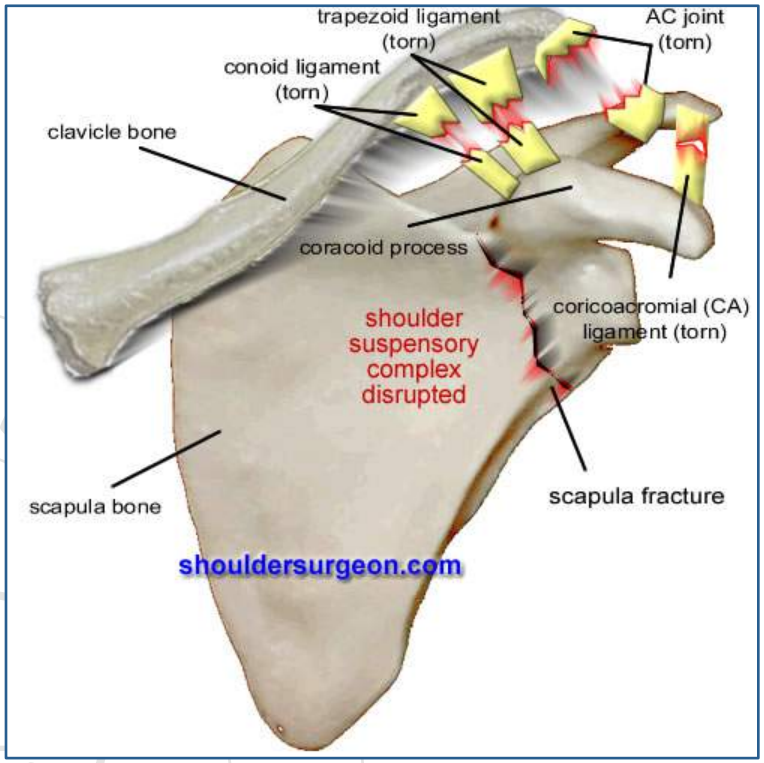
Fractures of upper extremity



Presenter:
László G Nőt, MD, PhD

Topics

- Scapula
- Clavicle, AC- and SC-joint
- Shoulder Dislocations
- Humerus
- Elbow
- Forearm fractures

Characteristics

- Injuries of the upper extremities impairs peoples' ability to **handle and get contact properly with their environment**.

- The upper extremity is basically **'designed'** for ***motion, not for the support of large loads!!***

Clavicle fractures

Mechanism:

- Fall onto shoulder (87%)
- Direct blow (7%)
- Fall onto outstretched hand (6%)

Clavicle fractures - Diagnostics

Clinical Evaluation:

- Inspect and palpate for deformity/abnormal motion
- Thorough distal neurovascular exam
- Auscultate the chest for PTX

Radiographic Exam:

- AP (PA) chest radiographs
- Clavicular 45deg A/P oblique X-rays
- Traction pictures may be used as well

Clavicle fractures - Classification

Medial **Middle** **Lateral** **1 / 3**

Clavicle fractures - Treatment

I. Non-operative treatment

- closed reduction
- ‘backpack’ (‘8-shaped’) sling
- arm sling, Gilchrist / Desault bandage for 3 weeks

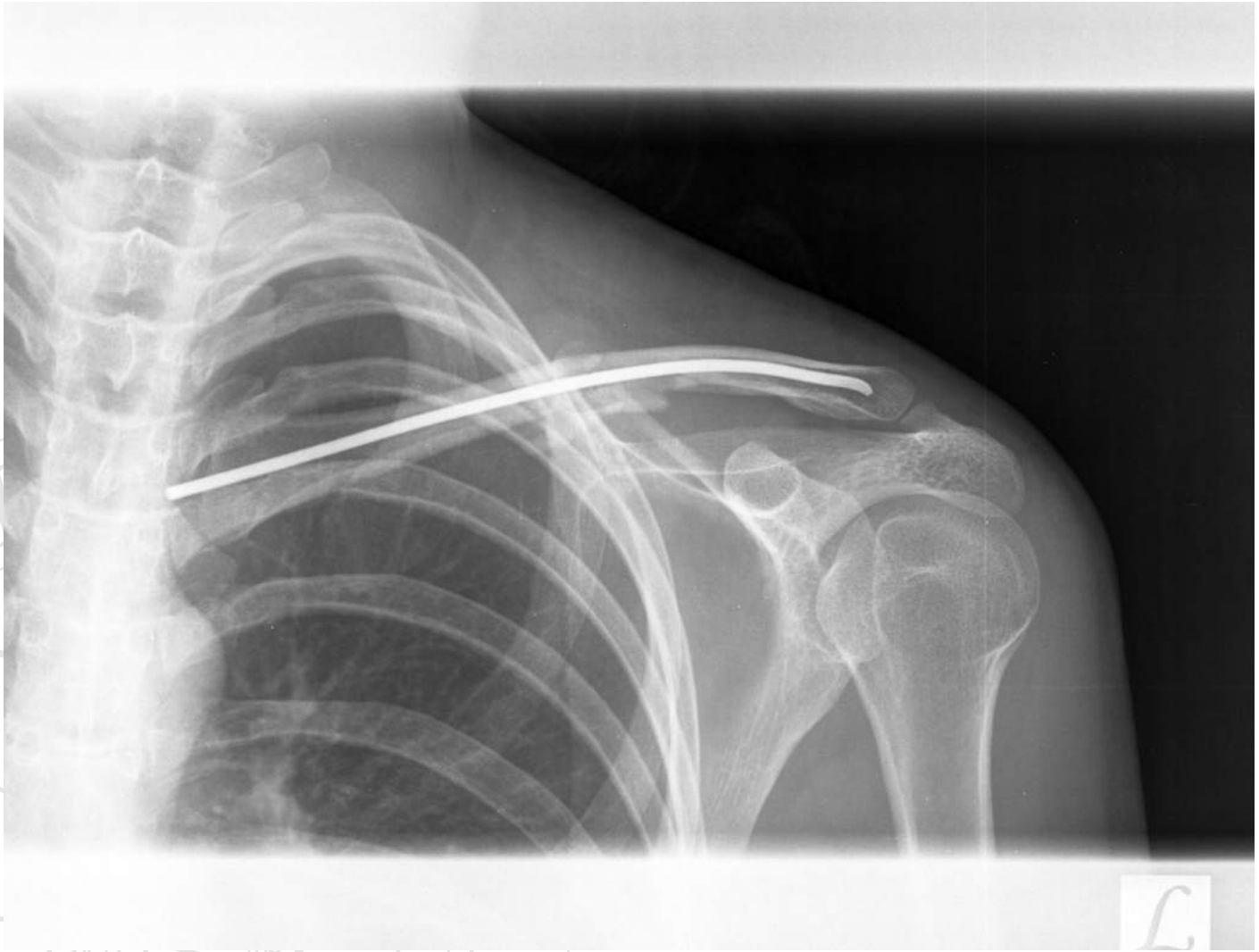
Clavicle fractures - Treatment

II. Operative treatment

- TEN (Titanium Elastic Nail) fixation
- plate OS, ‘hook’ – plate, clavicle - plate
- *distal end frx: usually operative*
- *open fracture*
- *associated with NV injury or severe chest injury*
- cosmetic reason, large deformity, nonunion, etc…

Midshaft clavicle fracture

Midshaft clavicle fracture



TEN - Titanium Elastic Nail

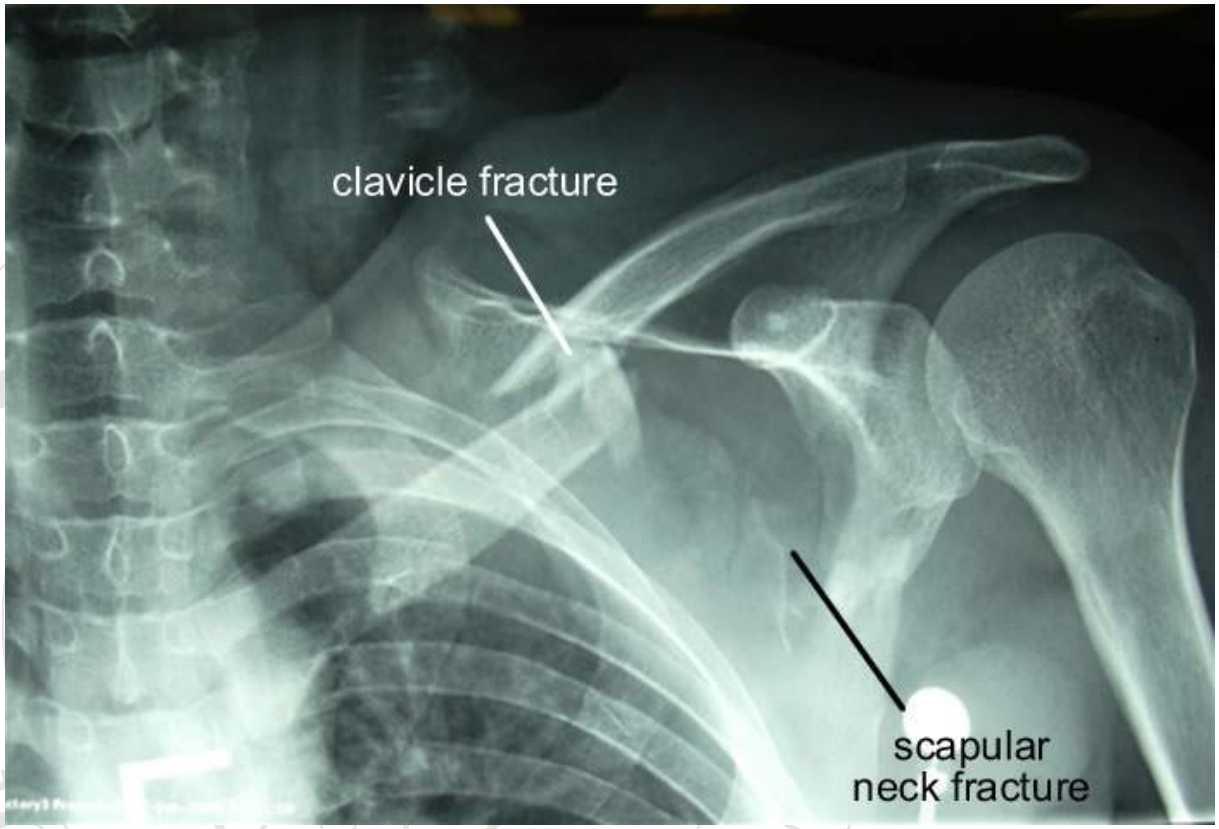
Scapula fractures

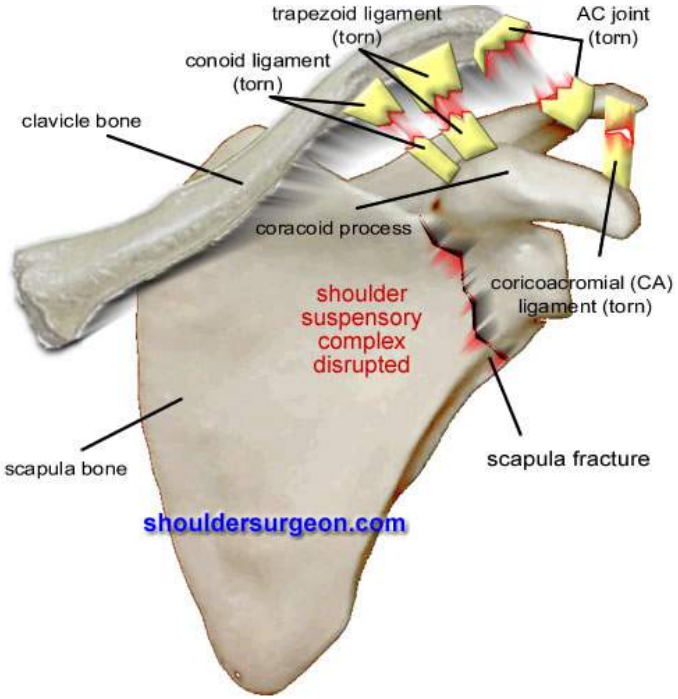
- relatively *rare injuries*
- neck and / or glenoid cavity
- **non-operative treatment:**
  - facture of the body of the scapula
  - no major dislocation of the neck
- **operative treatment:**
  - displaced neck fracture
  - closed reduction is not possible
  - involvement of glenoid cavity (articular surface!)

`Floating shoulder`

Definition: refers to ipsilateral fracture of scapula (neck) and clavicle (or AC joint injury)

Indication of operation!!



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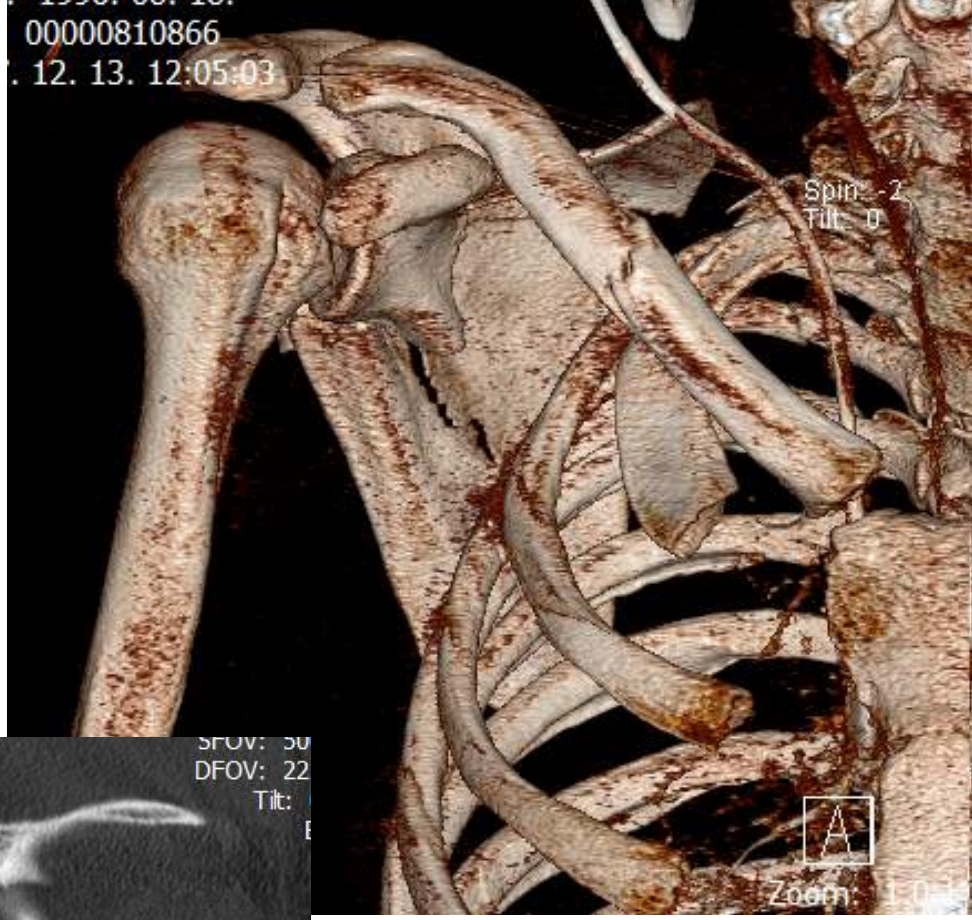
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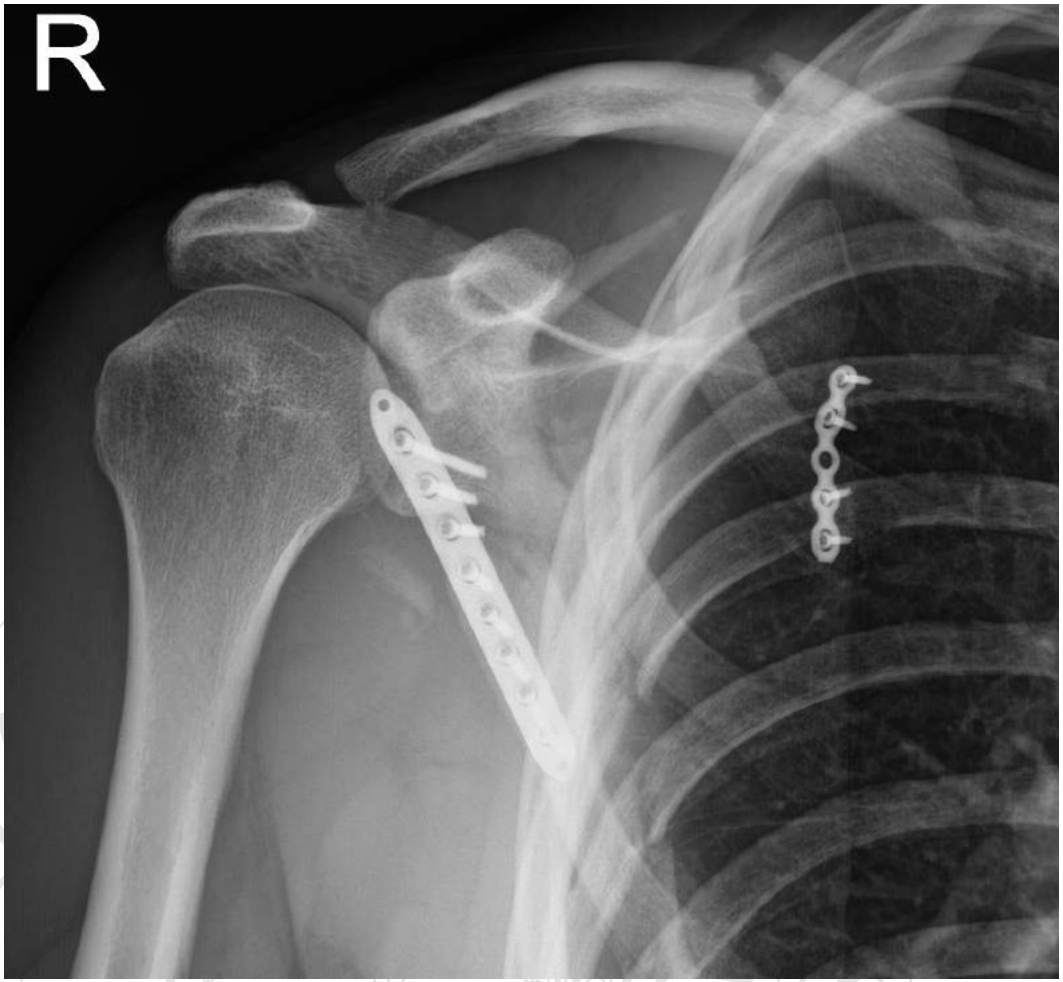
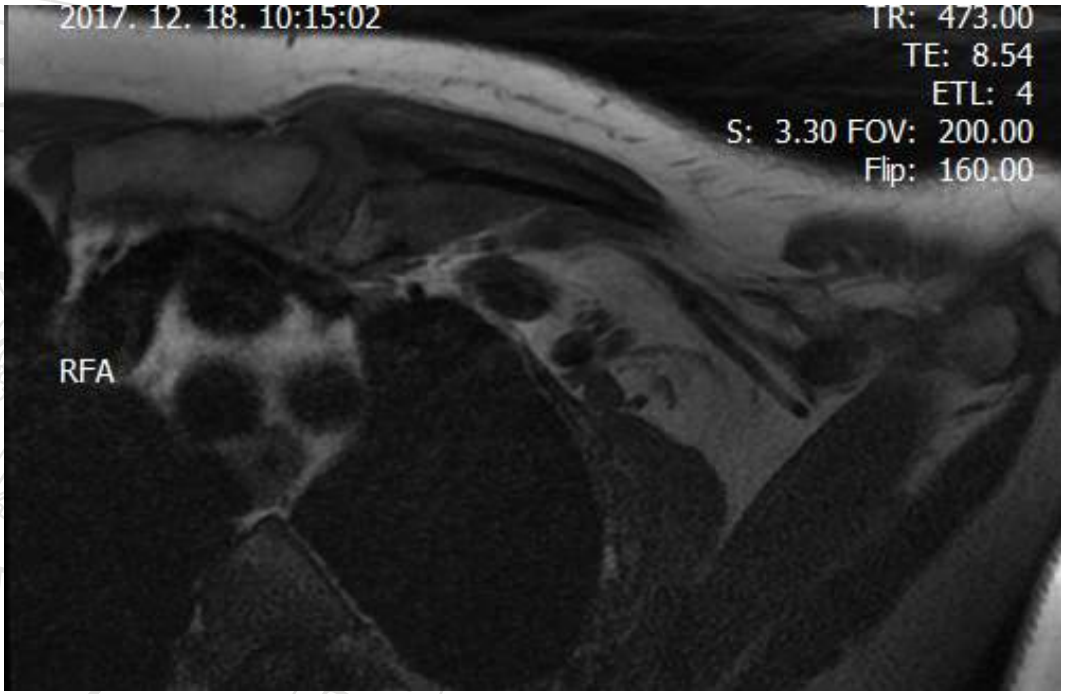
Postoperative X-rays



Sternoclavicular joint (SC) dislocations

Mechanism:

- indirect (presternal dislocation)
- direct (retrosternal dislocation) – possible injury of artery, nerve or esophagus...



Sternoclavicular joint (SC) dislocations

Treatment:

- **reduction**: relatively easy *BUT* **retention:** difficult
- **non-operative**: 3-4 weeks immobilization
- **operative**: K-wire, resection of clavicle proximal end

Acromioclavicular (AC) dislocations

Tossy classification

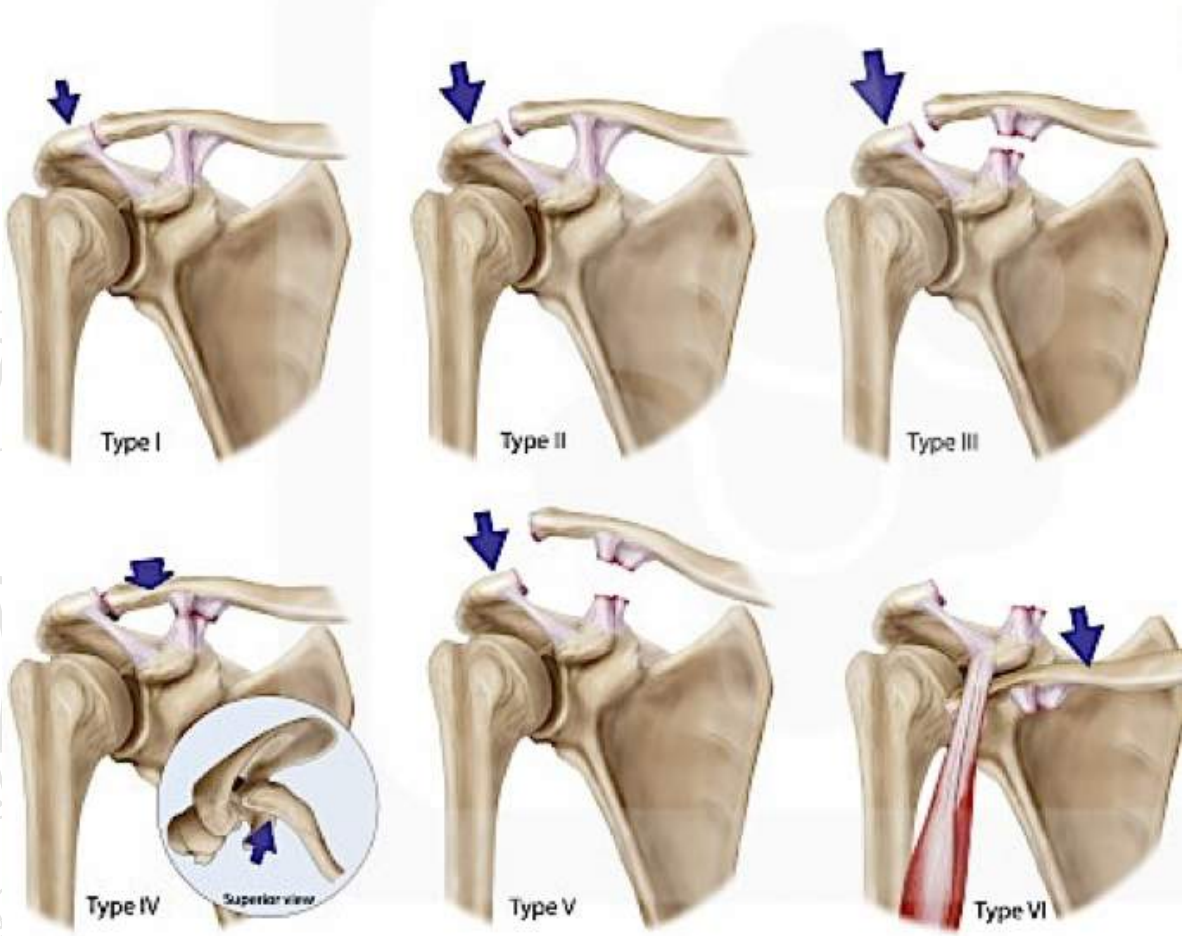
Type I

Type II

Type III

Acromioclavicular (AC) dislocations

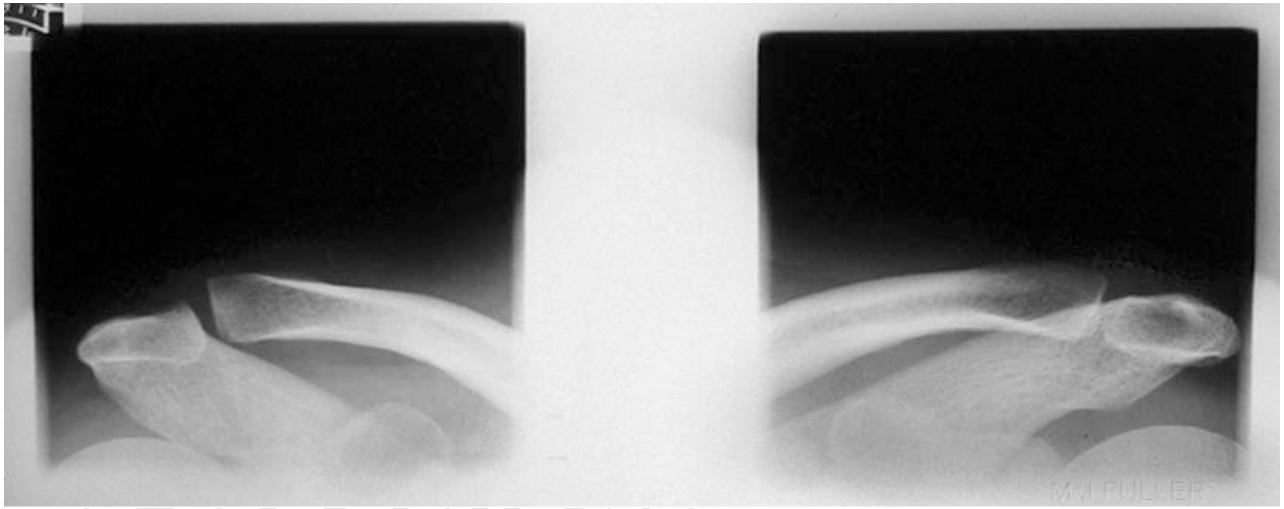
Rockwood classification

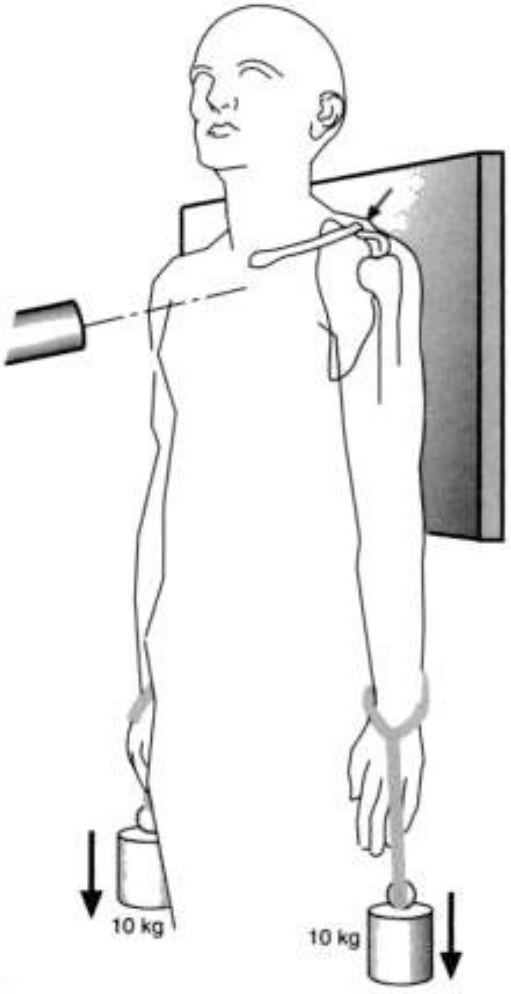


AC-dislocations - Diagnostics

- **Physical examination** – Type III: ***Typical symptom: piano key effect!!***
- **Conventional X-rays, CT - MRI**
- **Comparison X-rays**
- Type I and II injuries may be differentiated using ***stress views:*** weights are hung from the patient's wrists

AC-dislocations - Diagnostics





AC-dislocations - Treatment

Type I: Nonsurgical treatment

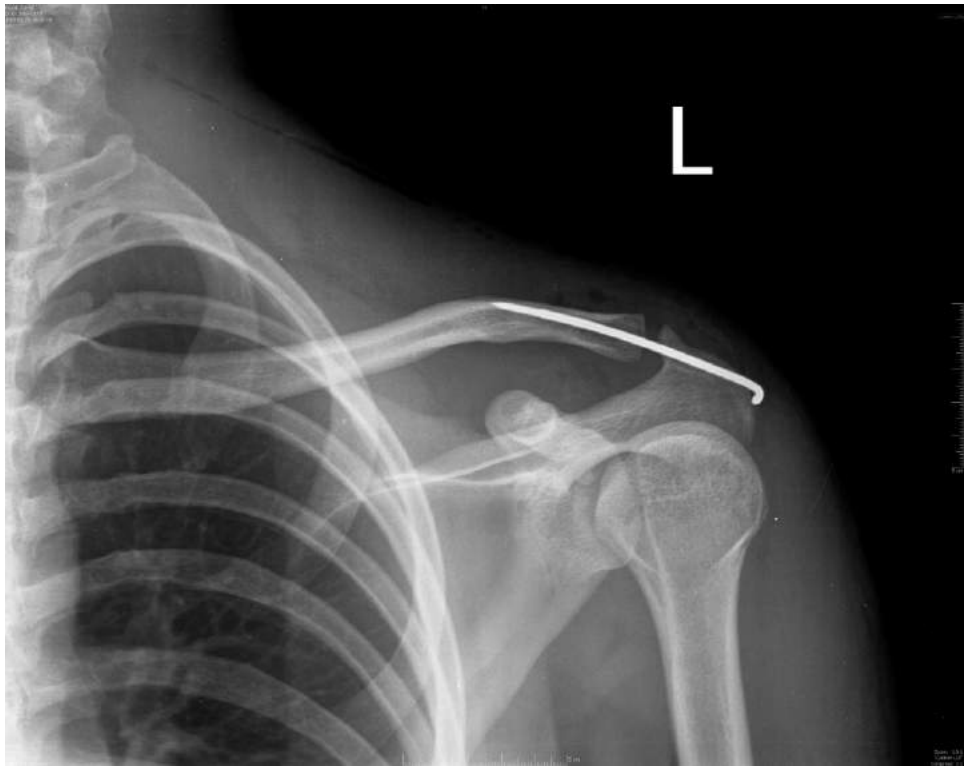
Type II: Nonsurgical or operative

Type III: Mostly surgical (debated in literature)

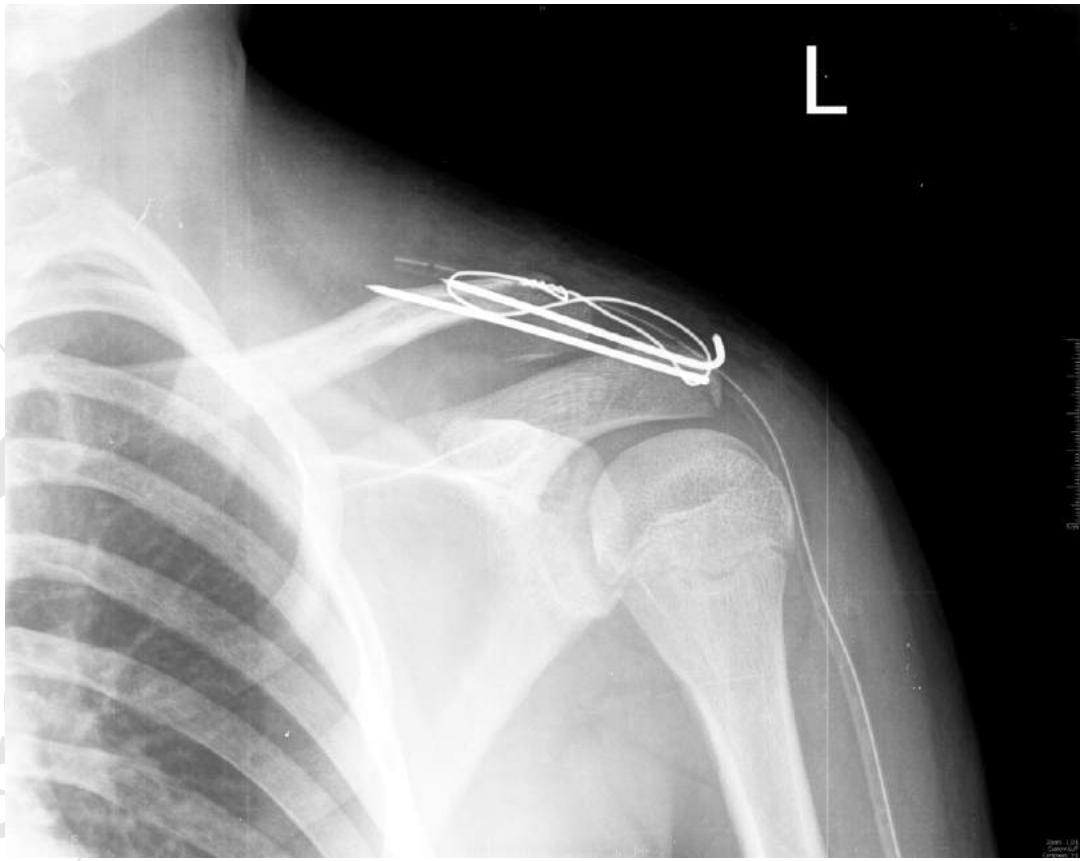
- open / closed reduction
- K-wire fixation
- tension band
- hook plate

IV - VI. Típus: Surgical indications.

AC-dislocations – K-wire

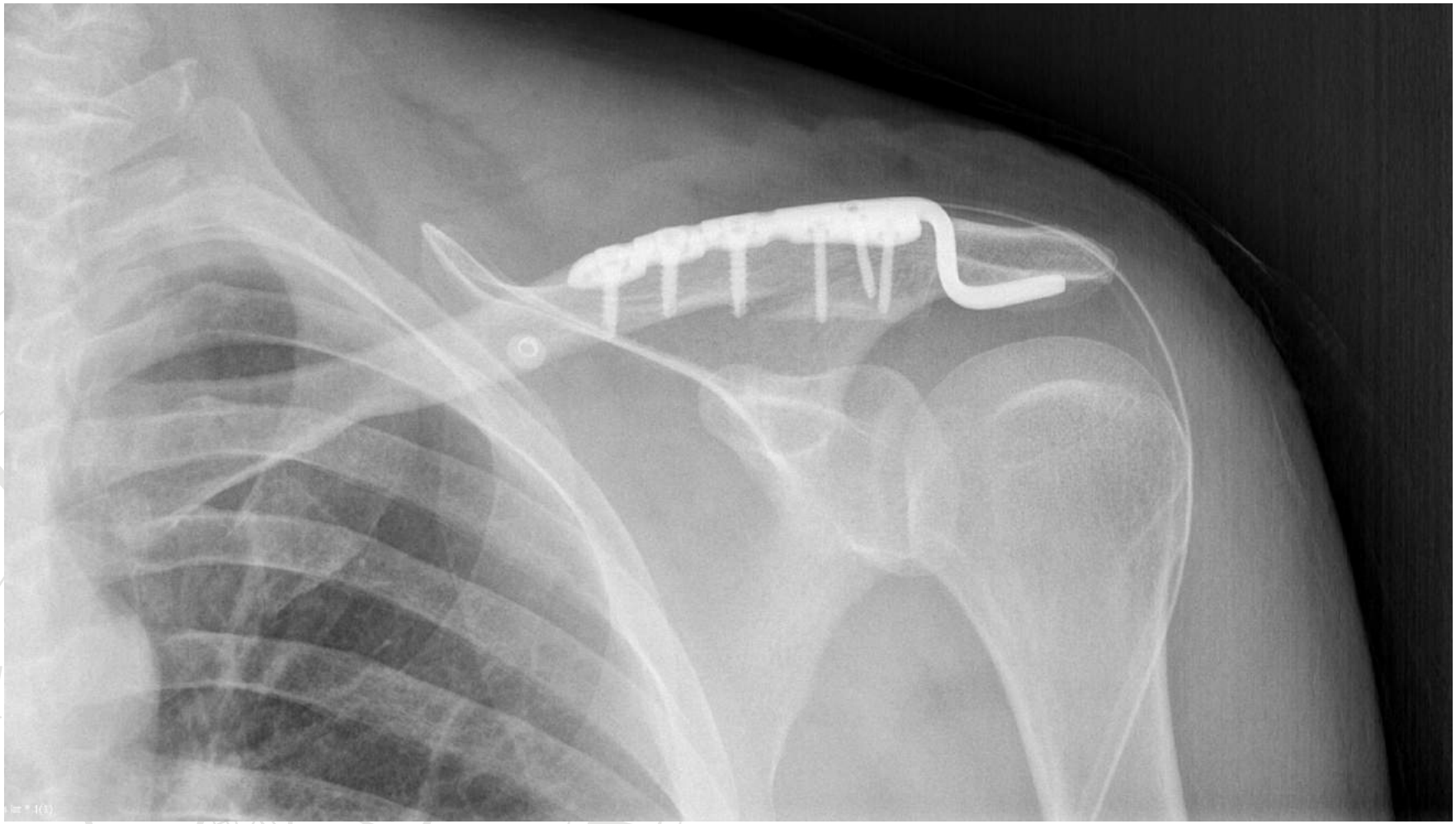


Lateral clavicle fracture – tension band

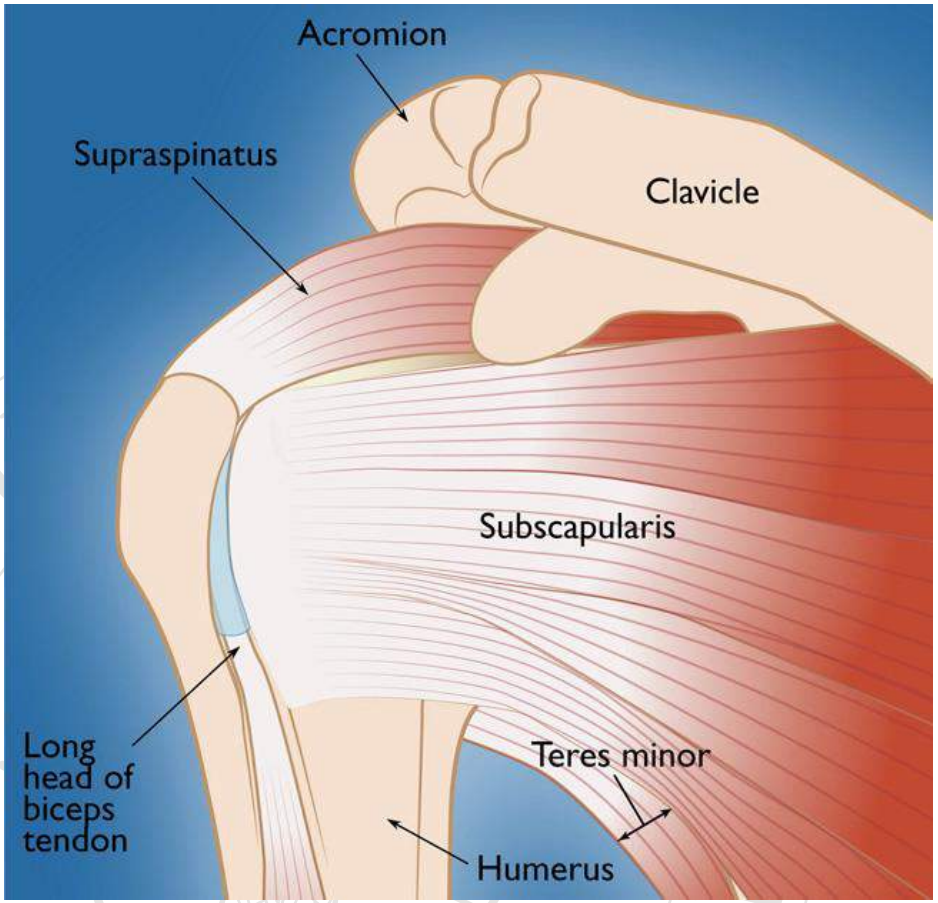


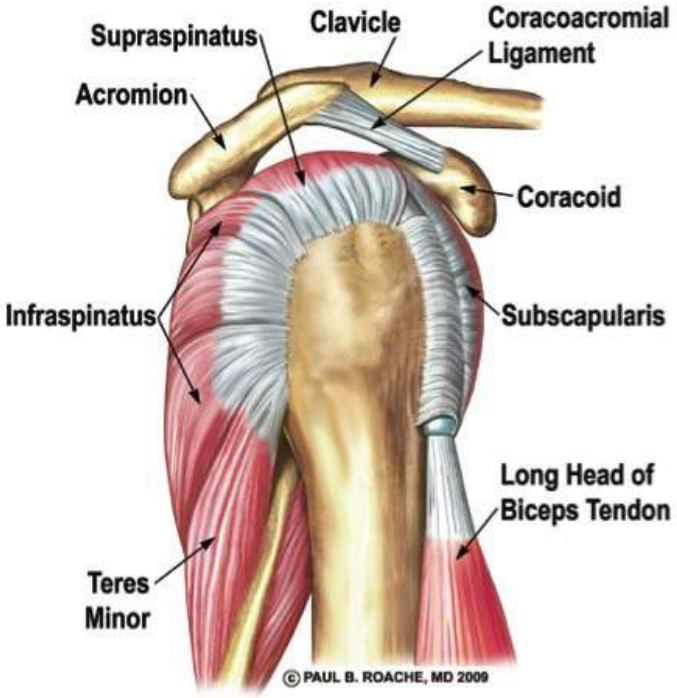
Lateral clavicle fracture

Hook plate



Rotator cuff = motion + stability





Shoulder dislocations

- **Anterior:** *most common*
- **Posterior:** <10%, electrocutions & seizures
- **Inferior (Luxatio Erecta):** rare, ‘hyperabduction’ injury

- **Glenoid** is **empty, elastic rigidity**
- **Conventional X-rays** (AP, axillary, Y views)
- **CT-scan / MRI: soft tissue, R.O.C.**

Shoulder dislocations

Look for associated injuries!!

A, Bone: Bankart, Hill-Sachs lesion, greater tubercle fx

B, Soft tissue: Rotator cuff

C, Vascular: axillar artery (atherosclerosis)

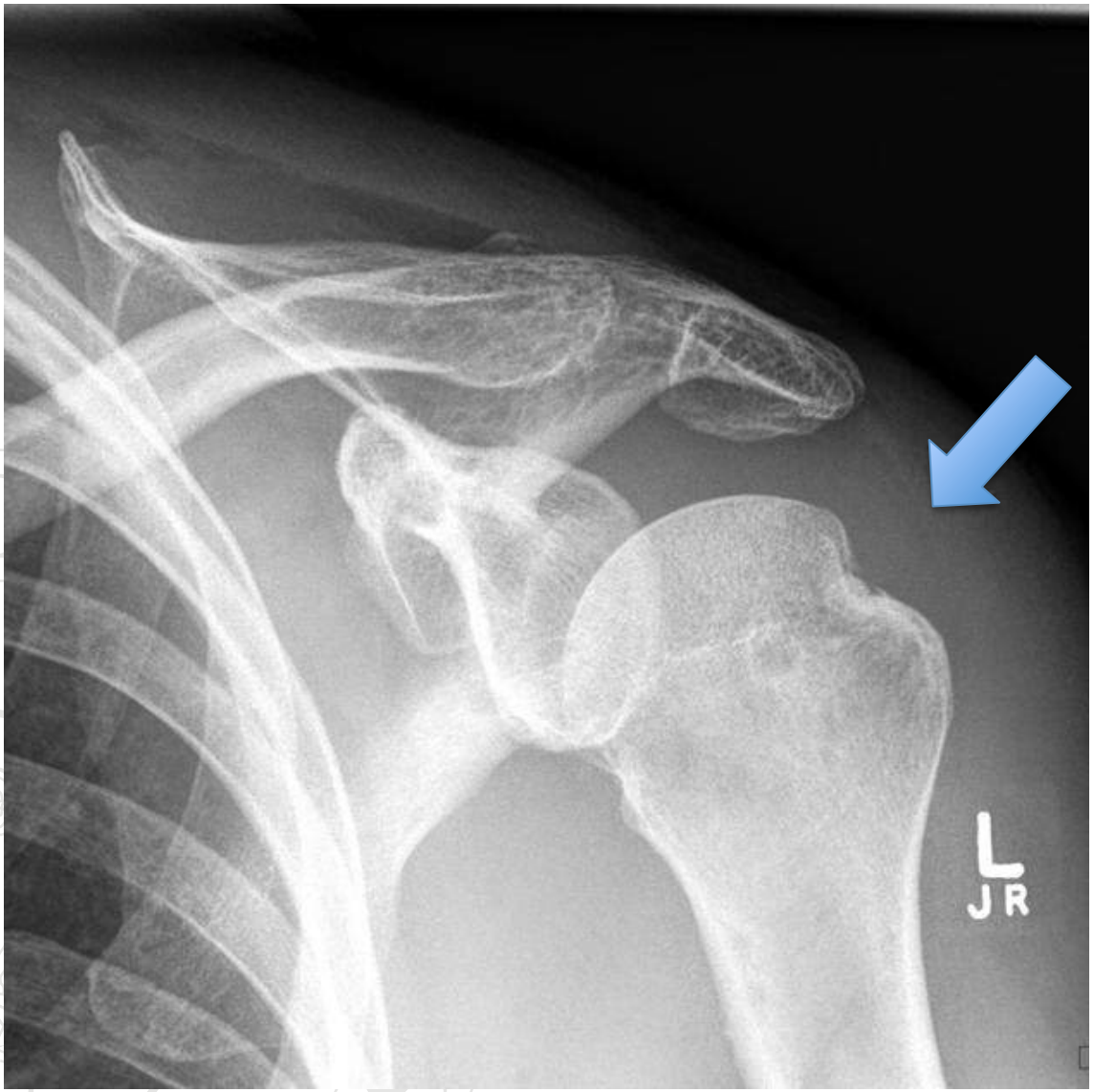
D, Nerve: axillar nerve, m/c nerve

Anterior dislocations

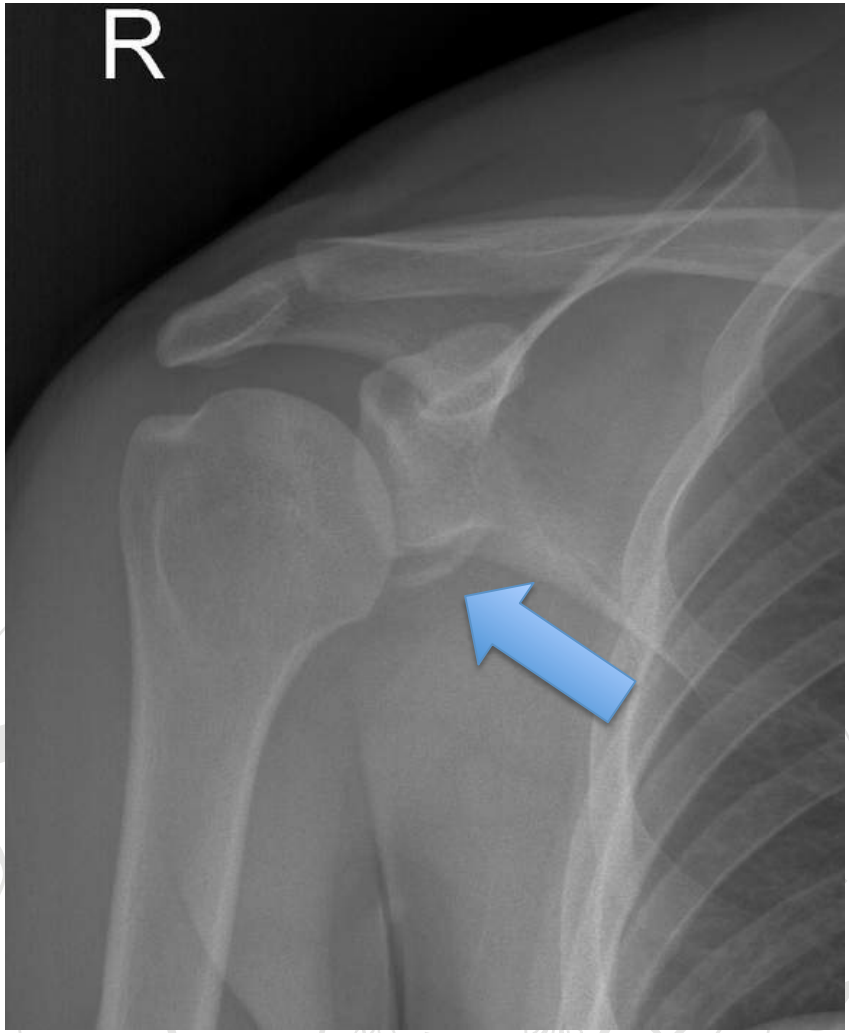
- **Traumatic**
- **Congenital** laxity
- **Acquired**

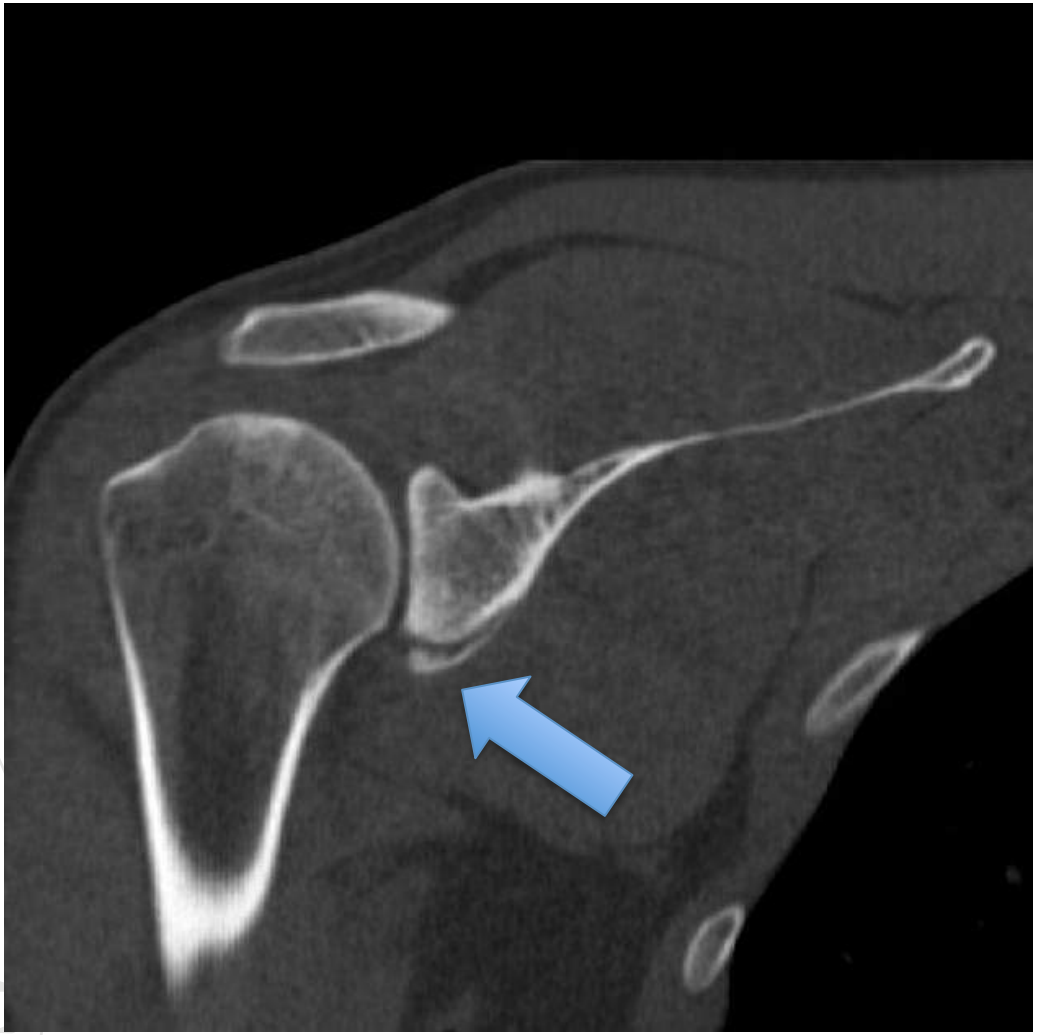
  (Repeated microtraumas)
- **Recurrent / habitual**

Hill - Sachs lesion



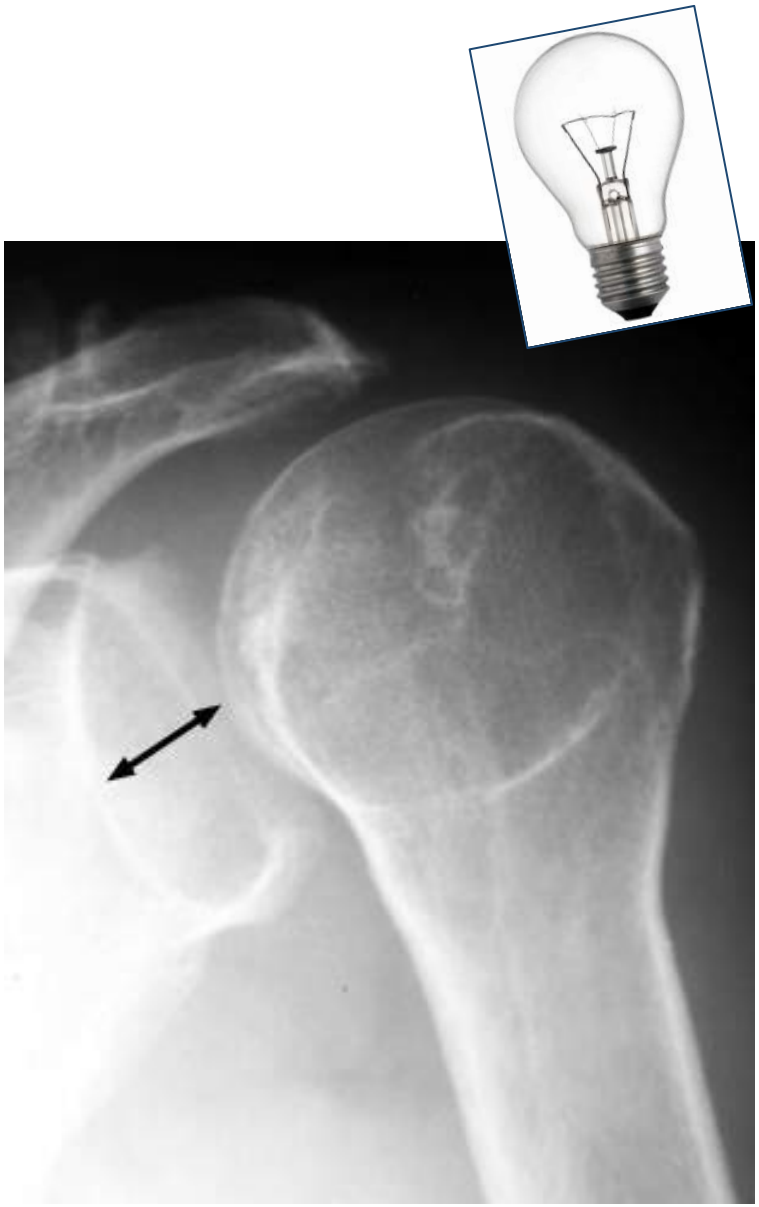
Bankart - lesion





Posterior dislocation

- **Adduction/Flexion/IR**
- **Electrocution and seizures** (overpull of subscapularis and latissimus dorsi)
- Look for **“lightbulb sign”** and **“vacant glenoid”** sign



Inferior dislocation (‘luxatio erecta’)

- ***Hyperabduction injury***
- Arm presents in a flexed **“asking a question”** posture
- High rate of **nerve** and **vascular injury**

Shoulder dislocation - Treatment

I. **Nonoperative: anesthesia (!!) and closed reduction** - *Hippocrates, Kocher, Stimson, Snow Bird method*

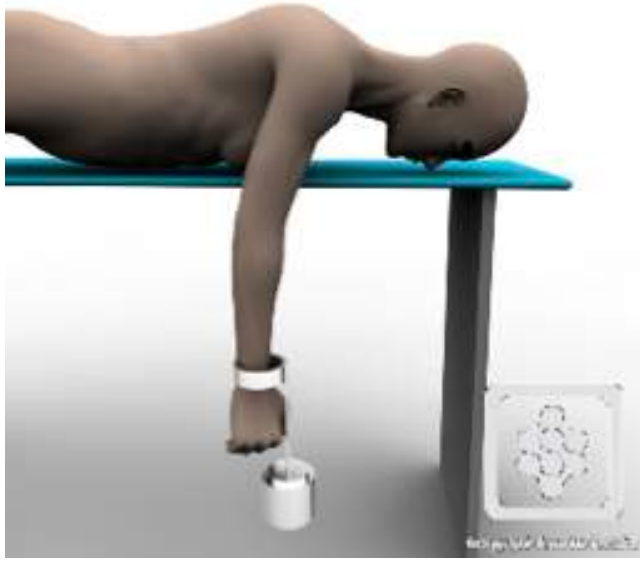
II. **Operative:** failed reduction, greater tubercle fx, Bankart-lesion, RCT (rotator cuff tear)

Postoperative care: immobilization for 7-21 days; physiotherapy***: to prevent 'frozen shoulder'***

Shoulder reduction

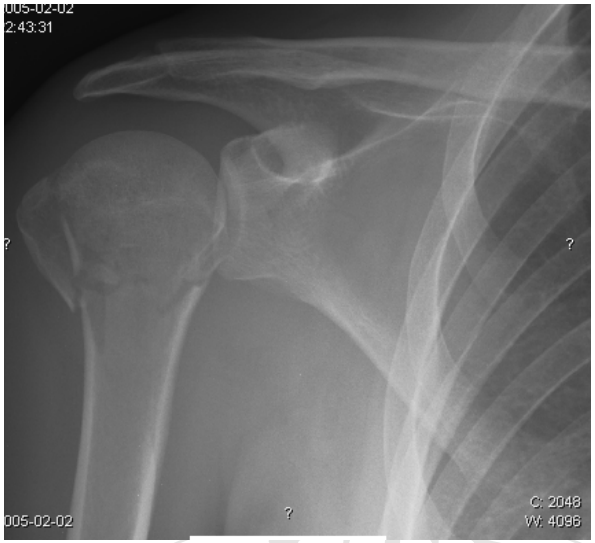
Hippocratic

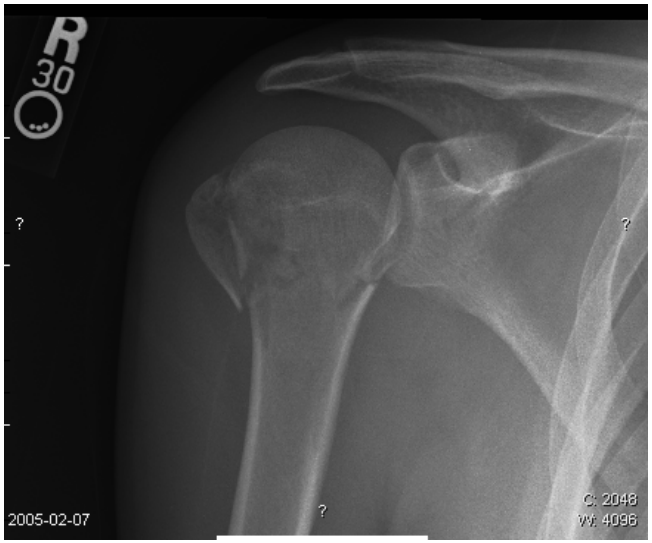
Stimson



Snowbird

Proximal humerus fractures





Proximal humerus fractures

Epidemiology:

- **Most common** fracture of the humerus
- **Higher incidence** in the **elderly** (osteoporosis)
- **Females** 2:1 **greater incidence** than males

Mechanism:

- Fall onto an **outstretched arm**
- Younger patient: **high energy trauma** such as MVA (motor vehicle accident)

Proximal humerus fractures - Diagnostics

- **Physical examination:**

- Patients typically present with arm held close to chest by contralateral hand.
- Pain and crepitus detected on palpation
- NV: axillary nerve (deltoid muscle)

- **conventional X-rays** (AP + axillary + Y)

- **CT (dislocated, multifragmentary fx)**

- **MRI:** Rotator cuff injury

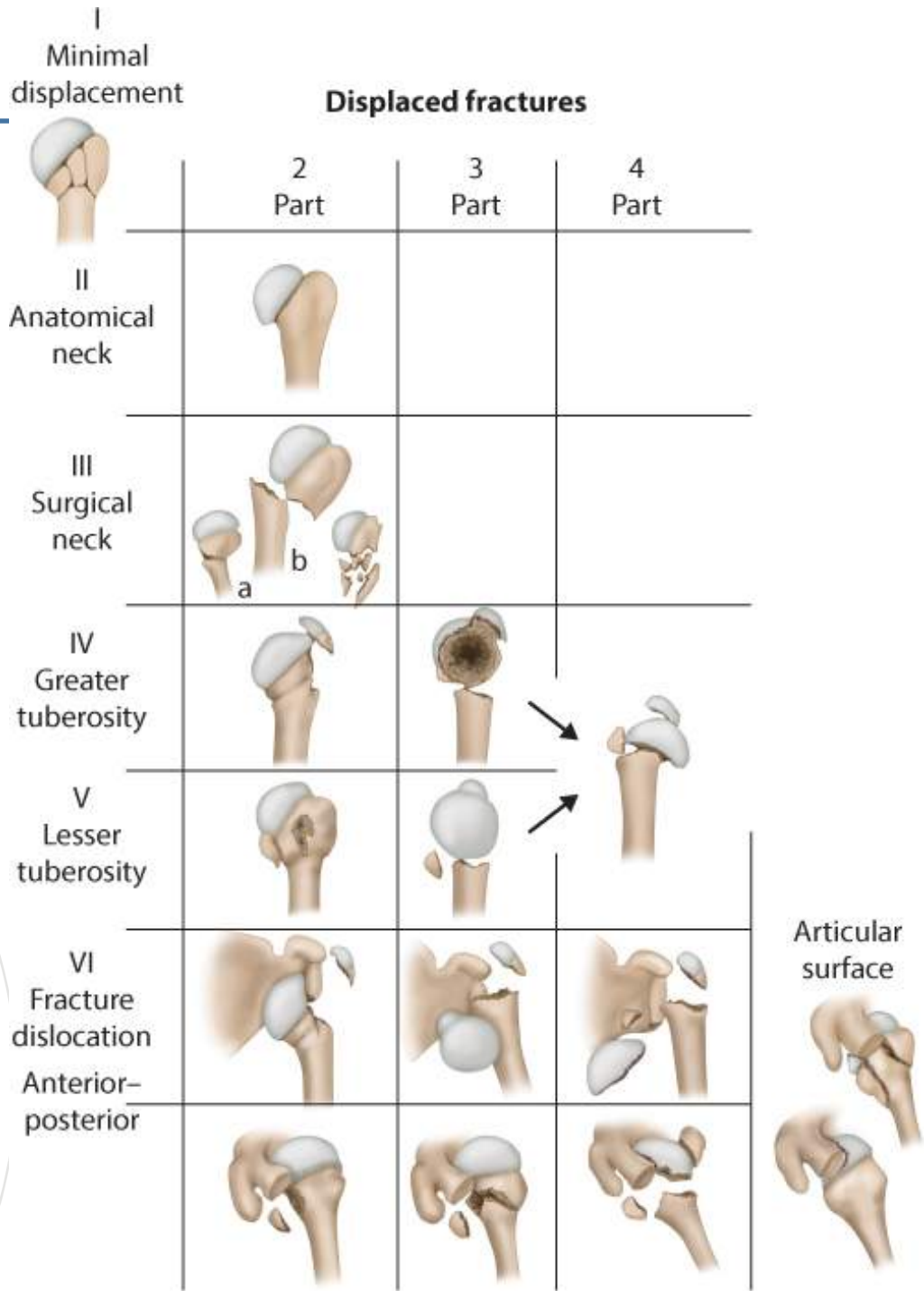
Neer - classification

Four parts:

- Greater tuberosity
- Lesser tuberosity
- Humeral shaft
- Humeral head

Dislocated:

- A part is displaced if >1 cm displacement or >45 degrees of angulation is seen



Proximal humerus fractures - Treatment

I. Nonsurgical treatment:

- minimal displacement
- elderly
- severe concomitant diseases

- Arm sling, Desault / Gilchrist bandages (1-3 weeks)
- Functional treatment – Pölchen - exercises

Proximal humerus fractures - Treatment

II. Surgical treatment:

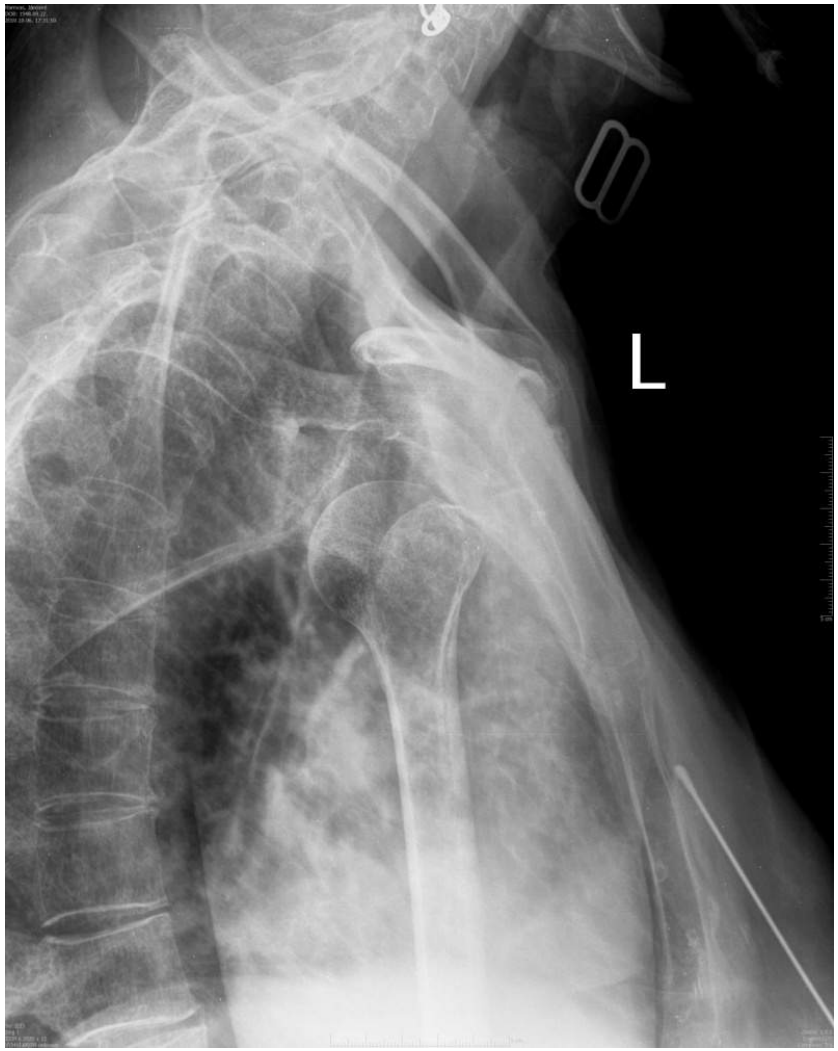
- Significant **displacement**, **unstable** fx
- **Multifragmentary fx**
- **Anatomical neck fx** (AVN)
- **Neer VI: fx with dislocation**
- **NV-injury, open fracture**

Proximal humerus fractures - Treatment

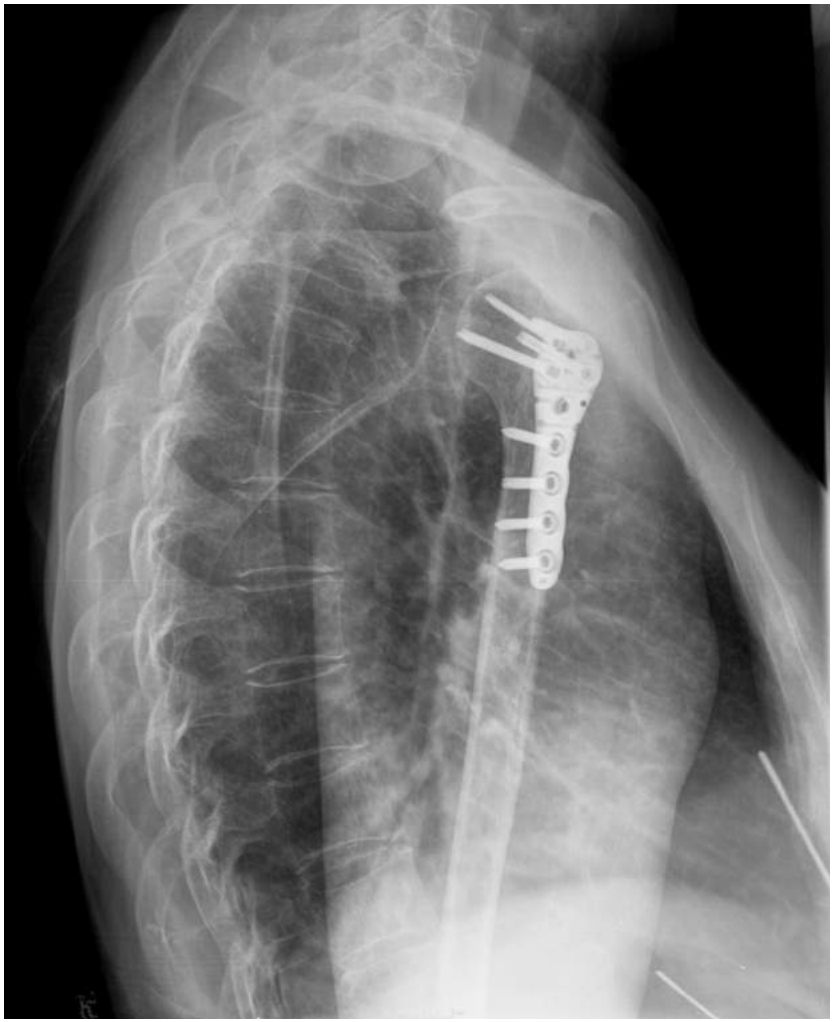
II. Surgical treatment:

- Screw fixation
- K-wires, tension-band
- Plate: angle-stable plates
- Unreamed humeral nails
- Hemiarthroplasty
- Delta (reverse) prosthesis

Neer Type VI



Neer Type VI



Open reduction and angle-stable plating

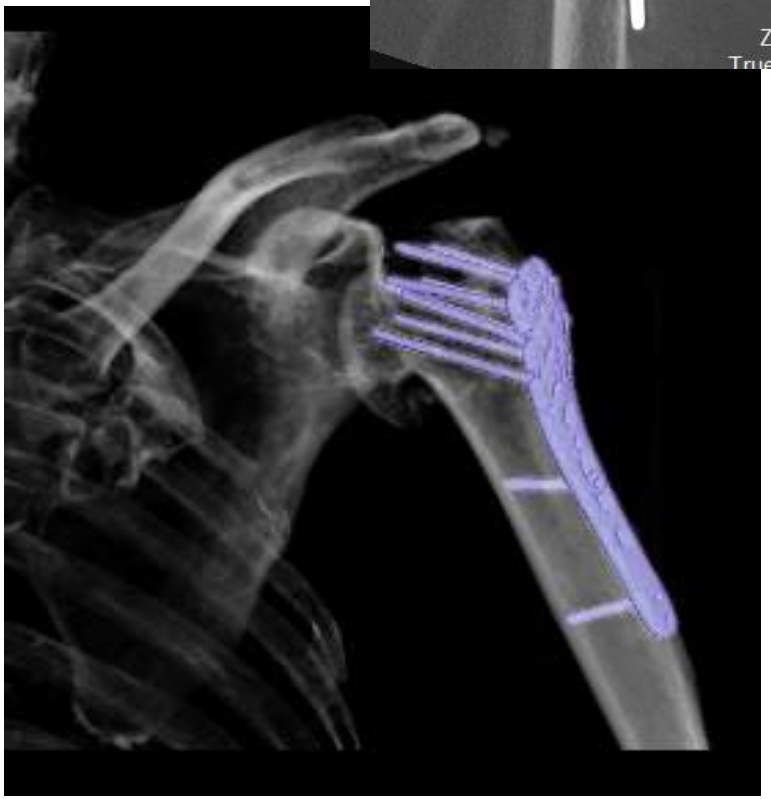
4-parts fracture

4-parts fracture

DREAM
INVENT
CREATE
PTE3D

MEDICAL WORKING GROUP

Redislocation



Hemiarthroplasty

Reverse (delta) prosthesis

Distal humerus fractures

Distal humerus fractures

- **Mechanism:**

- **Direct trauma** is the most common especially MVA (motor vehicle accident)
- **Indirect trauma** such as fall on an outstretched hand

- The humerus **is not a weightbearing** bone
- Bordered by the **two most mobile joint**
- Good **muscle coverage**
- **Radial nerve**

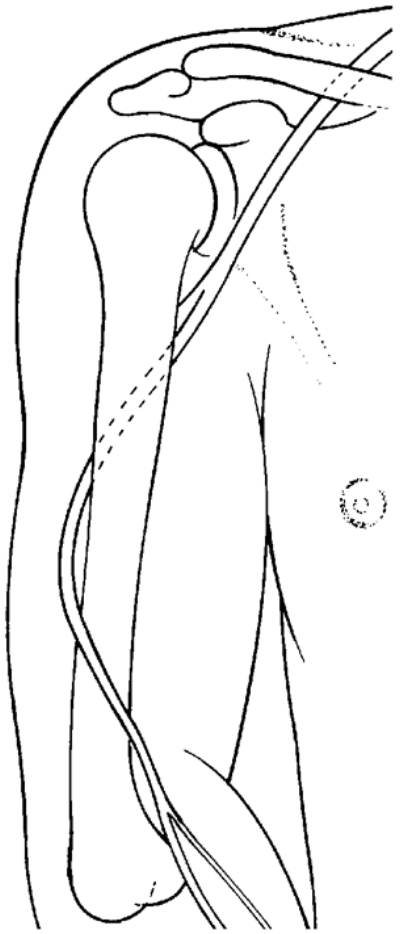
Diagnostics

Physical examination:

- Pain, swelling, deformity
- ***NV – radial nerve !!***

Radiological examination:

- AP and lateral views
- Traction radiographs may be indicated in case of displacement / comminution.



Treatment

I. Nonoperative:

- **functional reduction**
- **relative stability**
- >90% of humeral shaft fractures heal with nonsurgical management
- Böhler-cast, “hanging-cast”, braces

Sarmiento - brace

Treatment

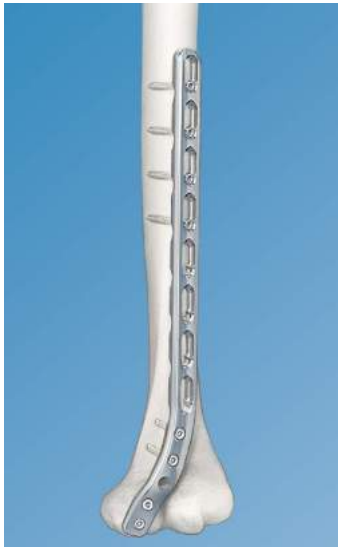
II. Operative:

- **Indications:**
  - inadequate reduction
  - non-union
  - segment or transverse fx
  - ***open fx***
  - ***neurovascular injury***

Treatment

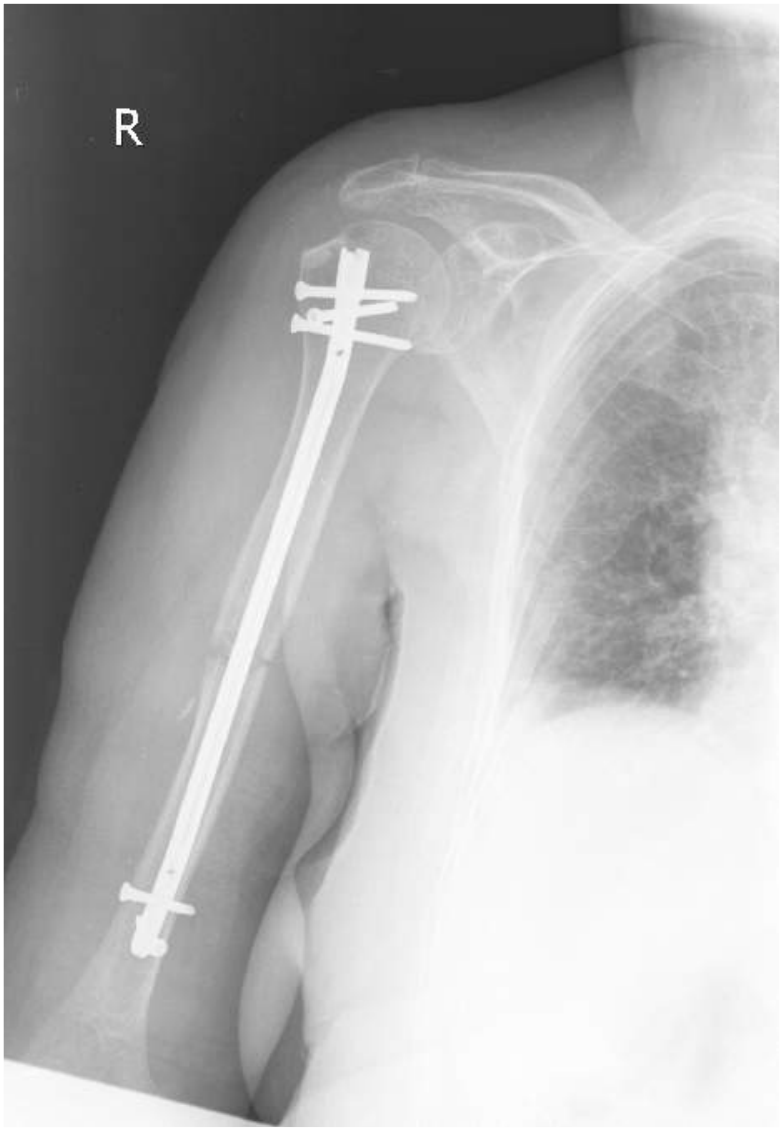
II. Operative:

- **Unreamed humeral nail**
- **Plates** (with screw fixation)
- Open or comminuted: **external fixator**



Humerus transverse fx (AO-12 A3)

Anterograde humeral nail



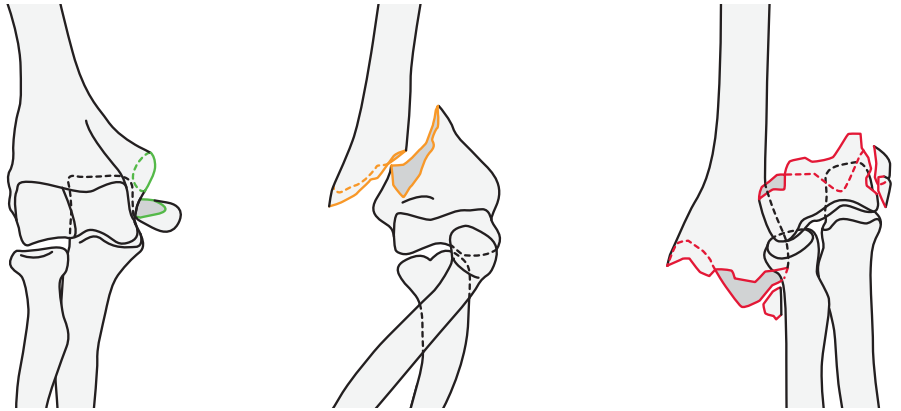
Distal humerus fractures

Distal humerus fractures

A: Supracondylar fracture

13 distal

13-A1 | 13-A2 | 13-A3



13-A **extraarticular fracture**

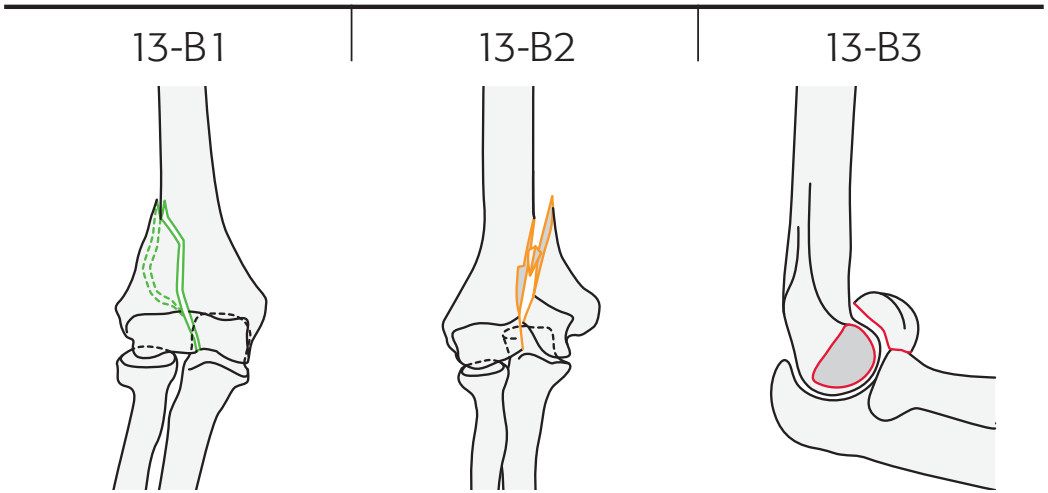
13-A1 apophyseal avulsion

13-A2 metaphyseal simple

13-A3 metaphyseal multifragmentary

Distal humerus fractures

B: Simple intrarticular fx / condylar fx



13-B partial articular fracture

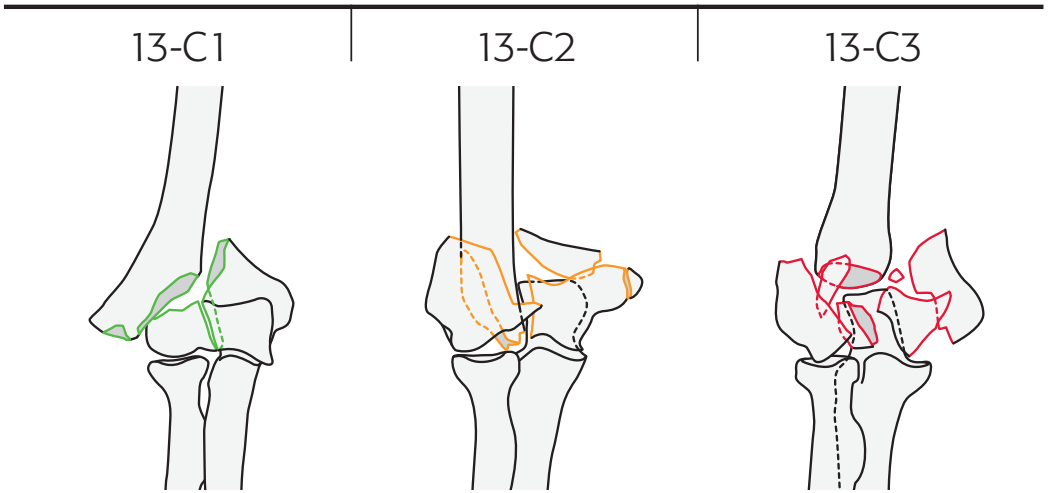
13-B1 sagittal lateral condyle

13-B2 sagittal medial condyle

13-B3 coronal

Distal humerus fractures

C: Complete articular fx / trans-diacondylar fx



13-C complete articular fracture

13-C1 articular simple, metaphyseal simple

13-C2 articular simple, metaphyseal multifragmentary

13-C3 articular multifragmentary

Principles of treatment

Type A: supracondylar fx

- **Functional reduction**
- **Conservative treatment**: cast, braces
- **Operative treatment**:
  - retrograde nail
  - plate OS (angle-stable)
  - external fixator

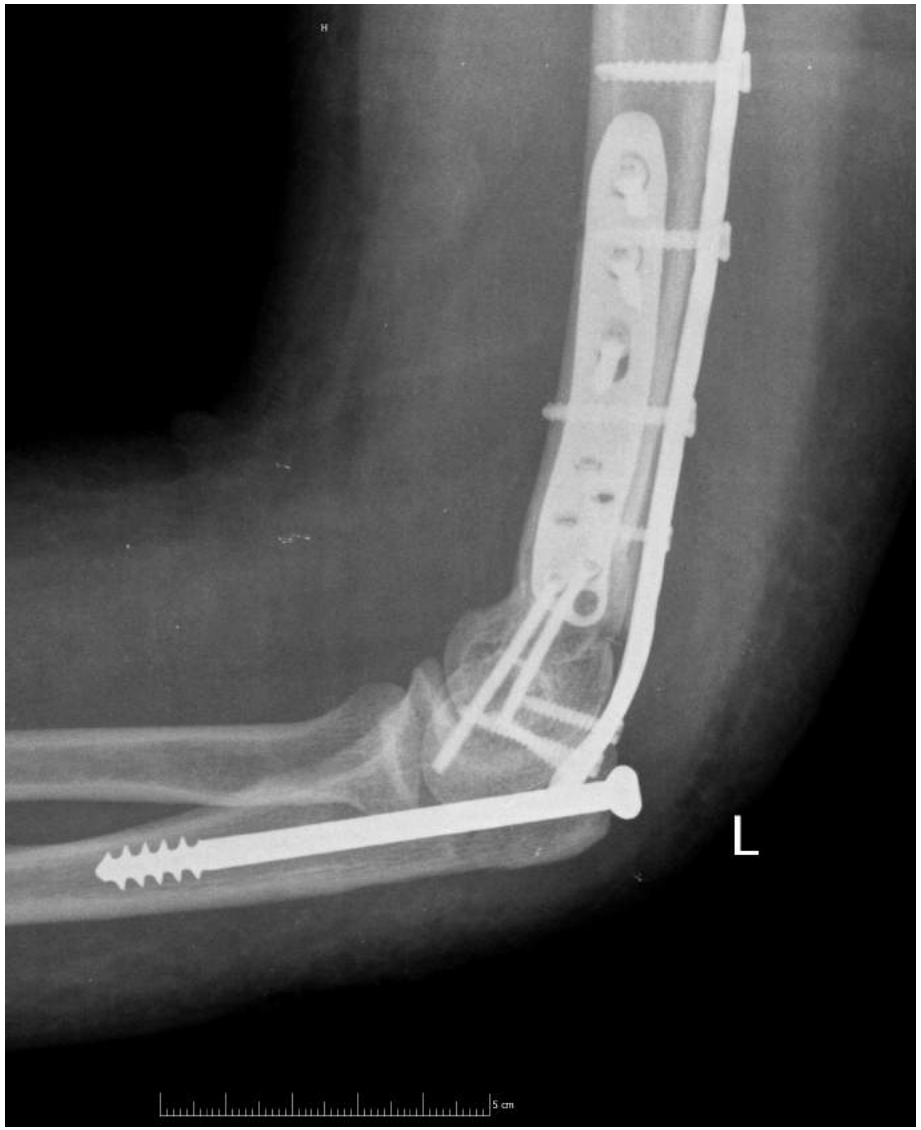
Principles of treatment

Type B: simple (partial) articular
Type C: complete articular

- **Anatomical reduction, absolute stability**
- Nonoperative treatment
- **Operative treatment:**
  - Screw fixation
  - Plate OS (angle-stable), double plating
  - K-wiring + additional support
  - External fixator

Distal humerus fracture

Double LCP (locking compression plate)



Elbow dislocations

Elbow dislocations

Epidemiology:

- **Posterior dislocations** are the most common
- Highest incidence **in the young, sports injuries**

Mechanism:

- Most commonly due to **fall on outstretched hand**
- **Anterior dislocation** ensuing from **direct force** to the posterior forearm with elbow flexed

Diagnostics

Clinical evaluation:

- Patients typically present **guarding the injured extremity**
- Swelling and **deformity**
- **Elastic rigidity**

Radiological evaluation:

- **AP and lateral views *before and after reduction***
- CT-scan, MRI

Look for associated fractures!!

Treatment

1. **Closed (open) reduction** *under sedation*

2. Treatment of **associated injuries**

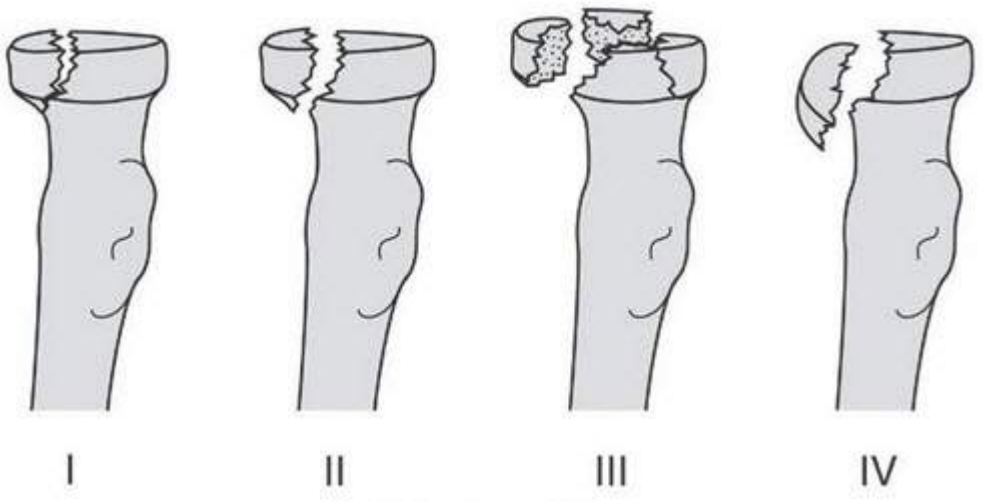
3. **Immobilization:** 3 - 4 weeks cast / brace

Radial head fracture

Type I.: minimal displacement − conservative

Type II - III.: ORIF (screw, plate)
radial head prosthesis

Type IV.: reduction + ORIF / prosthesis



Olecranon fracture

I. No displacement: conservative

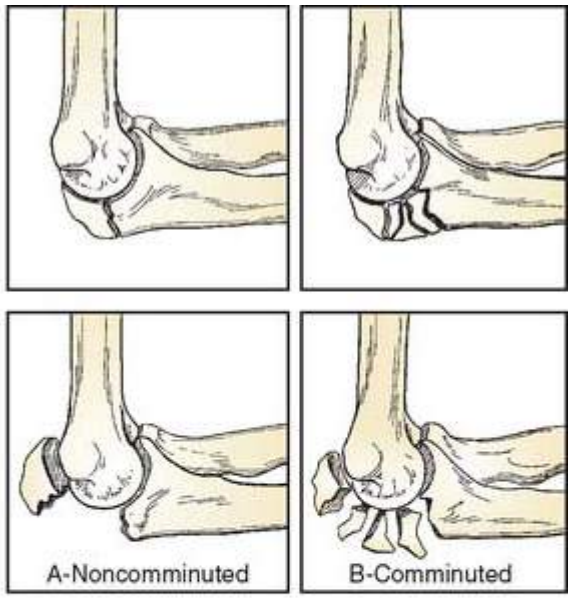
II. Displacement, stable: operative

III. Unstable: operative

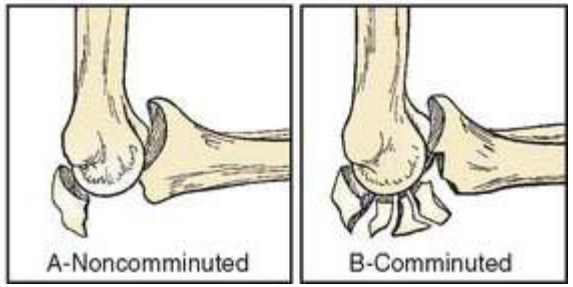
- **Tension band**
- Olecranon **plate**
- **Screw** fixation

I.

II.



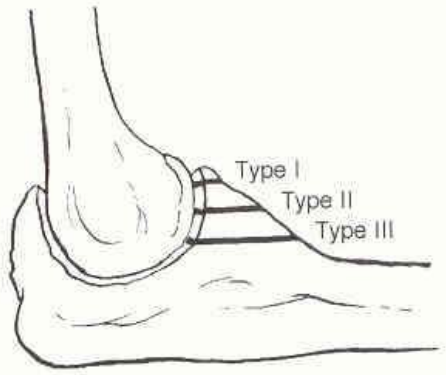
III.



Fractures around the elbow

Associated with elbow dislocations

Process Coronoideus törések
(5-10%)



Coronoid fractures.
Reproduced by permission from W Regan et al., *Journal of Bone and Joint Surgery* 71A:1348, 1989.

Medialis / Laterális epicondylus törések
(12-34%)

Olecranon fracture

Olecranon fracture – tension band

Radial head fracture

Mini titanium screws

Forearm = Joint !!

Goal: anatomical reduction and absolute stability !!

Forearm fractures

Physical examination:

- Deformity, pain, swelling, loss of function
- **Important:** NV injuries
- **Compartment syndrome**

Radiological examination:

- AP + lateral
- oblique views

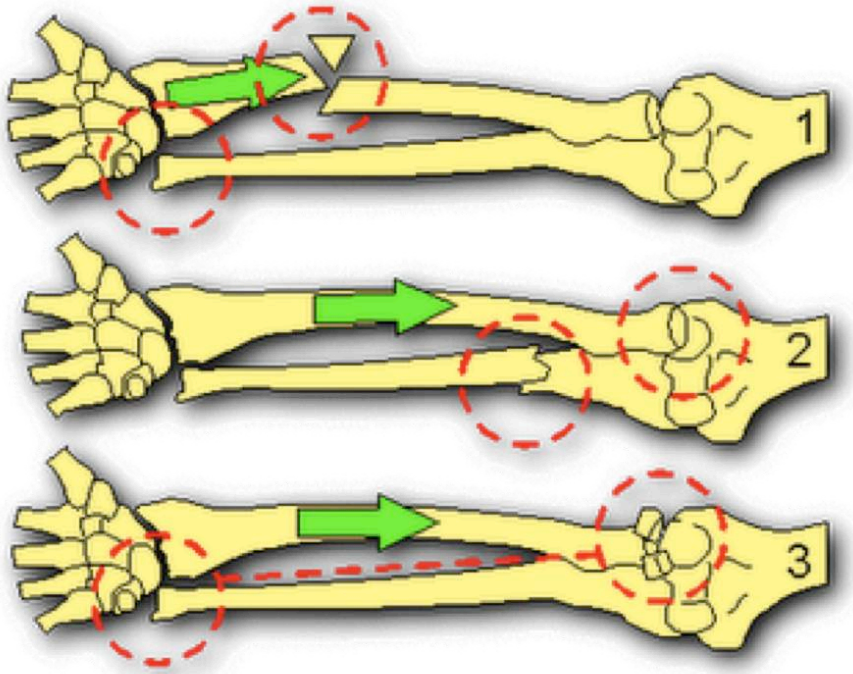
Forearm fractures

Double plating

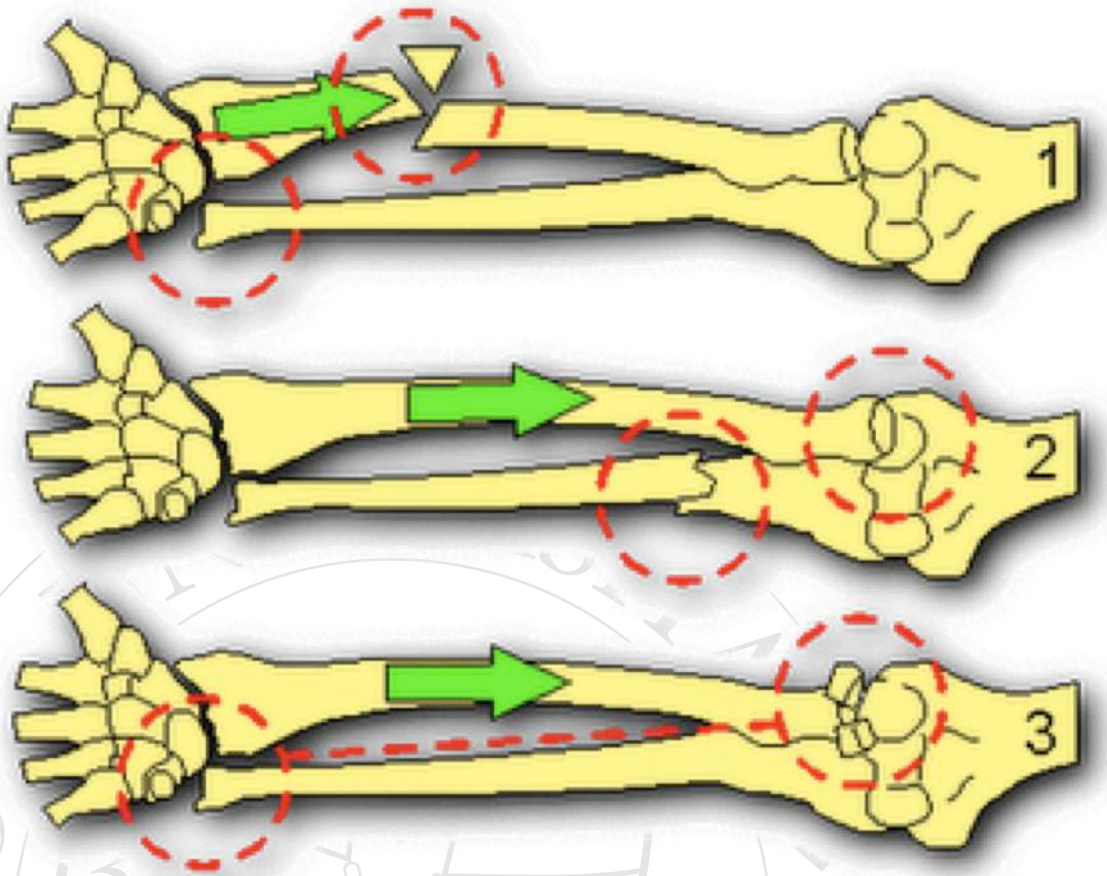
DCP = dynamic compression plate

Fracture-dislocations

- ***Complex injury: fracture + dislocation***
- ***Rupture of interosseal membrane***



Fracture-dislocations



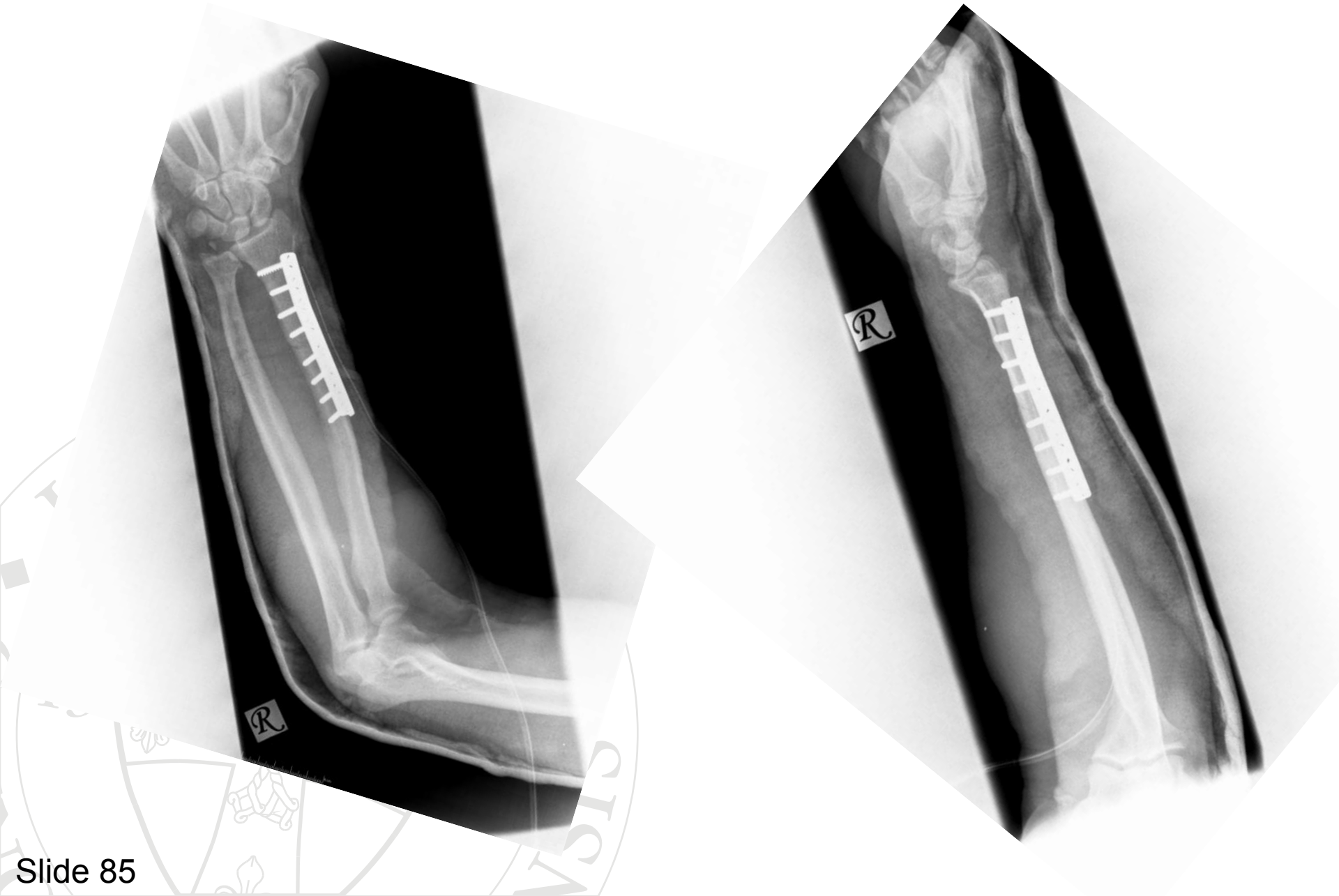
1. Galeazzi

2. Monteggia

3. Essex Lopresti

Galeazzi fracture-dislocation

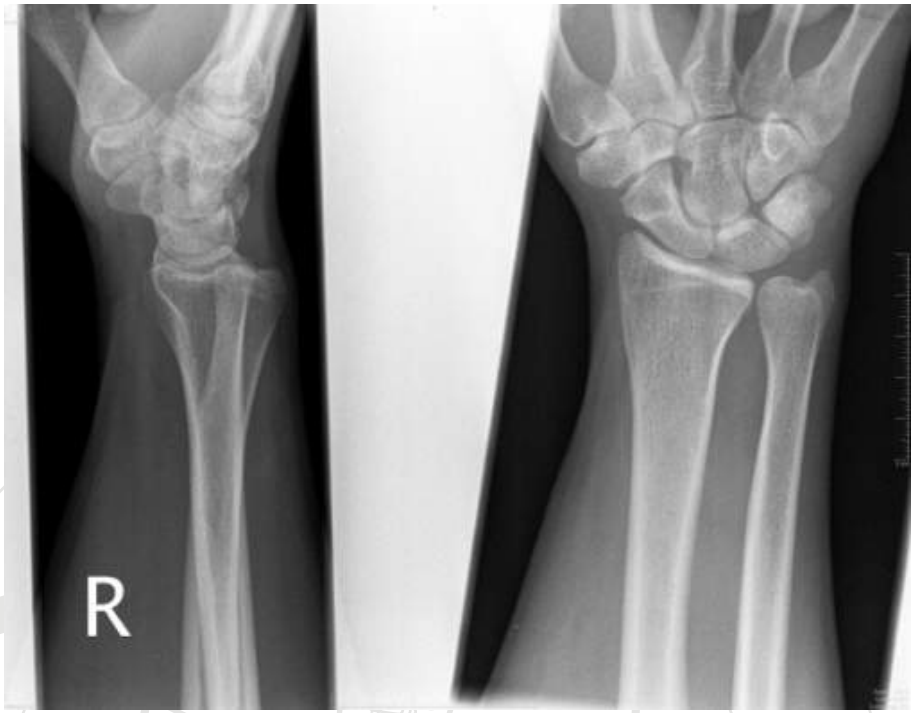
Galeazzi fracture-dislocation

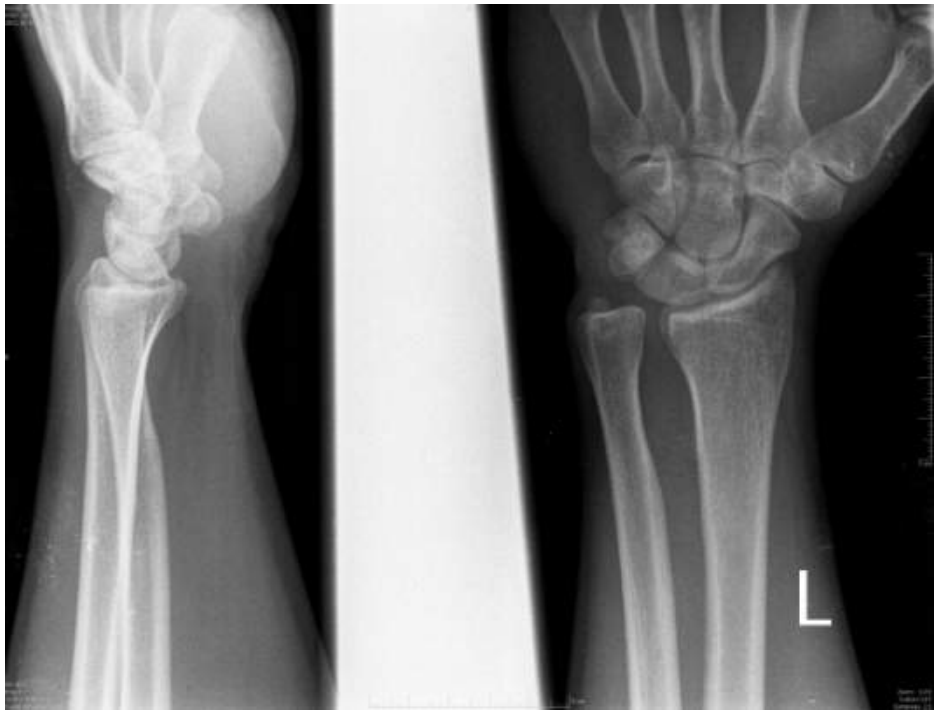


Monteggia fracture-dislocation

Monteggia fracture-dislocation

Essex - Lopresti fracture-dislocation





Radio-ulnar dissociation
(comparative X-rays)

Essex - Lopresti fracture-dislocation

Radial head fx

Essex - Lopresti fracture-dislocation

Upper extremity traumas

BASIC REQUIREMENTS for the EXAM:

Here are some hints to help…

- **Tossy-classification** (at least: I – II – III)
- **Principles of Neer-classification**
- **Galeazzi / Monteggia / Essex-Lopresti injuries**

Upper extremity traumas

If you are interested in, please, check the following links for further information:

1. AO Surgery Reference & Online Education
www.aotrauma.org:

2. Wheeles' Textbook of Orthopaedics
www.wheelessonline.com

3. OTA Education Resources – *really useful site with online lectures*
http://ota.org/education/resident-resources/core-curriculum/upper-extremity/

THANKS FOR YOUR ATTENTION!