Proximal Humerus Fractures

Trafford General Hospital, June 2010

Nehmat Singh, Jawad Sultan

Anatomy of the Proximal Humerus

- Consists of four parts: humeral head, surgical neck and greater and lesser tubercles
- **Head**: joins the glenoid fossa scapula to make the glenohumeral joint. Curved.
- **Anatomical neck**: narrow groove between the tubercles, on which the articular capsule attaches
- **Surgical neck**: narrowing on the humeral shaft distal to the tubercles
- **Greater tubercle:** lateral to the anatomical neck, insertion of 3 of the tendons of the **rotator cuff**
- **Lesser tubercle**: medial to the anatomical neck: insertion of the *subscapularis*

Anatomy

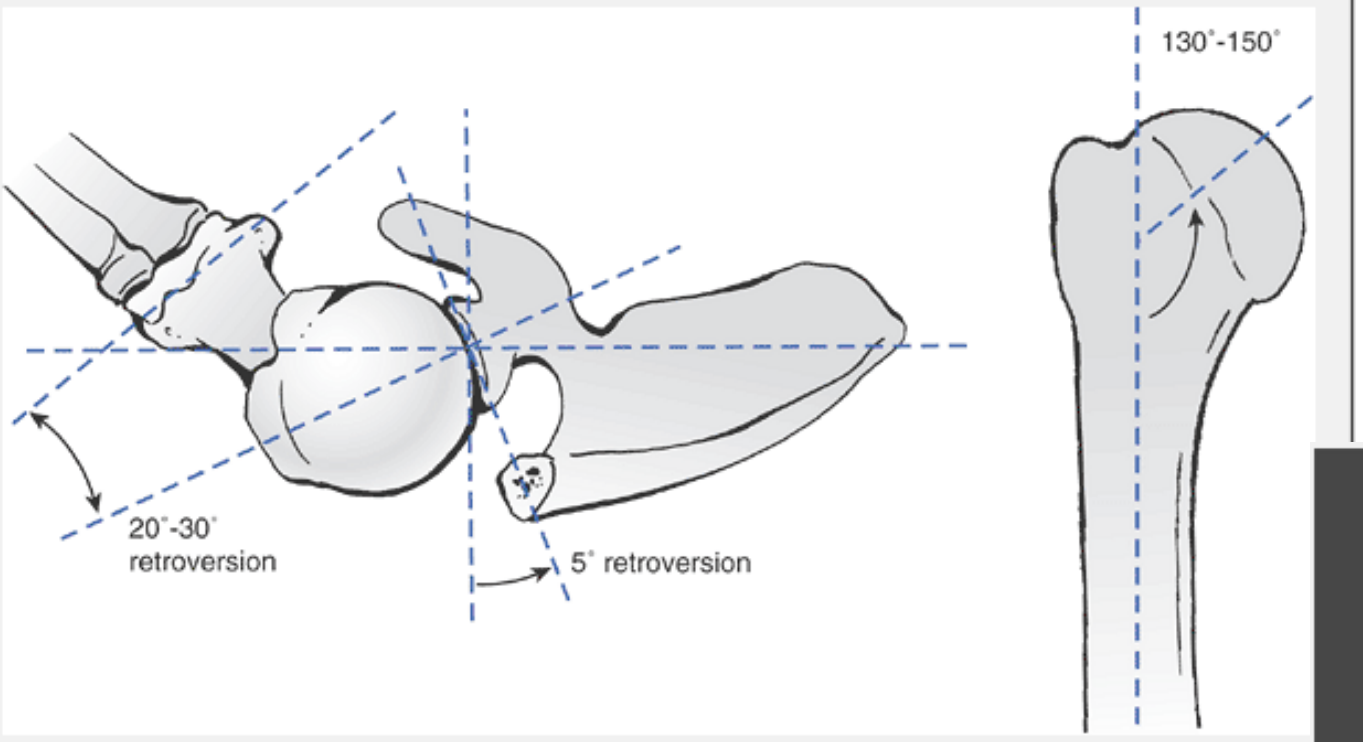
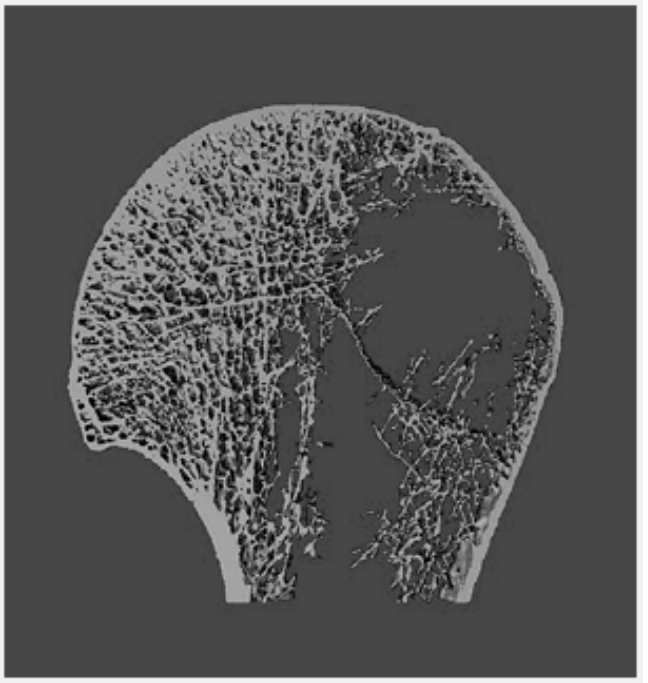


FIGURE 31-1 Proximal humerus anatomy.



Epidemiology

- Relatively rare ~3% of upper limb fractures.
- Mostly in women >50 y/o
  Exception – isolated gr. tuberosity #
- Mechanism – Indirect: fall onto outstretched arm (secondary to muscle spasm: ie seizure activity)
- Young people: high energy trauma, more devastating effects including shoulder dislocation
- Most are minimally displaced ~85%

Presentation

- Pain
- Loss of shoulder/arm function
- Bruising
- Swelling
- Loss of sensation

History and Examination

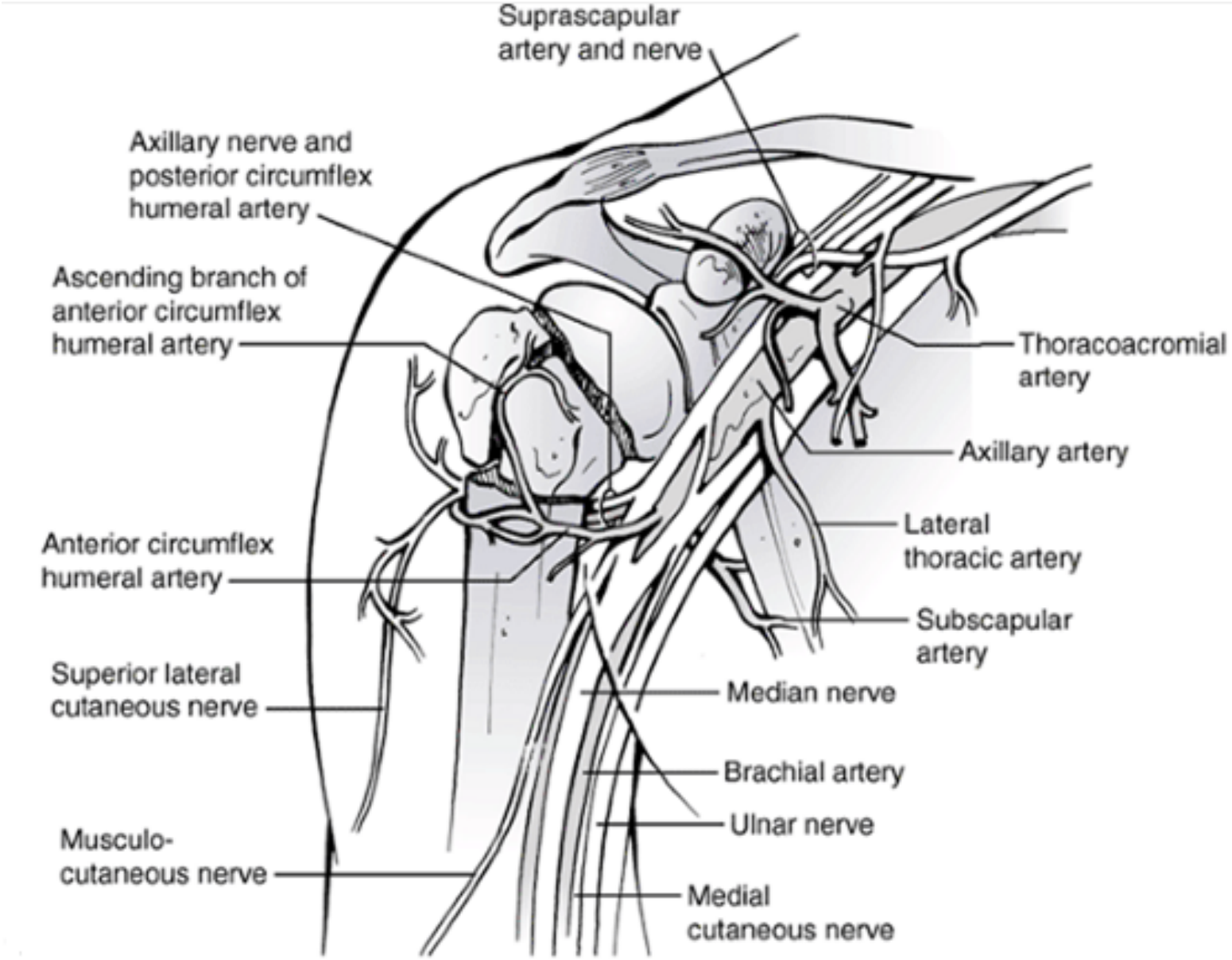
- Trauma
- Mechanism– direct or indirect
- Seizure
- Past medical history (osteoporosis)
- Drug history (steroids, bisphosphonates)

- Full shoulder examination - stable/unstable : gently rotate the humeral shaft while palpating the humeral head to assess whether unified motion is present
- Neurological examination: brachial plexus injury including regiments patch (axillary nerve)
- Vascular examination: pulsating mass, distal pulses
- Rule out associated injuries (ie pneumothorax)

Blood supply

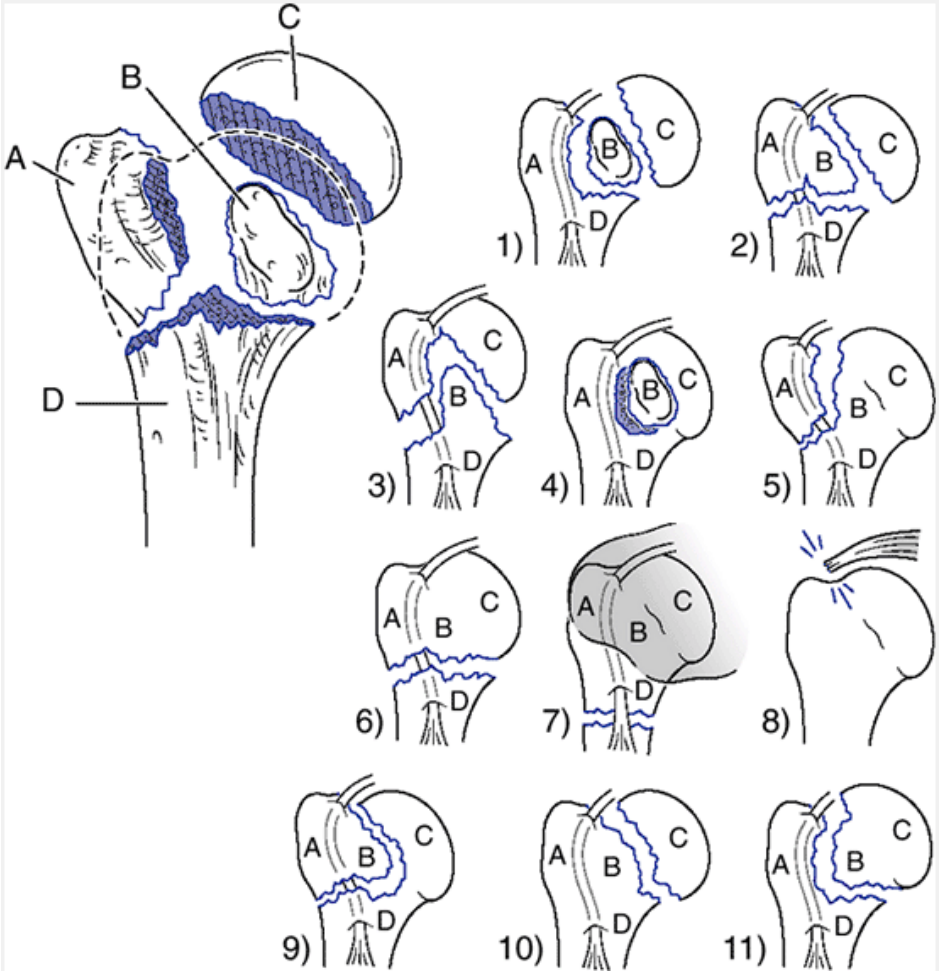
- Anterior and posterior humeral circumflex arteries
- Branch of axillary artery (3rd part)
- Anterior HC branches off from the axillary and runs anteriorly along the humeral head – branching into the arcuate artery at the intertubecular sulcus
- Arcuate artery is within and thus supplies the humeral head
- Posterior HC arises from the opposite side to the anterior, at the lower border of the subscapularis. It runs posteriorly along the humeral head, and distributes to the shoulder joint – anastomosing with the anterior HC.

Vascular Anatomy



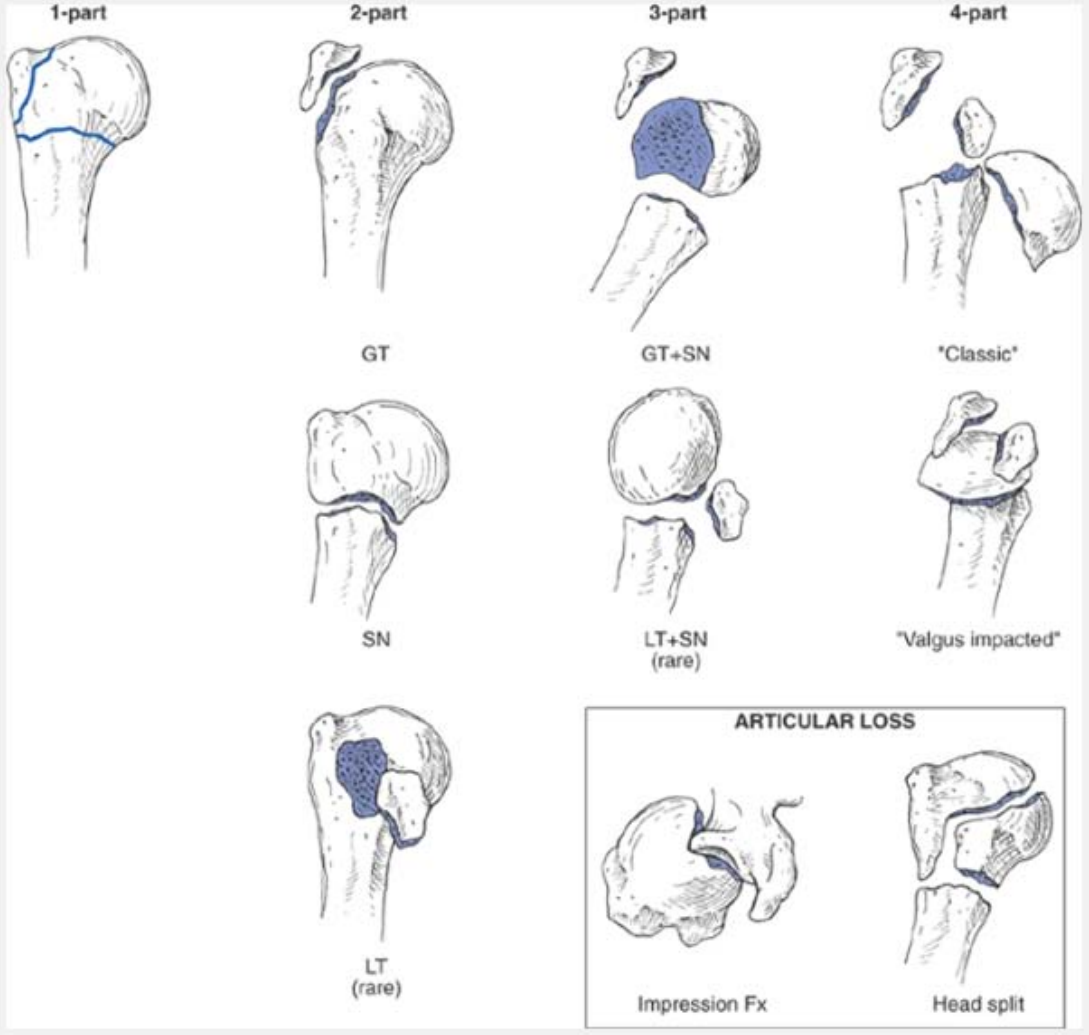
Classification

- Codman (1934) attempted to classify according to pattern of fracture lines.
- Identified four major parts:
  - Head
  - Lesser Tuberosity
  - Greater Tuberosity
  - Shaft



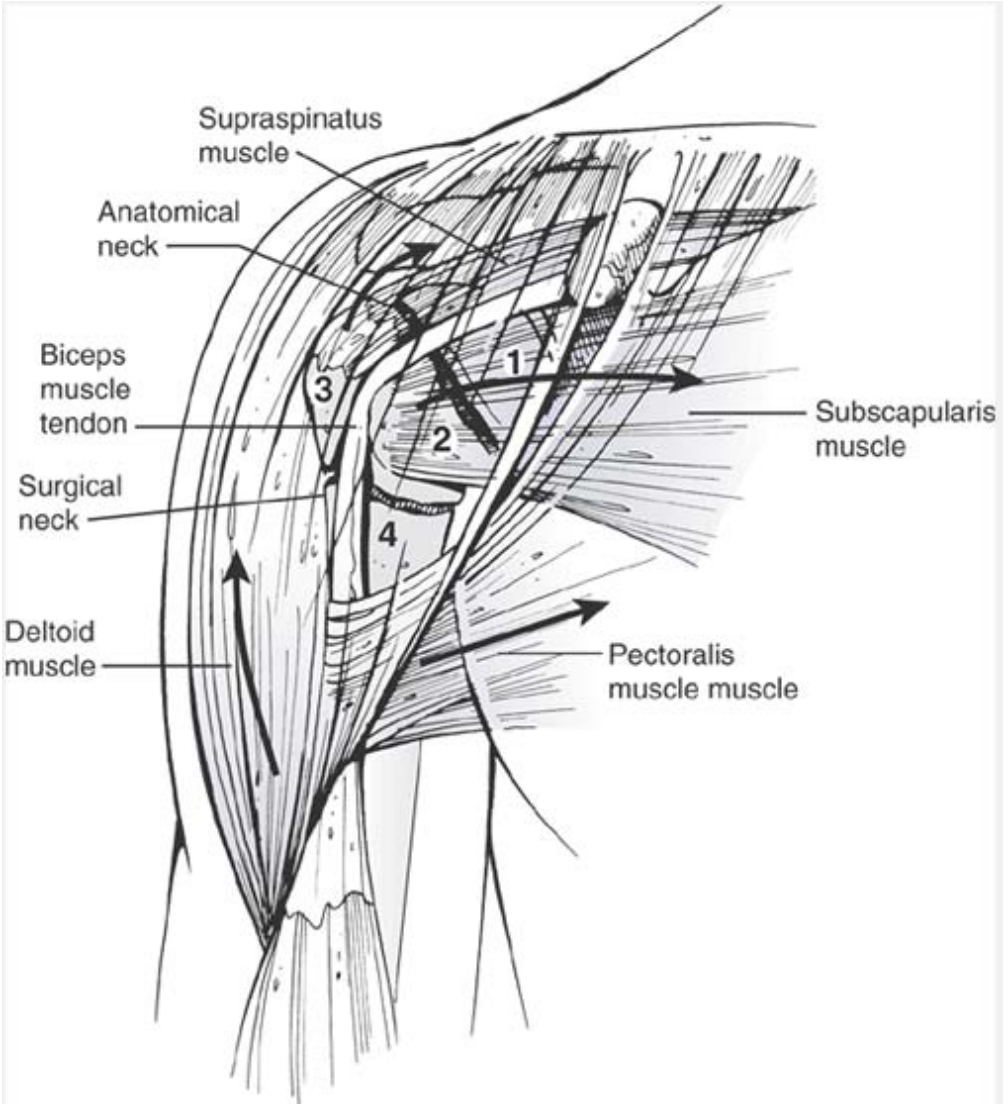
Neer's Classification

J Bone Joint Surg Am 1970;52:1077-1089.



- Less than 45 degrees or 1cm displacement is considered minimally displaced.

Direction of Displacement



Binary (LEGO) Description

Hertel et al, J Shoulder Elbow Surg 2004;13(4):427-433.

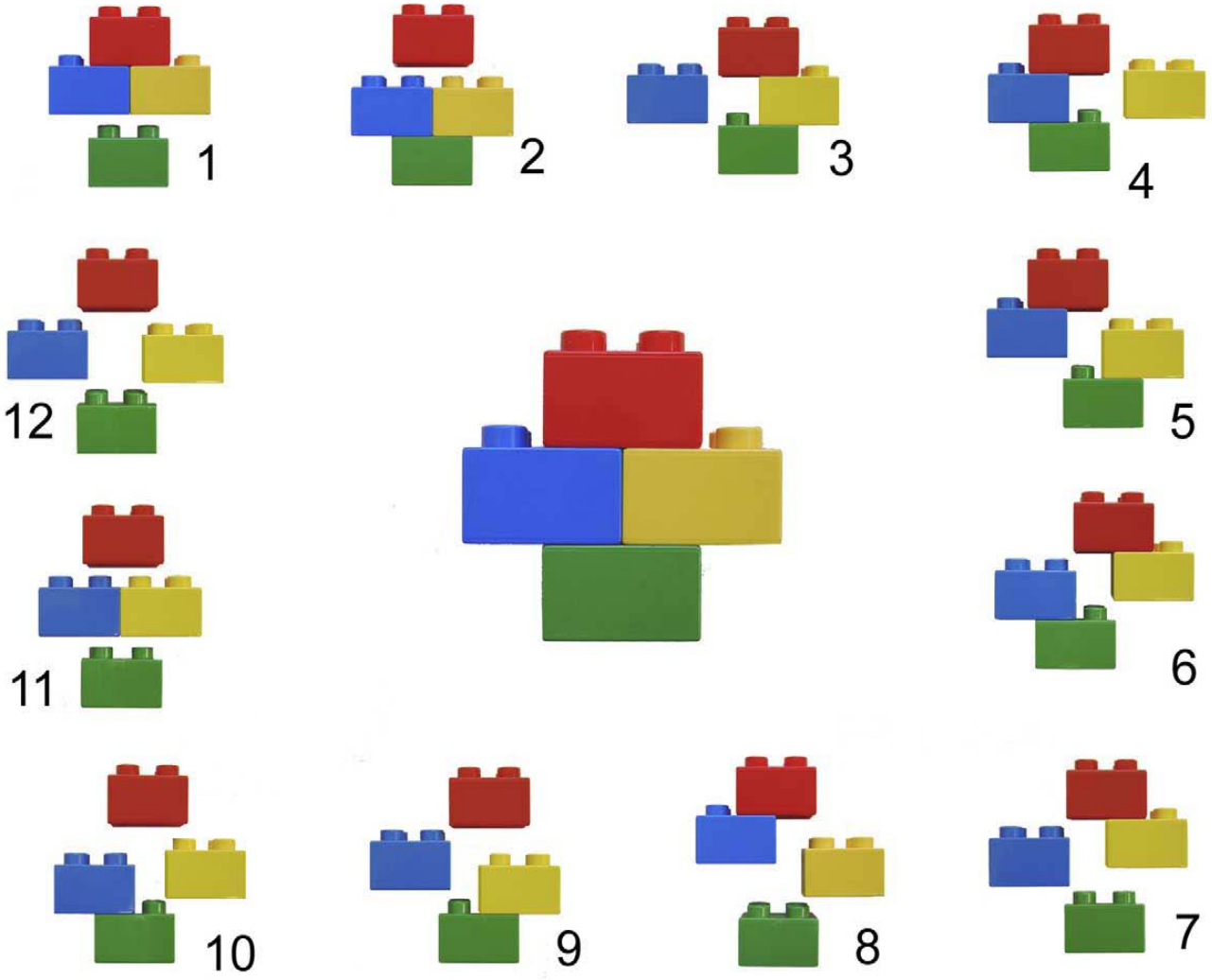


Figure 2 First additional criterion: length of the medial metaphyseal head extension. The longer the extension, the more likely the head is perfused.

Figure 3 Second additional criterion: integrity of the medial hinge. Integrity of the hinge is a predictor of both ischemia and practical feasibility of reduction.

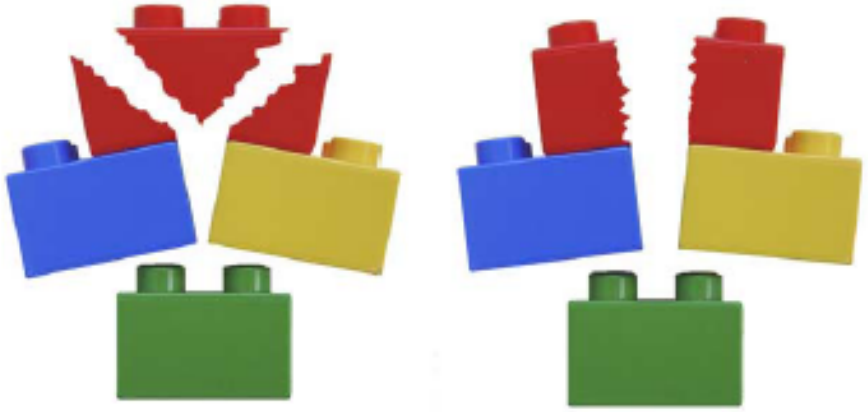


Figure 4 Third additional criterion: head-split components. There are classic head-split geometries (*left*) and special head-split geometries where both fragments remain perfused (*right*).

Hertel’s predictors of ischemia

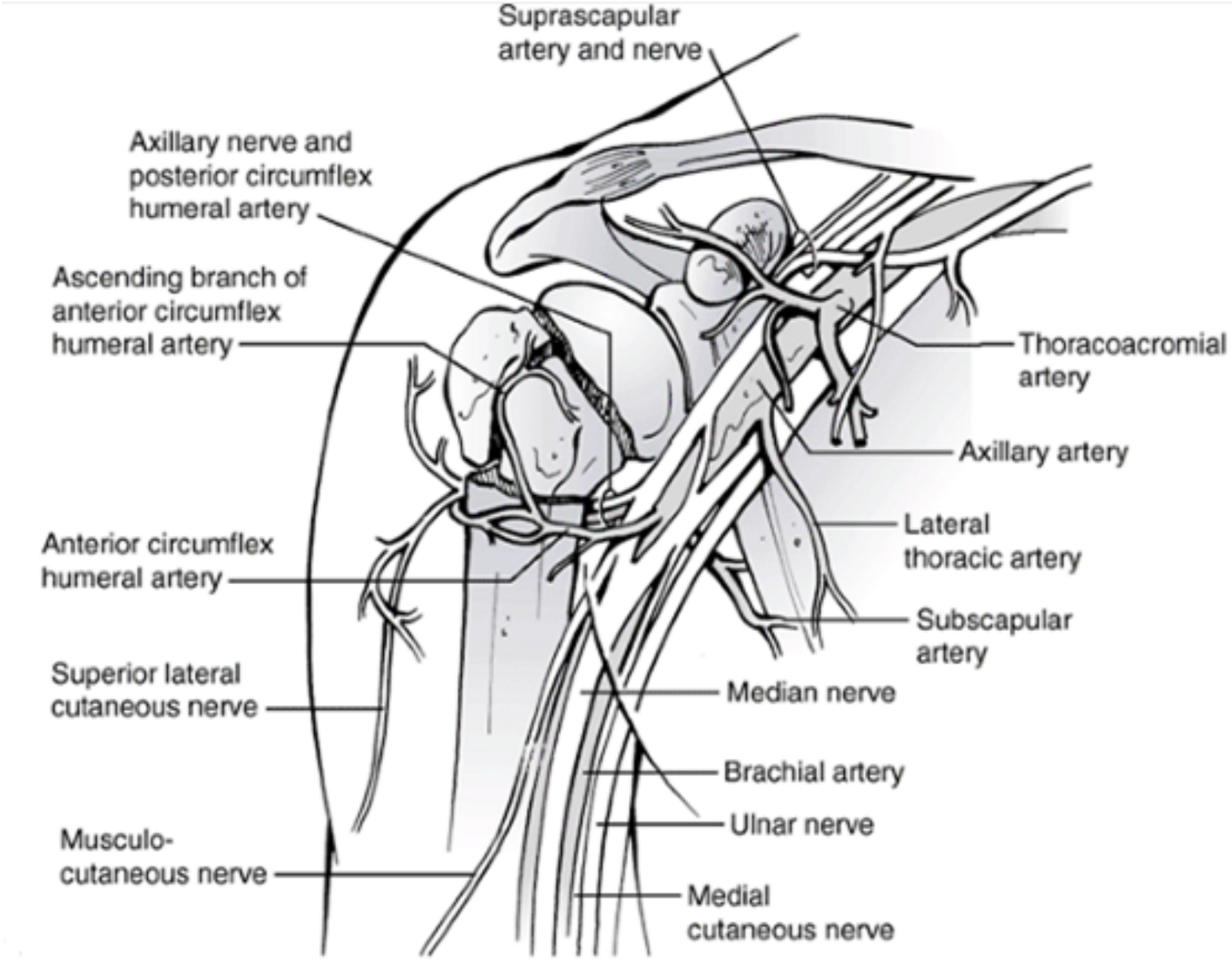
Good Predictors:

- Medial metaphyseal head extension < 8mm
- Integrity of the medial hinge >2mm displ.

Moderate / Poor Predictors:

- Four part / three part fracture
- >45 degrees and >1cm displacement
- Dislocation

Vascular Anatomy



Treatment options

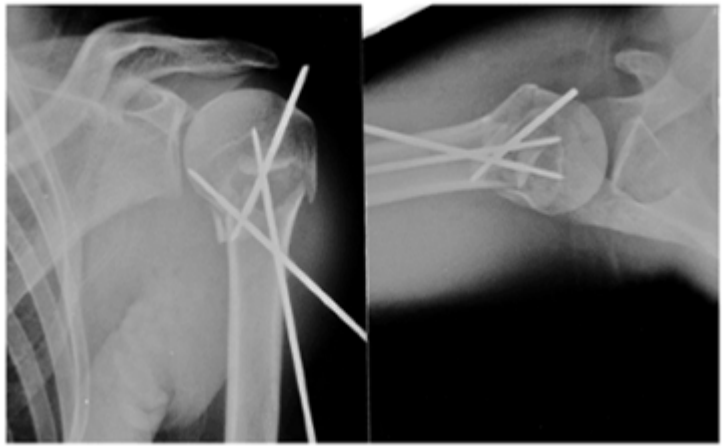
- Most (~85%) are minimally displaced and can be treated conservatively.
- Fracture/dislocation: Reduction should be carried out gently by delivering the head under GA or OPEN.
- Monitor gr.tub. # closely +/- fix if migration >5mm

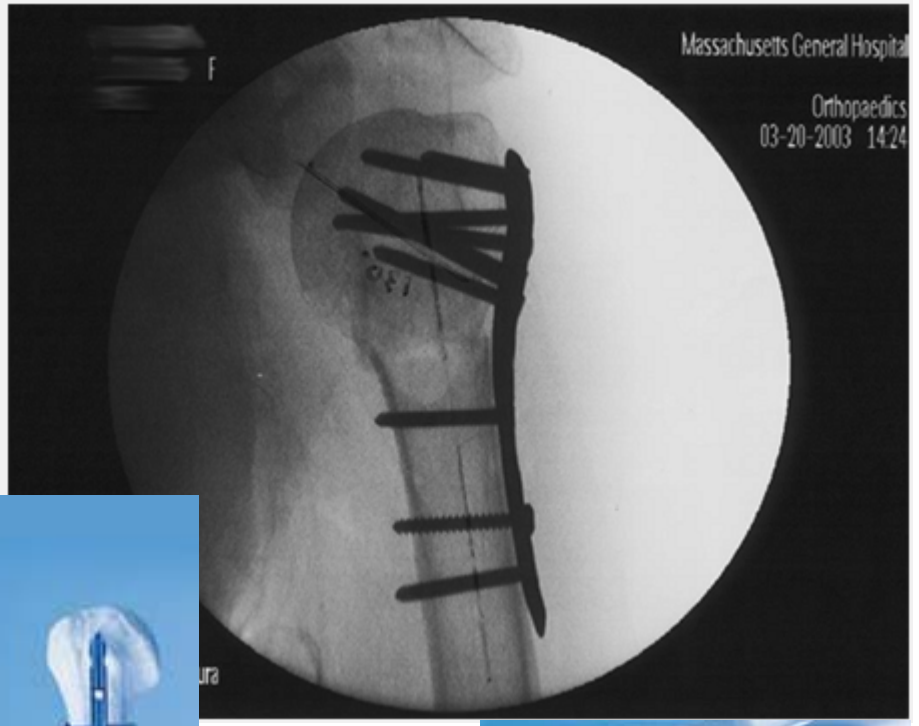
Surgical Treatment

- Displaced gr.tub. # - usually suture fixation
  If with ant. dislocation, usually reduces
- Displaced lesser tub. # - rare, usually missed.
  If with post. dislocation, BE CAREFUL!
- Two-part displaced surgical neck:
  - Conservative: C&C +/- hanging cast
  - Operative: K-wires, IM nail, plate (+locking)
- More complex fracture – usually treated with locking plates (e.g. PHILOS)

Comparison

- Wires:
  Adv.: Less dissection, closed reduction
  Disad: Difficult, less stable
- IM nails:
  Adv.: Less dissection, pathological fractures
  Disad: Penetrate the RC, less torsional stability
- Plates:
  Adv.: Allows direct reduction and rigid fixation
  Disad: Tissue dissection
  Improved with the introduction of locking plates




Massachusetts General Hospital
Orthopaedics
03-20-2003 14:24

Acute Hemiarthroplasty

- Indications:
  - Severely comminuted
  - Poor bone quality precluding ORIF
  - Articular segment separation or destruction
- Pain relief is expected, functional recovery is less predictable.
- The key is to restore the anatomic relationship of the humeral head to the tuberosities and to the shaft by achieving proper component height, offset, and version.
- Optimum fixation of tuberosities is critical.

Hertel et al.

J Shoulder Elbow Surg 2008;17(1):2-8.

- Follow on to his original study of 100 patients with 55 originally ischemic heads.
- 51 treated with ORIF, min. 5 yr follow-up:
  41 initially perfused – 4 collapsed
  10 initially ischemic – 2 collapsed
- Concluded that “despite acute ischemia, preservation of the humeral head may be a viable treatment option when adequate reduction and stable fixation can be obtained”

Treatment considerations for complex fractures

- Fracture configuration and displacement, AVN
- Age (and bone quality) are the main prognistics
- Functional requirements, co-morbidities
- Surgeon’s experience
- Post-op rehab...

DECISION IS MADE ON CASE BY CASE BASIS