Proximal Humerus Fractures: *contemporary perspectives*

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Proximal Humerus Fractures

High Incidence:

- ***2nd most frequently fractured long bone in upper extremity***
  80,000 a year in US

Proximal Humerus Fracture

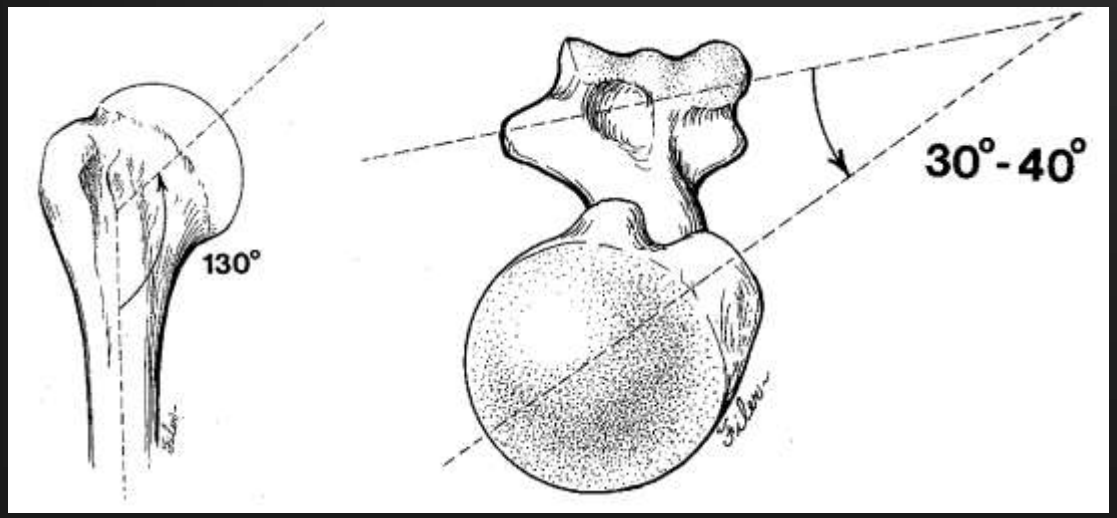
Age group helps determine personality of fracture

- Young patient
- Male > Female
- High energy
- Good bone quality
- ORIF

- Older patient
- Female > Male
- Low energy
- Poor bone quality
- Hemiarthroplasty > ORIF

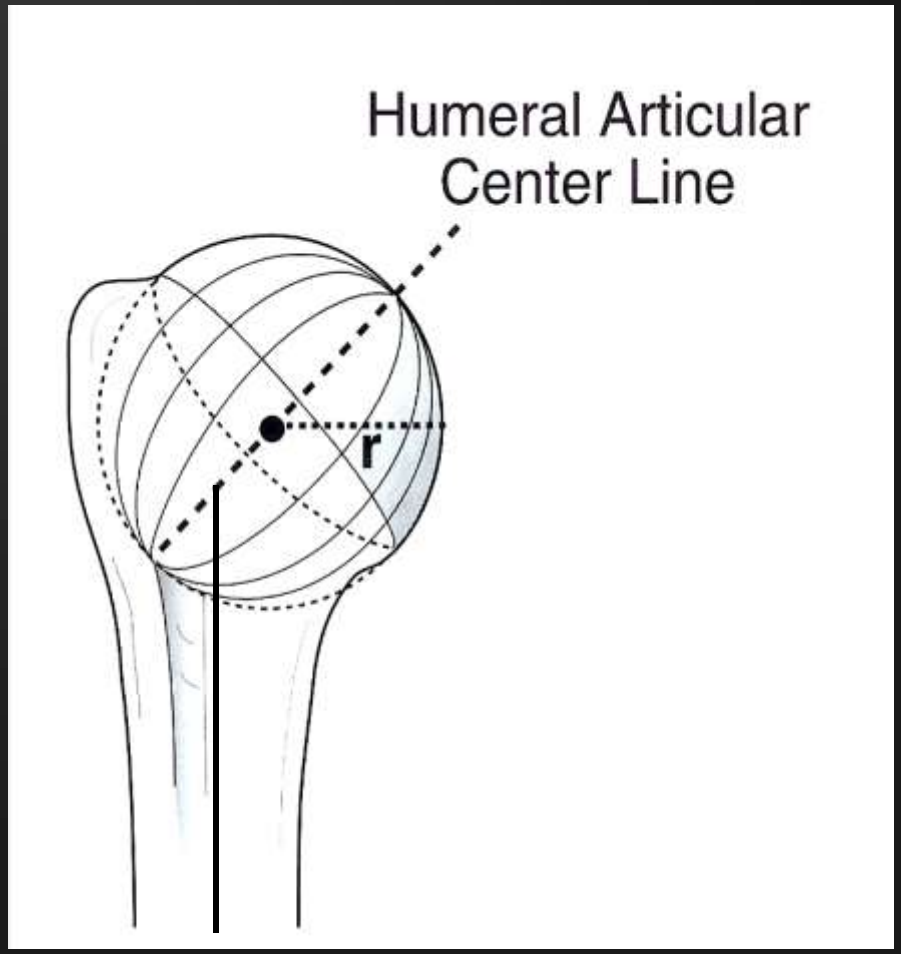
Anatomy

- **Humeral head retroverted 20-30º**
- **Neck-shaft angle 120-150º**



Anatomy

the proximal humeral articular centerline is inclined 135° to the axis of the shaft



Vascular Anatomy

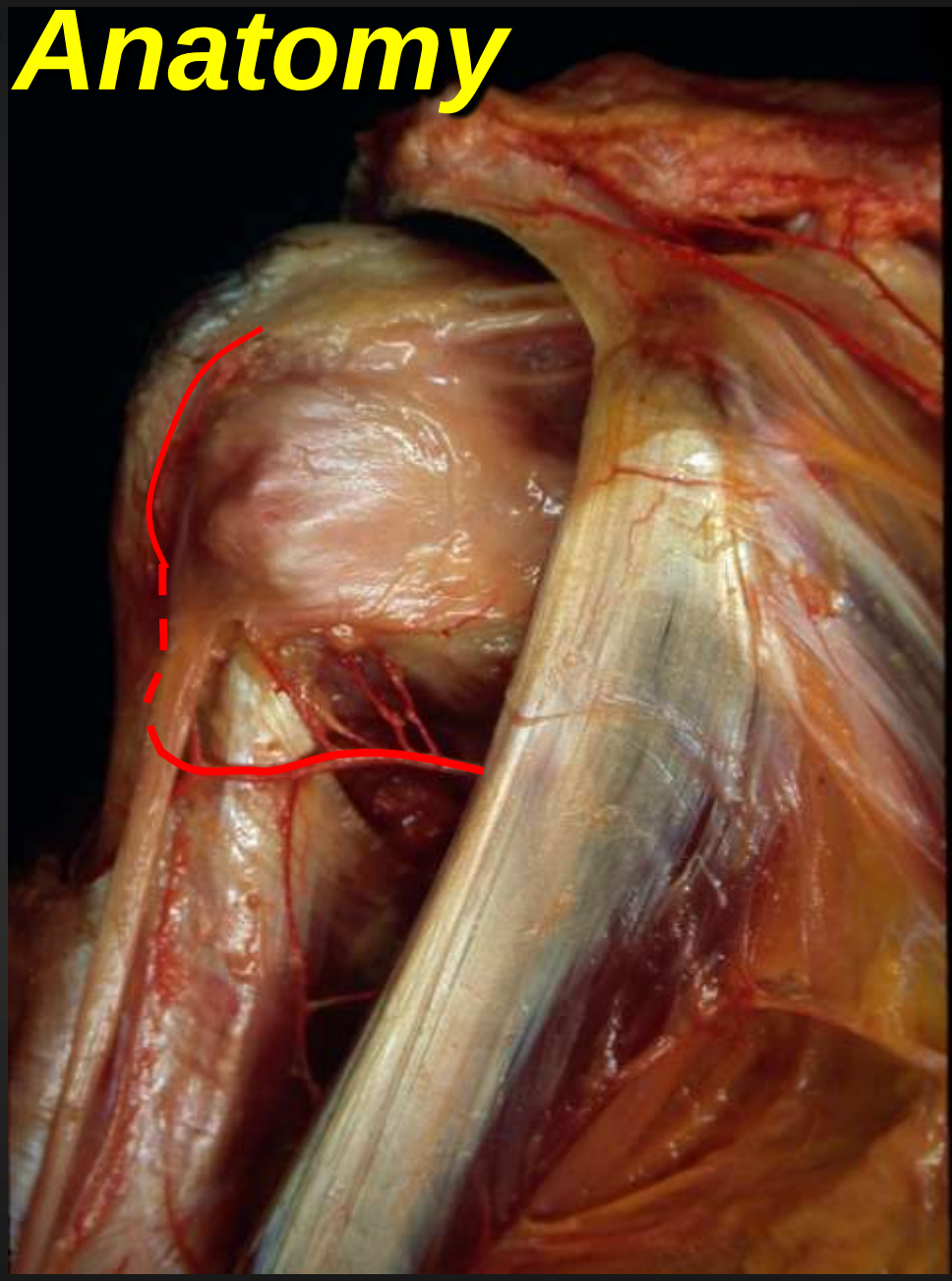
Blood supply

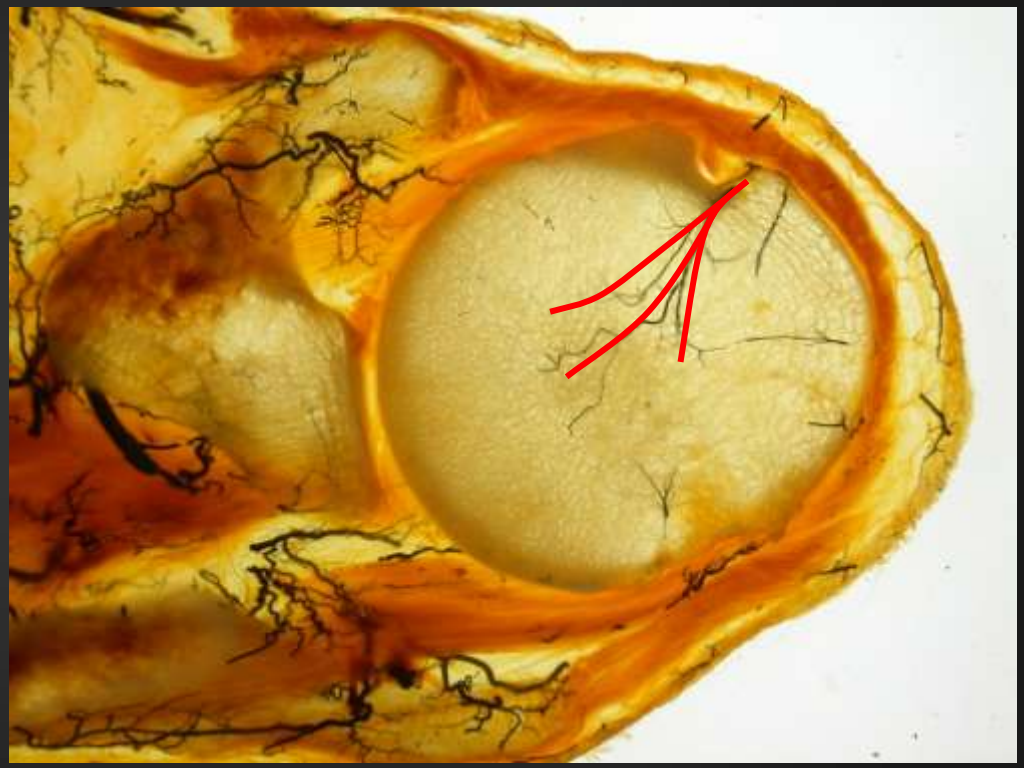
•Anterior Humeral circunflex

•Ascending branch, along the lateral ridge biceps grove

•Enters into the greater tuberosity

Gerber, Schneeberger, Vinh. The arterial vascularization of the humeral head. JBJS 1990;72A:1486

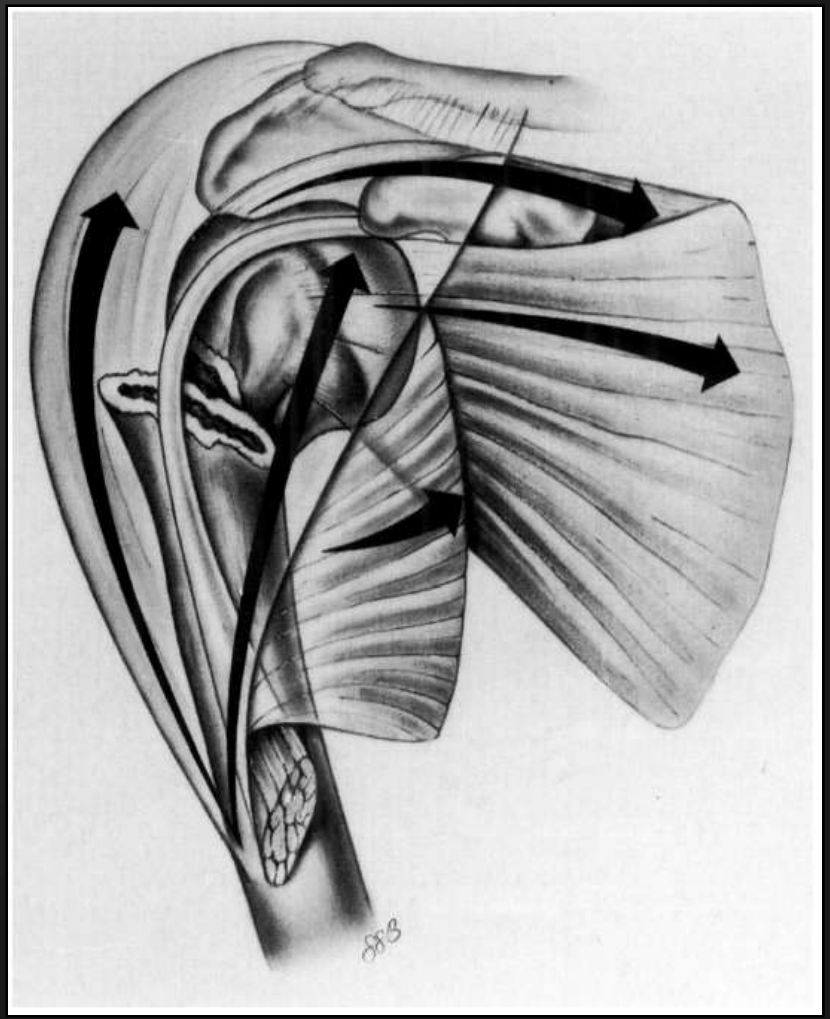




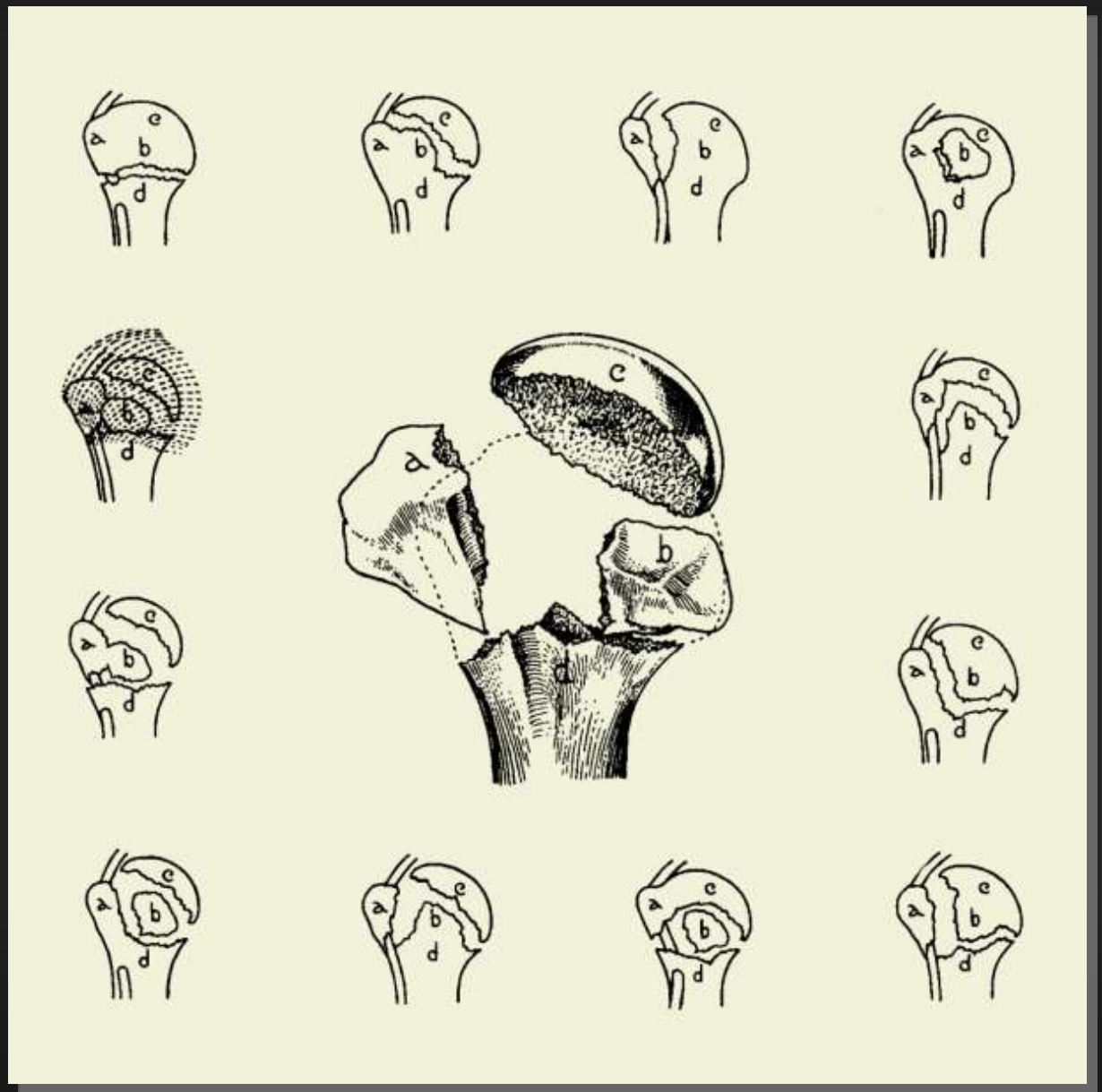
Courtesy:
Dr Manuel Llusa, Barcelona, Spain.

Deforming Forces

- **Pectoralis Major**
  - **Shaft medial**
- **Deltoid**
  - **Shaft proximal**
- **Subscapularis**
  - **Lesser tuberosity medial**
- **Rotator Cuff**
  - **Greater tuberosity superior and posterior**

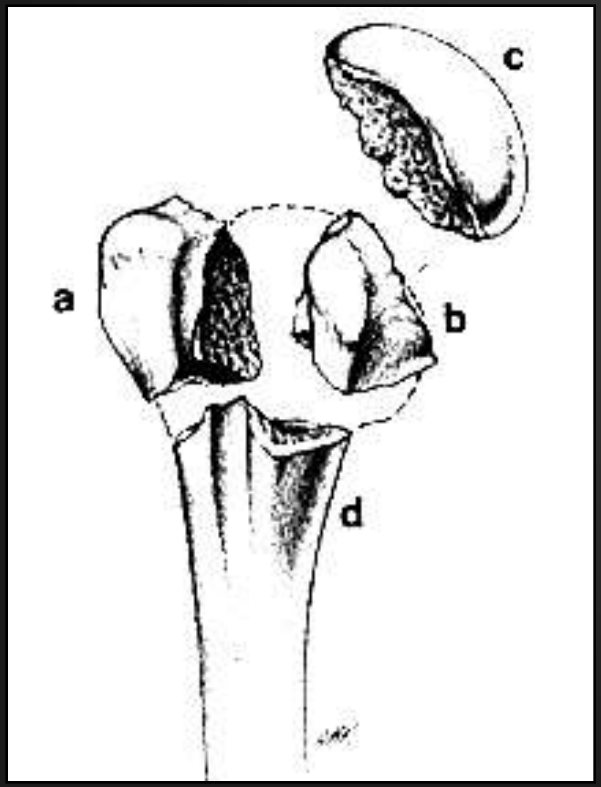


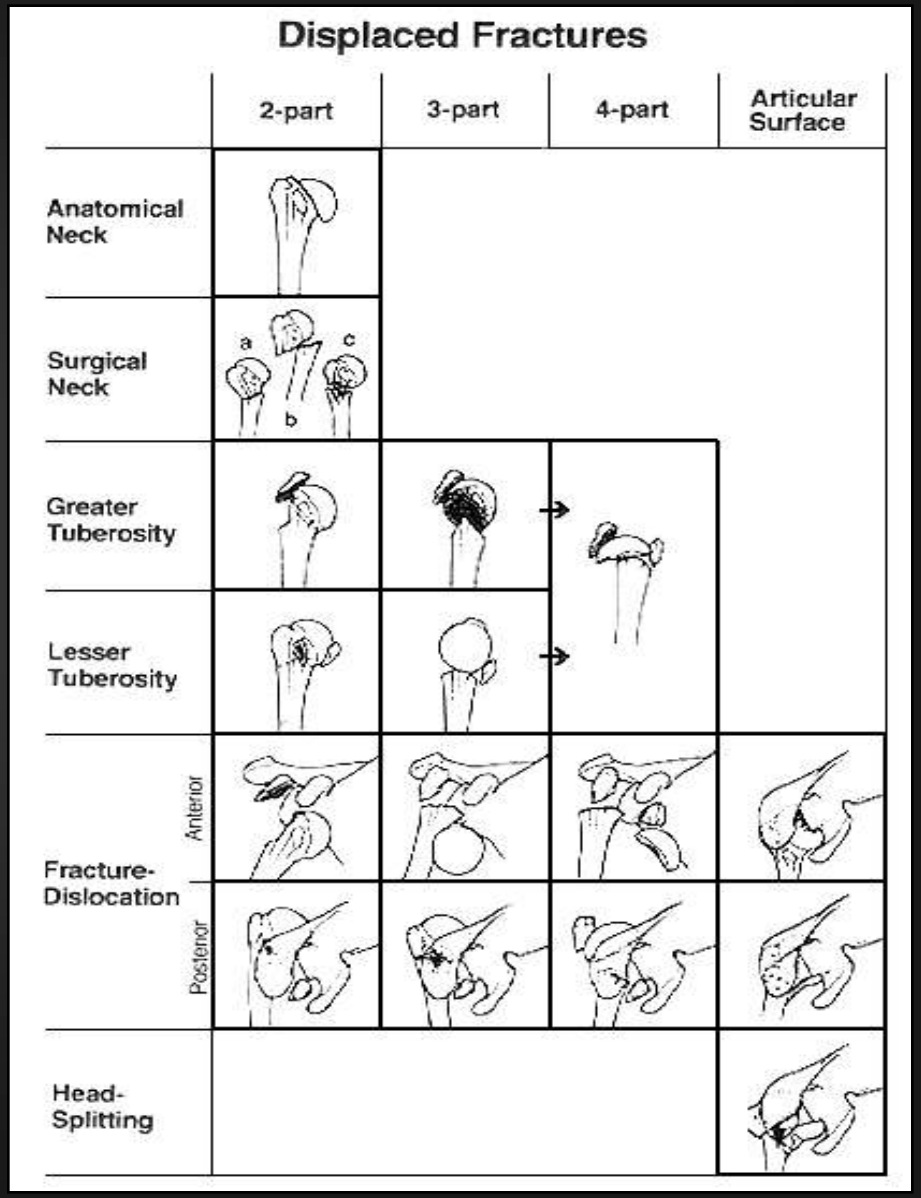
Classification E.A. Codman 1934



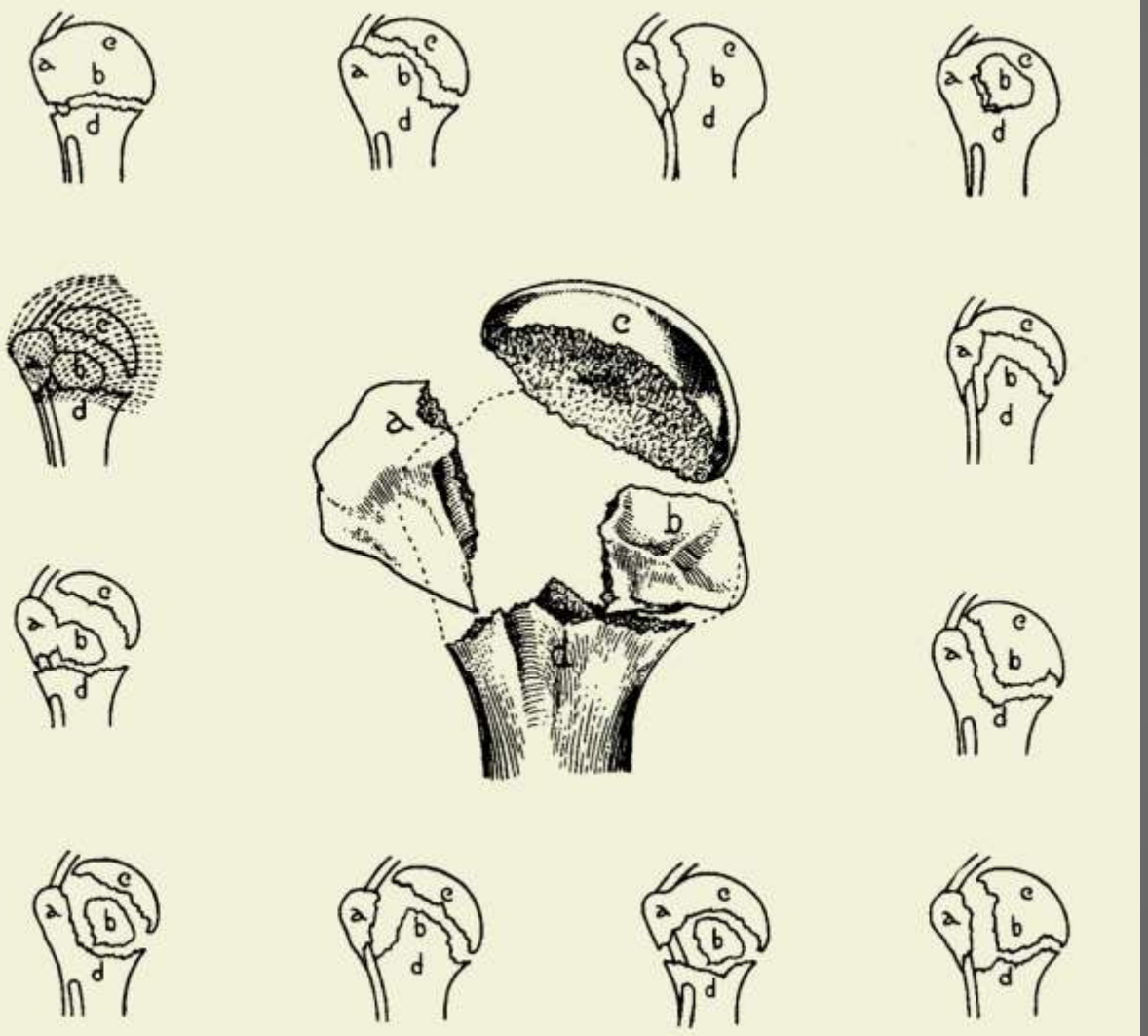
Proximal Humerus Fractures

Neer's Classification





HERTEL `s modified Codman`s classification



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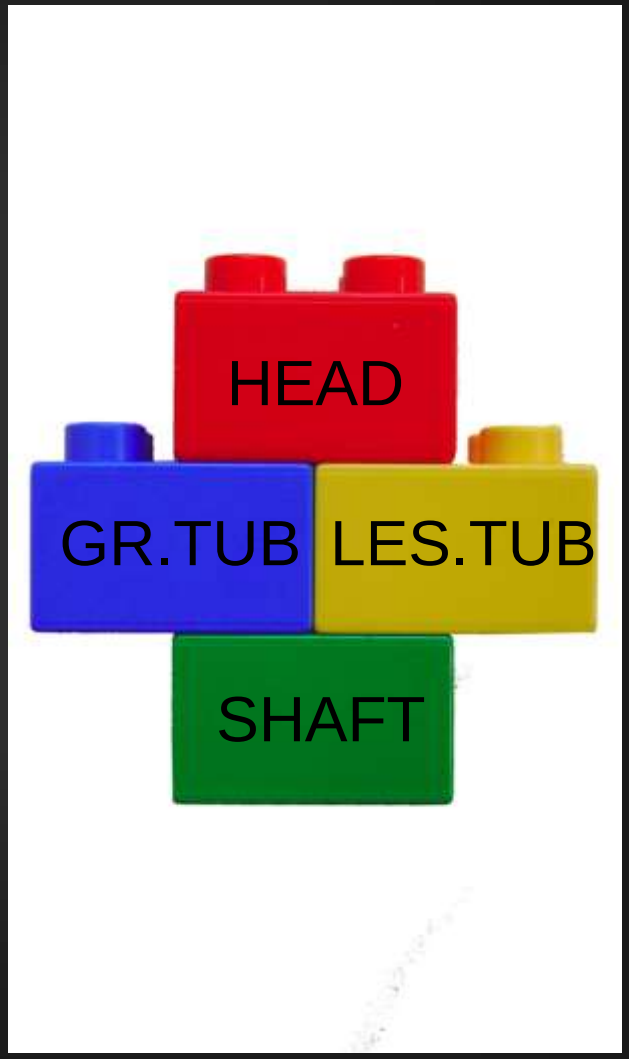

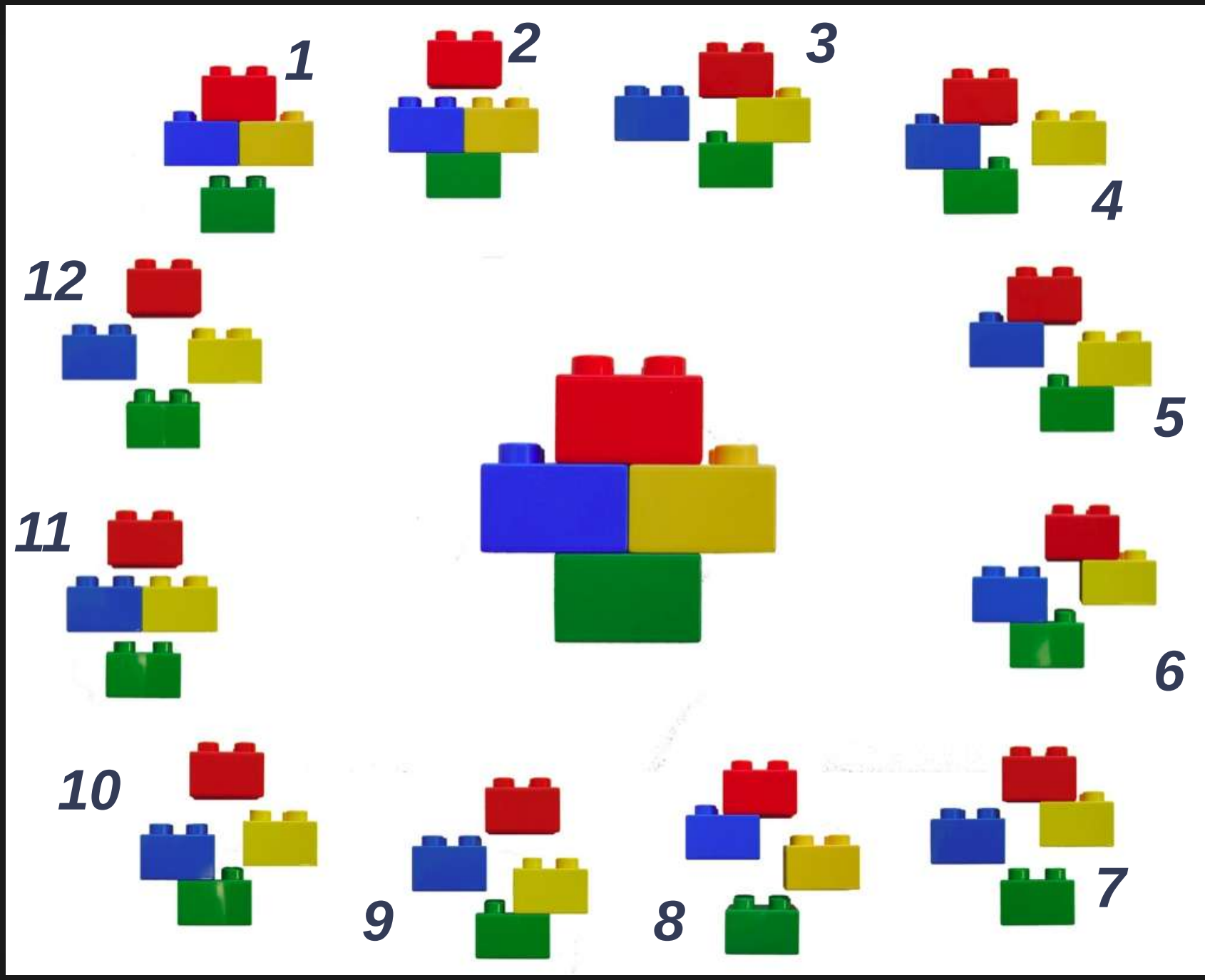
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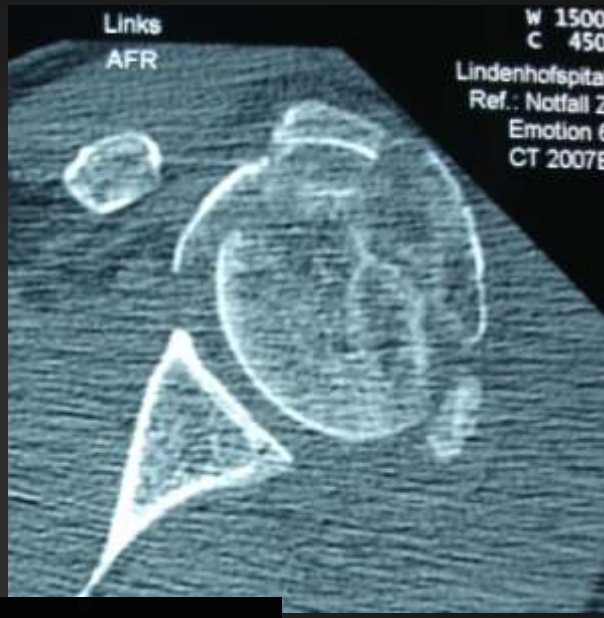
Proximal Humerus Fractures *IMAGING*



Proximal Humerus Fractures *IMAGING*

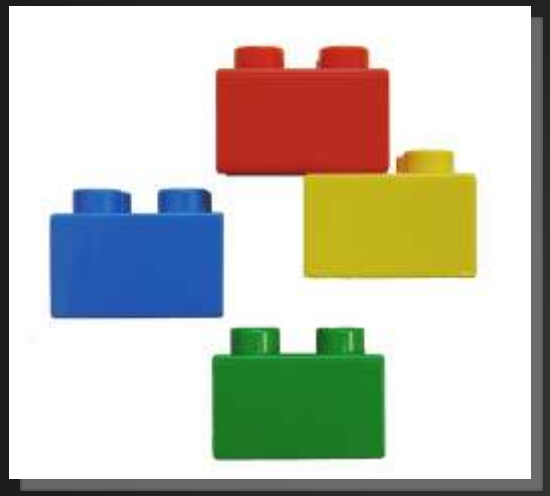
3D CT reconstruction Very useful:
The exact fracture pattern can be visualized

Predictors of ischaemia?

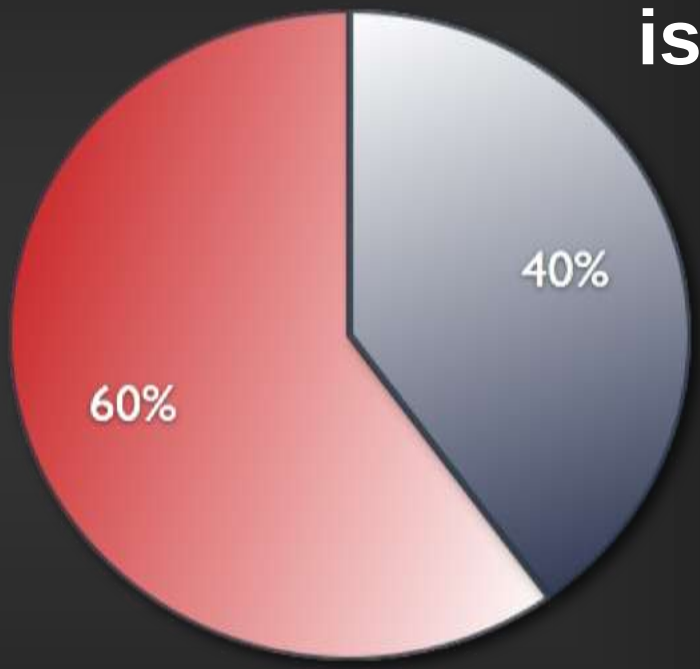
prospective study, 100 consecutive intracapsular fractures

- **type of fracture**
- **displacement**
- **gleno-humeral dislocation**
- **metaphyseal extension**
- **medial hinge**

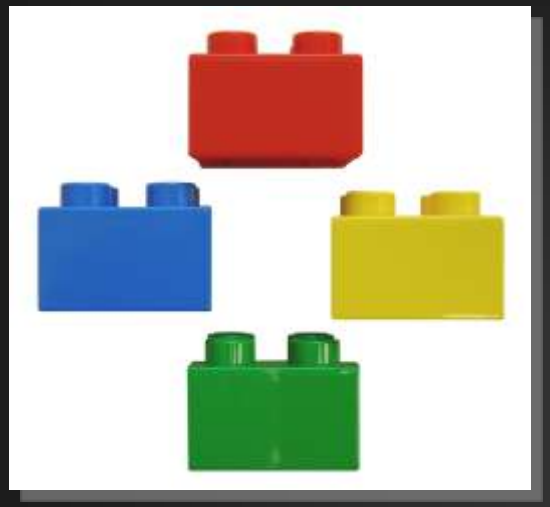
Predictors of humeral head ischemia, Hertel et al., J Shoulder Elbow Surg 13:427-433 2004



3-part fracture

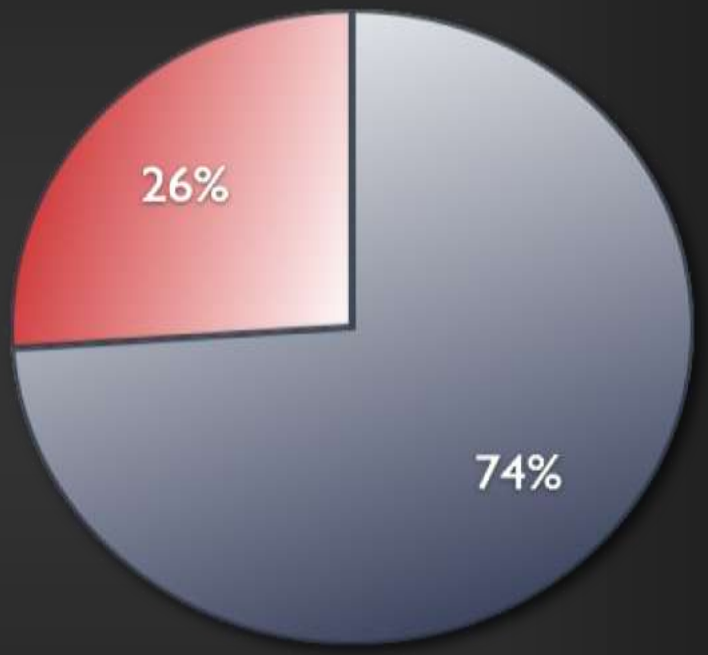


Predictors of humeral head ischemia, Hertel et al., J Shoulder Elbow Surg 13:427-433 2004



4-part fracture

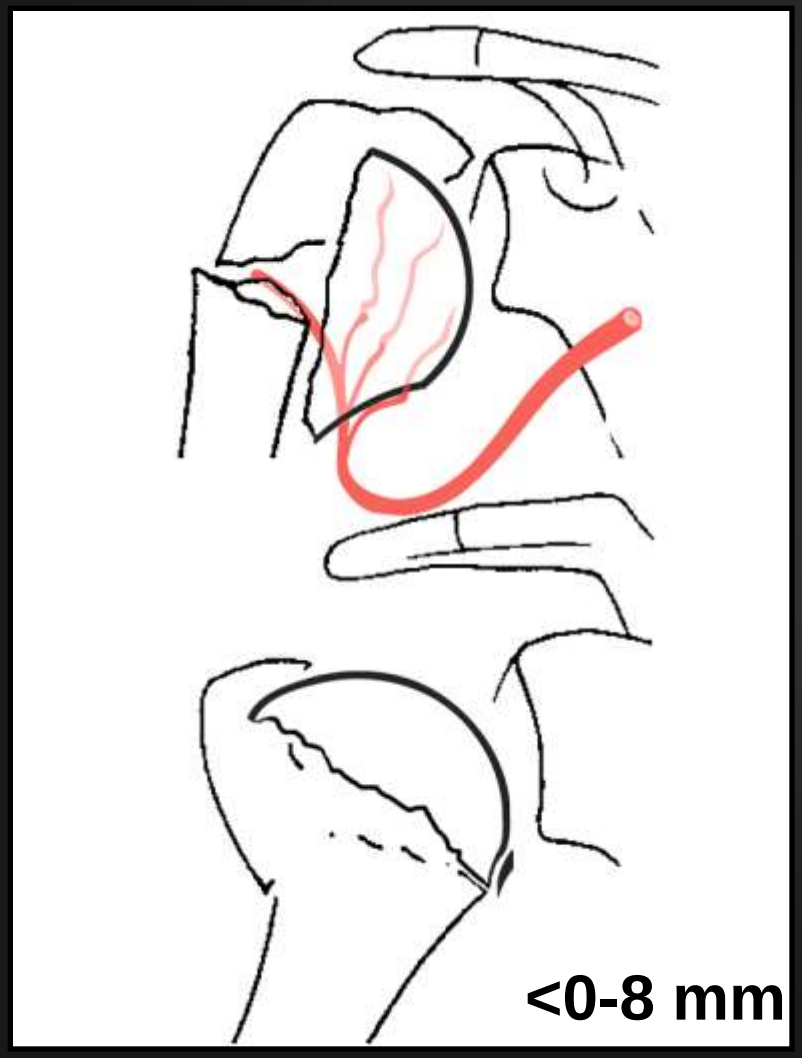
perfused



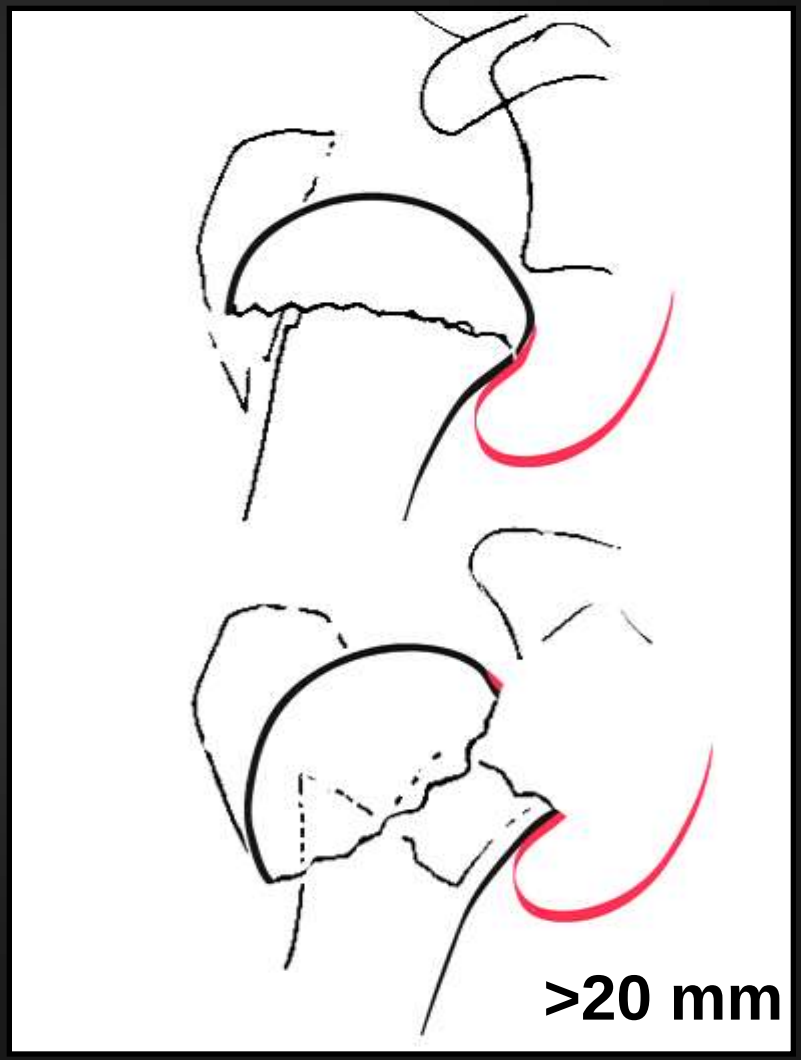
ischaemic

Predictors of humeral head ischemia, Hertel et al., J Shoulder Elbow Surg 13:427-433 2004

Postero-medial metaphyseal extension



Displacement of the medial hinge



. . . other variables

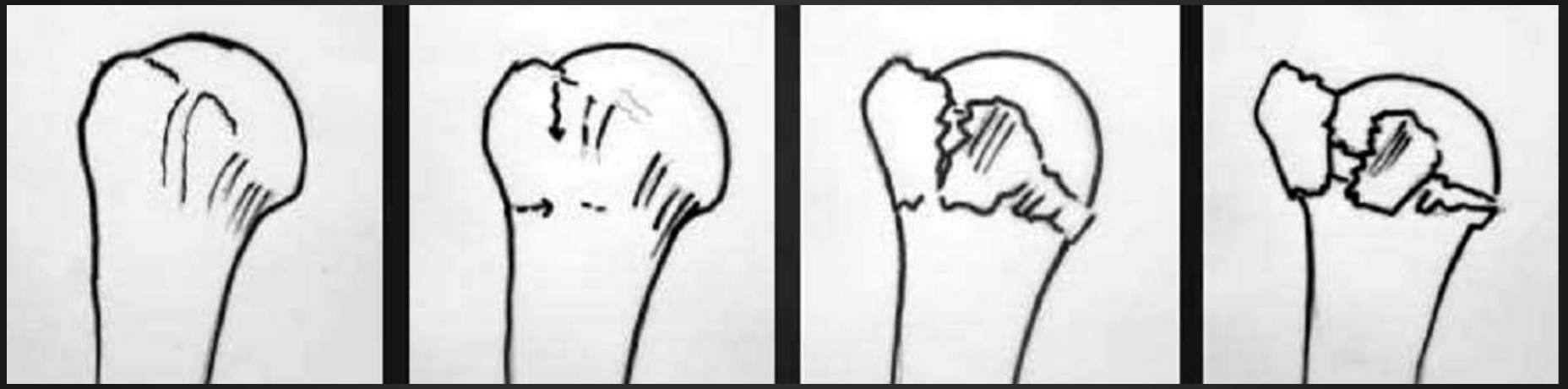
1. fragment displacement
2. gleno-humeral dislocation
3. intracapital fracture line

were not so useful !

the two most common 4-part fracture displacement patterns: Valgus and Varus

Proximal Humerus Fractures

Valgus impacted 4-part fracture



displacement pattern

Proximal Humerus Fractures

Only two columns disrupted:

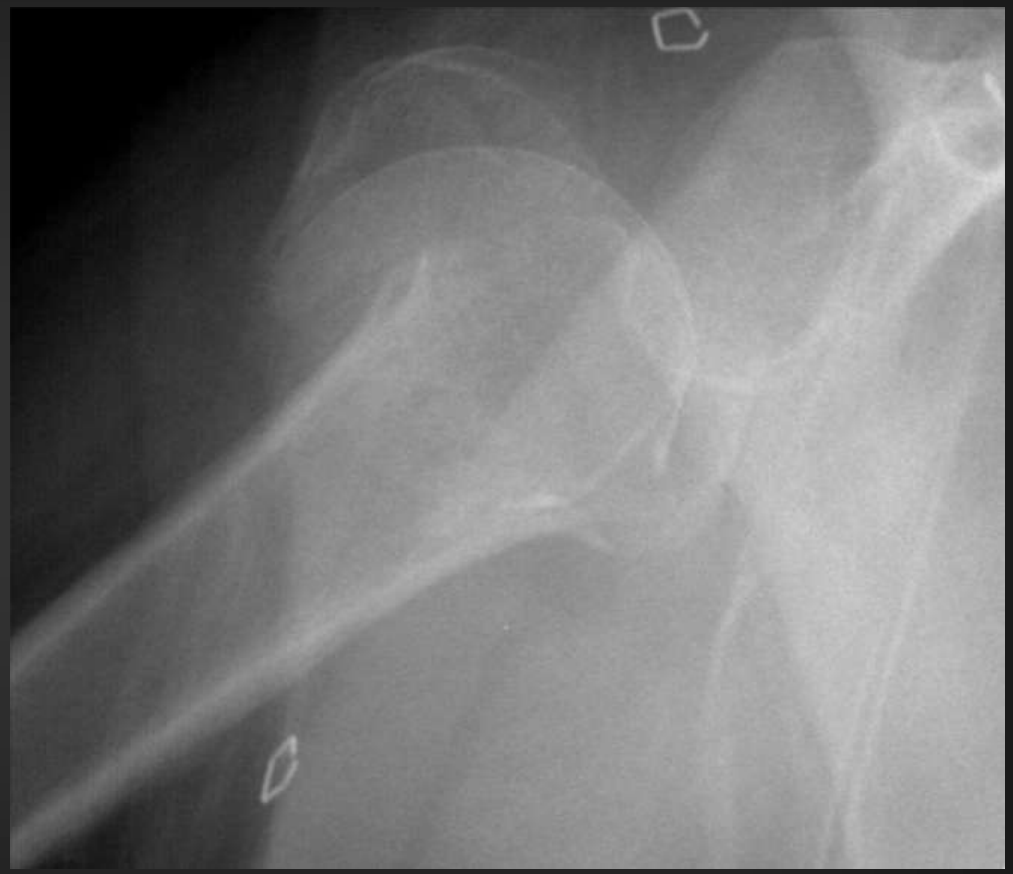
Greater tuberosity column

Lesser tuberosity column

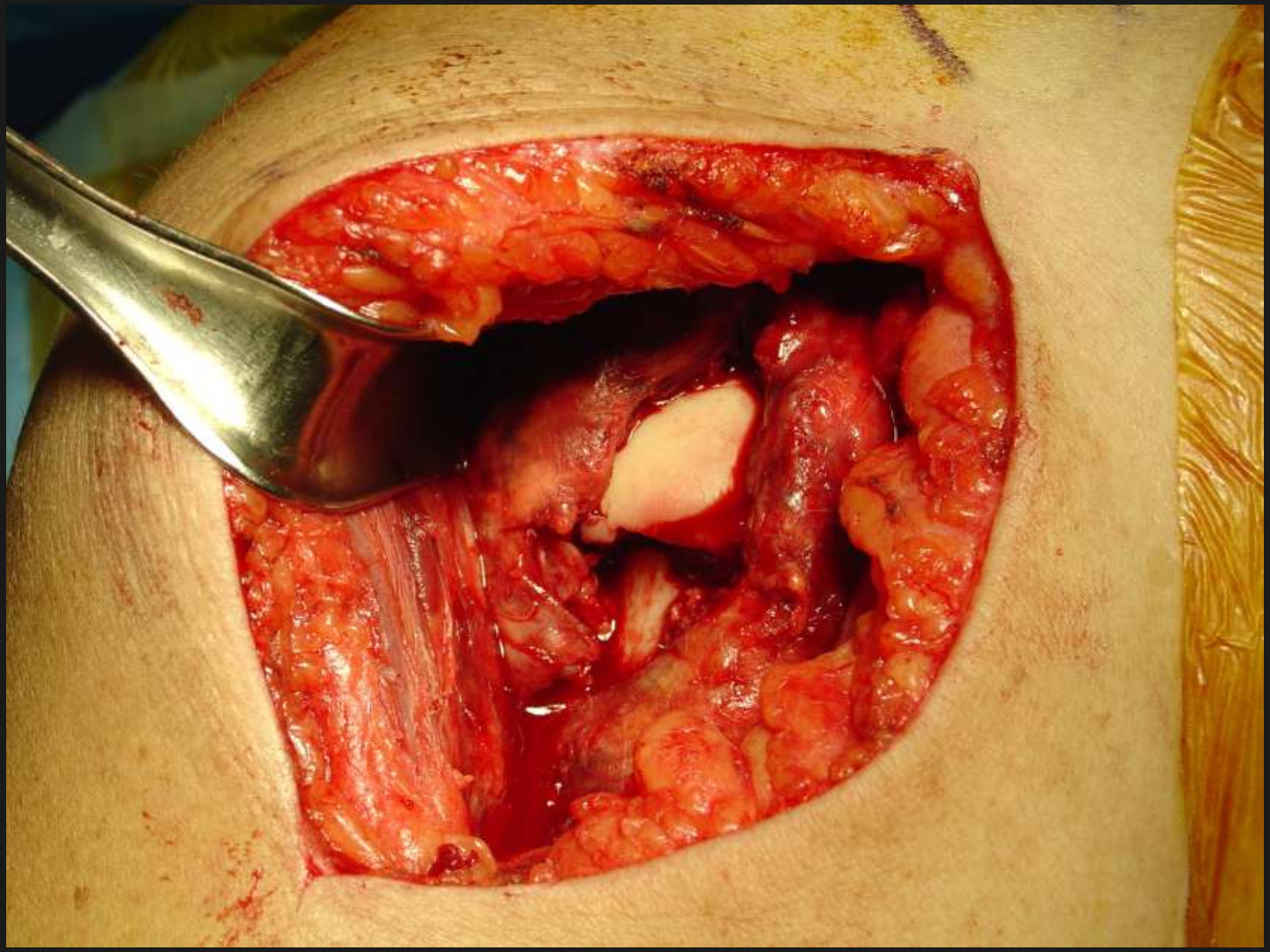
Medial calcar intact

Valgus impacted fracture

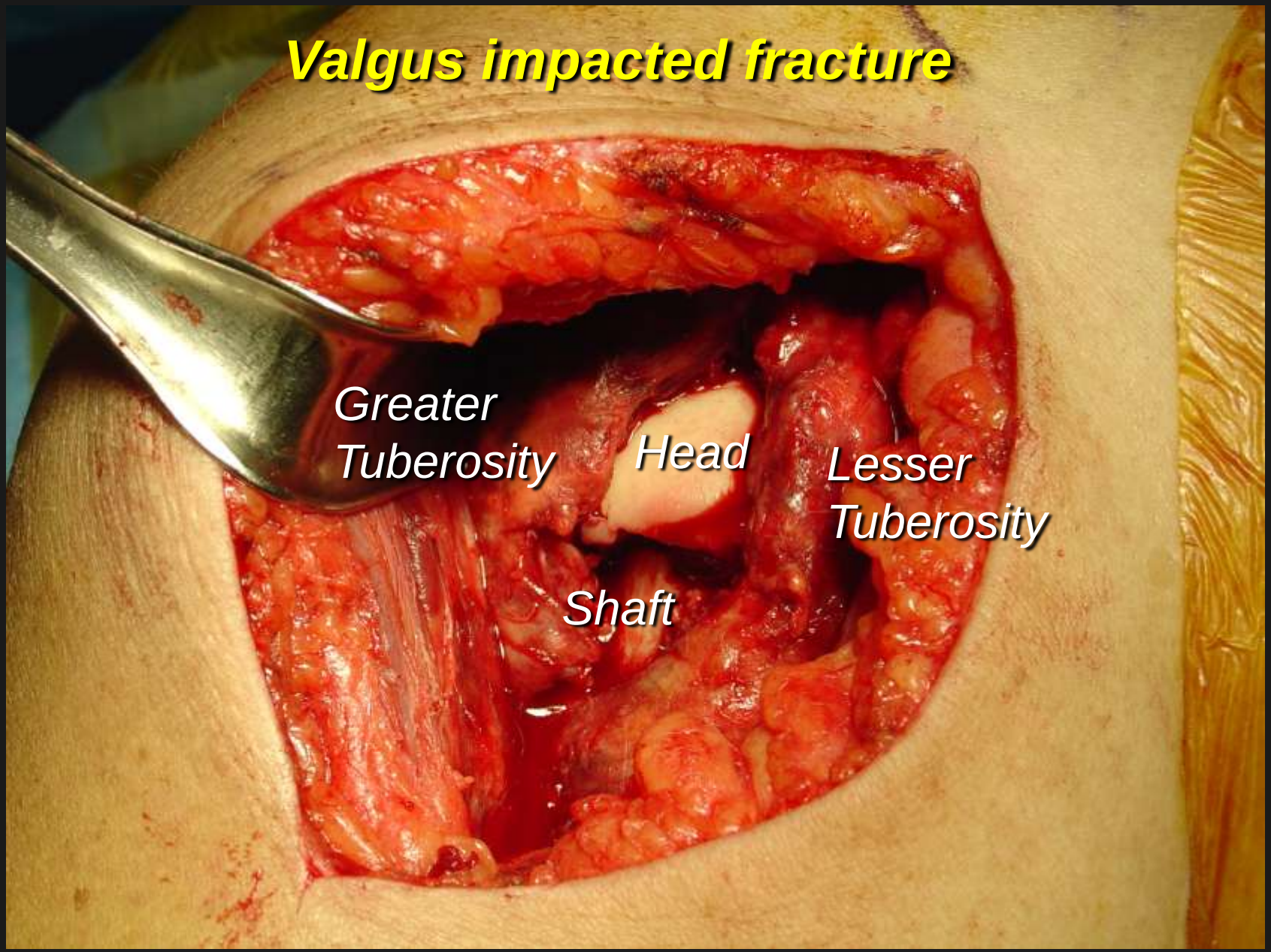
Proximal Humerus Fractures



Valgus impacted fracture

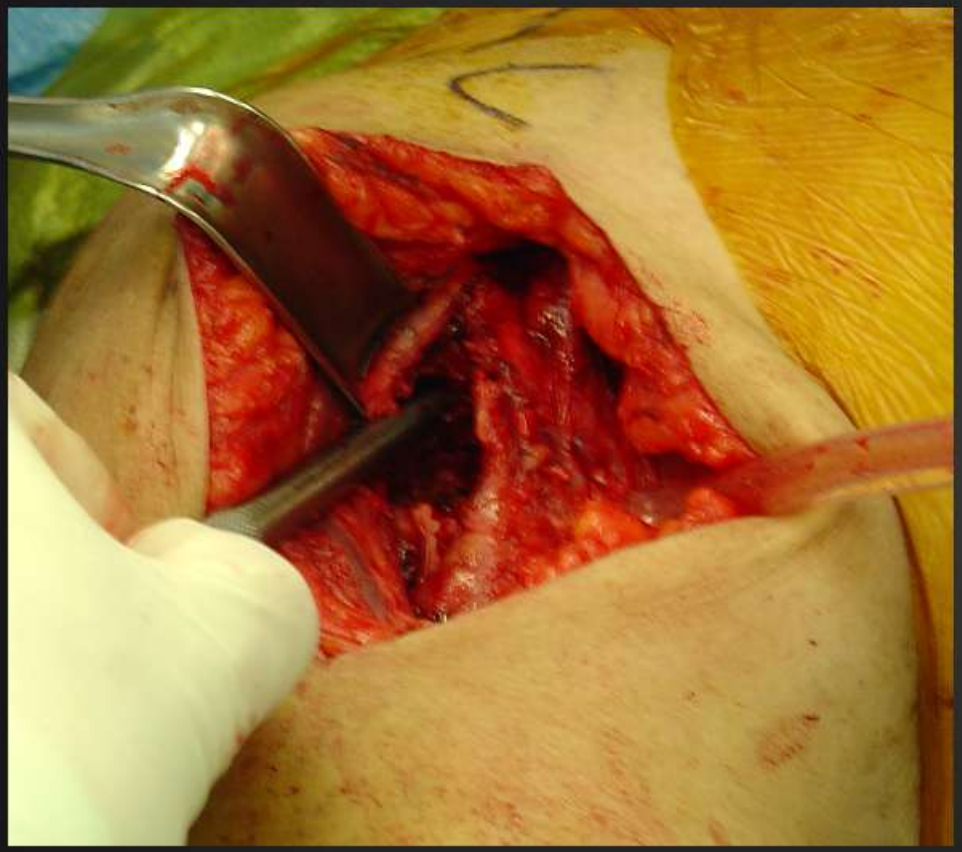


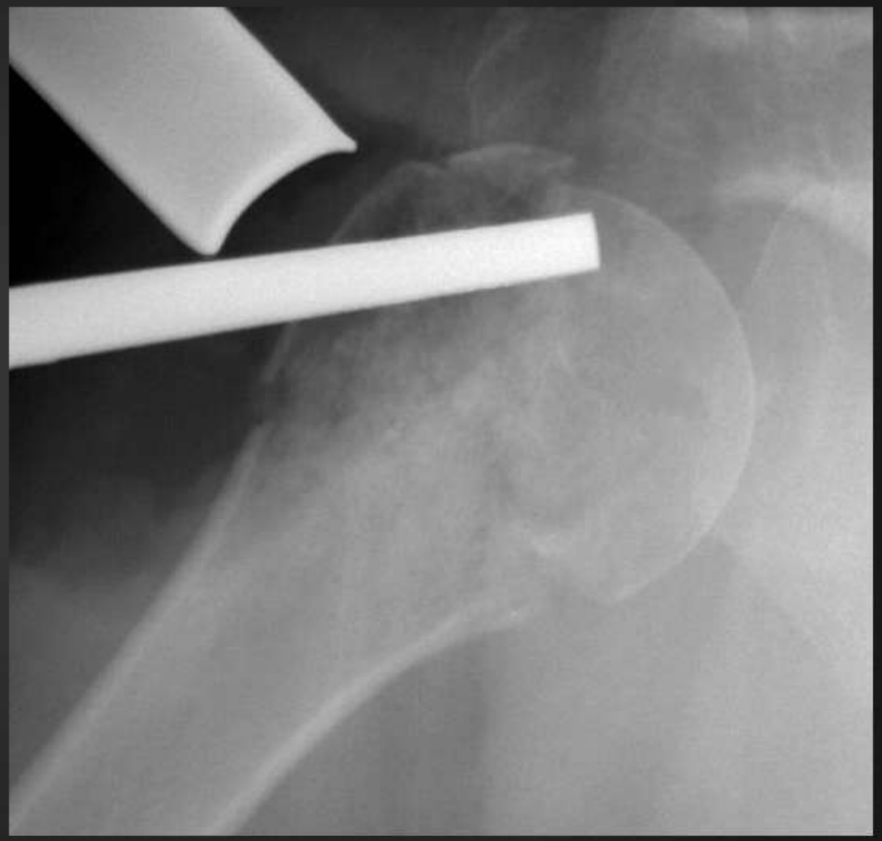
Valgus impacted fracture



Delto-pectoral incision, Intra–focal approach

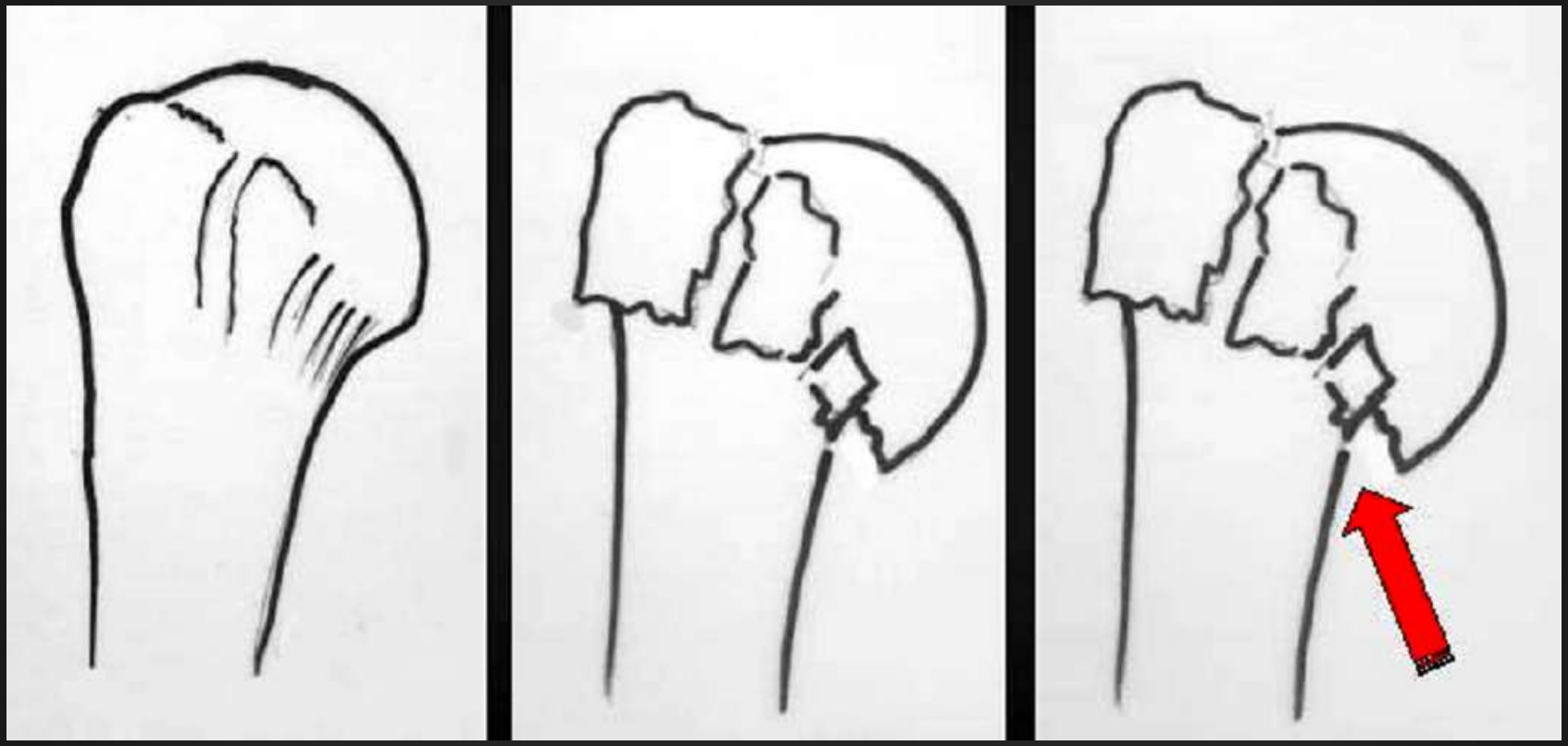
Valgus impacted fracture





Proximal Humerus Fractures

Varus displacement (varus and posterior shear)



loss of the inferior support of the head:
<u>the medial calcar</u>

Proximal Humerus Fractures

Varus displacement (varus and posterior shear)

All three columns disrupted:

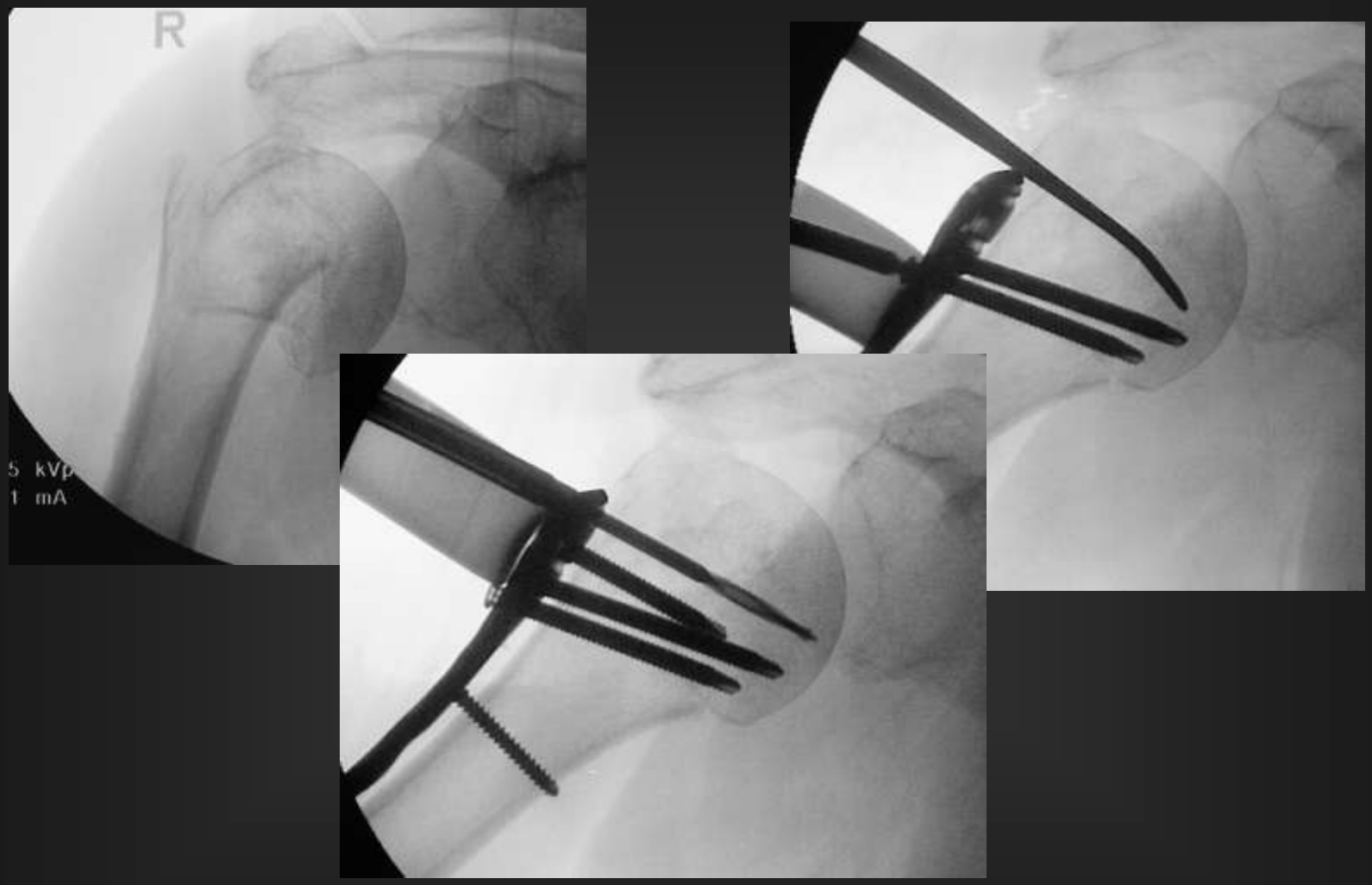
Greater tuberosity column

Lesser tuberosity column

Medial calcar

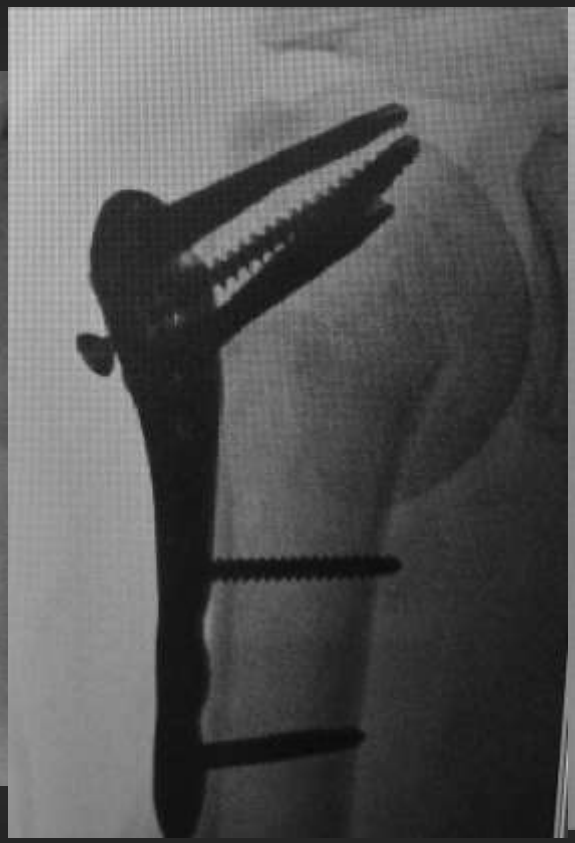
Proximal Humerus Fractures

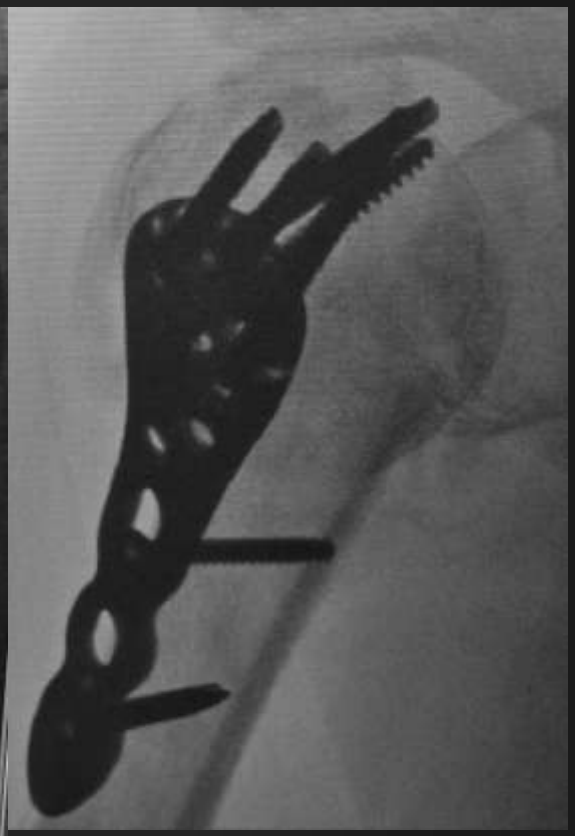
Varus displacement (varus and posterior shear)



Varus displacement (varus and posterior shear)

Loss of reduction, secondary displacement





Varus displacement (varus and posterior shear)

Proximal Humerus Fractures

Valgus impacted fractures… better prognosis:

1- Less incidence of AVN

2- Lower rates of failure from loss of reduction

Mechanical factors
Biologic factors

Jakob, Miniaci, Anson. Four-part valgus-impacted fractures of the proximal humerus. JBJS 1991;73B:295

Varus displacement fractures have a worse prognosis than valgus impacted fractures

Proximal Humerus Fractures

Valgus impacted

4 part
2 column fracture
More stable pattern

Varus and posterior shear

4 part
3 column fracture
More unstable pattern

Proximal Humerus Fractures
MANAGEMENT

- Non- operative treatment
- Internal fixation
- Prosthetic replacement

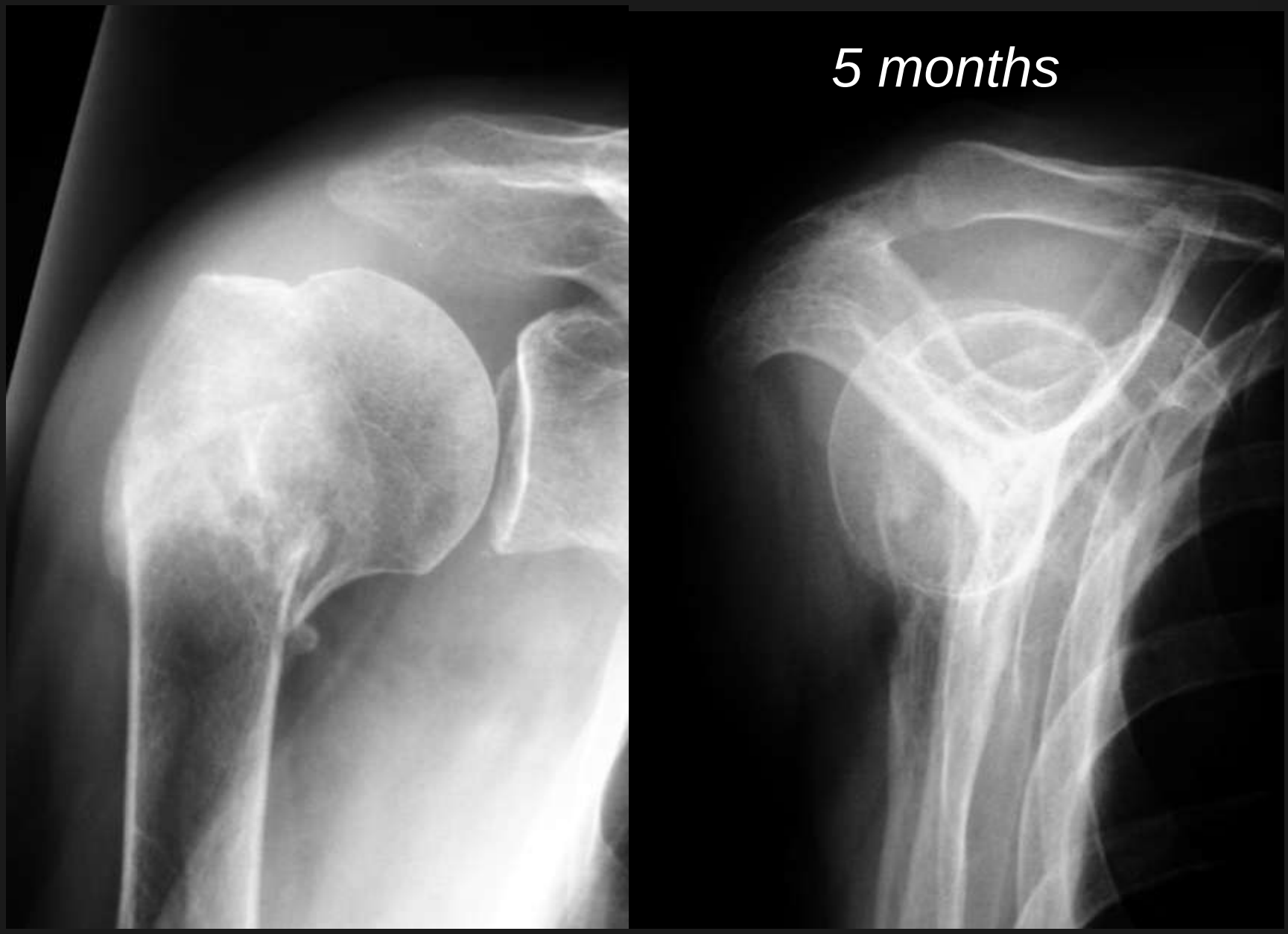
Proximal Humerus Fractures

- **Non- operative treatment:**

non-displaced fractures

impacted stable fractures with acceptable malalignment

displaced but relatively stable fractures in the elderly patient


5 months

Proximal Humerus Fractures

- **Internal fixation**

displaced, unstable fractures with low risk of avascular necrosis

although partial or total AVN may be compatible adequate function and tolerable symptoms !!

Proximal Humerus Fractures

„MINIMAL“ INTERNAL FIXATION MODALITIES

Tension band principle

4-part fracture

impacted medial hinge !!


1 year
post-op

displaced greater tuberosity fractures

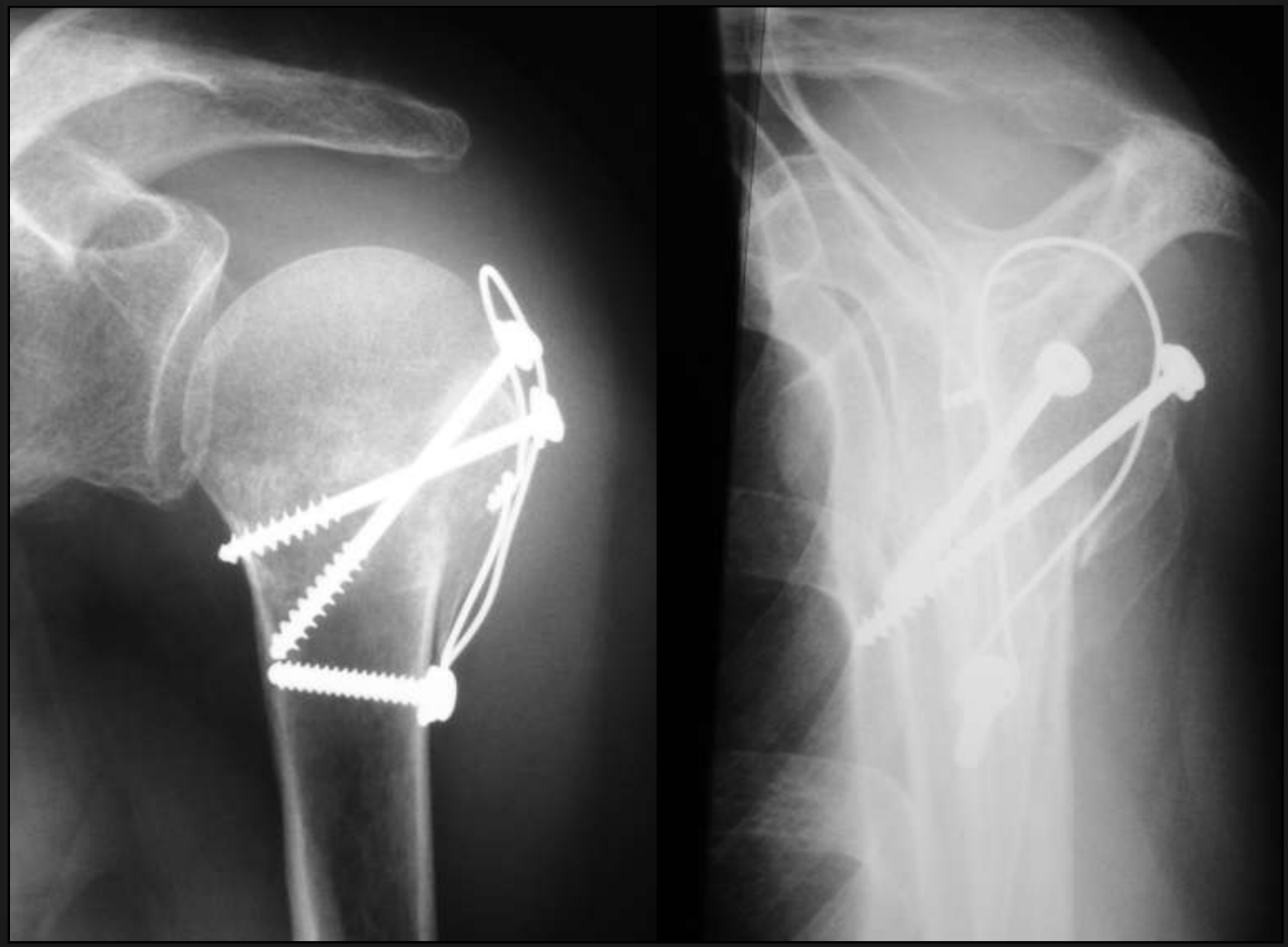

DIDIEleva01
Ex: 101480002
Neer
Se: 4 / 5
Im: 1 / 1
Cor:
1976 x 1576
ET:
TR:

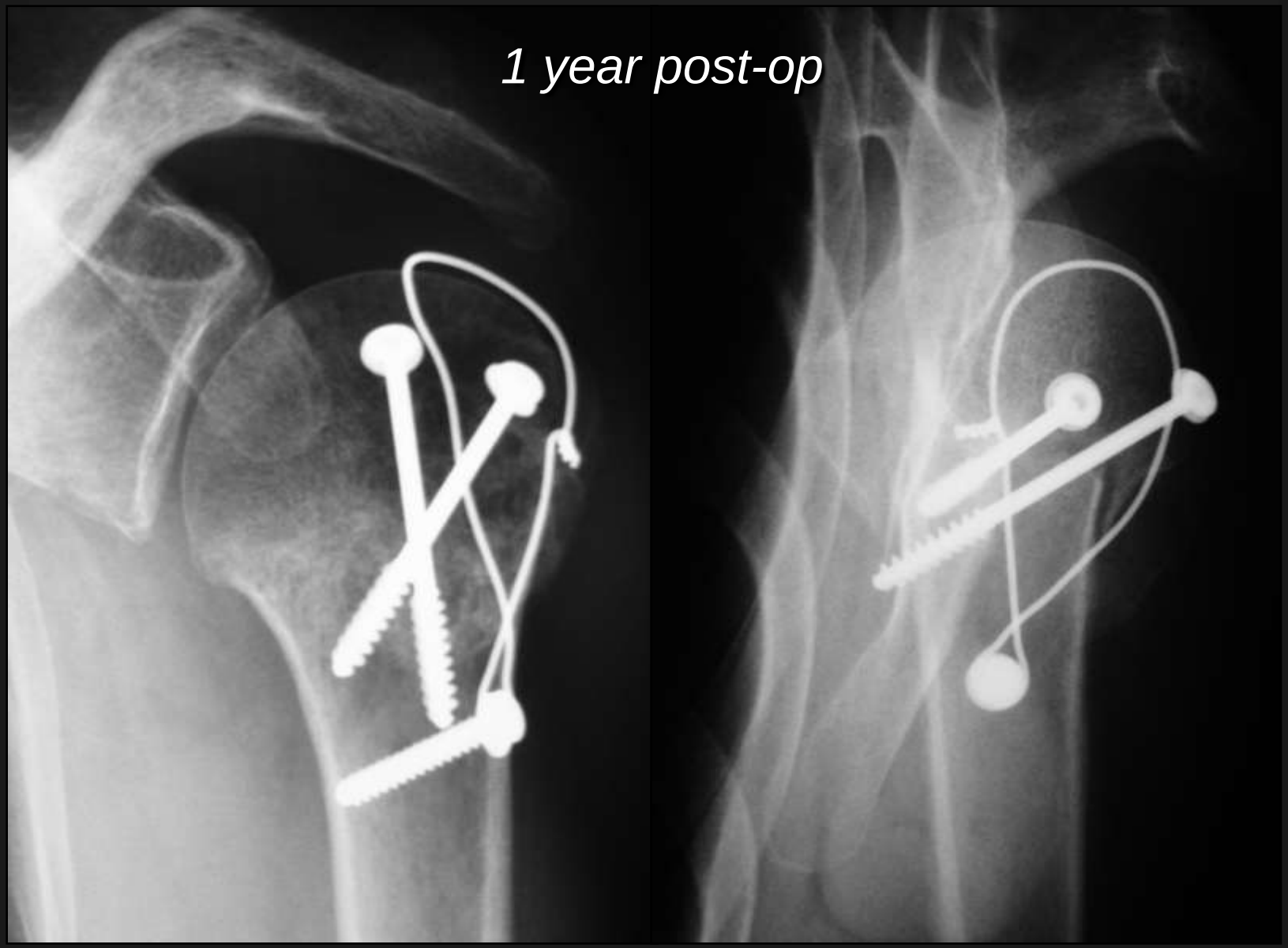
post-op

8 weeks post-op

valgus impacted 4-part fracture

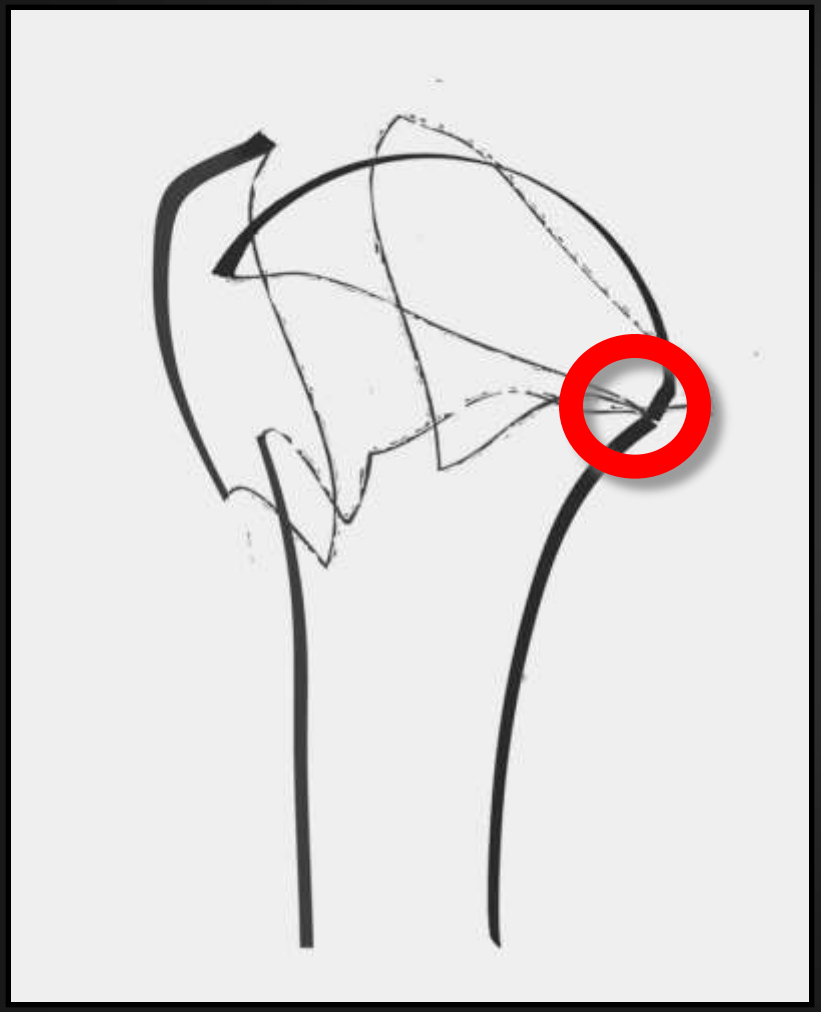
post-op xrays

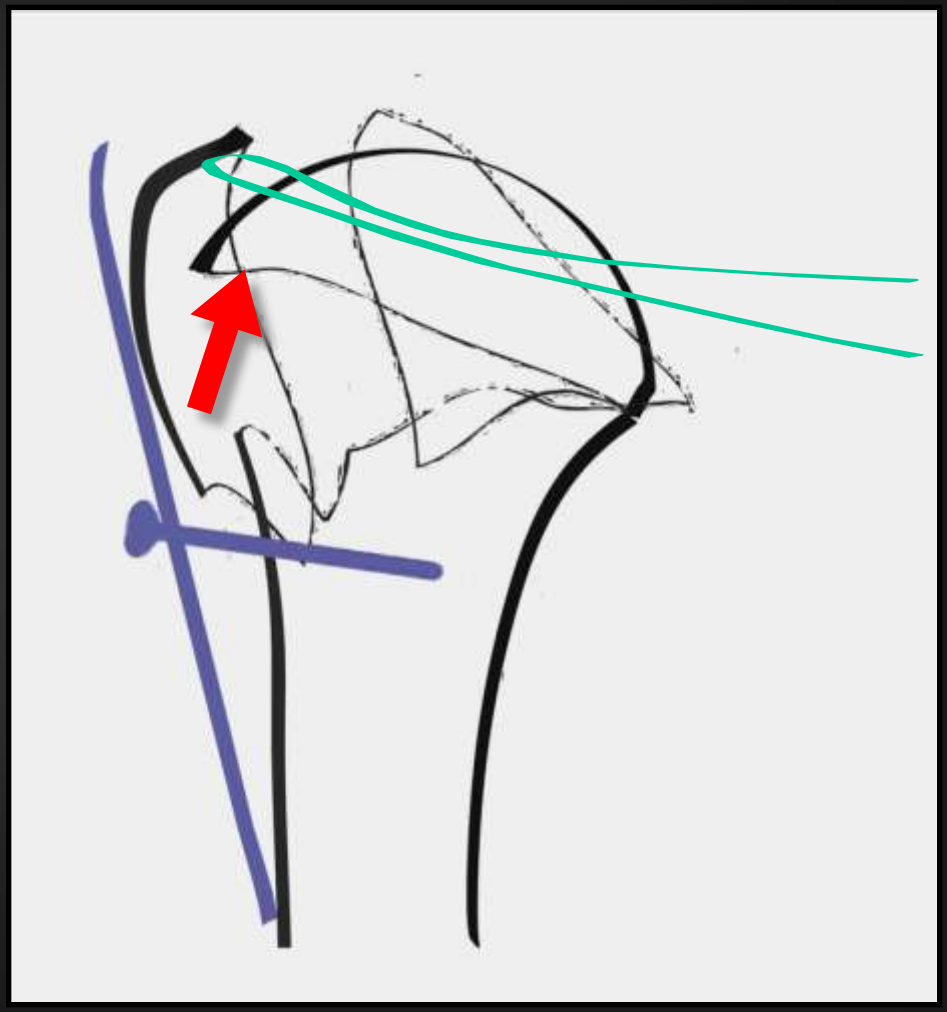



1 year post-op

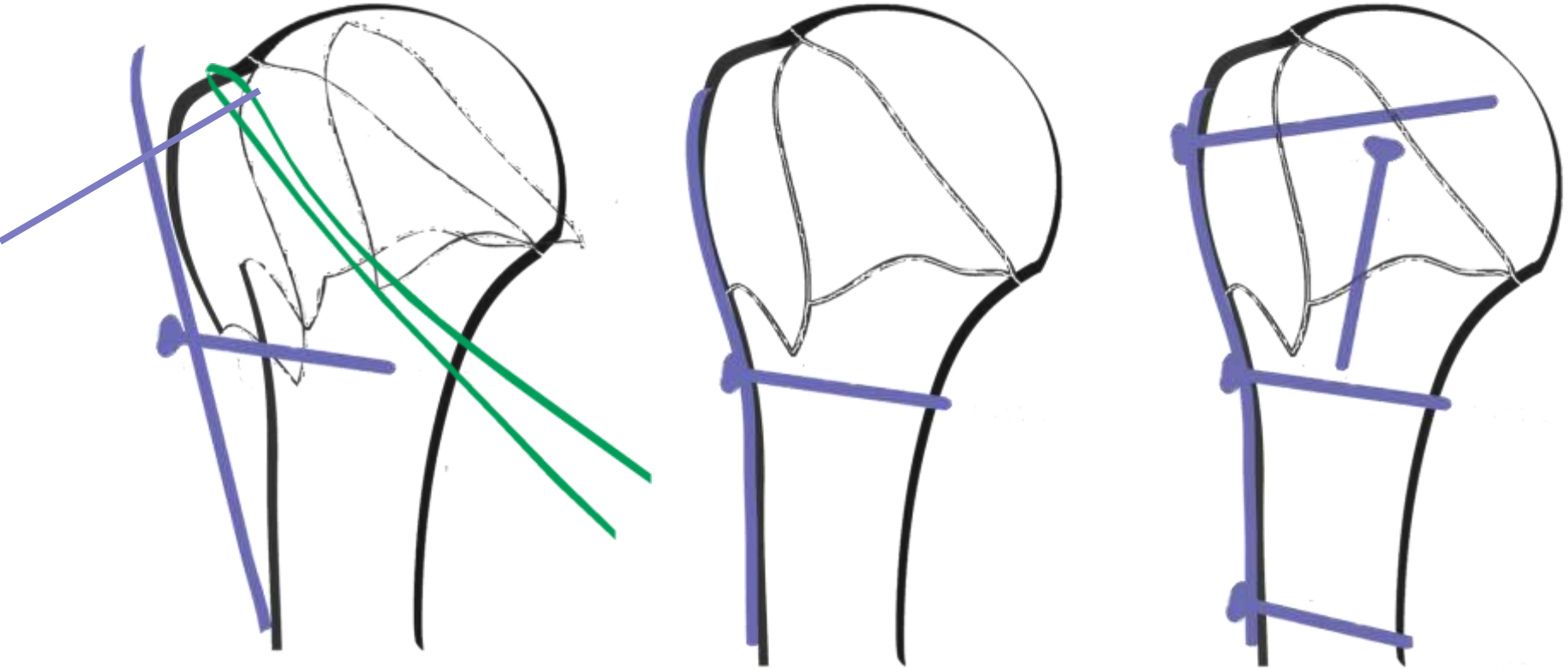
„MINIMAL“ INTERNAL FIXATION MODALITIES

Buttress Plating (R. Hertel)

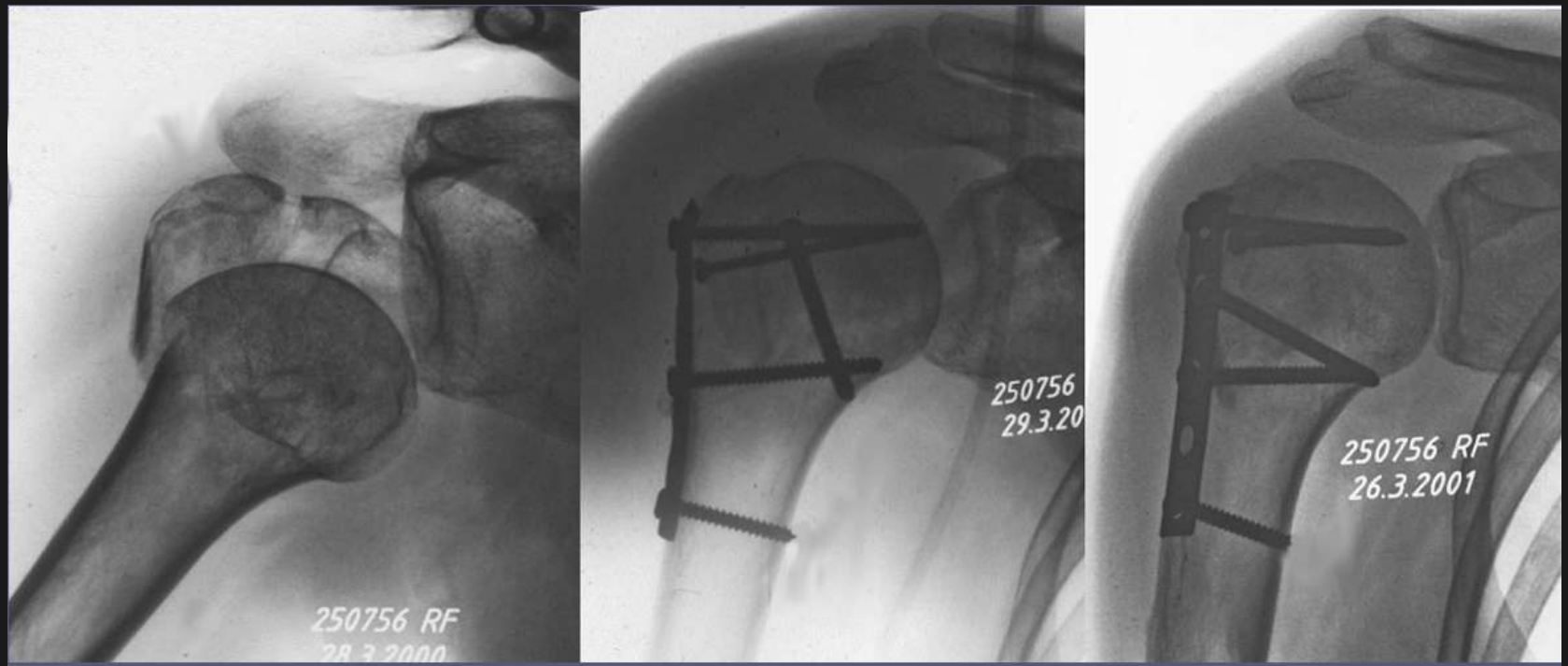




Buttress Plating (R. Hertel)



valgus impacted 4-part fracture



Proximal Humerus Fractures

„MAXIMAL“ INTERNAL FIXATION MODALITIES

- *unstable displaced subcapital fractures with or without intra-articular component*
- *extensive metaphyseal comminution*
- *fractures extending to proximal shaft*
- *proximal humeral non-union*

6 weeks post op

10 weeks post op

1 year post op

LOCKING PLATES, proximal humerus non-union

surgical neck 2-part fx

ipsilateral distal radius fx

osteoporotic 80 y old female


L


40 y old, unstable surg neck fx


8 weeks

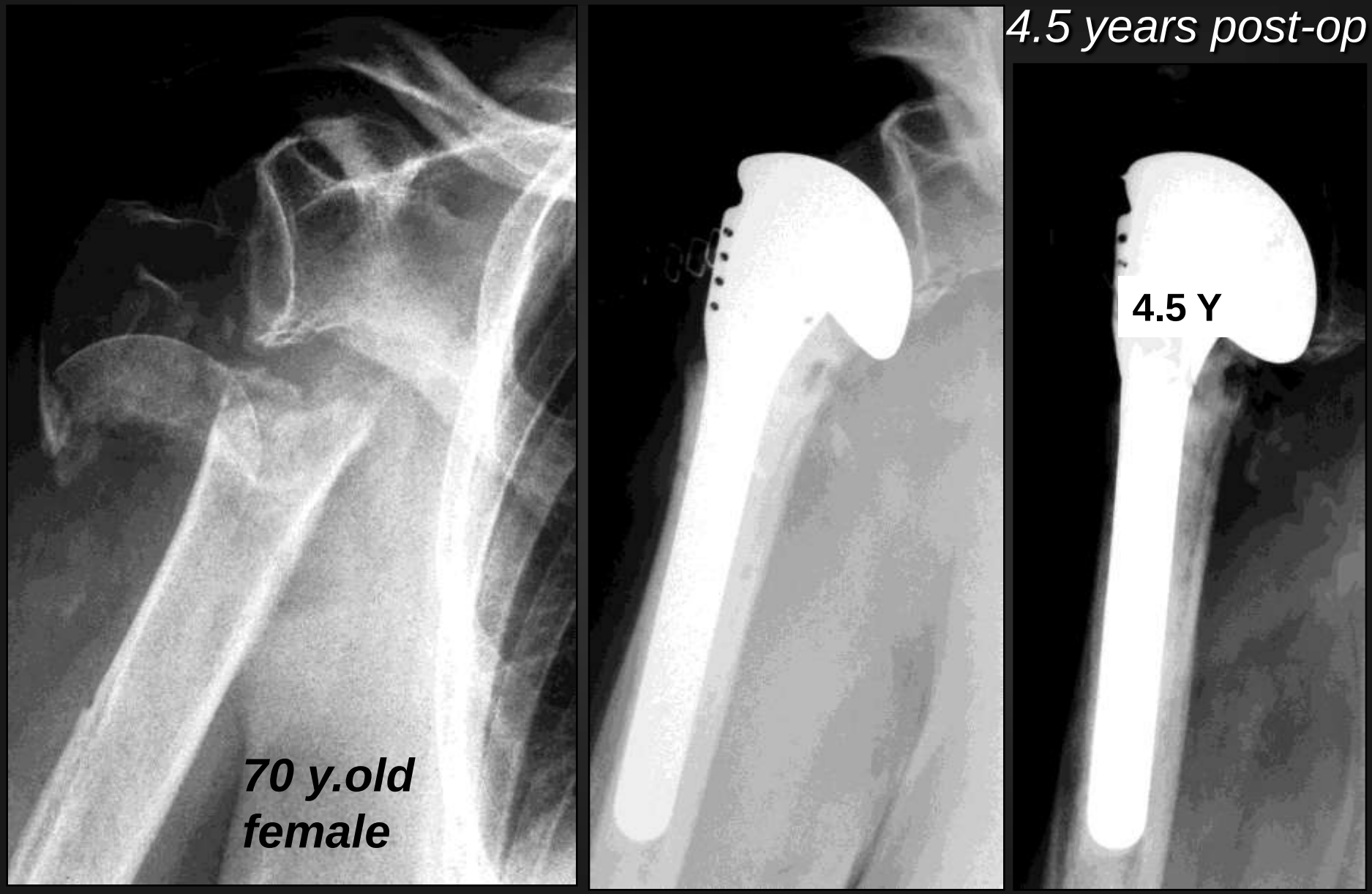
12 months post-op

12 months post-op

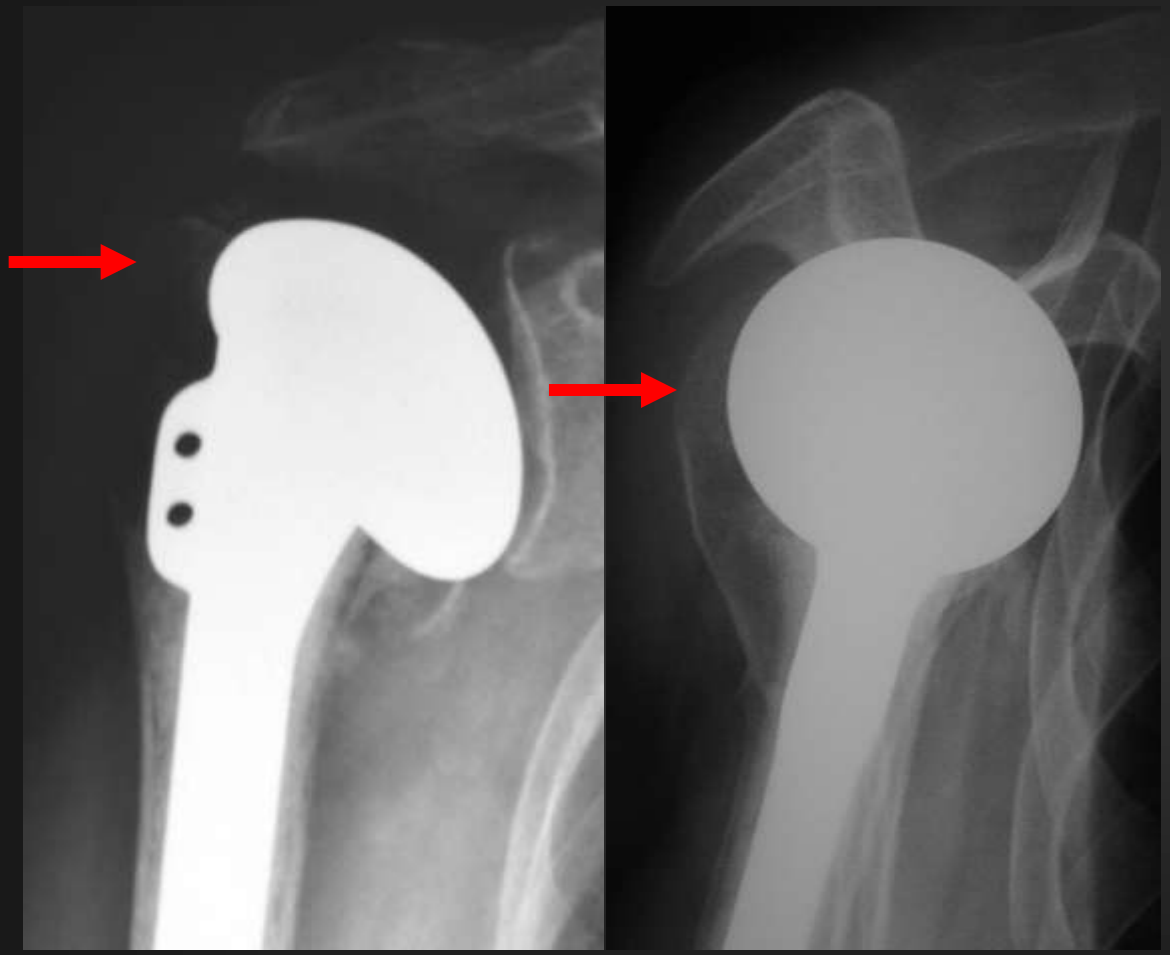
Proximal Humerus Fractures

- **Prosthetic replacement (hemiarthroplasty)**

1. ***Complex fracture dislocation***
2. ***Severely displaced medial hinge***
3. ***Short metapyhseal extension (anatomical neck)***
4. ***Intra-capital split fractures***
5. ***Severe osteoporosis, associated DJD***
6. ***Elderly patients***


4.5 years post-op
4.5 Y
70 y.old
female

1 year post-op




Thank you !