

Proximal humerus fractures

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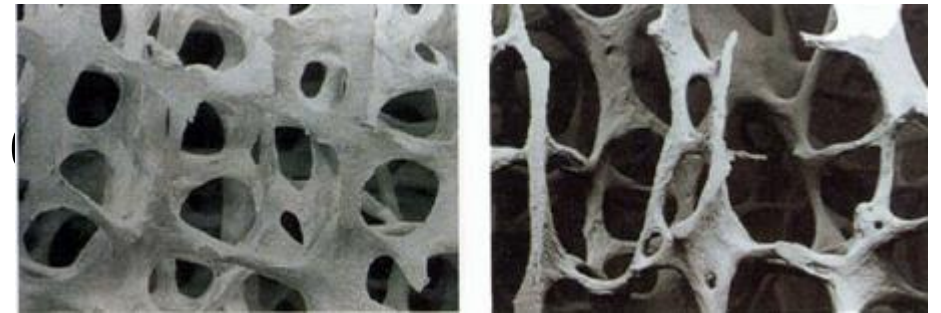
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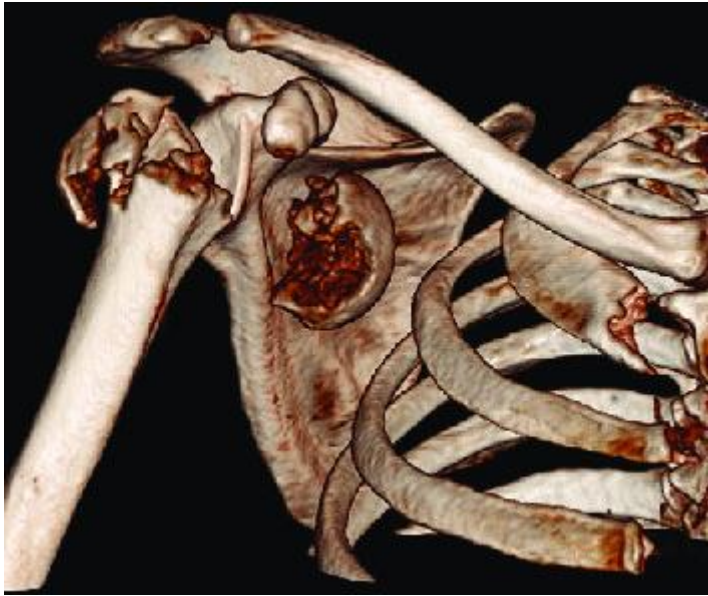


Introduction

- 7-10% all fractures
- 45% of all humerus fractures, increases to 75% in Elderly
- 80% affects women
- Exponential increase >age 50
- Osteoporosis – elderly (75%)
- High energy trauma – young (25%)
- 8% lifetime risk of fractures for women > 65



Challenges in Prox Humerus Fx



Bone quality/vascularization

Varus biomechanics

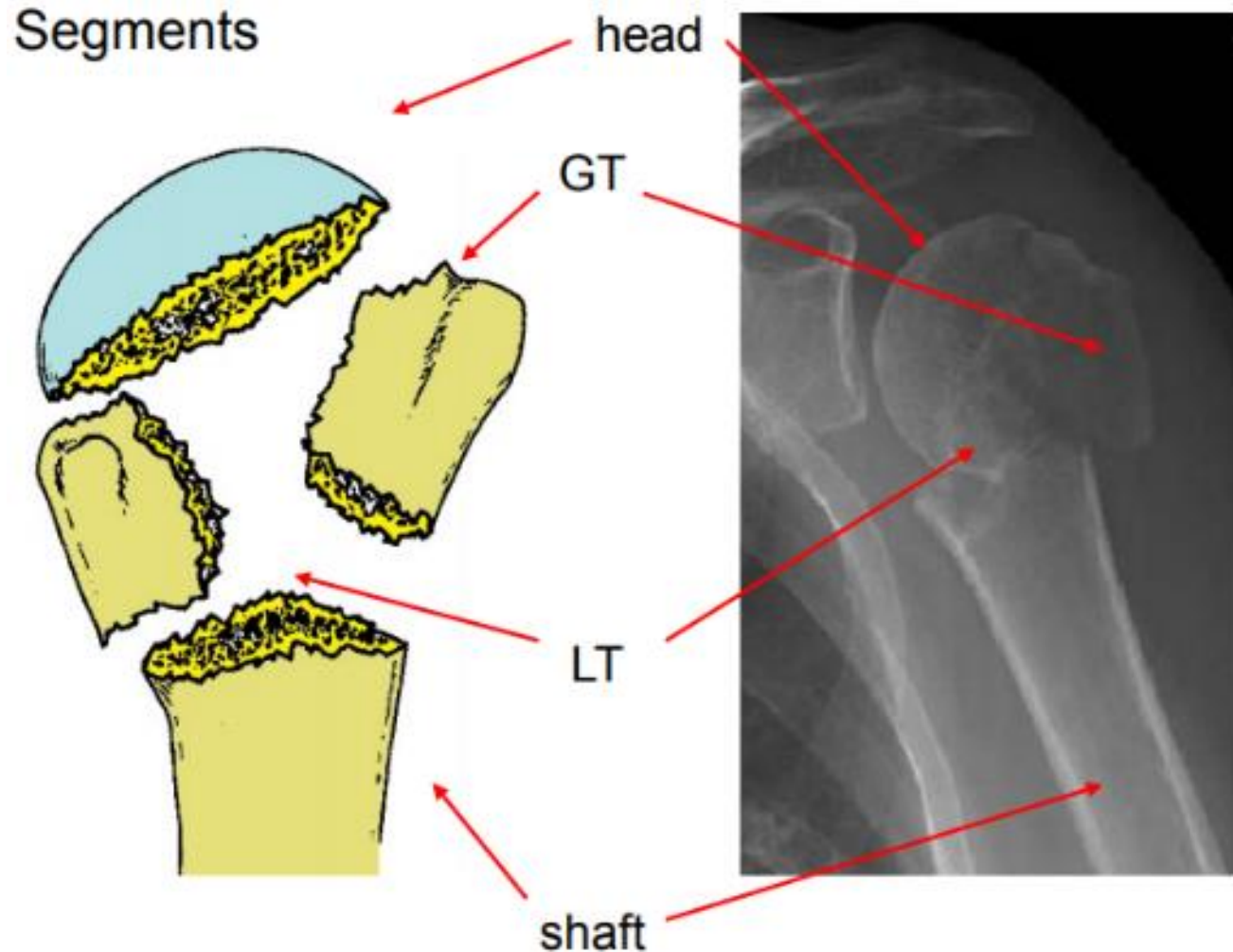
One column of support

Impossible bicortical fixation in the humeral head

Long lever arm



Anatomy



- Fracture type

- anatomical neck AN
- surgical neck SN
- greater tuberosity GT
- lesser tuberosity LT
- fracture dislocation
- head split

Codman, 1934 - first description of based on four parts

Vascularization

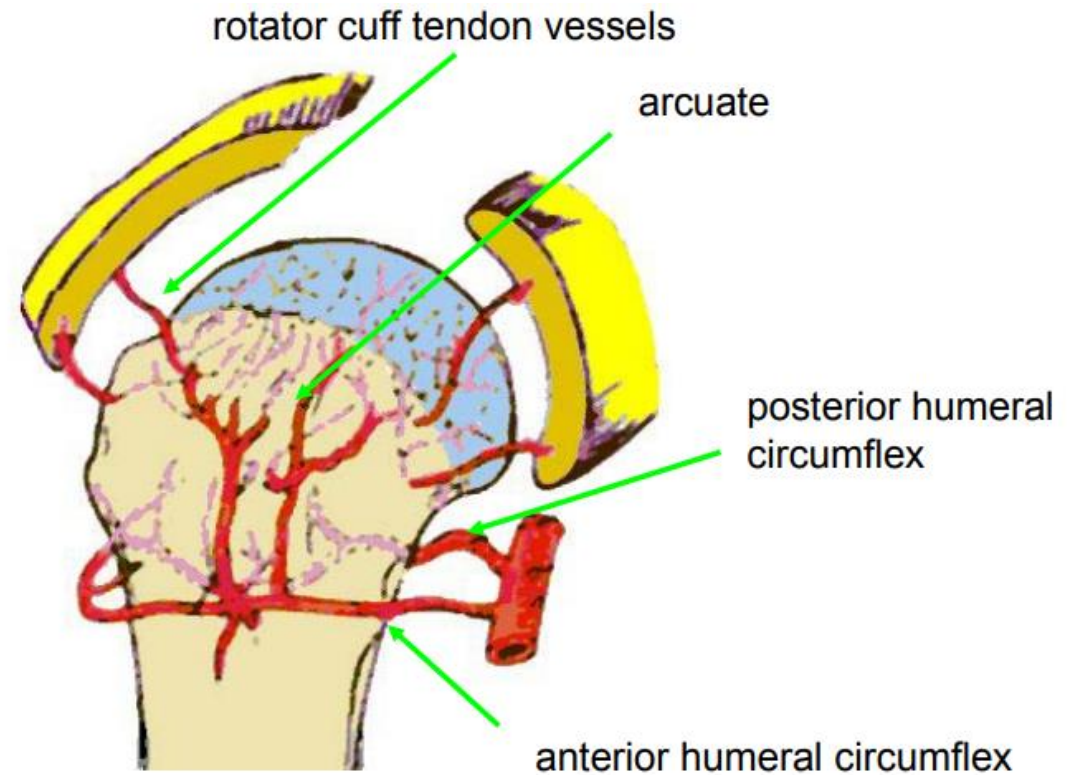
Anterior humeral circumflex

Arcuate

Posterior humeral circumflex

Rotator cuff tendon arteries

Periosteal



X-rays

- Complete **trauma series**

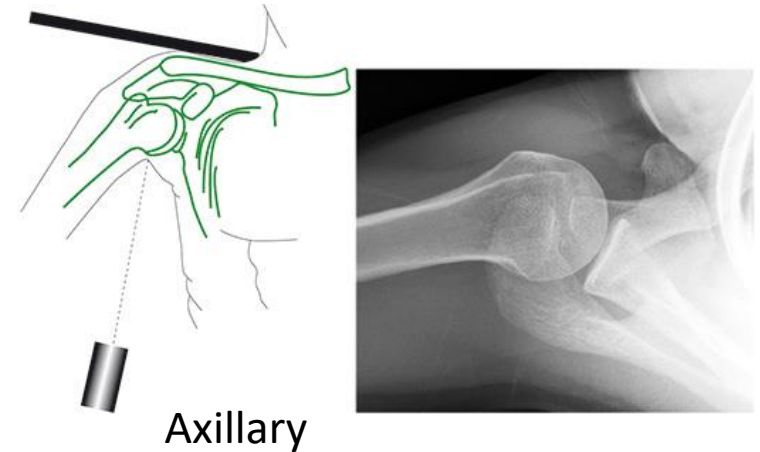
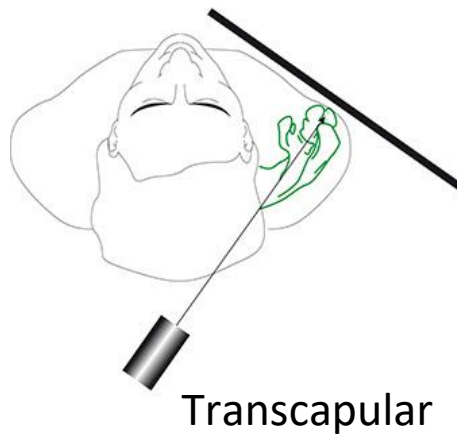
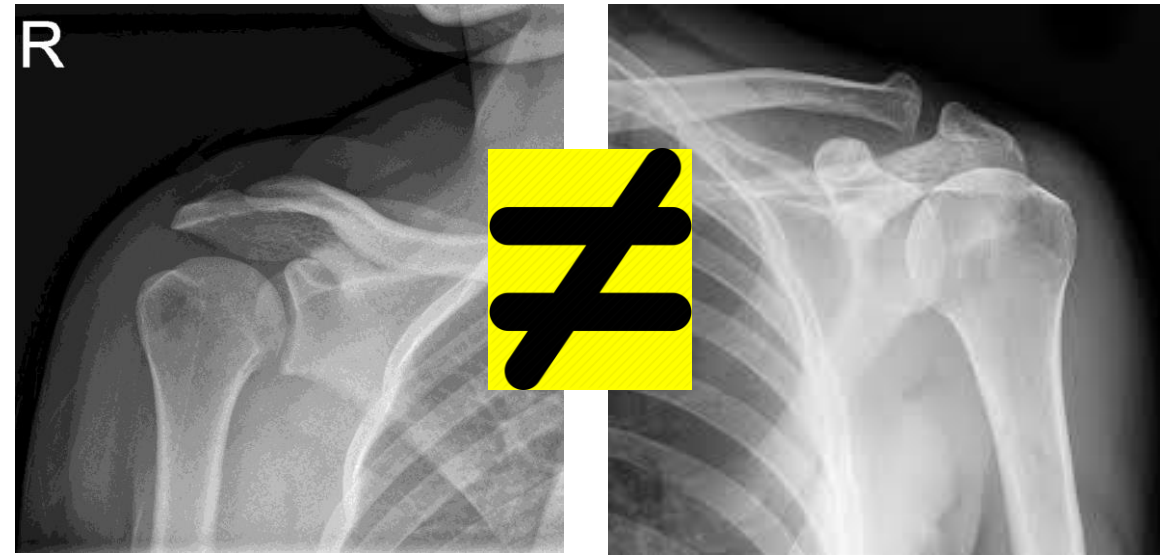
- True AP (Grashey)
- Scapular Y
- Axillary

- Additional views

- Apical oblique
- AP internal/external rotation
- Velpeau
- West point axillary

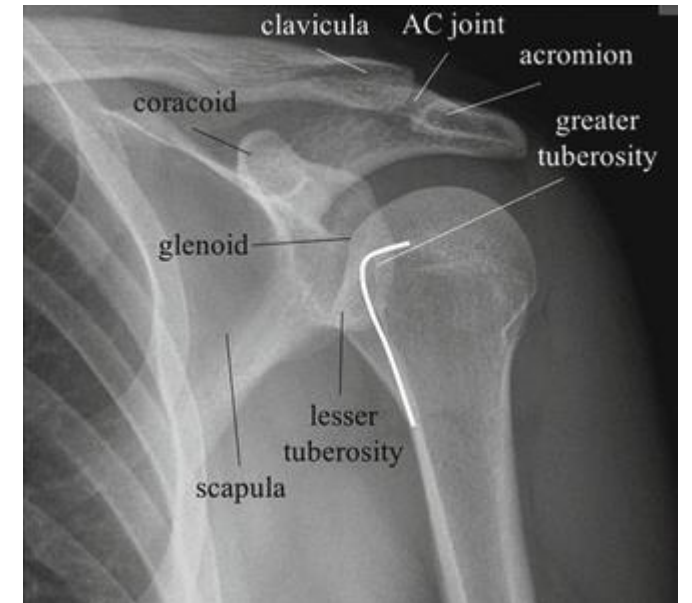
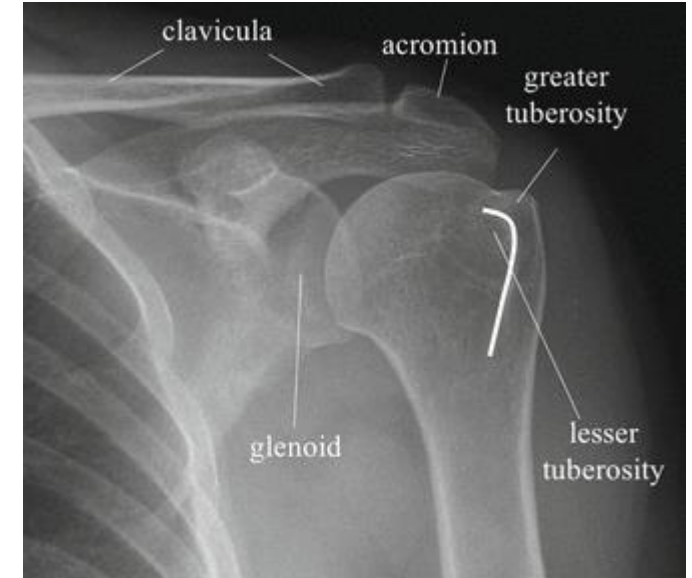
True AP (Grashey)

AP



Radiographic interpretation

- Dependent – arm rotation
- Rotation changes the neck-shaft angle
- Use contralateral x-rays if needed



X-rays

- Other findings
- **pseudosubluxation** (inferior humeral head subluxation) caused by blood in the capsule and muscular atony
- **combined cortical thickness** (medial + lateral thickness >4 mm)
 - studies suggest correlation with increased lateral plate pullout strength



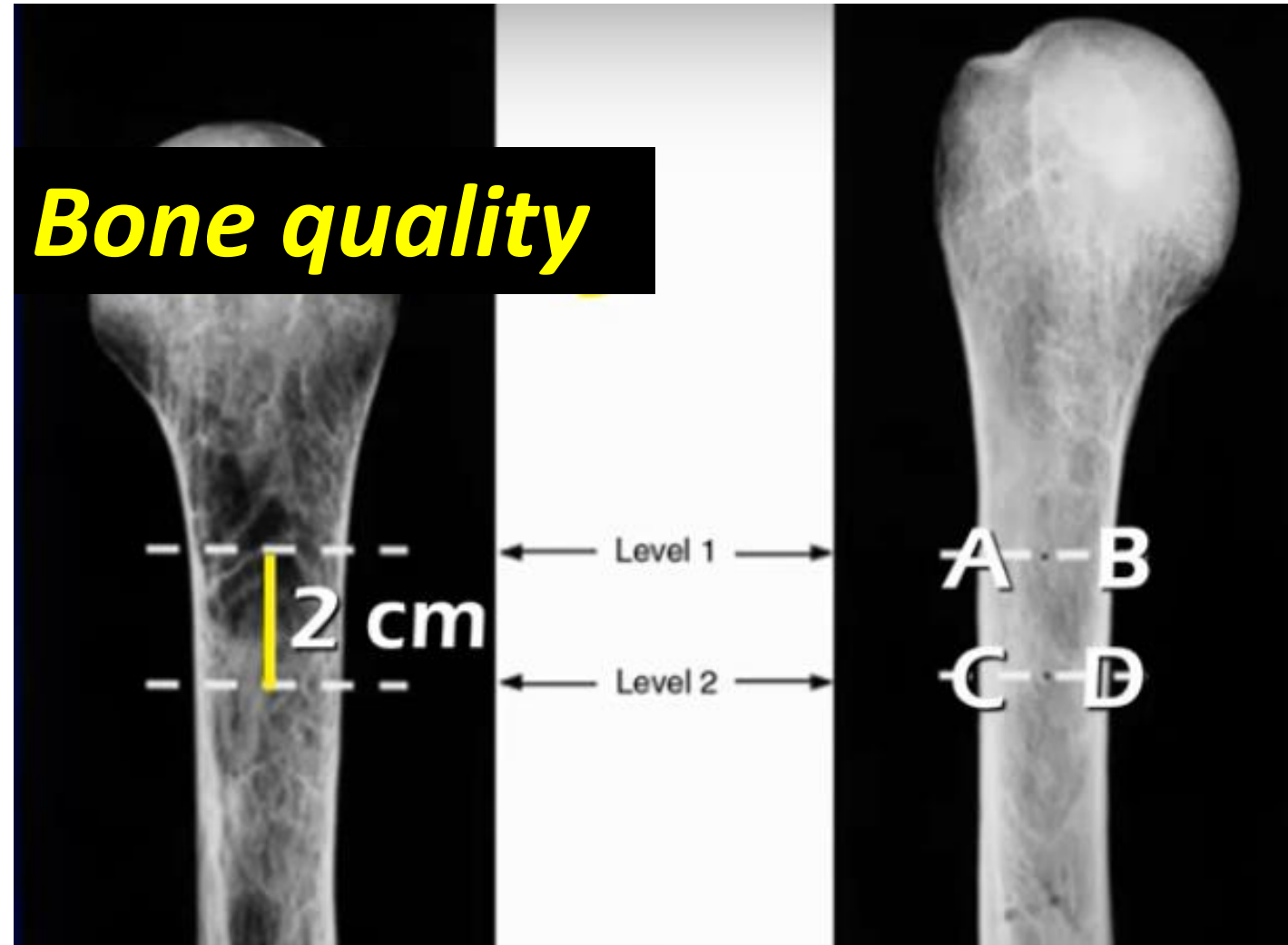
- Tingert et al. JBJS(B), 2003

- Mean cortical thickness

- $\frac{A+B+C+D}{4}$

“A mean cortical thickness < 4 mm is highly indicative of low BMD”

Bone quality



Predictable loss of fixation?

CT scan

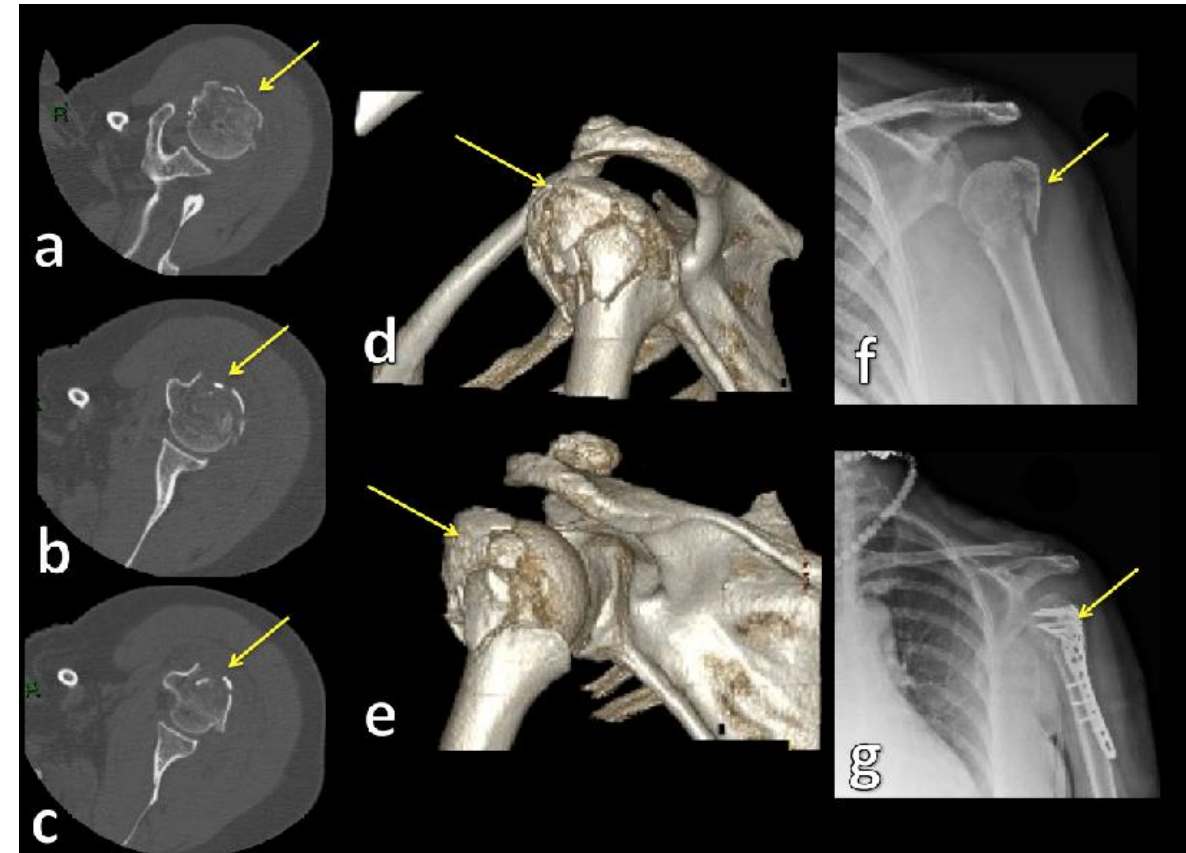
Are not necessary for all proximal humerus fractures especially if minimally displaced

Indications

- preoperative planning
- humeral head or greater tuberosity position uncertain
- intra-articular comminution

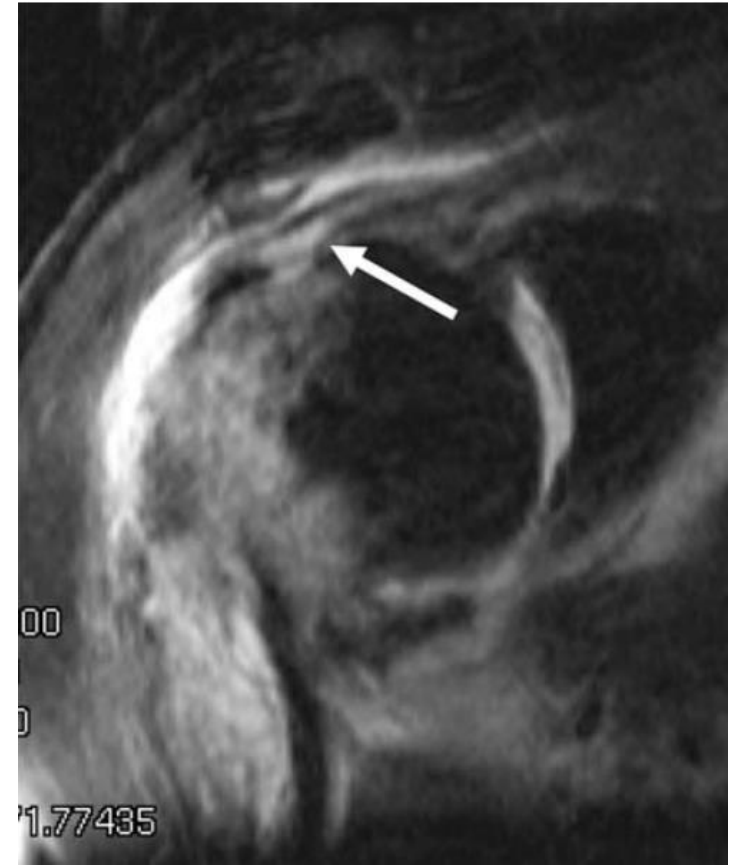
CT scans aid assessment of:

- Fracture morphology (including the number of fragments)
- Bone stock of the tuberosities and humeral head fragment
- Degree of comminution
- Size of fixable fragments
- Length of posteromedial metaphyseal extension



MRI

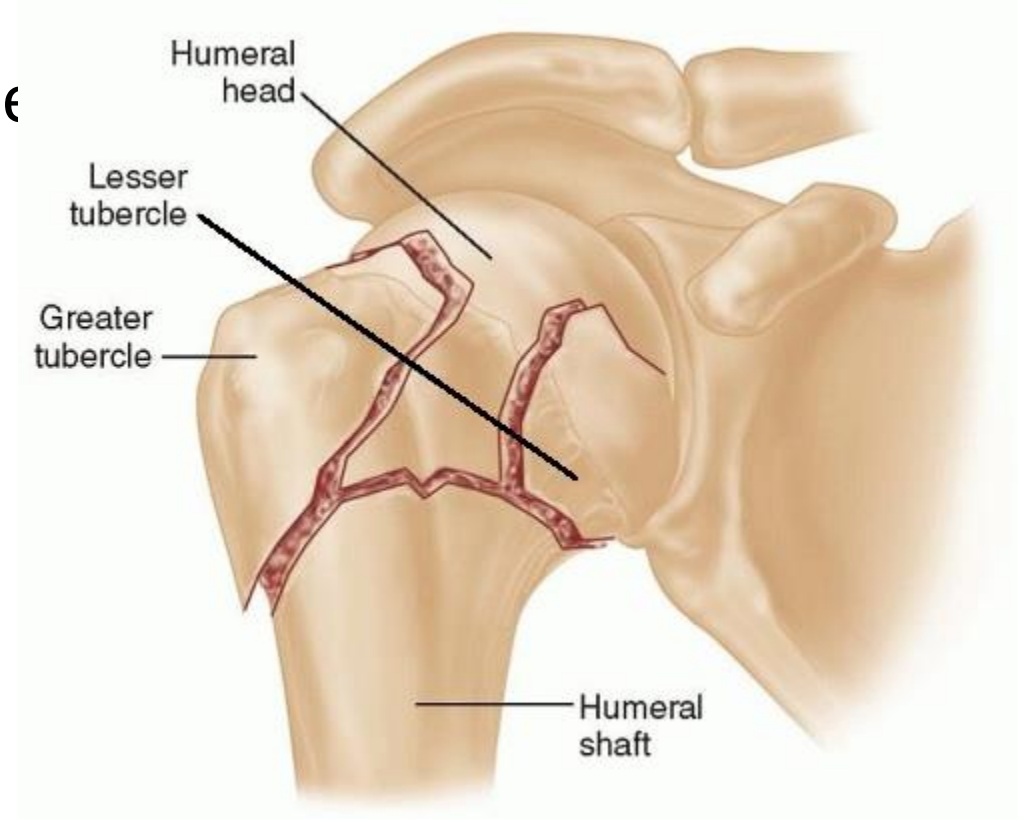
- Indications
 - rarely indicated
 - useful to identify associated rotator cuff injury



Neer Classification

- Classification based on four fracture segments
- (1) the articular segment
- (2) the greater tuberosity
- (3) the lesser tuberosity
- (4) the humeral shaft

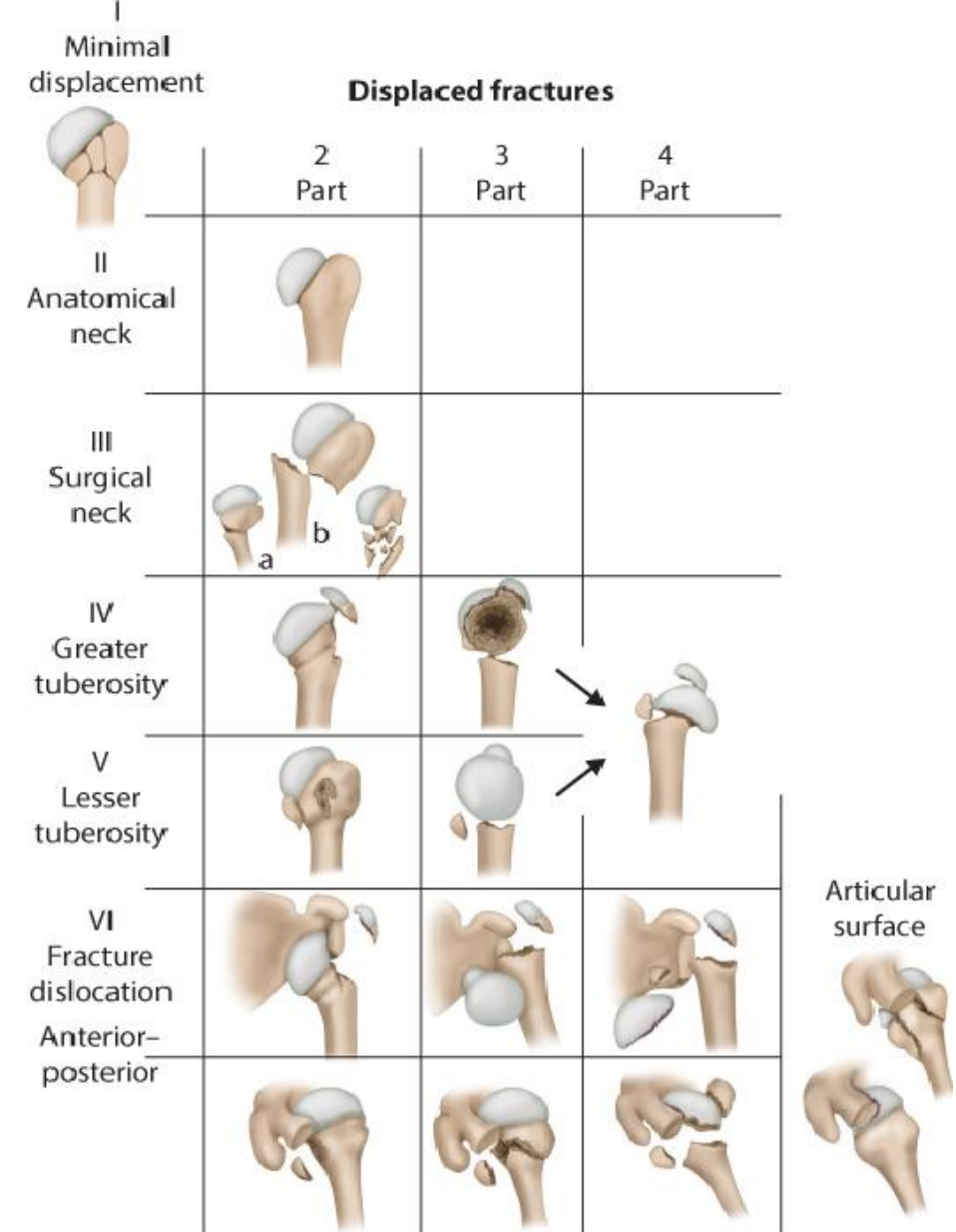
Multiple configurations are possible



Neer Classification

- The most popular
- Displacement = one or more of the four segments are displaced more than 10mm (GT-5mm) or angulated more than 45°
- 1-part fracture nondisplaced ~ 70-80%
- 2-part fracture ~ 20%
- 3-part fracture ~ 5%
- 4-part fracture ~ 5%
- **The 16 categories of the Neer classification**
- The varus/valgus distinction is not found in the Neer classification

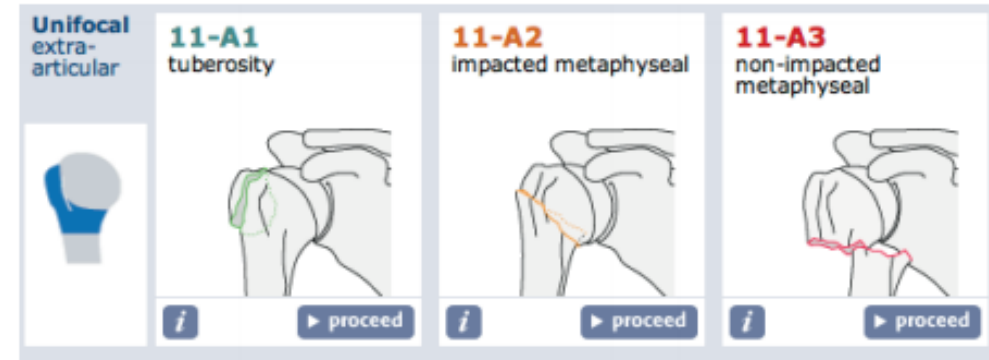
80% of PROXIMAL HUMERUS FRACTURES ARE MINIMALLY DISPLACED



Neer CS II: Displaced proximal humeral fractures: I. Classification and evaluation. J Bone Joint Surg Am 1970;52[6]:1079.)

AO classification - **type A**

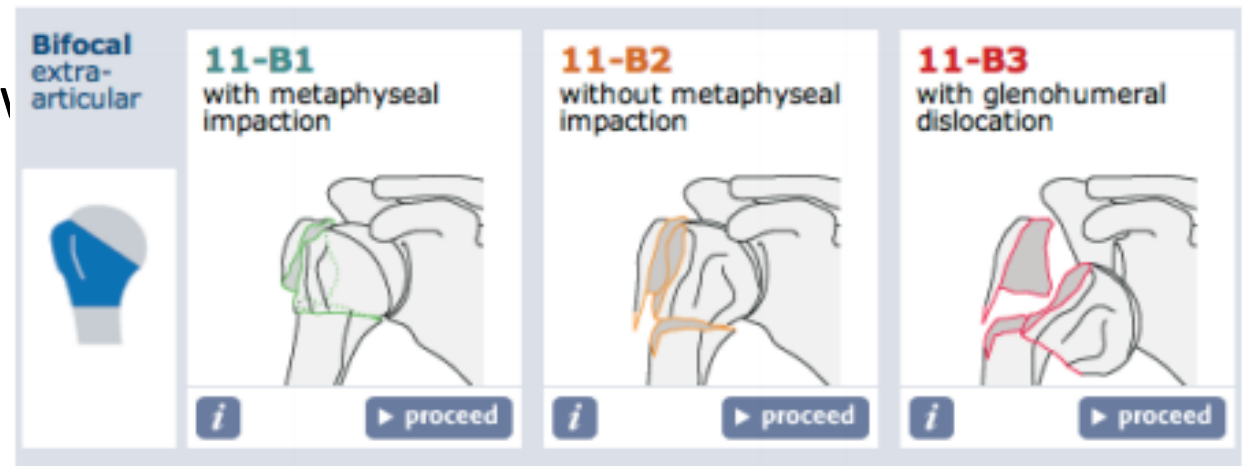
- The AO classification places more emphasis on the blood supply to the articular surface
- The assumption is that if either the lesser or greater tuberosity remains attached to the articular segment, then blood supply is probably adequate to avoid AVN
- **Extra-articular unifocal** (either tuberosity, +/- surgical neck of the humerus)
 - **A1:** extra-articular unifocal fracture
 - **A2:** extra-articular unifocal fracture with impacted metaphyseal fracture
 - **A3:** extra-articular unifocal fracture with non-impacted metaphyseal fracture



AO classification - type B

Extra-articular bifocal (both tuberosities, +/- surgical neck of the humerus or glenohumeral dislocation)

- **B1:** extra-articular bifocal fractures with impacted metaphyseal fracture
- **B2:** extra-articular bifocal fractures with non-impacted metaphyseal fracture
- **B3:** extra-articular bifocal fractures with glenohumeral dislocation



AO classification - type C

- **Extra-articular** (anatomical neck) but with compromise to the vascular supply of the articular segment
 - **C1**: anatomical neck fracture, minimally displaced
 - **C2**: anatomical neck fracture, displaced and impacted
 - **C3**: anatomical neck fracture with glenohumeral joint dislocation



The risk of **avascular necrosis** increases from type A (very low) to type C (high risk) and thus determines treatment

Valgus type fracture

Impacted



Periosteum on the medial side serves as a mechanical hinge
Radiographically will see alignment between medial shaft and head segments

Low rate of AVN if posteromedial component intact thus preserving intraosseous blood supply
74% satisfactory results in this injury.

With lateral displacement



The mechanical hinge is torn head fragment is very unstable
Hinge – reduced first, before raising the head

Varus type fracture

Impacted



Impaction of the head on the medial side
No disruption on the lateral side
Sagittal plane – increased anterior angulation
Shaft is not separated

With disruption



The varus disruption type is characterized by complete avulsion of the head from the shaft
The shaft is separated from the head in an anteromedial position

Case report

AGE	67 / Male
Symthoms	L shoulder pain
History	Right hand dominant male who had episode of lightheadedness causing ground level fall resulting in L shoulder pain and inability to move shoulder.
PMH	CAD, AFIB
Physical exam	Left shoulder with bruising and ecchymosis. TTP at shoulder. Unable to range shoulder. NVI LUE.

X-rays: A view and



Question 1

What additional imaging studies would you get to determine treatment?

None - Current 2-view X-rays are enough

Additional X-rays only (+/- axillary, apical oblique etc)

CT only

MRI only

Additional X-rays and CT only

CT and MRI only

Additional X-rays, CT, and MRI

Question 2

If you got additional x-rays, what additional views would you obtain in addition to the AP and Scapular Y provided?

Axillary

Apical oblique

Velpeau

West Point axillary

I would not get additional xrays, current 2-views are enough

Question 3

According to Neer, How would you classify this fracture?

1 part

2 part

3 part

4 part

I would not classify it with the Neer system, it does not help guide my treatment

Question 4

How would you treat this injury?

Nonoperative - Sling immobilization

Operative

Question 5

If performing operative treatment, what would you do?

CRPP (closed reduction percutaneous pinning)

ORIF (open reduction and internal fixation)

Intramedullary nail

Hemiarthroplasty

Reverse TSA

TSA (total shoulder arthroplasty)

I would not perform operative treatment

Question 6

If performing ORIF, what approach would you use?

Anterior (deltopectoral)

Lateral (deltoid-splitting)

I would not perform ORIF

Question 7

If performing ORIF, what type of fixation would you perform?

Heavy nonabsorbable sutures

Isolated screw fixation

Locking plate

Blade Plate

Recon Plate

I would not perform ORIF

Question 8

If performing ORIF, when would you allow weight bearing?

Immediately

2 weeks

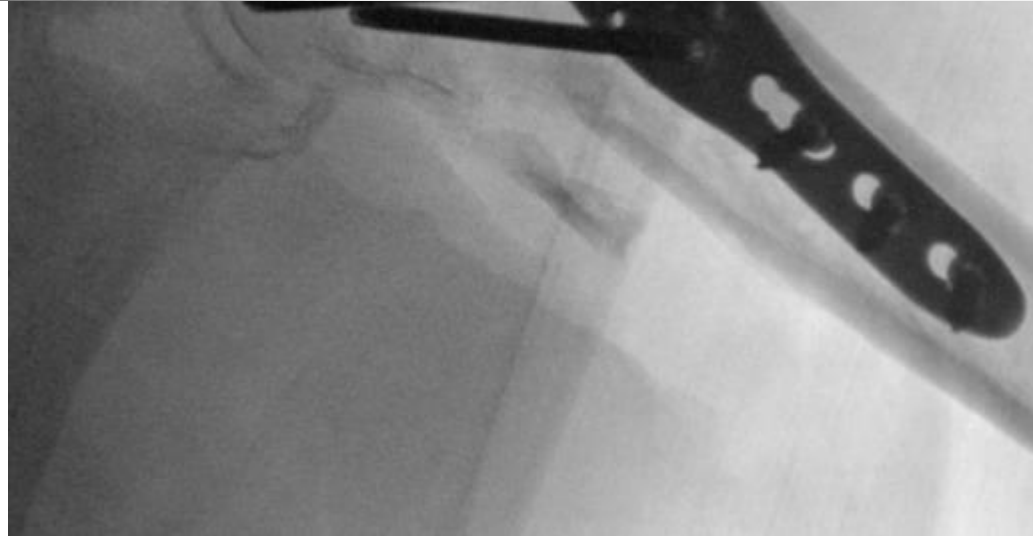
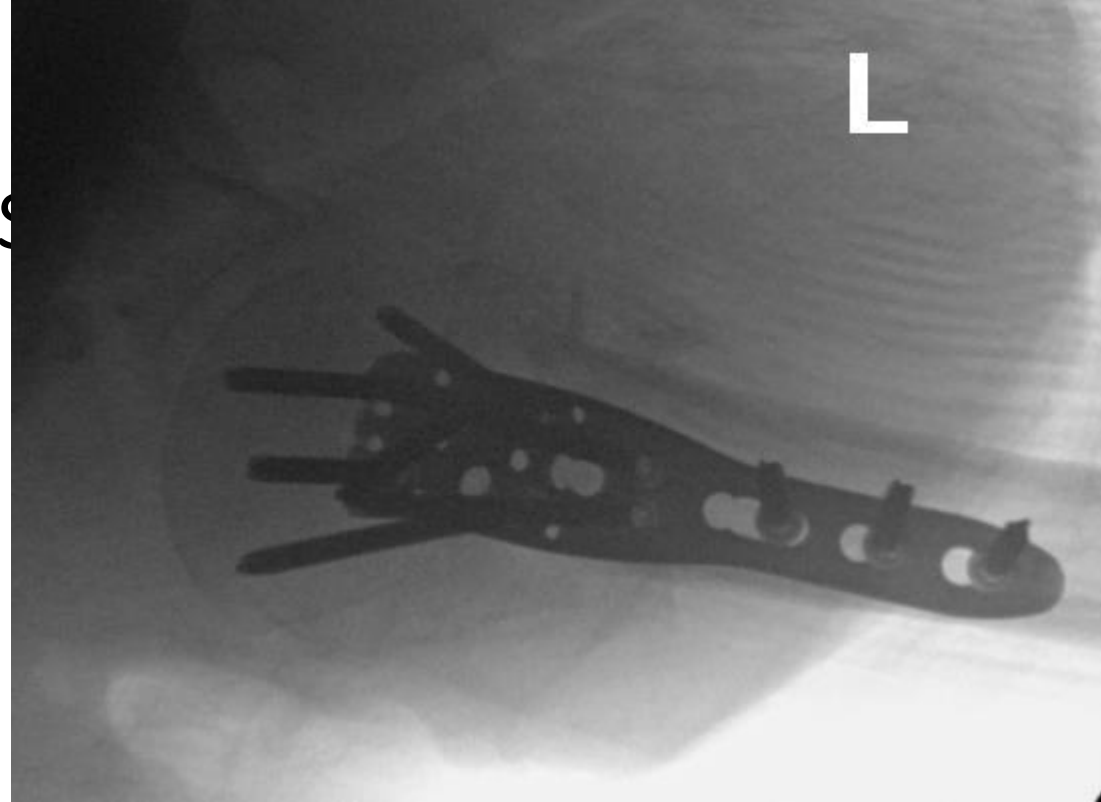
4 weeks

6 weeks

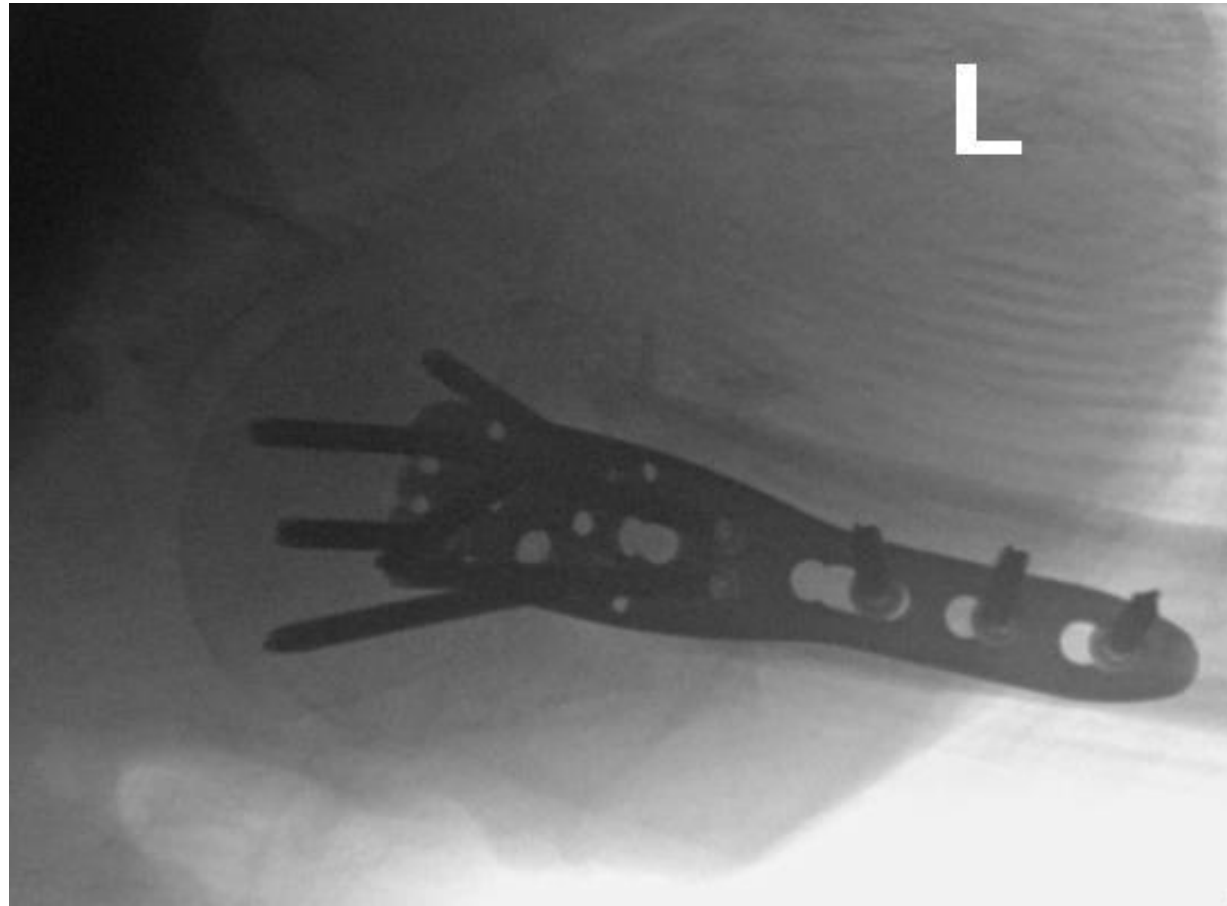
12 weeks

I would not perform ORIF

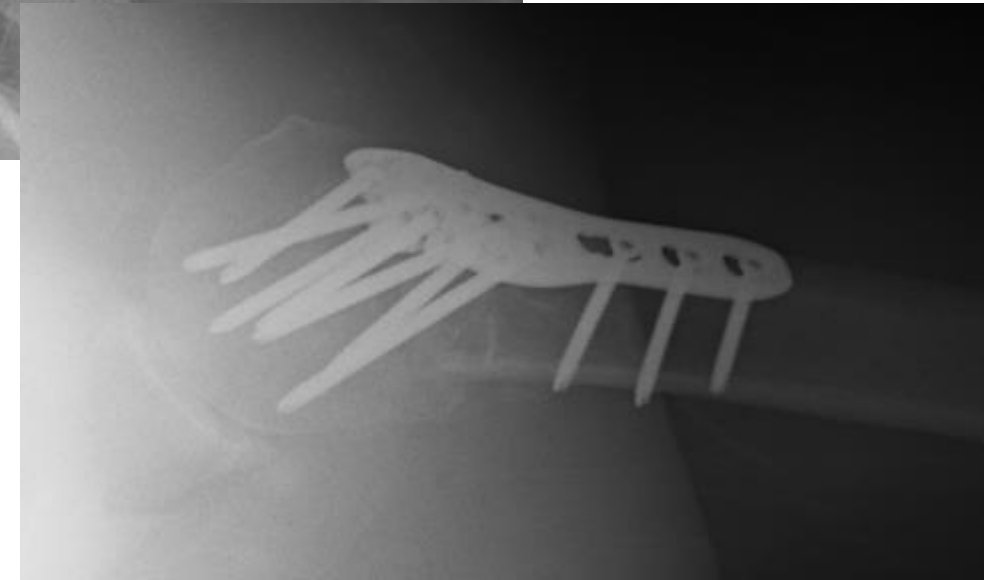
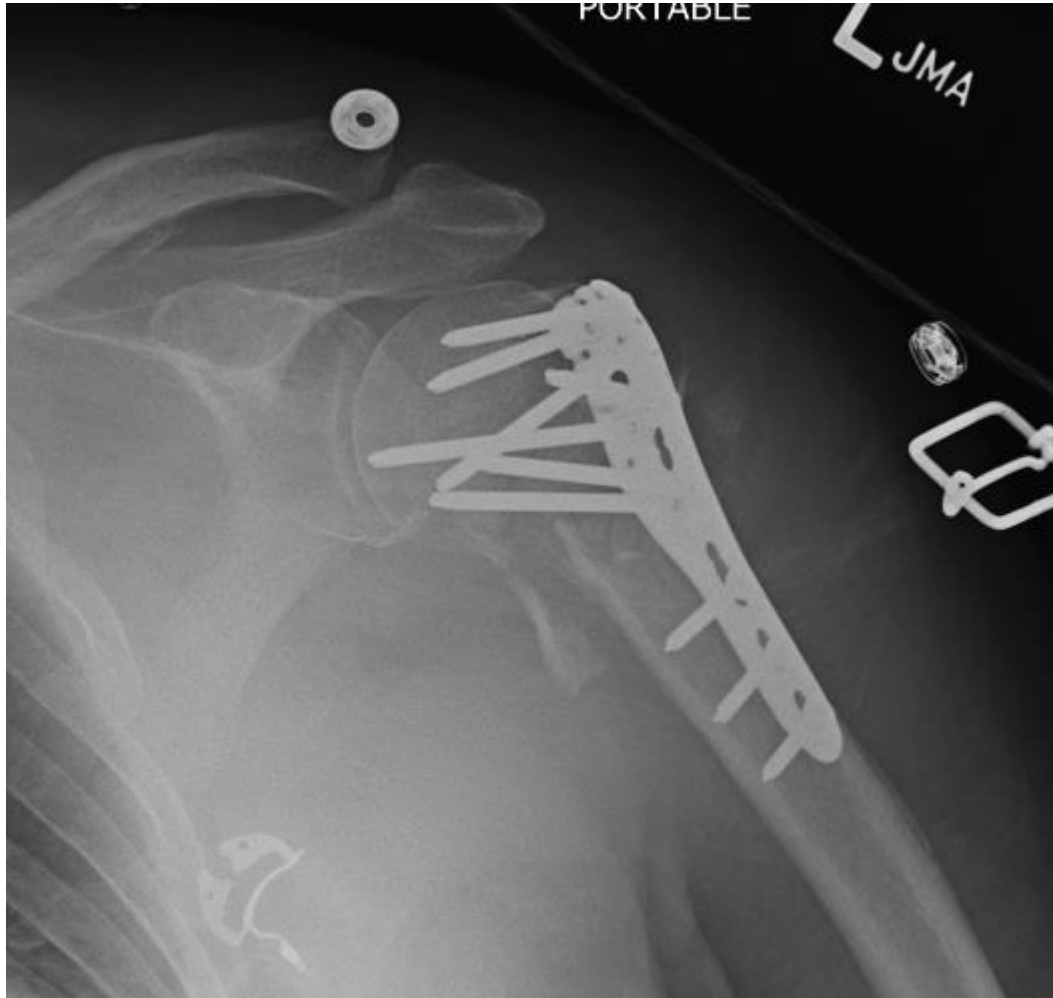
Intraoperative x-rays



Intraoperative x-rays



Postoperative x-rays



Video - surgery

