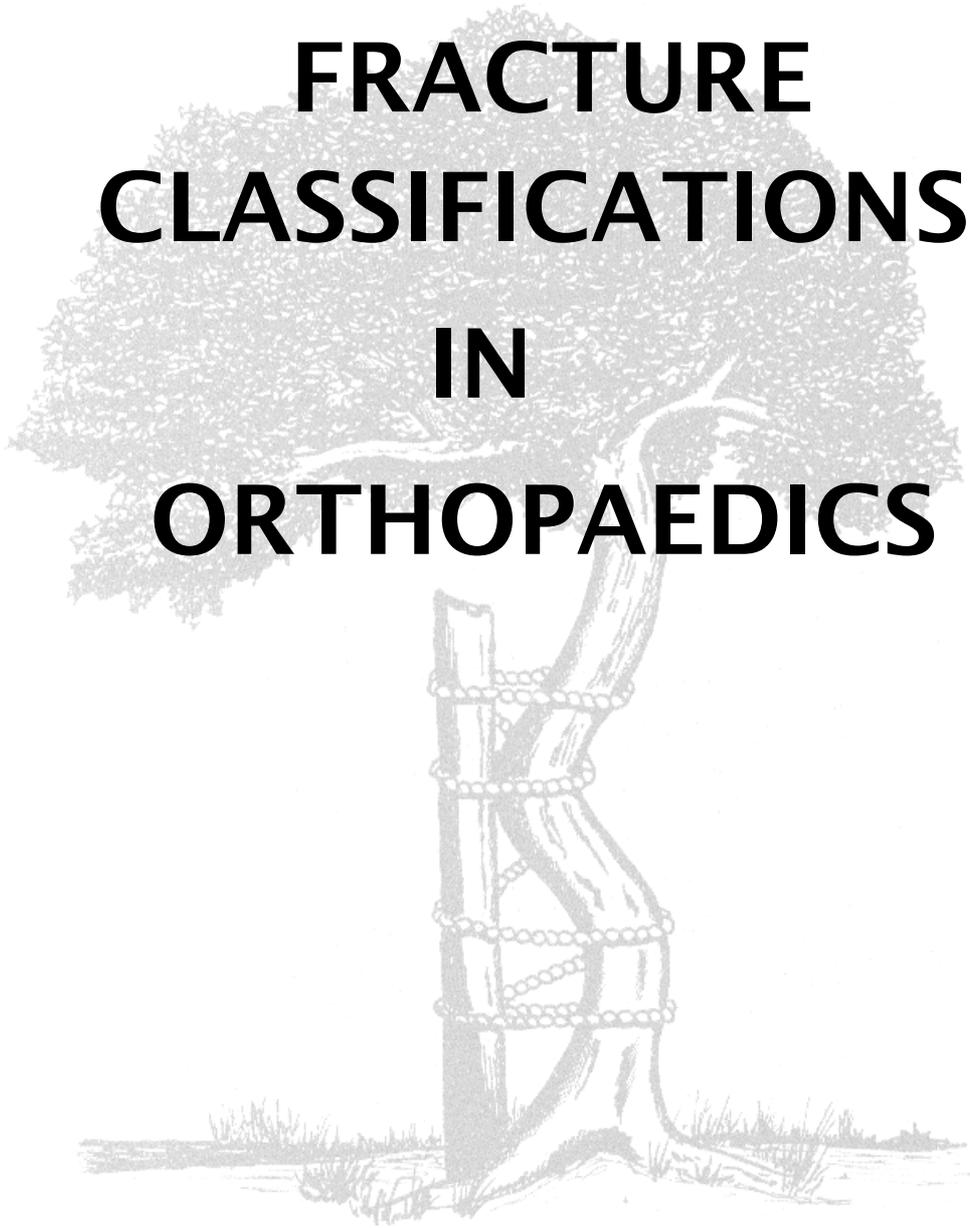


**FRACTURE  
CLASSIFICATIONS  
IN  
ORTHOPAEDICS**



*Mungbo Okeke*

“You cannot discuss SHAKESPEAR if you do not know the ENGLISH language. You cannot discuss FRACTURE PATTERNS if you do not know CLASSIFICATIONS”

Zamel Sadek FRCS (Orth.)

Orthopaedics is a field of specific clinical tests, special x-ray views and several classifications. This can be challenging especially for trainee surgeons.

The purpose of this mini-book is to provide a quick reference to most classifications of fractures that are encountered in clinical practice as materials that put them together like this are quite uncommon. Hence a very wide range of classification systems is covered in this compendium so as to bring a great depth of knowledge to the surgeon's fingertips.

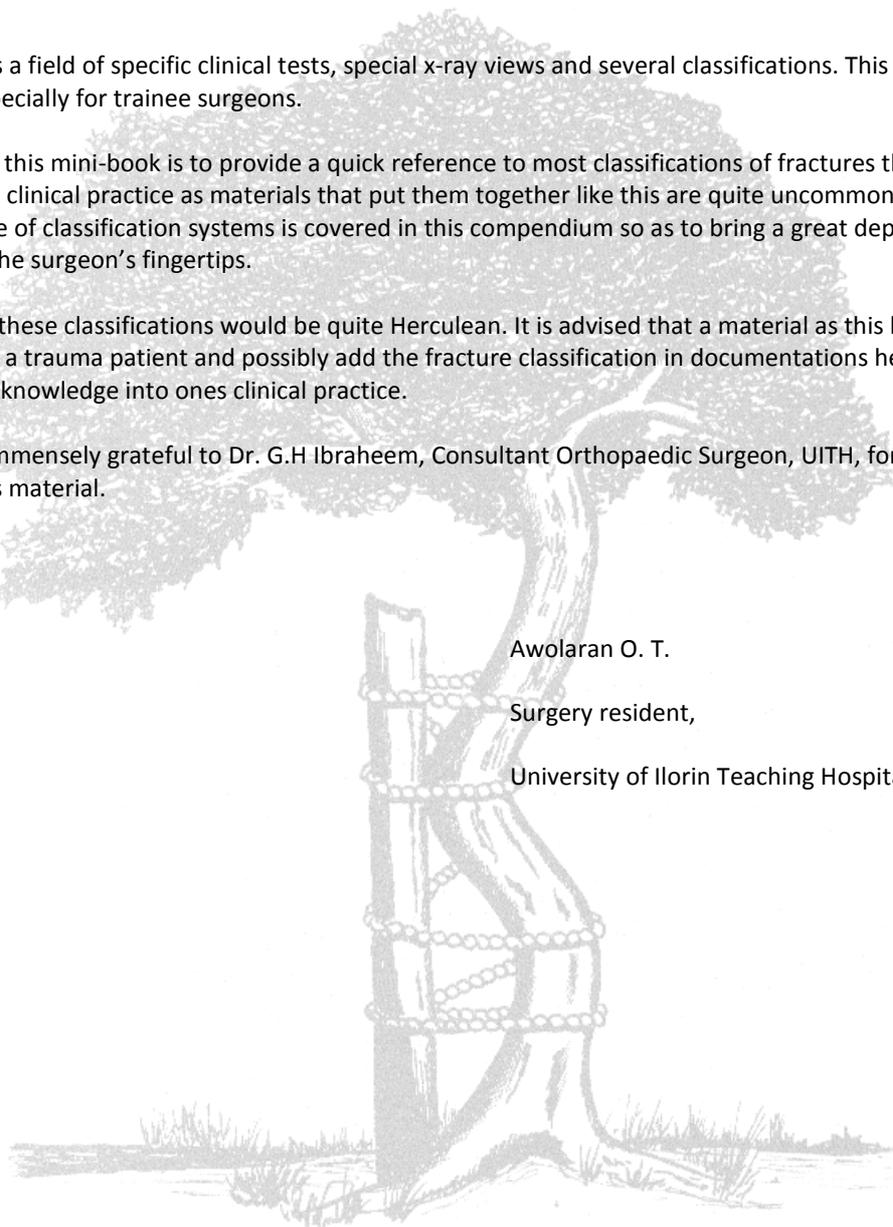
Trying to cram these classifications would be quite Herculean. It is advised that a material as this be looked up after reviewing a trauma patient and possibly add the fracture classification in documentations hence inculcating the knowledge into ones clinical practice.

The author is immensely grateful to Dr. G.H Ibraheem, Consultant Orthopaedic Surgeon, UITH, for reviewing and editing this material.

Awolaran O. T.

Surgery resident,

University of Ilorin Teaching Hospital, Nigeria.



*Maugbo Okeke*

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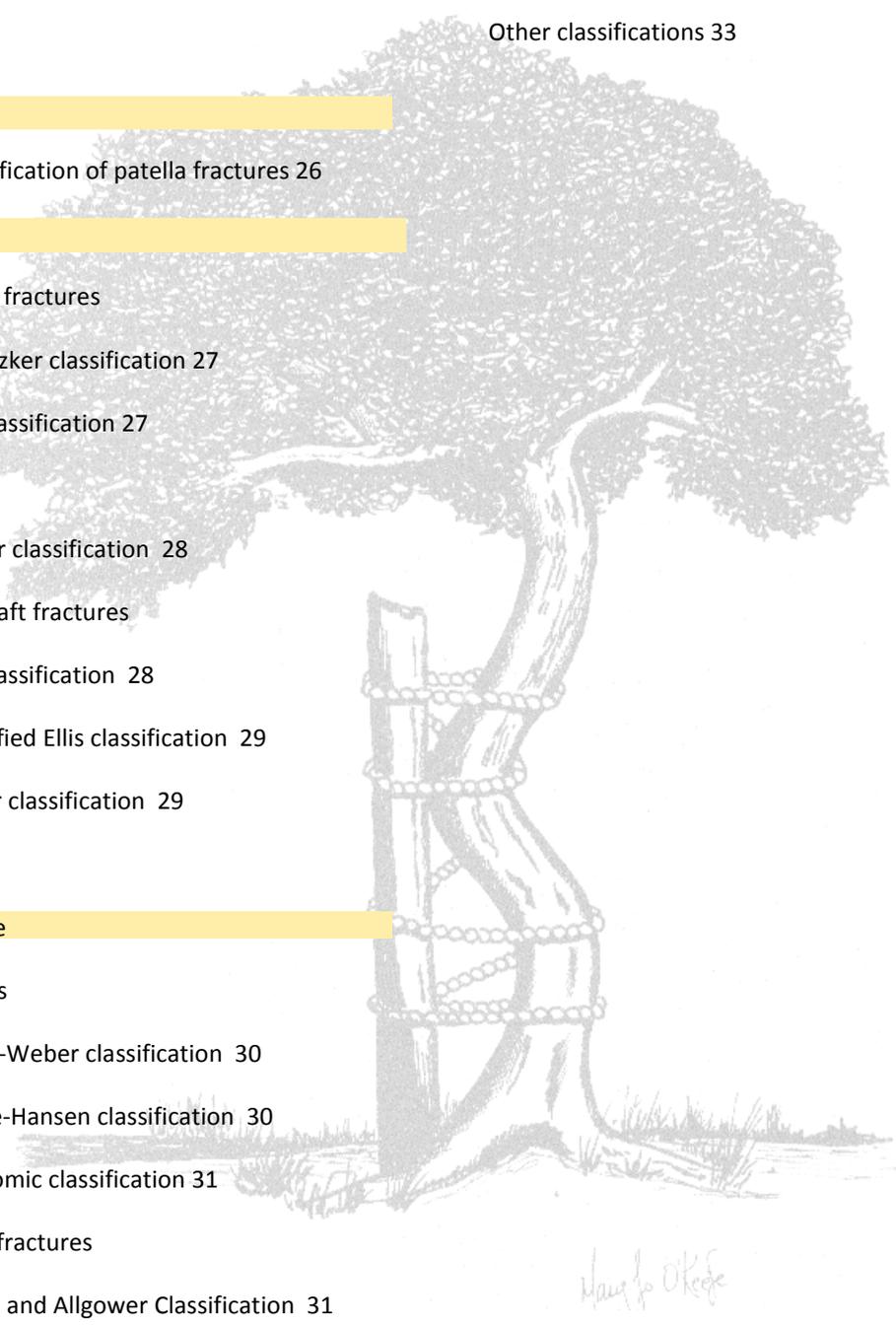
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**Abridged version**

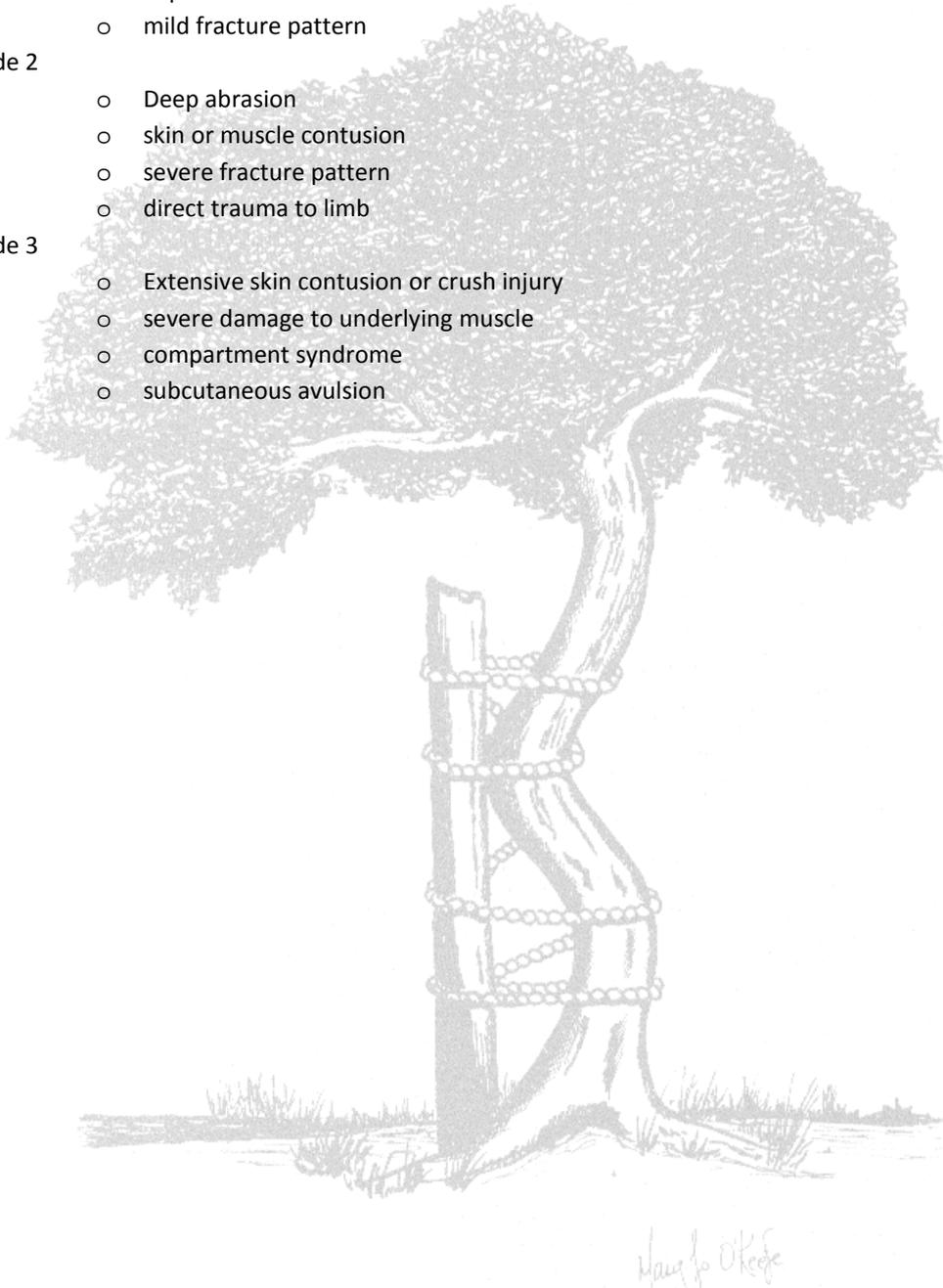
- Type I - <1cm
- Type II - 1-10cm
- Type III - >10cm or high energy
  - A - adequate tissue for coverage
  - B – extensive periosteal stripping and requires a flap
  - C – vascular injury requiring vascular repair

**Complete Version**

- Type I
  - skin lesion <1cm
  - clean
  - simple bone fracture with minimal comminution
- Type II
  - skin lesion > 1cm
  - no extensive soft tissue damage
  - minimal crushing
  - moderate comminution and contamination
- Type III
  - Extensive skin damage with muscle and neurovascular involvement and/or
  - High speed crush injury
  - Segmental or highly comminuted fracture
  - Wound from high velocity weapon
  - Extensive contamination of the wound bed
  - Any size open injury with farm contamination
  - A
    - Extensive ulceration of soft tissues with bone fragment covered
    - Usually high-speed traumas with severe comminution or segmental fractures
  - B
    - Extensive lesion of soft tissue with periosteal stripping and contamination
    - Severe comminution due to high speed trauma
    - Usually requires replacement of exposed bone with a local or free flap as cover
  - C
    - Exposed fracture with arterial damage that requires repair

## TSCHERNE CLASSIFICATION OF CLOSED FRACTURES

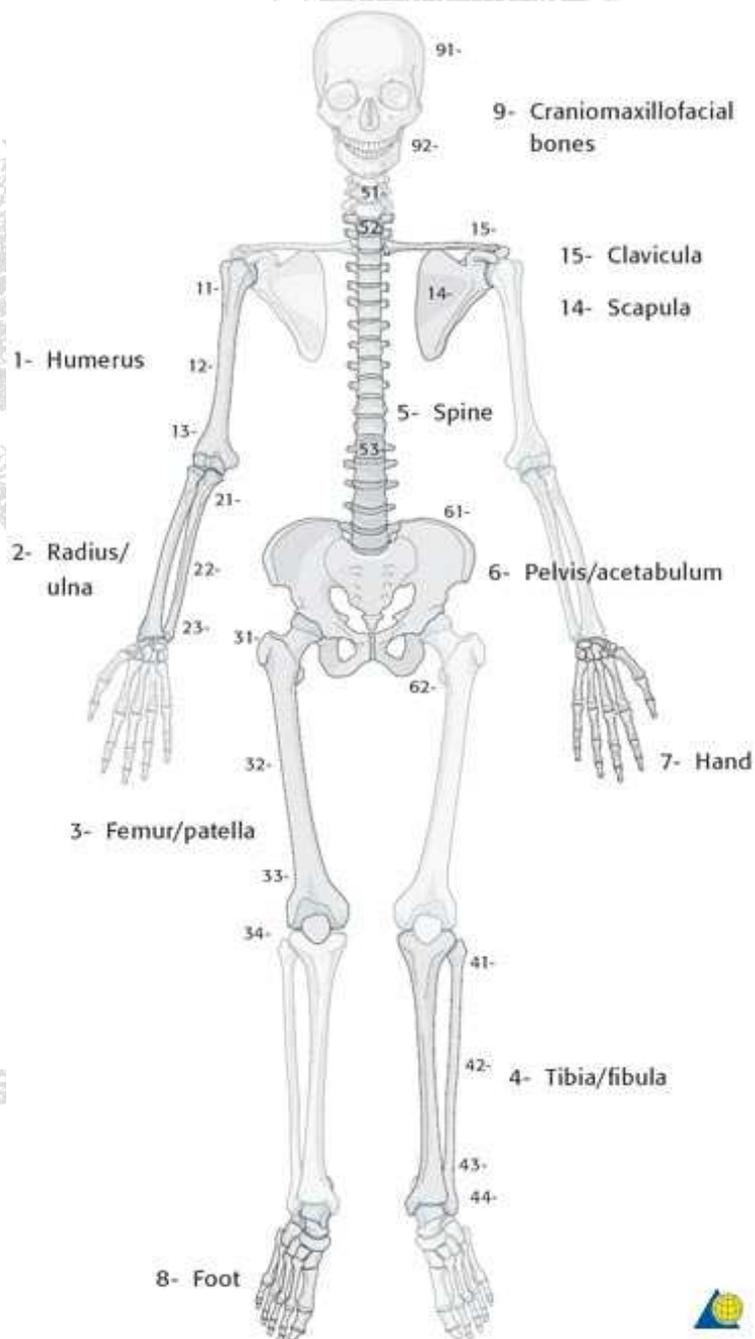
- Grade 0
  - Minimal soft tissue damage
  - indirect injury to limb (torsion)
  - simple fracture pattern
- Grade 1
  - Superficial abrasion or contusion
  - mild fracture pattern
- Grade 2
  - Deep abrasion
  - skin or muscle contusion
  - severe fracture pattern
  - direct trauma to limb
- Grade 3
  - Extensive skin contusion or crush injury
  - severe damage to underlying muscle
  - compartment syndrome
  - subcutaneous avulsion



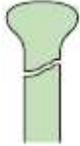
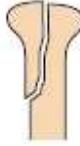
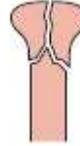
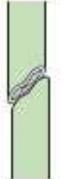
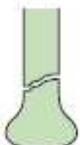
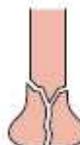
## AO/OTA UNIVERSAL CLASSIFICATION OF FRACTURES

In a bid to provide a comprehensive classification system that is adaptable to the entire skeletal system, Maurice E Muller and the AO foundation came up with the widely accepted AO/OTA universal classifications (also called Muller AO Classification).

- 1) Every major bone and each bone segment are numbered
  - Humerus – 1, Radius/ulnar – 2, Femur – 3, Tibia – 4 e.t.c.
  - Proximal segment – 1, Diaphysis – 2, Distal segment – 3
  - E.g Proximal femur is coded as – 31 (3 – Femur, 1 – Proximal)



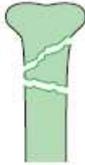
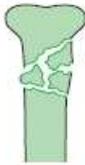
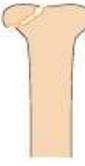
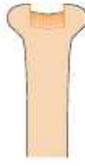
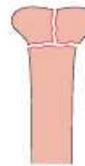
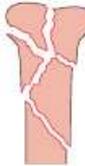
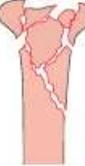
- 2) Proximal and distal segment fractures are classified as TYPES;
- A – Extra-articular
  - B – Partial articular
  - C – Complete articular
- 3) Diaphyseal fractures TYPES;
- A – Simple
  - B – Wedge
  - C – Complex

| Segment             | Type   |  |  |
|---------------------|--|--|--|
|                     | A  | B  | C  |
| <b>1 Proximal</b>   |  <p><b>Extraarticular</b></p> <p>No involvement of displaced fractures extending into the articular surface</p>   |  <p><b>Partial articular</b></p> <p>Part of the articular component is involved, leaving the other part attached to the meta-/diaphysis</p>   |  <p><b>Complete articular</b></p> <p>Articular surface involved, metaphyseal fracture completely separates articular component from the diaphysis</p>   |
| <b>2 Diaphyseal</b> |  <p><b>Simple</b></p> <p>One fracture line, cortical contact between fragments exceeds 90% after reduction</p>   |  <p><b>Wedge</b></p> <p>Three or more fragments, main fragments have contact after reduction</p>   |  <p><b>Complex</b></p> <p>Three or more fragments, main fragments have no contact after reduction</p>  |
| <b>3 Distal</b>     |  <p><b>Extraarticular</b></p> <p>No involvement of displaced fractures extending into the articular surface</p> |  <p><b>Partial articular</b></p> <p>Part of the articular component is involved, leaving the other part attached to the meta-/diaphysis</p> |  <p><b>Complete articular</b></p> <p>Articular surface involved, metaphyseal fracture completely separates articular component from the diaphysis</p> |

*Maya Okeke*

4) Each fracture pattern is further subdivides as GROUPS;

- Proximal and distal segment fractures

| Type                       | Group   |  |  |
|----------------------------|---|--|--|
|                            | 1   | 2  | 3  |
| <b>A Extraarticular</b>    | <br>Simple                                   | <br>Wedge                                     | <br>Complex                                    |
| <b>B Partial articular</b> | <br>Split                                    | <br>Depression                                | <br>Split-depression                           |
| <b>C Articular</b>         | <br>Simple articular,<br>simple metaphyseal | <br>Simple articular,<br>complex metaphyseal | <br>Complex articular,<br>complex metaphyseal |

- Diaphyseal fractures

| Type             | Group   |  |   |
|------------------|---|--|---|
|                  | 1   | 2  | 3   |
| <b>A Simple</b>  | <br>Spiral | <br>Oblique   | <br>Transverse       |
| <b>B Wedge</b>   | <br>Spiral | <br>Bending   | <br>Multifragmentary |
| <b>C Complex</b> | <br>Spiral | <br>Segmental | <br>Irregular        |

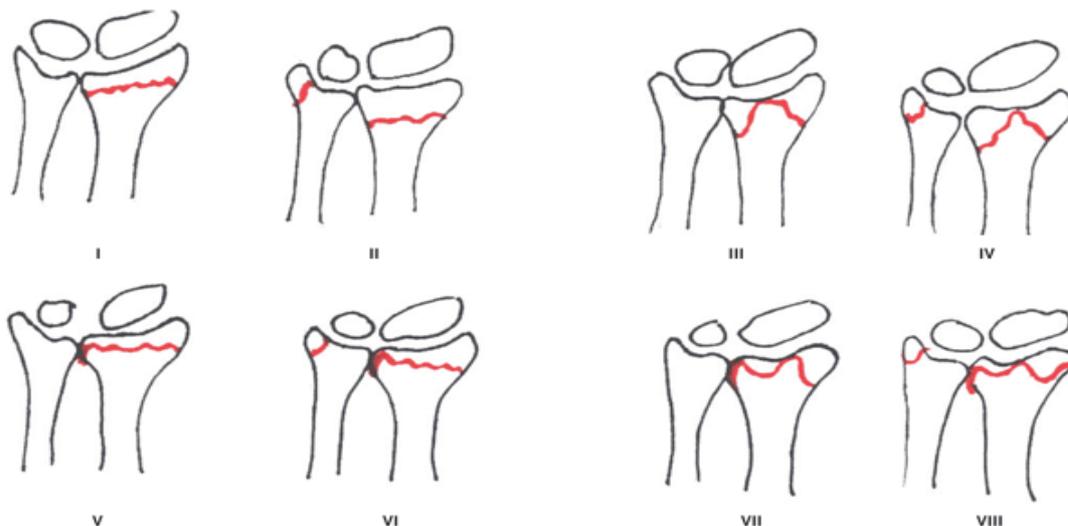
- 5) Using the AO/OTA system
- Which bone? (e.g Femur – 3)
  - Which segment? (e.g Diaphysis – 2)
  - Which type? (e.g Simple – A)
  - Which group? (e.g Transverse - 3)

Using the above example, the fracture is coded as – 32-A3 (Simple transverse diaphyseal femoral fracture).



**DISTAL RADIOULNAR FRACTURES**

**1) Frykman Classification of distal radial fractures – based on joint involvement**



- Type I - transverse metaphyseal fracture
- Type II - type I + ulnar styloid fracture
- Type III - fracture involves the radiocarpal joint
- Type IV - type III + ulnar styloid fracture
- Type V - transverse fracture involves distal radioulnar joint
- Type VI - type V + ulnar styloid fracture
- Type VII - comminuted fracture with involvement of both the radiocarpal and radioulnar joints
- Type VIII - type VII + ulnar styloid fracture

**2) AO Classification of distal radial fractures**

|                 |  |  |  |
|-----------------|--|--|--|
| Extra-articular | <b>23-A1</b><br>Ulna fractured and radius intact   | <b>23-A2</b><br>Simple or impacted metaphyseal radial fracture | <b>23-A3</b><br>Comminuted metaphyseal radial fracture |
| Part of joint   | <b>23-B1</b><br>Sagittal in radius                 | <b>23-B2</b><br>Frontal and dorsal radius                      | <b>23-B3</b><br>Frontal and volar radius               |
| Complete joint  | <b>23-C1</b><br>Simple joint and simple metaphysis | <b>23-C2</b><br>Simple joint and comminuted metaphysis         | <b>23-C3</b><br>Multifragmented joint                  |

Abridged AO  
 I – Extra-articular  
 II – Partial articular  
 III – Complete articular

**Figure 1 – AO classification for fractures of the distal radius<sup>(27)</sup>.**

### 3) Other classifications of Distal radial fractures

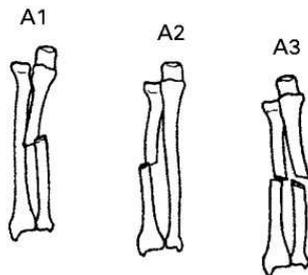
|                      |          |           |
|----------------------|----------|-----------|
| Fernandez            | Melone   | Mathoulin |
| Lidstrom             | Jenkins  | Sarmiento |
| Gartland             | McMurtry | Mayo      |
| Castaing and Le Club | Cooney   |           |
| Shin and Schenck     | Older    |           |

### RADIOULNAR SHAFT FRACTURES

#### AO Classification

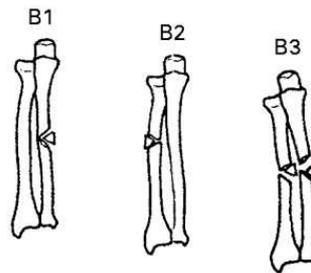
22- Radius/Ulna diaphysis

22-A Simple fracture



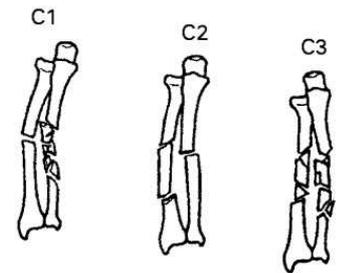
22-A1 of ulna, radius intact  
 22-A2 of radius, ulna intact  
 22-A3 of both bones

22-B Wedge fracture



22-B1 of ulna, radius intact  
 22-B2 of radius, ulna intact  
 22-B3 of one bone wedge, the other simple or wedge

22-C Complex fracture

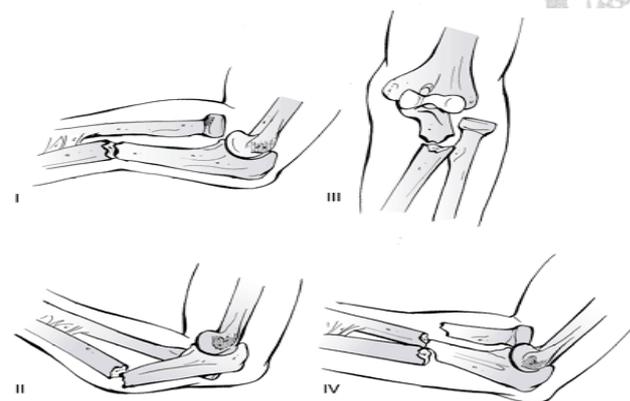


22-C1 of ulna  
 22-C2 of radius  
 22-C3 of both bones

#### Abridged

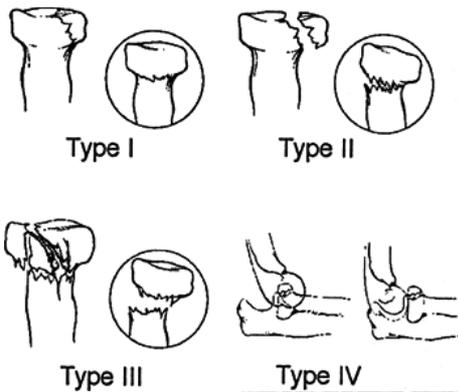
- A – Simple fracture of radius or ulnar or both
- B – Wedge fracture of radius or ulnar or both
- C – Complex fracture

### BADO CLASSIFICATION OF MONTEGGIA FRACTURE



- Type I – Anterior angulation of ulnar fracture, anterior dislocation of radial head
- Type II – Posterior angulation of ulnar fracture, posterior dislocation of radial head
- Type III – Lateral dislocation of radial head
- Type IV – Fracture of both radius and ulnar, dislocation of radial head in any direction

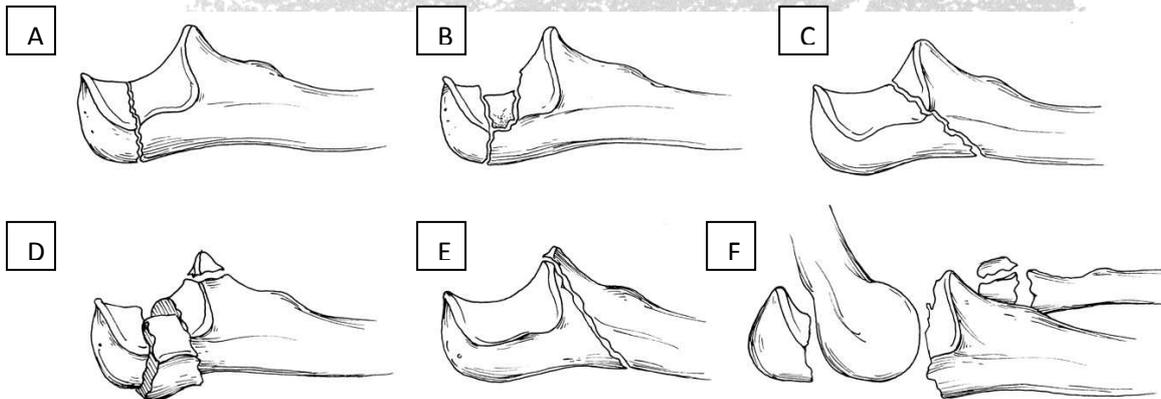
**MASON CLASSIFICATION OF RADIAL HEAD FRACTURE** (also called *Mason and Johnson*)



- Type I - Undisplaced
- Type II - Displaced
- Type III - Comminuted and displaced
- Type IV - Radial head fracture + elbow dislocation

**OLECRANON FRACTURES**

**1) Schatzker classification** (also called *Schatzker-Schmeling*)



- Type A - Simple transverse fracture
- Type B - Transverse impacted fracture
- Type C - Oblique fracture
- Type D - Comminuted fracture
- Type E - more distal fracture but extra-articular
- Type F - Fracture dislocation

**2) AO Classification**

- A - Extra-articular
- B - Intra-articular
- C - Intra-articular fracture of both radial head and olecranon

**3) Other classifications of Olecranon fractures**

- Mayo
- Colton

## **ANATOMICAL CLASSIFICATION OF ELBOW DISLOCATION**

Anterior

Posterior

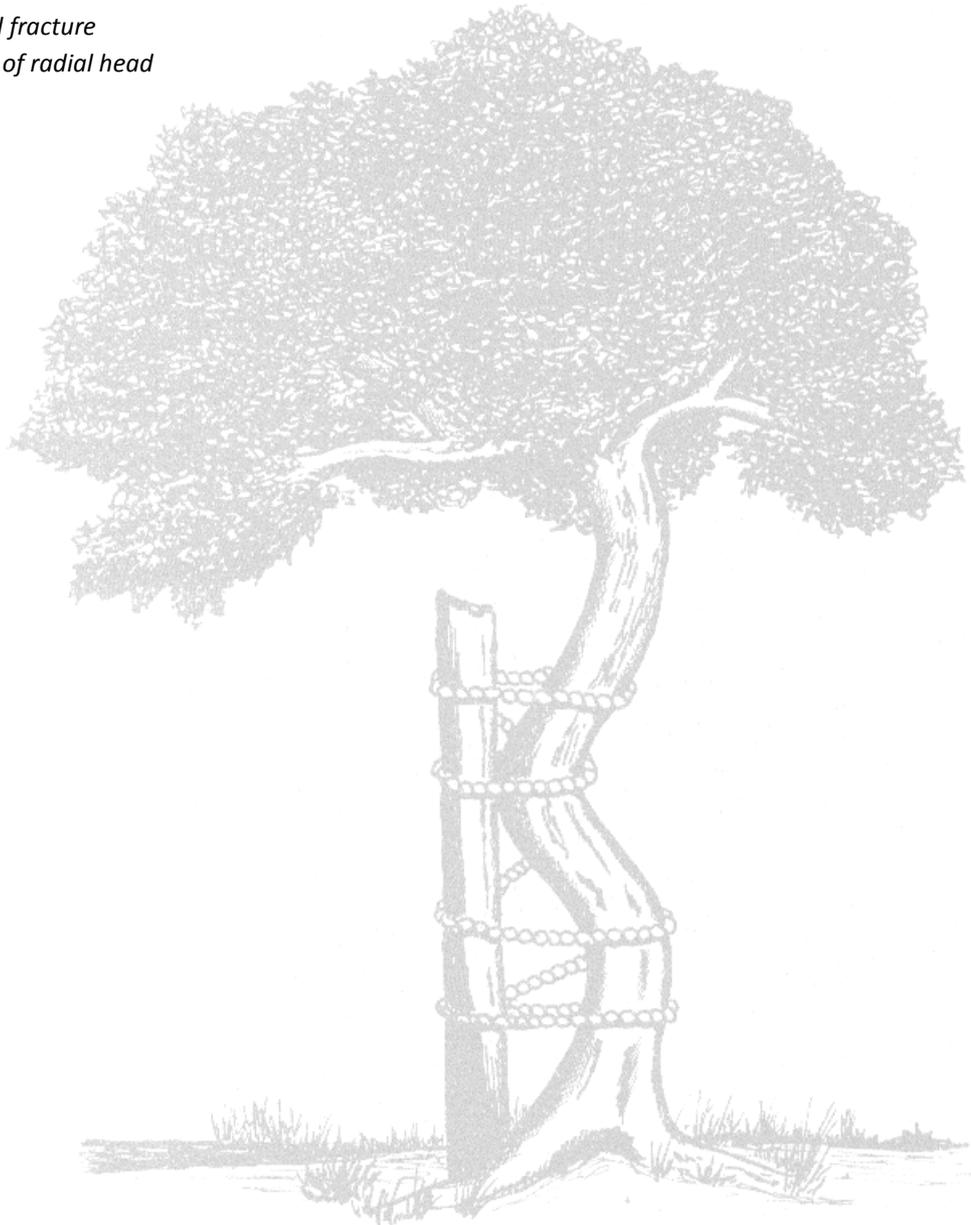
Posterior lateral

## ***TERRIBLE TRIAD OF THE ELBOW JOINT***

*Elbow dislocation*

*Coronoid fracture*

*Fracture of radial head*



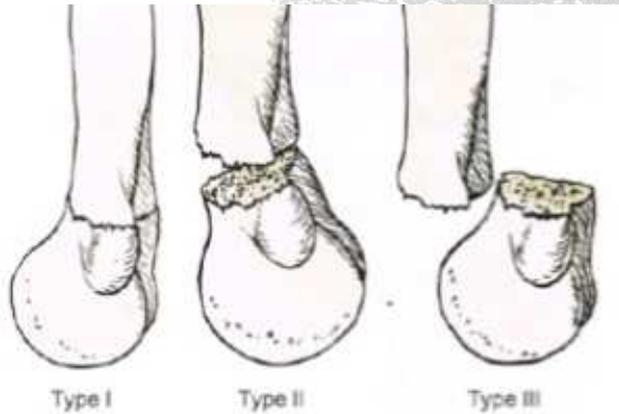
**DISTAL HUMERAL FRACTURES**

**1) Muller-AO Classification of distal humeral fractures** (also called just Muller or AO or OTA)

*Similar to AO classification of distal radius*

- A- Extra-articular fracture (Supracondylar)
- B – Unicondylar fracture (Single column or partial articular)
- C – Bicondylar fracture (Two column or complete articular)

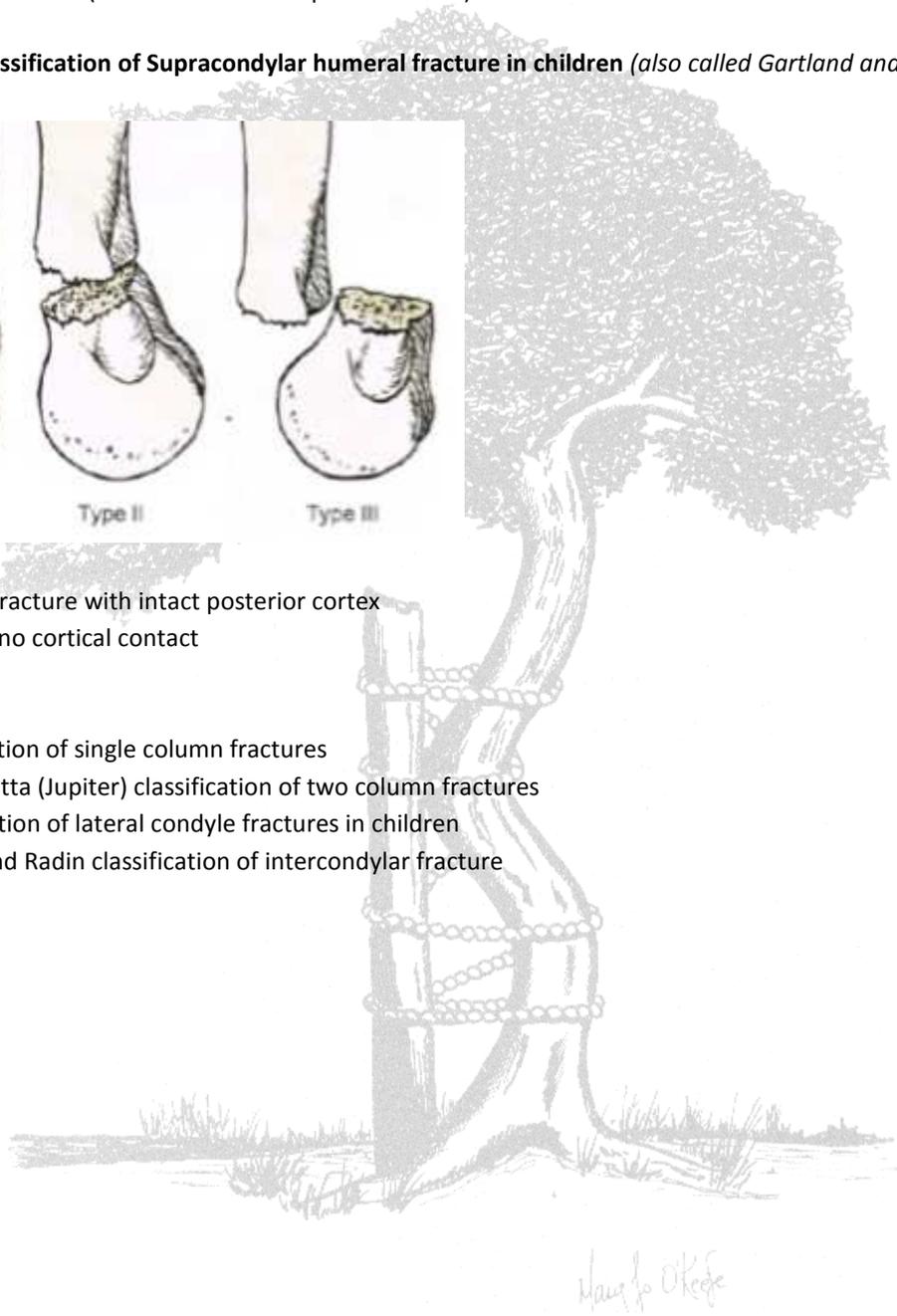
**2) Gartland Classification of Supracondylar humeral fracture in children** (also called Gartland and Wilkins)



- I – Undisplaced
- II – Angulated fracture with intact posterior cortex
- III – Displaced, no cortical contact

**3) Others**

- Milch classification of single column fractures
- Mehne and Matta (Jupiter) classification of two column fractures
- Jakob classification of lateral condyle fractures in children
- Riseborough and Radin classification of intercondylar fracture



## HUMERAL SHAFT FRACTURES

### AO Classification

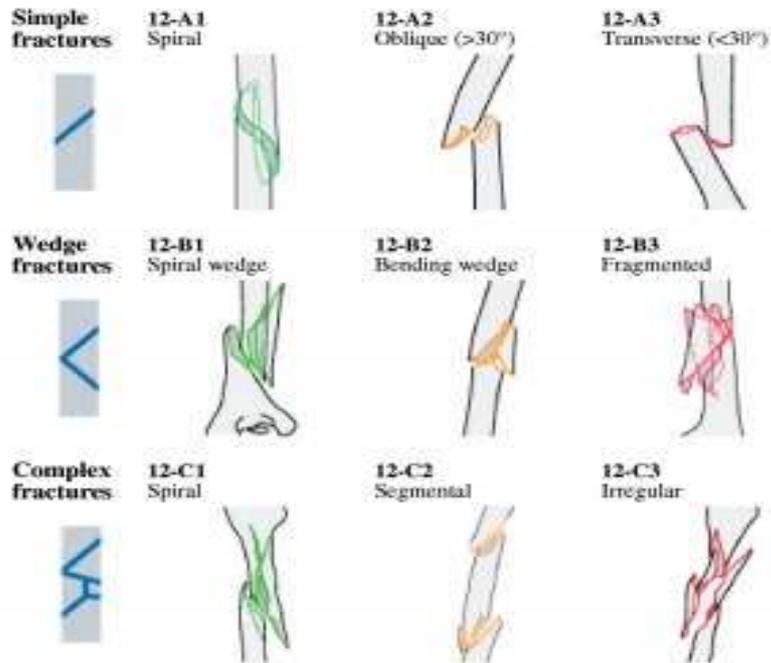
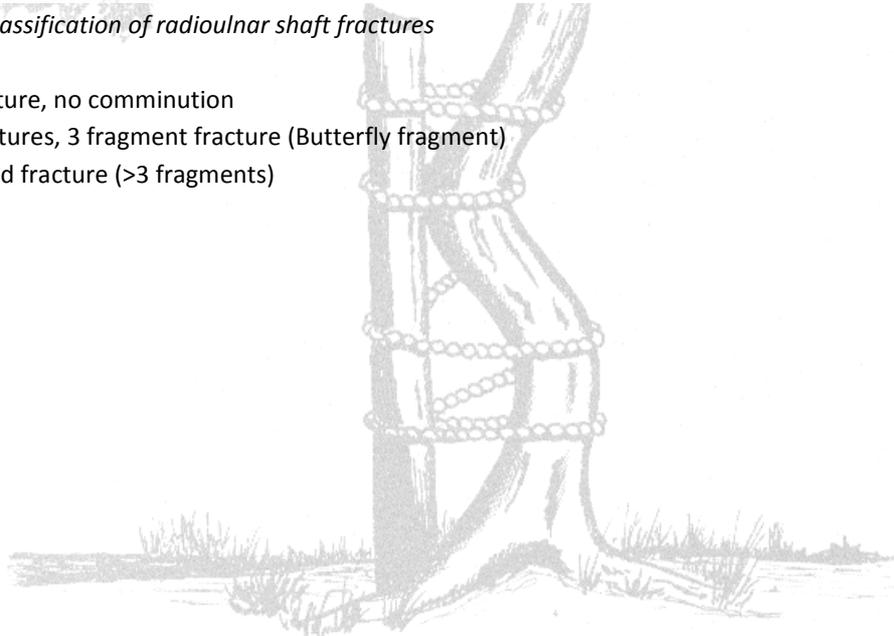


Fig. 1. AO-Classification of humerus shaft fractures according to Müller et al. (27)

Similar to AO classification of radioulnar shaft fractures

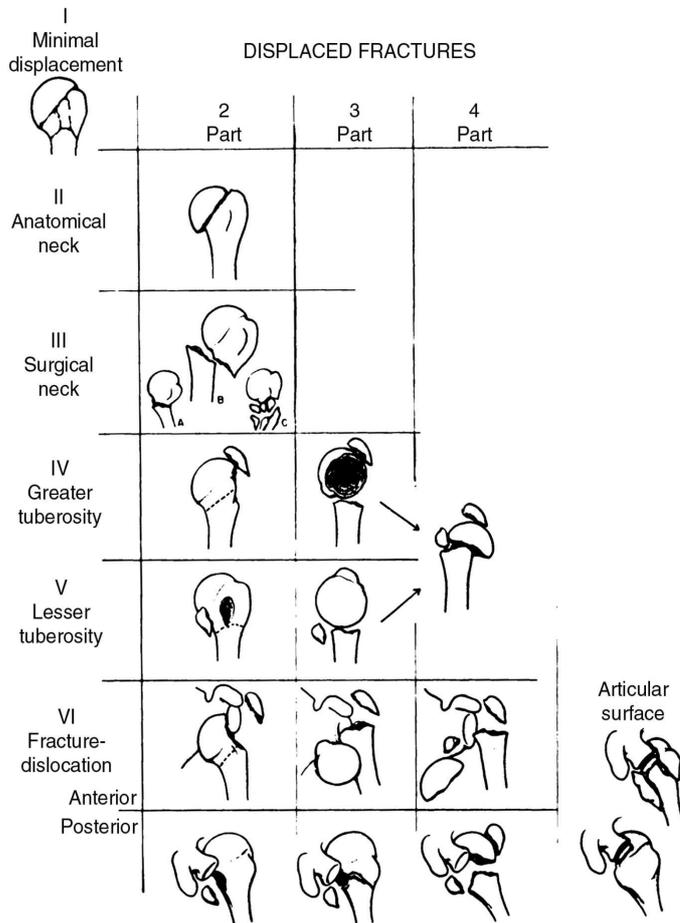
- A – Simple fracture, no comminution
- B – Wedge fractures, 3 fragment fracture (Butterfly fragment)
- C – Comminuted fracture (>3 fragments)



Maug to Okeke

# PROXIMAL HUMERAL FRACTURES

## Neer's Classification

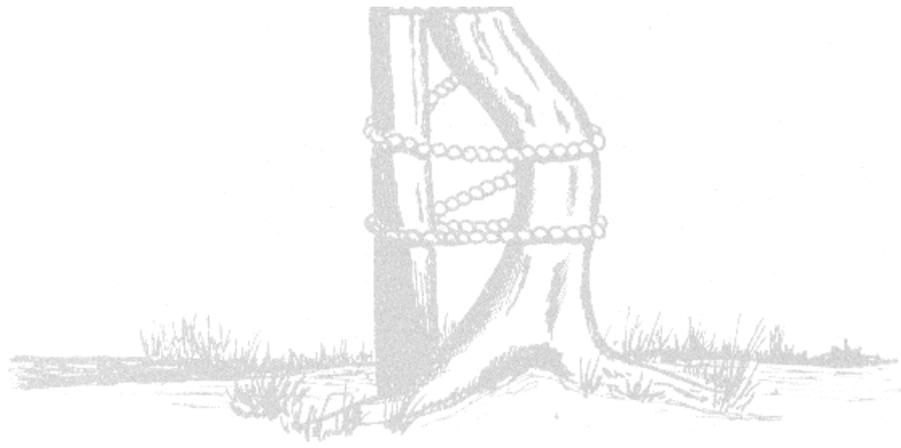


**The 4 Parts**

- Greater tuberosity
- Lesser tuberosity
- Articular surface
- Shaft

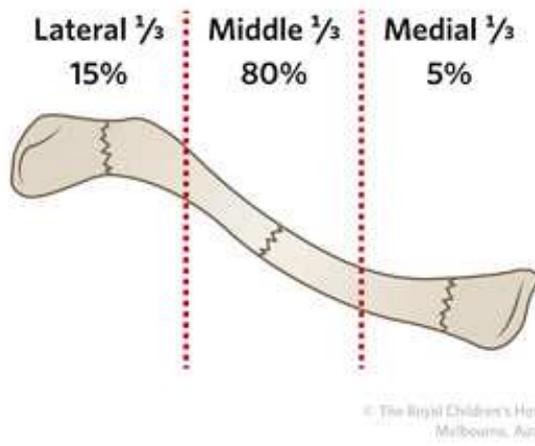
**Neer's definition of displacement**

- >1cm displacement
- >45° angulation



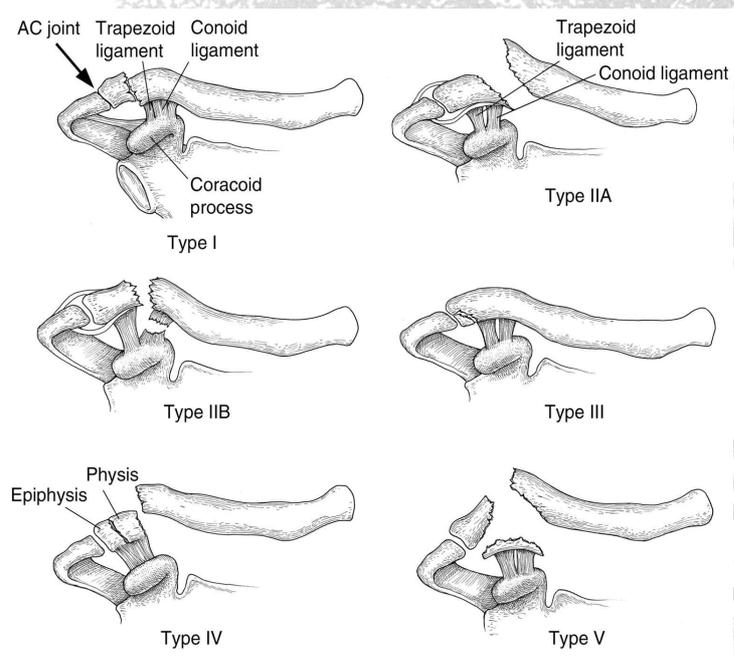
*Mayo Okeke*

1) Allman Classification



- Group I – Middle third fractures
- Group II – Lateral third fractures
- Group III – Medial third fractures

2) Neer's Classification of Allman Group II fractures (Lateral Third)



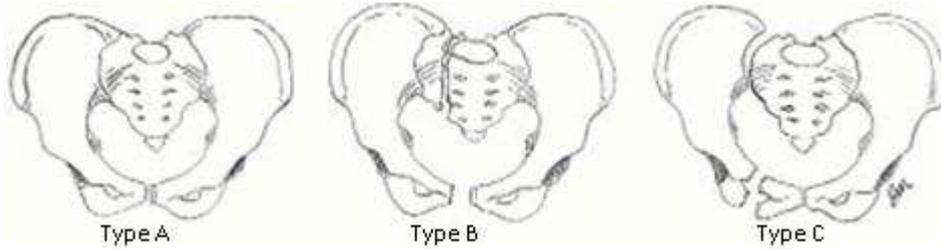
- I - Fracture lateral to coracoclavicular ligaments (trapezoid and conoid)
- II - Fracture medial to the coracoclavicular ligament
  - A - Both ligaments intact
  - B - Conoid torn, trapezoid attached to distal fragment
- III - Intra-articular extension into acromioclavicular joint
- IV - Fracture in children, intact coracoclavicular ligaments attached to periosteal sleeve, proximal fragment displaced
- V - Comminuted fracture

**NB:** Neer in 1968 described only I to III. Rockwood created subsets of Type II – A and B. Type IV and V was added by Craig. Hence this single classification is named differently by authors as Neer, Rockwood or Craig classification.

*Handwritten signature: May 10 Okeke*

**PELVIC RING**

**1) Tile Classification of Pelvic Ring fractures - based on the integrity of posterior sacroiliac complex**



**A – Stable (Posterior arch intact)**

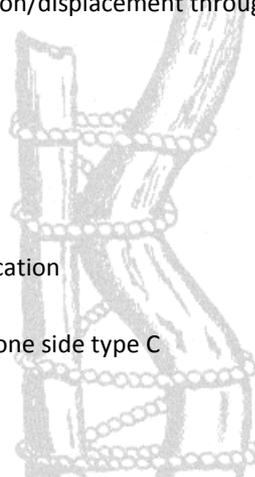
- A1: fracture not involving the ring (avulsion or iliac wing fracture)
- A2: stable or minimally displaced fracture of the ring e.g isolated pubic ramus fracture
- A3: transverse sacral fracture (Denis zone III sacral fracture)

**B – Rotationally unstable vertically stable (incomplete disruption of posterior arch)**

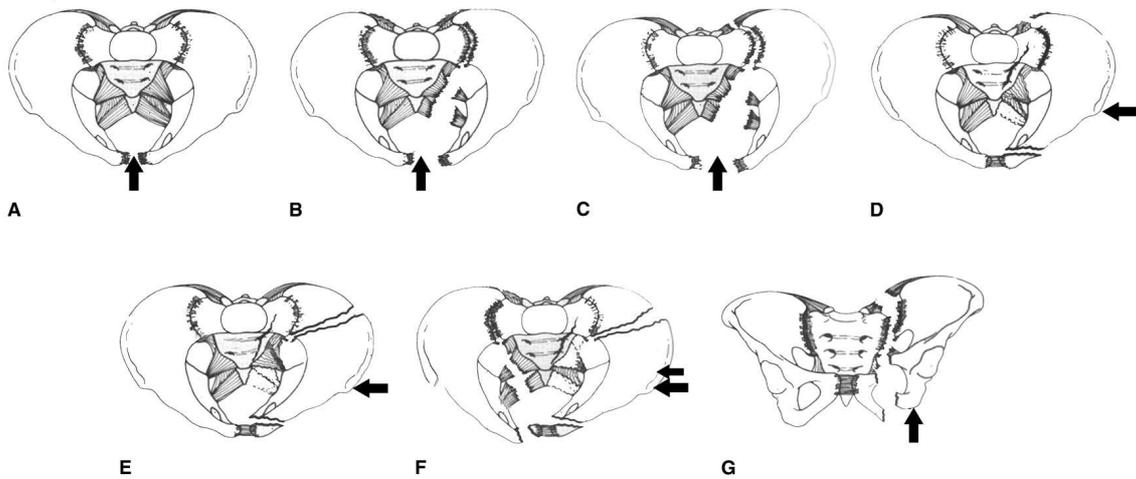
- B1: open book injury (external rotation) e.g symphyseal diasthesis
- B2: lateral compression injury (internal rotation) e.g fracture of both pubic rami on the same side
  - B2-1: with anterior ring rotation/displacement through ipsilateral rami
  - B2-2: with anterior ring rotation/displacement through contralateral rami (bucket-handle injury)
- B3: bilateral

**C – Rotationally and vertically unstable**

- C1: unilateral
  - C1-1: iliac fracture
  - C1-2: sacroiliac fracture dislocation
  - C1-3: sacral fracture
- C2: bilateral with one side type B and one side type C
- C3: : bilateral with both sides type C



2) Young-Burgess Classification of Pelvic Ring fractures – based on mechanism of injury



Anterior Posterior compression APC

- I – symphysis widening <2.5cm,
- II - symphysis widening >2.5, Anterior sacroiliac joint tear, posterior intact
- III – disruption of both anterior and sacroiliac joints

Lateral compression LC

- I – ramus fracture + ipsilateral sacral alar compression fracture
- II – rami fracture + ipsilateral posterior ilium fracture
- III – ipsilateral LC ( I/II) + contralateral APC

Vertical shear - posterior and superior directed force. (Associated with the highest risk of hypovolemic shock (63%); mortality rate up to 25%)

Combined injury

## ACETABULAR FRACTURES

### Letournel and Judet Classification

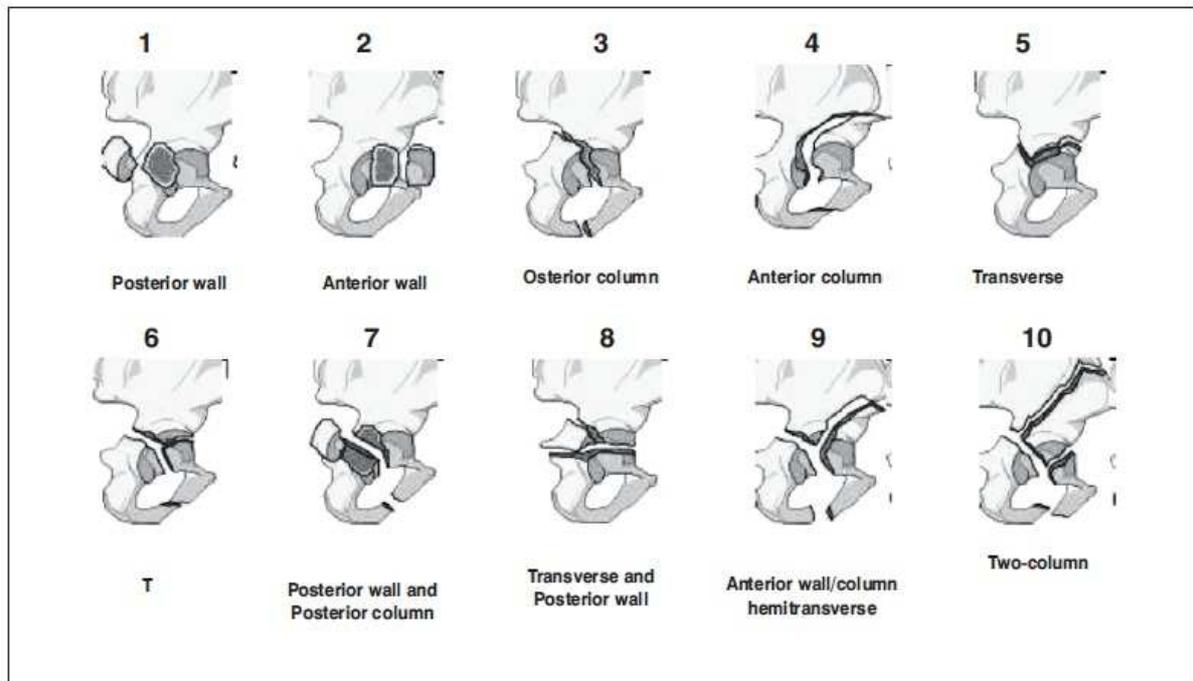


Figure 1. Classification of Judet and Letournel.

#### Elementary (simple) fracture

- Posterior wall
- Posterior column
- Anterior wall
- Anterior column
- Transverse



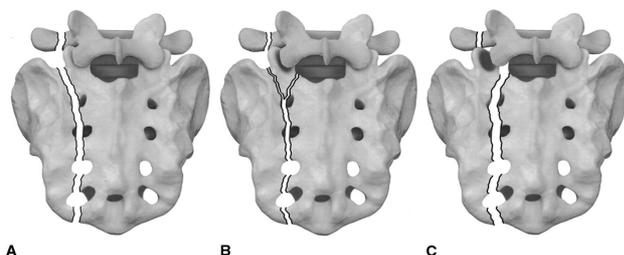
#### Associated (combined)

- T-shaped
- Anterior wall/column + posterior hemi transverse
- Transverse + posterior wall
- Posterior column + posterior wall
- Both column



## SACRAL FRACTURES

### Dennis Classification

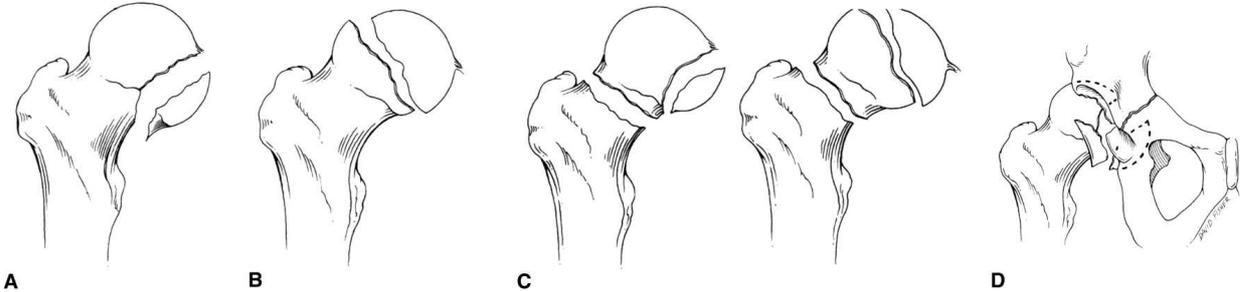


- Zone I – fracture lateral to foramina
- Zone II – fracture through foramina
- Zone III – Fracture medial to foramina extending into spinal canal

## FEMUR

### FEMORAL HEAD

#### Pipkin Classification of Femoral head fractures



I – Fracture below ligamentum fovea (small)

II – Fracture above ligamentum fovea (large)

III – Type I or II with femoral neck fracture

IV – Type I or II with acetabular fracture

### PROXIMAL FEMORAL FRACTURES

#### 1) Anatomic Classification

##### Intracapsular

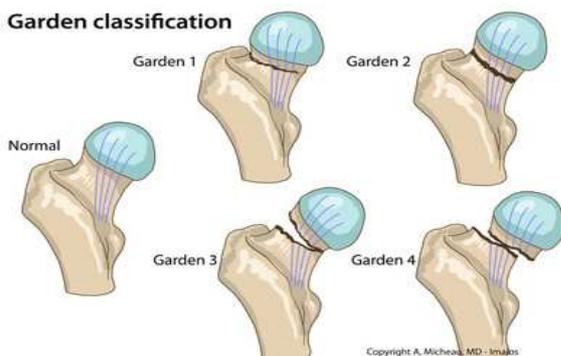
- Subcapital
- Transcervical
- Basicervical

##### Extracapsular

- Intertrochanteric
- Subtrochanteric

#### 2) Garden Classification of femoral neck fractures

##### Garden classification



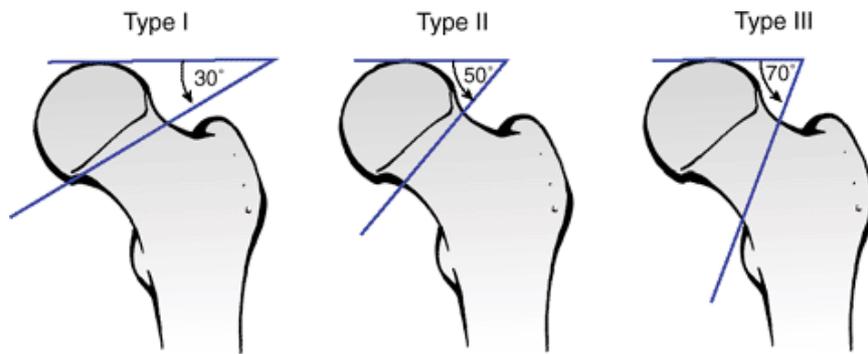
I – Incomplete fracture, impacted in valgus, trabecular lines of inferior neck are still intact

II – Complete but no displacement, trabecular lines are interrupted by fracture line across entire femoral neck but still aligned

III – Complete with partial displacement (<50%), trabecular pattern of femoral head does not line up with those of acetabulum

IV – Completely displaced, femoral head assumes its normal position within the acetabulum, and therefore the trabecular patterns of the acetabulum and the femoral head are aligned

### 3) Pauwels Classification of femoral neck fractures



Pauwels angle- The angle formed by extending the fracture line upwards to meet an imaginary horizontal line drawn through the transtuberular (iliac crest) plane on AP film is described as "Pauwels' angle." The higher the value of this angle, the greater is the instability of the fracture.

I – Pauwels angle  $<30^\circ$

II – Pauwels angle between  $30^\circ$  and  $50^\circ$

III – Pauwels angle  $>70^\circ$

### 4) Delbert Classification of femoral neck fractures in Children

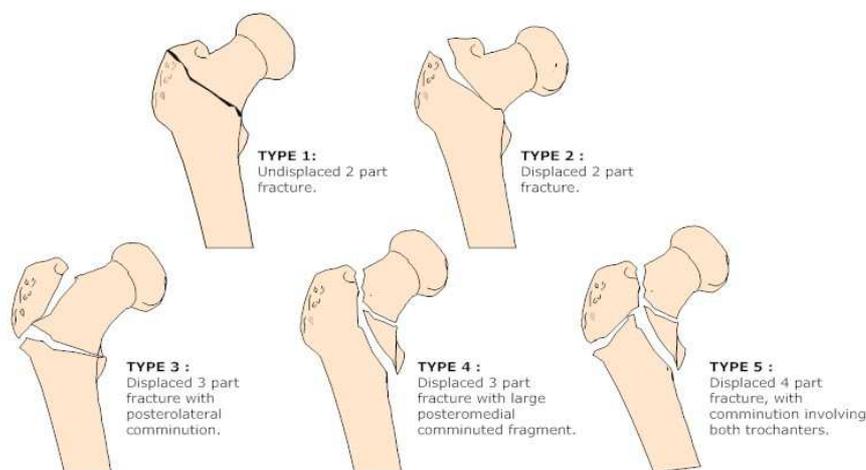
I – Trans-epiphyseal, AVN 100% risk

II – Transcervical, AVN – 50%

III – Cervicotrochanteric, AVN – 30%

IV – Intertrochanteric, AVN – 10%

### 5) Evans Classification of Intertrochanteric Femoral fracture

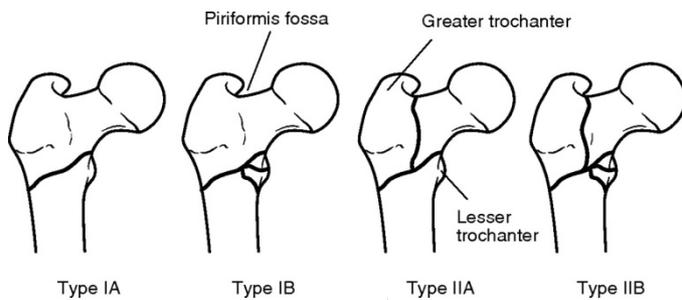


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**Other Classifications of intertrochanteric Femoral fracture**

|                  |         |        |
|------------------|---------|--------|
| Boyd and Griffin | Tronzo  | Jensen |
| Ramadier         | Briot   | AO     |
| Ender            | Deburge | e.t.c  |

**7) Russell-Taylor Classification of Subtrochanteric Femoral fractures**



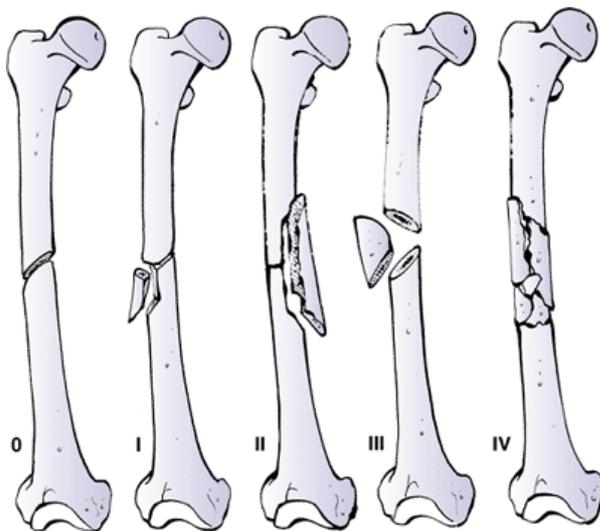
- I – Fracture do not extend into Piriformis fossa
  - A – no comminution of lesser trochanter
  - B – comminution of lesser trochanter
- II – Fracture extend into Piriformis fossa
  - A - no comminution of lesser trochanter
  - B - comminution of lesser trochanter

**Other Classifications of Subtrochanteric fractures**

|                 |                |             |
|-----------------|----------------|-------------|
| Murray and Frew | Cech and Sonsa | Zickel      |
| Watson          | Seinscheimer   | Waddell     |
| Fielding        | Harris         | Ungar e.t.c |

**FEMORAL SHAFT**

**1) Winquist and Hansen Classification of Femoral Shaft fractures**



- 0 – No comminution
- I – Minimal comminution, comminuted fragment <25% of width of femoral shaft
- II – Comminuted fragment involve 25% to 50%
- III – Comminuted fragment >50%, small contact between proximal and distal fragment
- IV – Comminution involve the entire circumference, no cortical contact

## 2) AO Classification of Femoral Shaft fractures

Similar to humeral and radioulnar shaft fractures

A – Simple fractures

B – Wedge fractures

C – Complex fractures

### Others

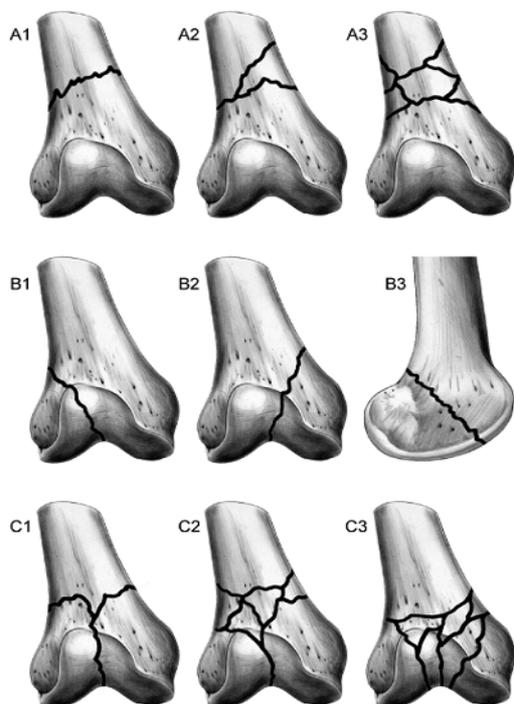
Dencker

Provost and Morris

## DISTAL FEMUR

### 1) Muller AO Classification of Supracondylar Femoral fracture

*Similar to AO Classification of distal humeral and radial fractures*



#### A - Extraarticular fracture

- A1: simple
- A2: metaphyseal wedge and/or fragmented wedge
- A3: metaphyseal complex

#### B: Partial articular fracture

- B1: lateral condyle, sagittal
- B2: medial condyle, sagittal
- B3: frontal

#### C: Complete articular fracture

- C1: articular simple, metaphyseal simple
- C2: articular simple, metaphyseal multifragmentary
- C3: articular multifragmentary

### Other Classifications of distal femoral fractures

Neer

Schatzker and Tile

Seinsheimer

Classification of Patella fractures

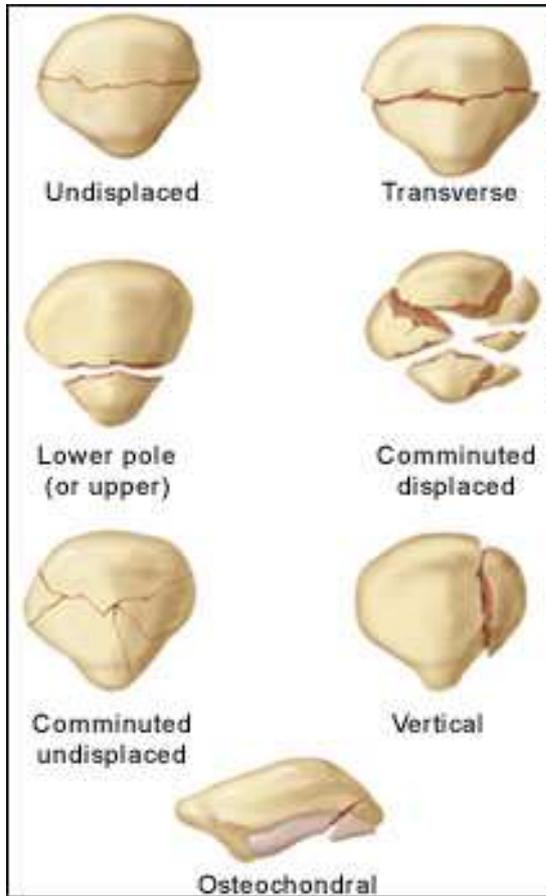
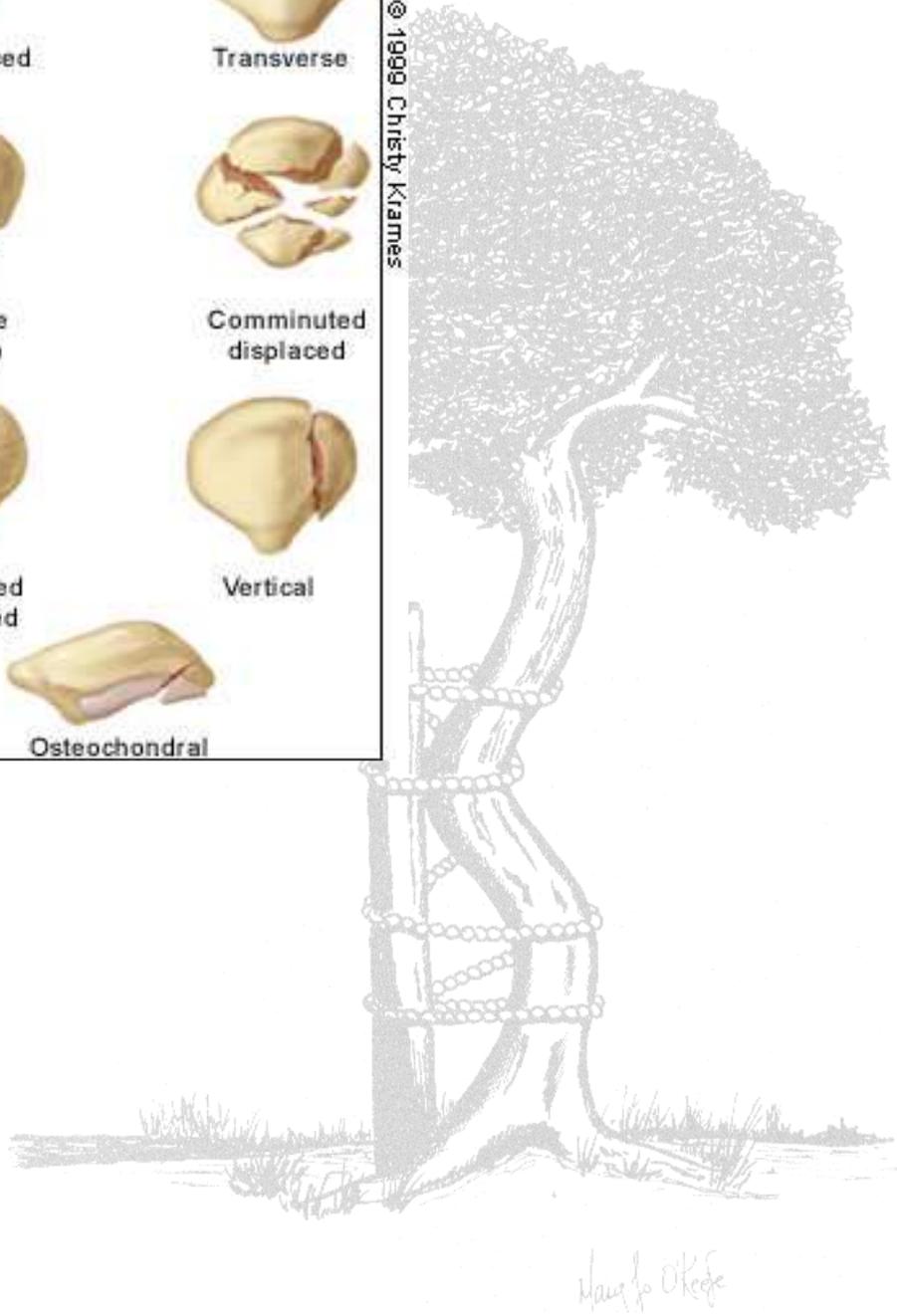
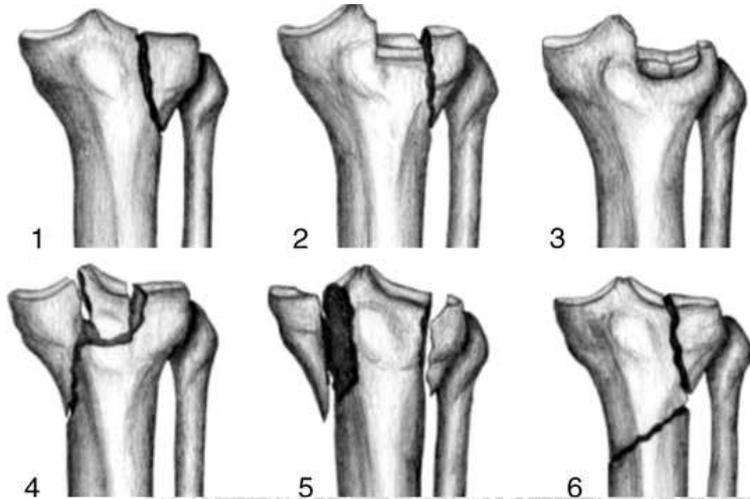


Illustration © 1999 Christy Krames



**PROXIMAL TIBIAL FRACTURES**

**1) Schatzker Classification of Tibial plateau fractures**



- I – Lateral split fracture
- II – Split-depressed fracture of lateral plateau
- III – Pure depression fracture of lateral plateau
- IV – Medial plateau fracture
- V – Bicondylar fracture
- VI – Metaphyseal-diaphyseal disassociation

**2) AO Classification of Tibial Plateau fractures**

**A - Non-articular**

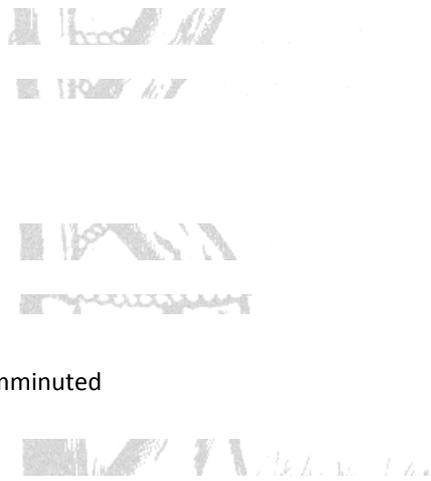
- A1 – Avulsions
- A2 – Simple metaphyseal
- A3 – Comminuted metaphyseal

**B: Partial articular**

- B1 – Pure split
- B2 – Pure depression
- B3 – Split depression

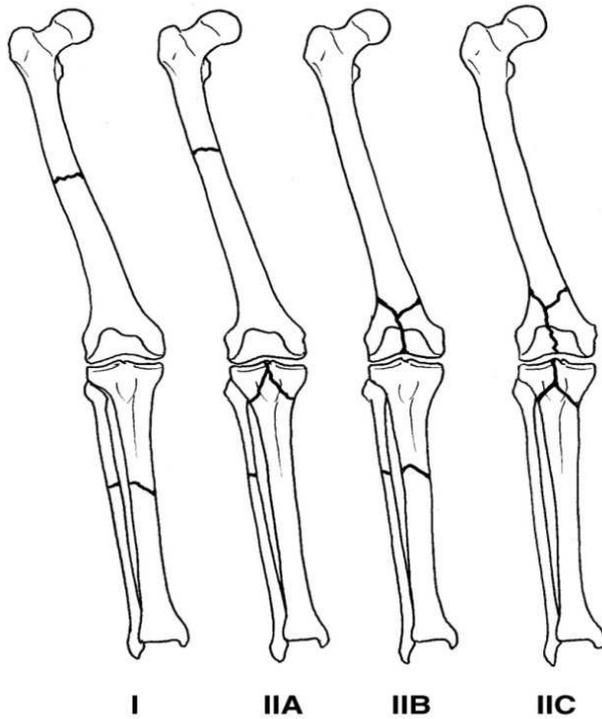
**C: Complete articular**

- C1 – Simple
- C2 – Articular simple, metaphyseal comminuted
- C3 – Articular comminution



## FLOATING KNEE (Ipsilateral fractures of femur and tibia)

### 1) Fraser Classification



I – Extra-articular fractures

II A – Tibial plateau fracture and femoral shaft fracture

II B – Intra-articular distal femoral fracture and tibial shaft fracture

II C – Intra-articular fractures of both tibial plateau and distal femur

## TIBIOFIBULAR SHAFT FRACTURES

### 1) AO Classification

*A modification of John and Wruh's classification. Still named as such by some authors*

*Similar to AO Classification of radioulnar, humeral and femoral shaft fractures*

A – Simple

B – Wedge

C – Complex

## 2) Modified Ellis Classification of Tibial fractures

The system incorporates soft tissue injury grading by Gustilo-Anderson (open) and Tscherne (closed).



### Minor

- Displacement - 0-50% displacement
- Comminution - No or minimal comminution
- Wound - No or small open wound (open grade I, closed grade 0)
- Energy/fracture pattern - Low energy/spiral fracture pattern

### Moderate

- Displacement - 51-100% displacement
- Comminution - Minimal comminution, butterfly segment
- Wound – open grade II, closed grade I
- Energy/fracture pattern - Moderate energy/oblique or transverse fracture pattern

### Major

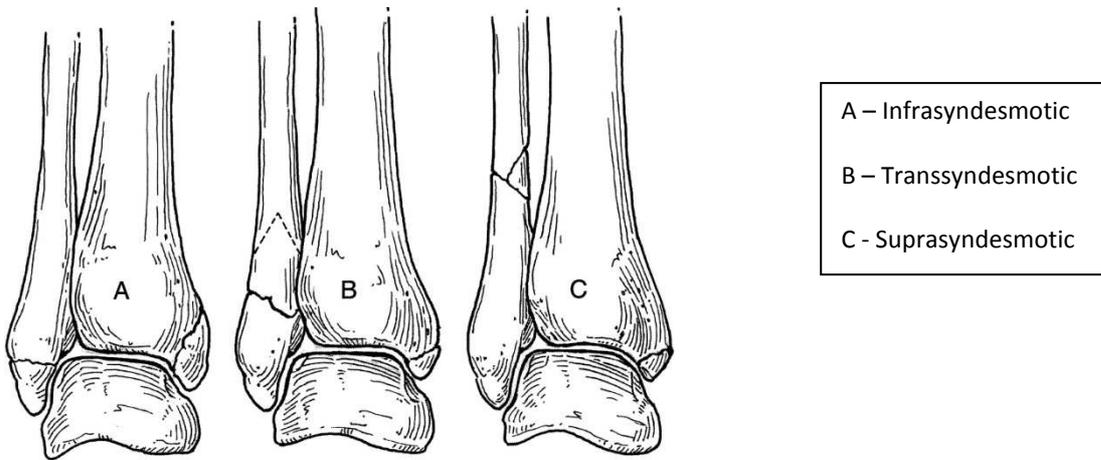
- Displacement - 100% displacement
- Comminution - 2 or more free fragments, segmental fracture
- Wound – open grades III-IV, closed grades II-III
- Energy/fracture pattern – High, crushing/transverse or fragmented

*The factor of greatest severity is used to grade the fracture i.e a spiral fracture pattern (minor) with open grade II wound (moderate) and 3 free fragments (major) is overall classified as Major*

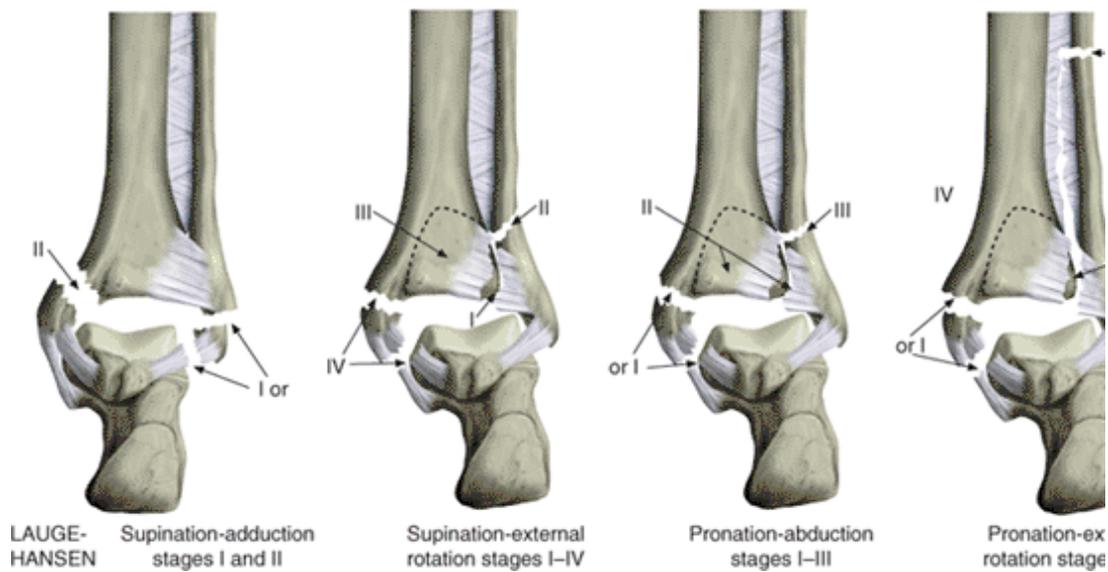
## 3) Others

- General classifications systems like Gustilo-Anderson classification of open fractures and Tscherne of closed are more commonly used for Tibial fracture classification
- Winquist and Hansen classification of femoral fractures has been applied to Tibia by Henley
- Nicoll classification

1) Danis-Weber Classification of ankle fractures (AO Classification)



2) Lauge-Hansen Classification of Ankle fractures



Supination-Adduction (SA)

- transverse lateral malleolar fracture below the tibial plafond
- vertical shearing fracture of the medial malleolus

Supination-External rotation (SER)

- anterior syndesmotom injury
- oblique fibular fracture at the level of the plafond
- posterior syndesmotom injury and posterior malleolar fracture
- medial malleolar fracture or deltoid avulsion

### Pronation-External rotation (PER)

- transverse medial malleolar/deltoid injury
- anterior syndesmotic injury
- short oblique fracture of fibula above syndesmosis
- posterior syndesmosis injury or posterior malleolar fracture

### Pronation-Abduction (PA)

- medial malleolar/deltoid avulsion
- syndesmotic injury with interosseous membrane tear
- high fibular fracture

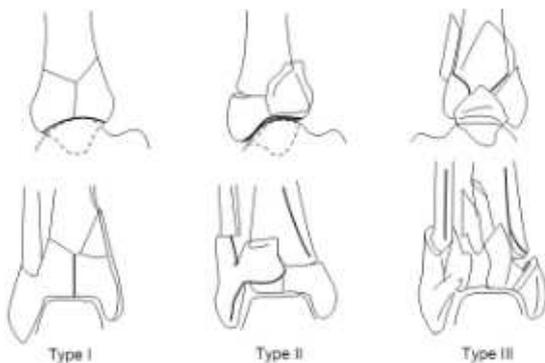
## 3) Anatomic Classification

Unimalleolar

Bimalleolar

Trimalleolar

## 4) Ruedi and Allgower Classification of Tibia plafond fractures



Ruedi & Allgower classification of pilon (tibial plafond) fractures.  
(Reproduced with permission from Ruedi, T. P. & Allgower, M. The operative treatment of intra-articular fractures of the lower end of the tibia. *Clin. Orthop. Relat. Res.*, **138**, 105-110, 1979.)

I – Nondisplaced

II – Simple displacement with incongruous joint

III – Comminuted articular surface

## TALAR NECK

### Hawkins Classification of Talar neck fractures

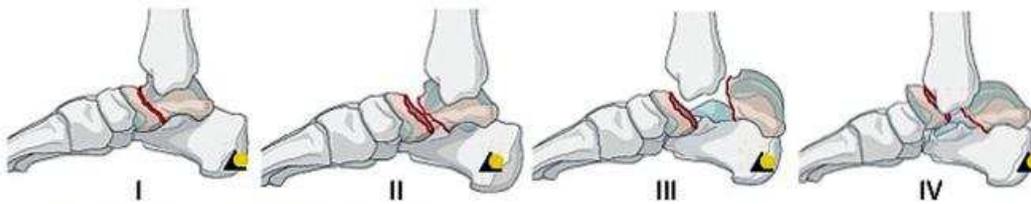


Fig. 2. Hawkins talar neck classification; types I-IV.

I – Nondisplaced, 0-13% risk of AVN

II – Subtalar dislocation, 20-50% risk of AVN

III – Subtalar and tibiotalar dislocation, 20-100% risk of AVN

IV – Subtalar, tibiotalar and talonavicular dislocations, 70-100% risk of AVN

## CALCANEUS

### 1) Classification of Calcaneus fractures

Extra-articular – 25%

Intra-articular – 75%

### 2) Sanders Classification of Intra-articular Calcaneus fractures

*Based on number of articular fragments seen on coronal CT*

I – Nondisplaced

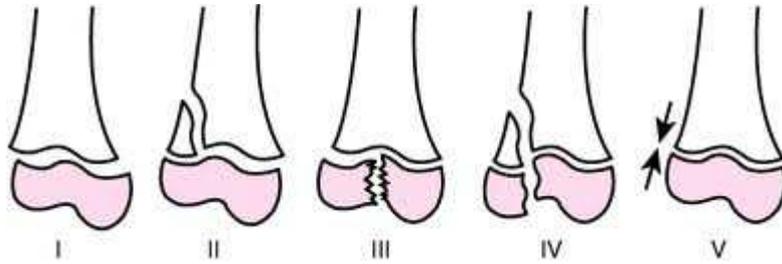
II – Two articular fragments

III – Three articular fragments

IV – More than three articular fragments

## CLASSIFICATION OF EPIPHYSEAL FRACTURES IN CHILDREN

### 1) Salter-Harris Classification



I – S – Shift/Slipped; fracture through the physis, 5-7%

II – A – Above; Fracture across the physis and up through the metaphysis, commonest, 75%

III – L – Lower; Fracture through the physis and down through the epiphysis, 7-10%

IV – T – Through; Fracture plane passes through the metaphysis, physis and the epiphysis, 10%

V – R – Rammed/Ruined; crushing type injury, damages the physis by compressing it, <1%

### 2) Others

|             |        |          |         |
|-------------|--------|----------|---------|
| Poland      | Aitken | Ogden    | Rang    |
| Peterson    | Weber  | Brashear | Shapiro |
| Bergenfeldt | Smith  | e.t.c    |         |

