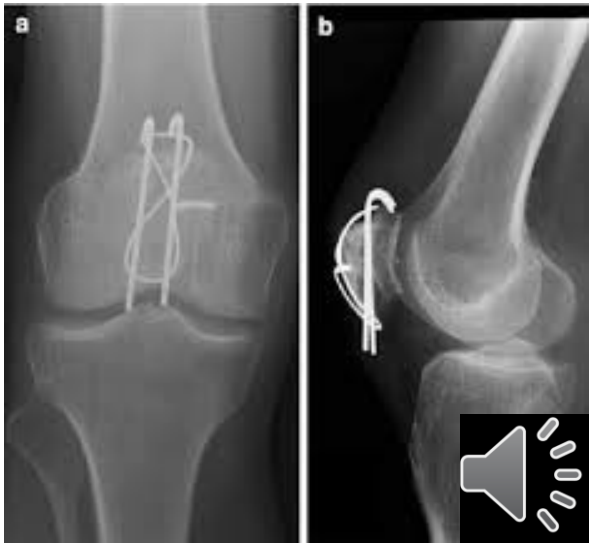
Osteosynthesis of patellar fracture

- Types of oteosynthesis



- Dynamic tension band – produces increased compression with motion





Děkuji za pozornost