

NECK OF FEMUR FRACTURE

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EPIDEMIOLOGY

- In elderly typically NOF # results from low-energy falls and associated with osteoporosis.
- in young typically NOF # result of a high-energy mechanism and other associated injuries are common.
- Mostly intra capsular and compromise blood supply of head of femur.

Risk factors

- Female sex
- White race
- Increasing age
- Poor health
- Tobacco and alcohol use
- previous fracture
- Fall history
- Low estrogen level

ANATOMY

- The upper femoral epiphysis closes by age 16 years.
- **Neck-shaft angle:** 130 ± 7 degrees
- **Femoral Anteversion:** 10 ± 7 degrees

ANATOMY....

- Three ligaments attach in this region:
- 1. **Iliofemoral**:Y –ligament of Bigelow (anterior)
- 2. **Pubofemoral**: Anterior
- 3. **Ischiofemoral**:Posterior

ANATOMY....

- **Calcar Femorale**

A vertically oriented plate from the posteromedial portion of the femoral

Shaft radiating superiorly toward the greater trochanter.

Blood Supply

A. Extra-Articular Artery Ring Formed Around base of Femoral Neck.

Formed by Mainly by Branches :

1. Medial Femoral Circumflex Artery

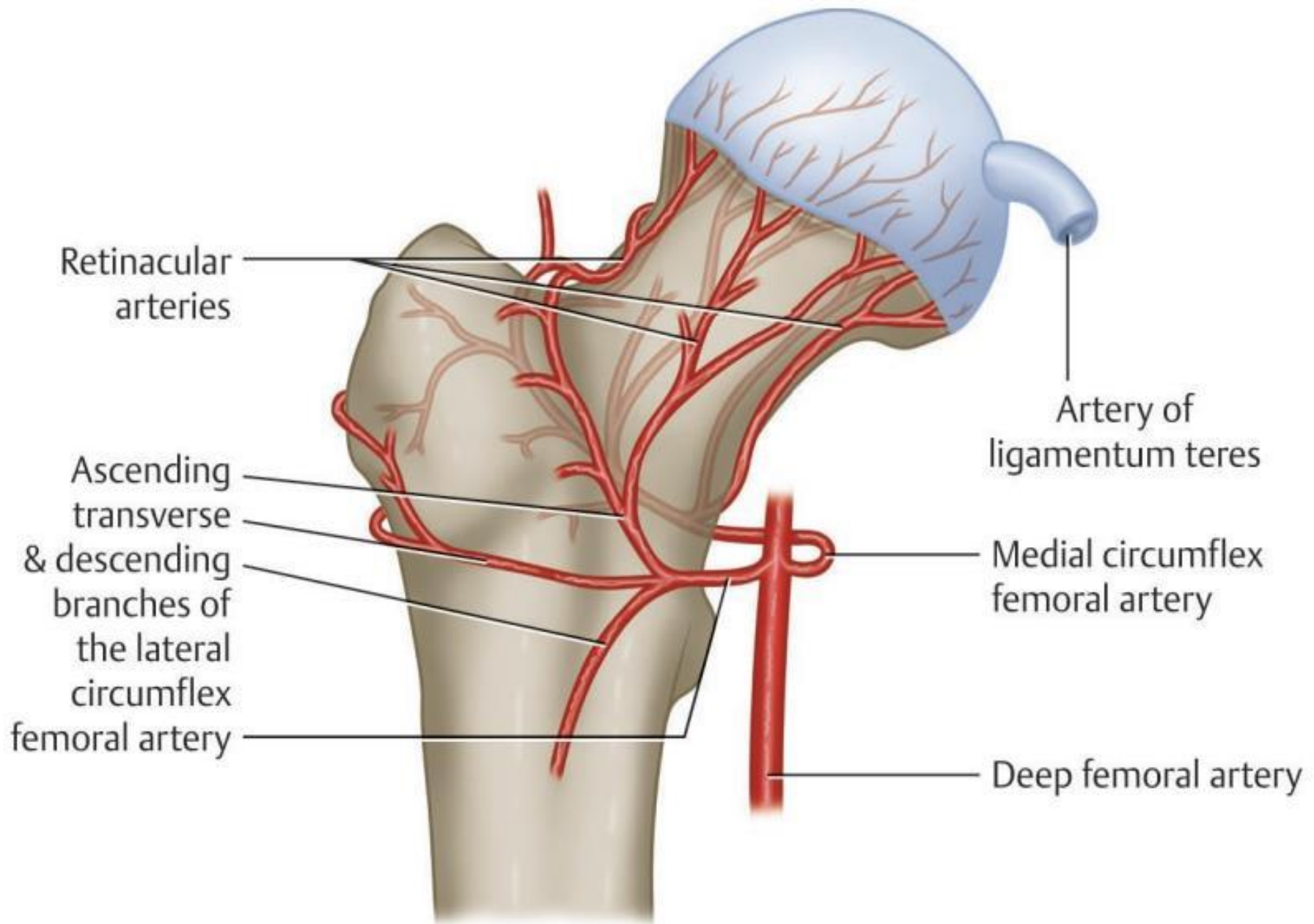
2. Lateral; Femoral Circumflex Artery

(Branch of Profunda Femoris Artery)

(Major Contribution)

B. Retinacular Arteries

C. Artery of Ligamentum teres (Branch of Obturator Artery)

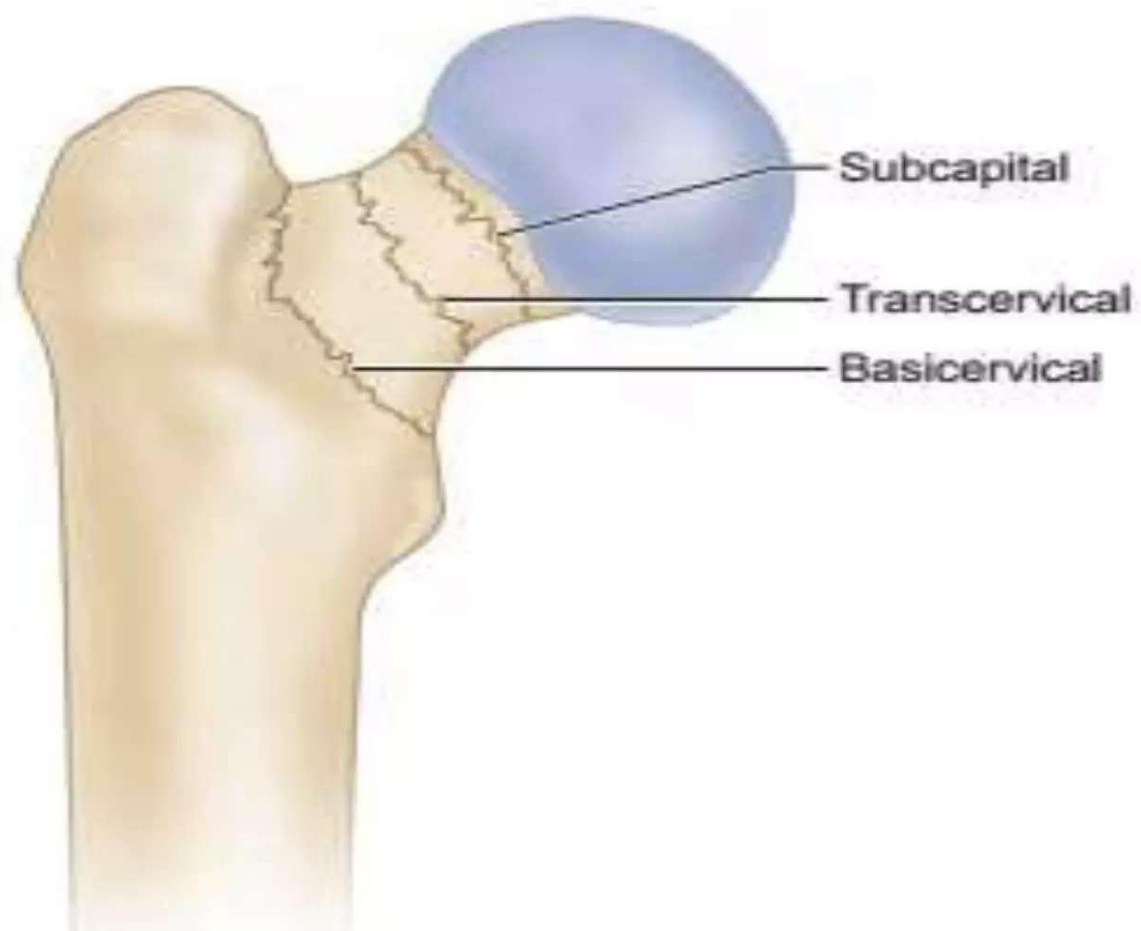


CLASSIFICATION

- Classified by location of fracture line
- Garden classification
- Pauwels classification.

By location of fracture line

- Subcapital
- Transcervical
- Basicervical



Garden classification

- most commonly used classification system
- based on the degree of displacement
- Garden classification is based on AP pelvis radiograph

Garden classification

Stage I: incomplete fracture line (valgus impacted)

Stage II: complete fracture line; nondisplaced

Stage III: complete fracture line; partially displaced

Stage IV: complete fracture line; completely displaced

Garden classification

Stage I:
incomplete fracture line (valgus impacted)



Stage I

Stage II:
complete fracture line; nondisplaced



Stage II

Garden classification

Stage III:
complete fracture line partially displaced



Stage III

Stage IV:
complete fracture line; completely displaced



Stage IV

Pauwels classification

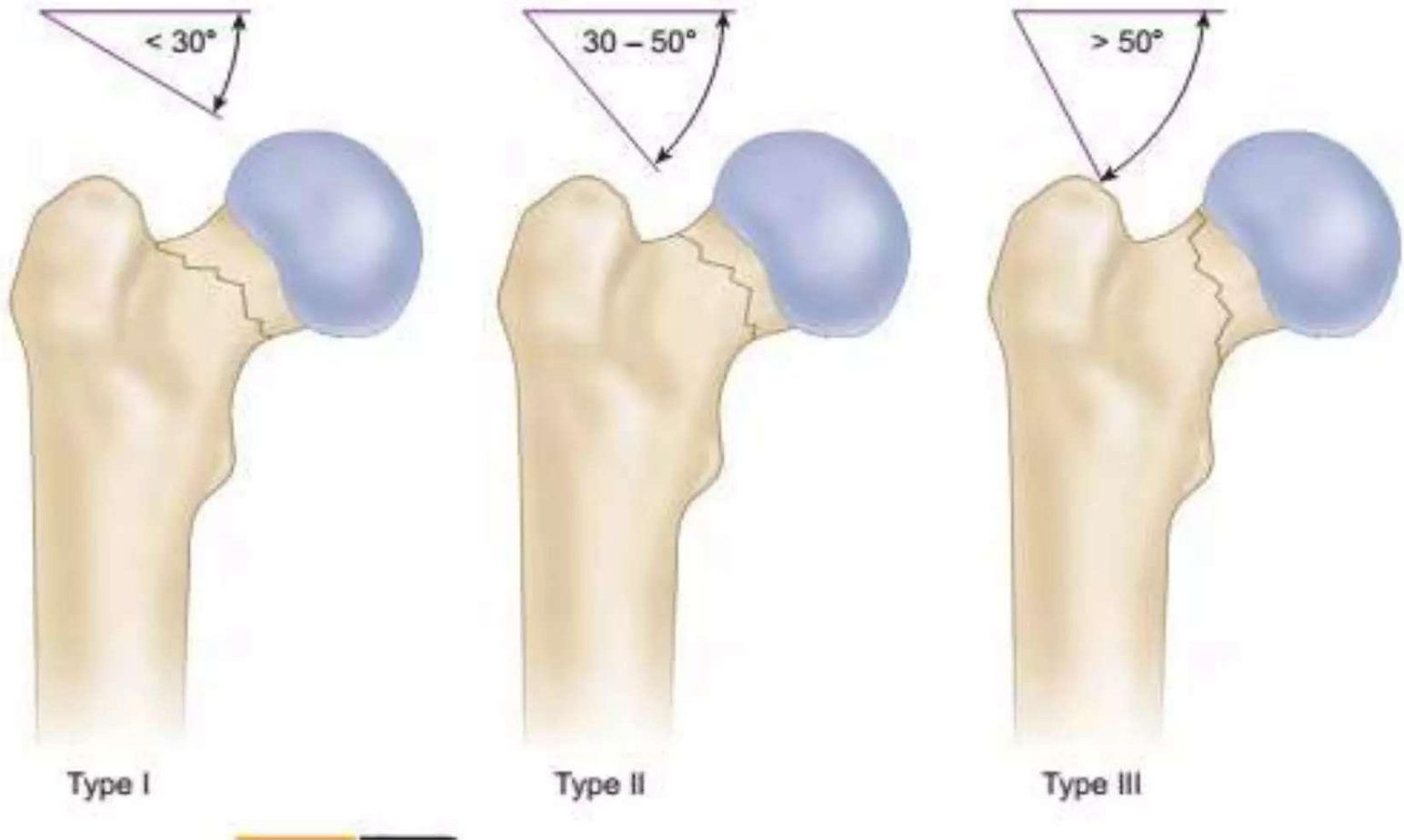
- The classification is based on the angle, the fracture line makes in reference to the horizontal.

Type I--fracture is between 0 and 30 degrees
in Reference to the horizontal

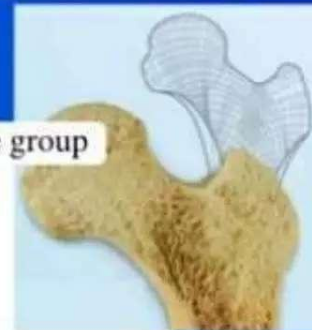
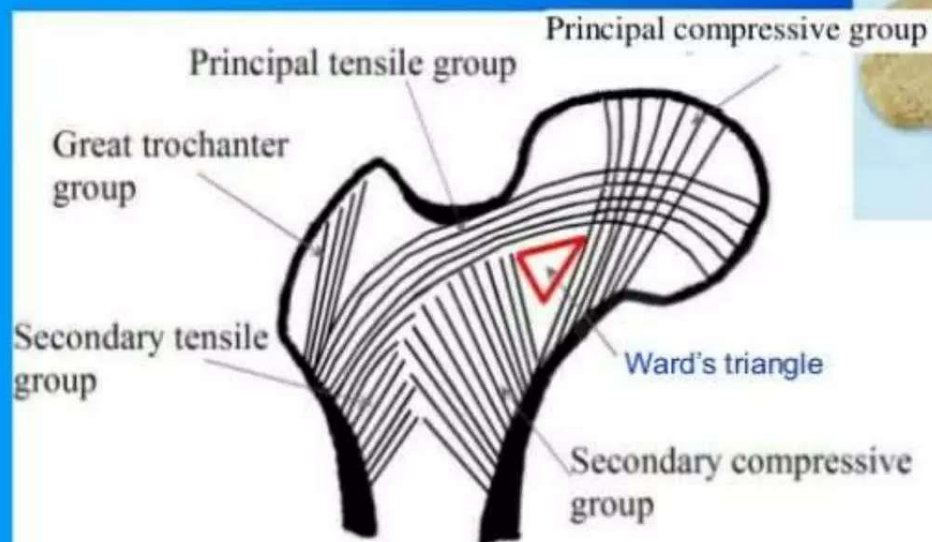
Type II--between 30 and 50 degrees

Type III--more than 50 degrees

Pauwels Classification



Trabecular pattern of proximal hip



DIAGNOSIS

- Diagnosis is based on
- History
- Physical examination
- Radiographs.

History

- History of a **traumatic** event with the exception of patients who have stress fractures of the femoral neck.
- young patients with high-energy femoral neck fractures have associated injuries including **head** injuries.
- missed femoral neck fracture can be disastrous.

Physical examination



On examination extremity is **shortened** and **externally** rotated

Radiographs

- Standard anteroposterior pelvic View
- Cross-table lateral views
- Traction internal rotation view

The entire femur should be imaged

Radiographs

- **MRI** has become the imaging study of choice to evaluate occult femoral neck fractures.
- **CT scan** is not routinely being used for femoral neck fractures.
- CT scan of the chest abdomen and pelvis often is available yield useful **information**.

Radiographs

- **BONE SCAN**

- Helpful to rule out occult fracture
- not helpful in reliably assessing viability of femoral head after fracture.

TREATMENT

- Closed reduction
- Open reduction
- Fluoroscopy

Closed reduction

- A closed reduction can be attempted in every patient for whom internal fixation is planned.
- Closed reduction is done by
Whitman technique
applying traction to the abducted,
extended , externally rotated hip
with subsequent internal rotation.

Closed reduction

- Attempts should not be **forceful**
- should not be repeated more than **two or three** times.
- Once reduction has been attempted, the **angulation** and **alignment** must be critically evaluated.
- Angulation and alignment evaluated By The **Garden alignment index.**

Garden alignment index

- On the **AP** image,

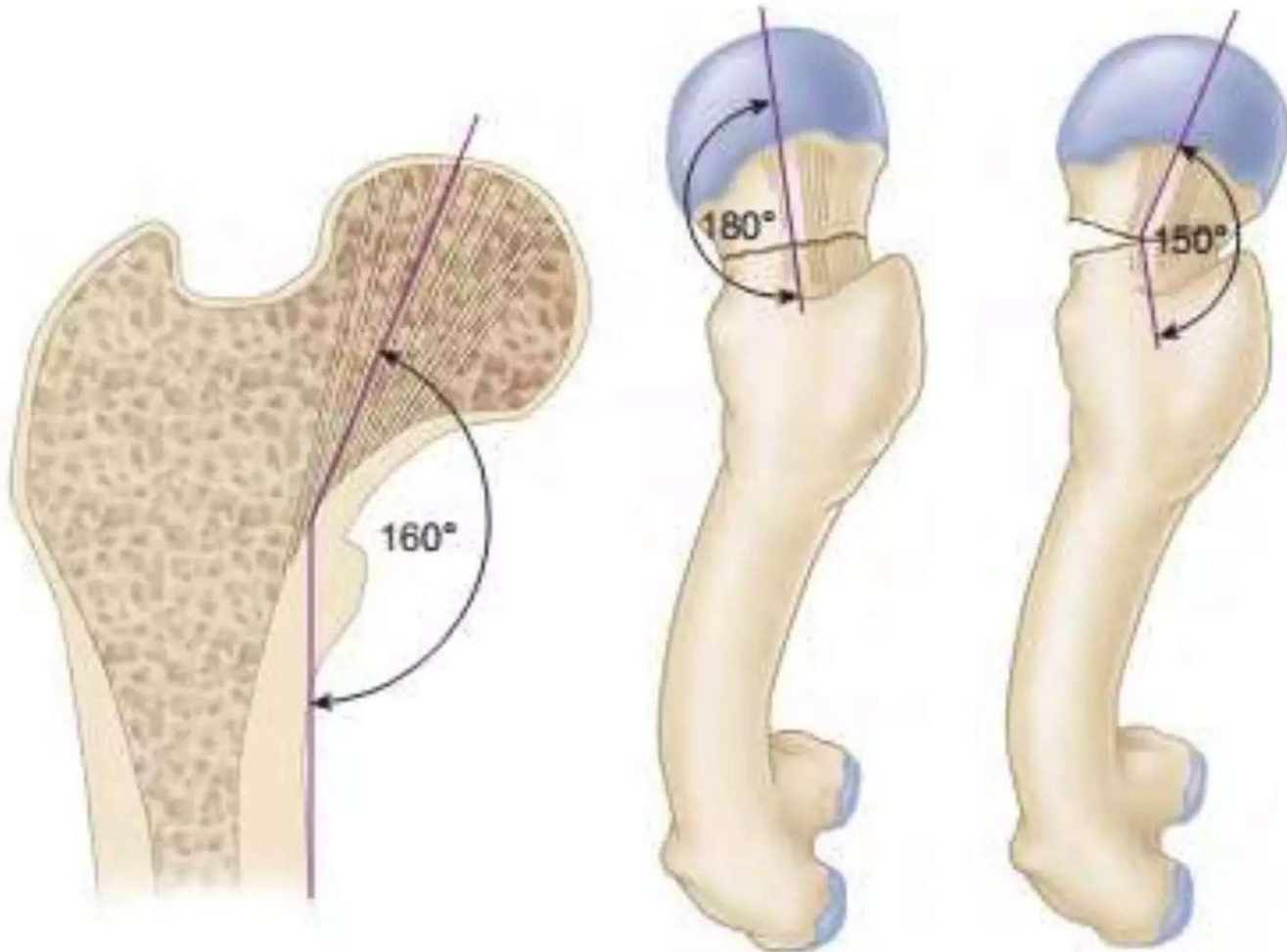
The angle between the medial shaft and the central axis of the medial compressive trabeculae should measure between 160 and 180 degrees.

<160 degrees indicates varus,

>180 degrees indicates valgus.

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Garden alignment index





Angle between medial trabecular stream in femoral head and medial cortex of femoral shaft

Garden Alignment index

On the **lateral** image

Angulation should be approximately 180 degrees and deviation of more than 20 degrees indicates excessive anteversion or retroversion.

TREATMENT

- **Non operative**
- **Operative**

TREATMENT....

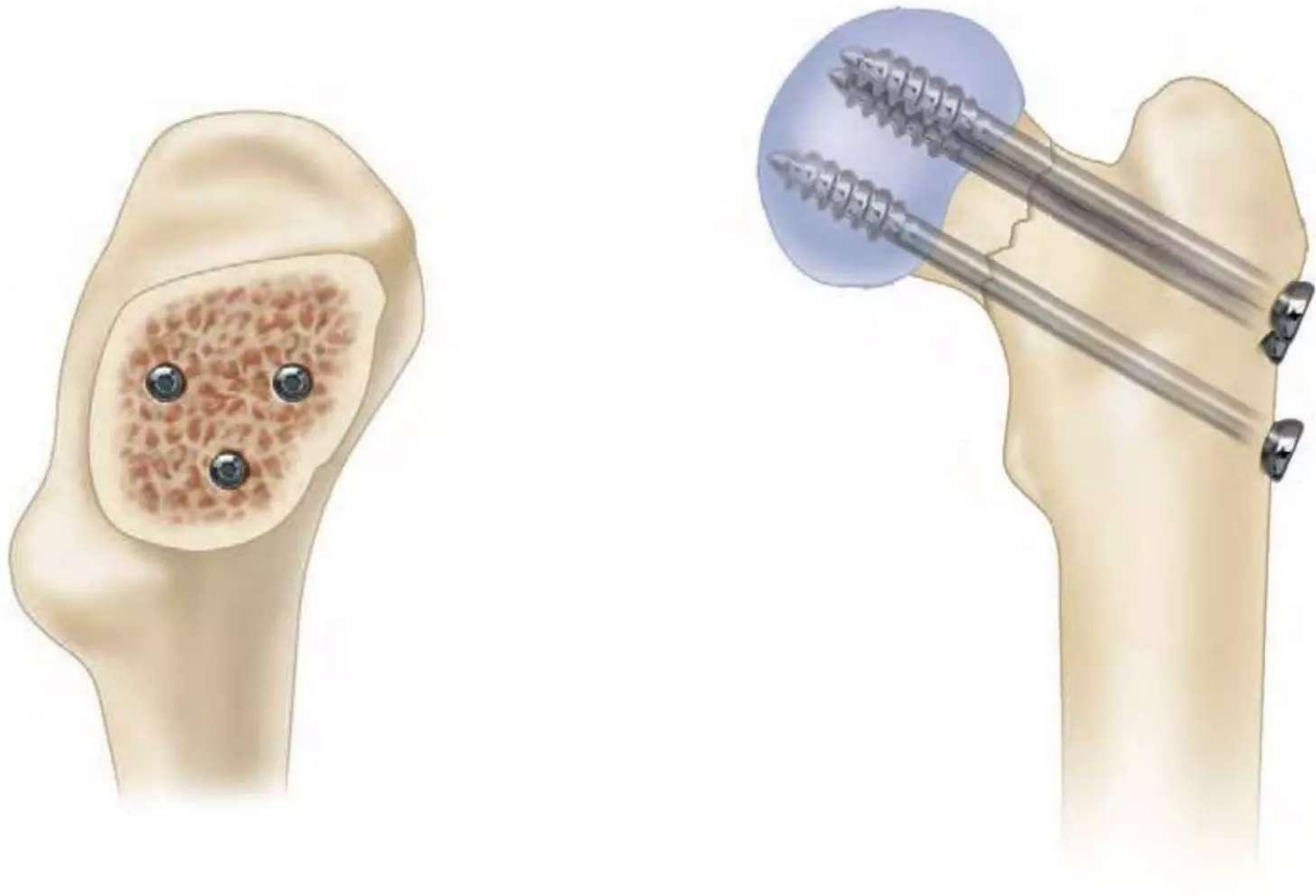
- **Non operative**
- Considered in some patients who are nonambulators
- Have minimal pain
- High risk for surgical intervention

TREATMENT

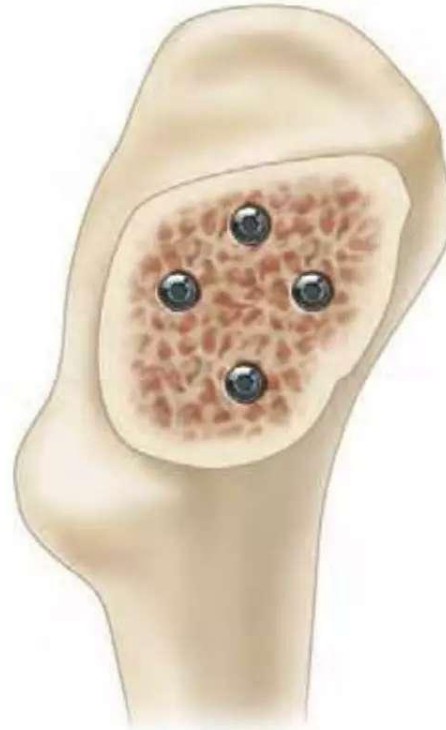
- **ORIF**
- indications
- Displaced# in young or physiologically young patients
- most pts <65 years of age
- low-energy fragility fractures in elderly patients
- Age 65-85, ORIF for Garden I and II patterns.
physiologically young pts with Garden III and IV
- Age >85 treated with ORIF for Garden I and II

- **cannulated screw fixation**
- **indications**
- Nondisplaced Transcervical fx
- Displaced transcervical fx in **young** patient
- Achieve reduction to limit vascular insult
- reduction must be anatomic, open if necessary

3 partially threaded screws can be inserted in inverted triangle configuration



Four screws can be placed in a diamond configuration when significant comminution is present



FIXATION OF NOF# WITH CANNULATED SCREWS

- Extreme care must be taken in the placement of guide pins.

(subtrochanteric femoral fractures)

- Fixed with an apex distal screw or apex-proximal screw configuration.
- Apex-distal configuration exhibited a greater load to failure

sliding hip screw or cephalomedullary nail

- **Indications**
- Basicervical fracture
- consider placement of additional cannulated screw above sliding hip screw to prevent rotation

ipsilateral to
femoral shaft
fracture,
fixed with
**compression hip
screw**
and derotational
screw



ARTHROPLASTY

Total hip Arthroplasty



Hemiarthroplasty



- (<65 years of age) should be treated with anatomical reduction and stable internal fixation.
- Displaced femoral neck fractures in older patients should be treated with arthroplasty.

controversial issues

- Type of arthroplasty
(hemiarthroplasty or total hip arthroplasty)
- unipolar or bipolar
- cemented or uncemented
- femoral stem
- surgical approach

Hemiarthroplasty

Indications

- controversial
- Debilitated elderly patients
- Metabolic bone disease

Total hip Arthroplasty

Indications

- Controversial
- Older active patients
- Arthroplasty for Garden III and IV in patient > 85 years

Potential Benefits of Total Hip Arthroplasty over Hemiarthroplasty

- Decreased pain
- Improved ambulation
- Lower reoperation rates
- A disadvantage of total hip arthroplasty appears to be a slightly higher **Dislocation rate**

COMPLICATIONS OF ORIF

- Nonunion
- Osteonecrosis
- Fixation failure
- Dislocation
- Mortality

Nonunion

- incidence of 5 to 30%
increased incidence in displaced fractures
- varus malreduction

Treatment

valgus intertrochanteric osteotomy

free vascularized fibula graft (YOUNG)

arthroplasty (OLD)

revision ORIF

- **1. In young (<50 year with Viable head)**

- Osteosynthesis with Bone Grafting

- a. Pauwel's osteotomy

- b. Meyer's Muscle Pedicle Graft (quadriceps femoris or Sartorius)

- c. Bone grafting With Internal Fixation

- 2. In Elderly (>60 year) or Non viable head**

- Hip replacement

- a. Hemiarthroplasty

- b. Total hip Arthroplasty (if Acetabulum is also involved)

- 3. Salvage Procedure (Rarely Used now)**

- a. Excision arthroplasty (Girdlestone Procedure)

Osteonecrosis

- Up to 10% of nondisplaced and up to 30% of displaced fractures.
- Not all cases develop evidence of radiographic collapse.
- Treatment is guided by symptoms.
- **Early without x-ray changes: Protected weight bearing or possible core decompression.**
- **Late with x-ray changes: Elderly individuals may be treated with arthroplasty, whereas younger**
- patients may be treated with osteotomy, arthrodesis, or arthroplasty

Fixation failure

- This is usually related to osteoporotic bone or technical problems (malreduction, poor implant insertion).
- **TREATMENT**
- It may be treated with attempted repeat open reduction and internal fixation or prosthetic replacement.

Dislocation

- Higher rate of dislocation with THA (~ 10%)
- About seven times higher than hemiarthroplasty

MORTALITY

- Pre-injury mobility is the most significant determinant for post-operative survival
- In patients with **chronic renal failure**, rates of mortality at 2 years postoperatively, are close to **45%**

