

# NAILED



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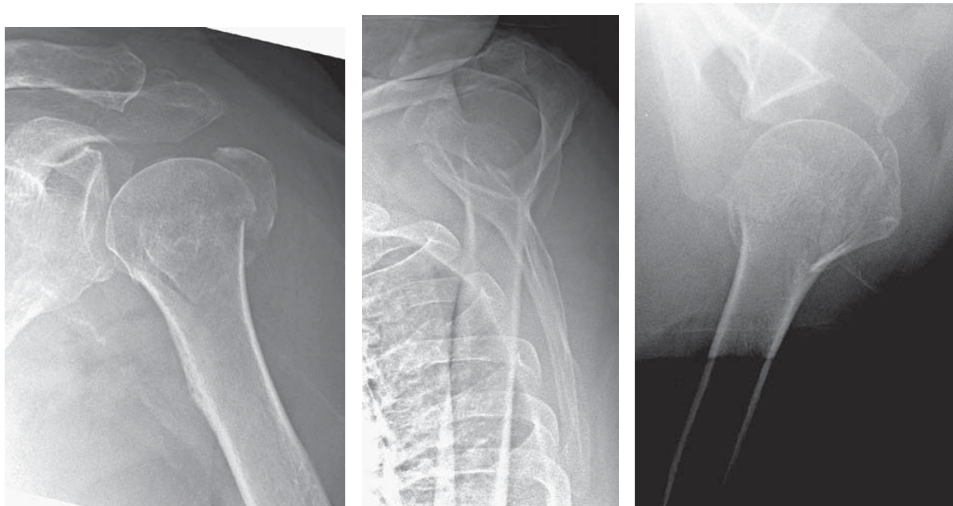
## Proximal Humerus fractures w/ Dr. Strelzow

### PE

- Inspection/ NV exam/ Open wounds
- Paresthesias over arm- axillary n
- Reflexes

### Xray:

- AP, grashey, Scapula y, axillary
- Traction view if comminution at metadiaphyseal junction



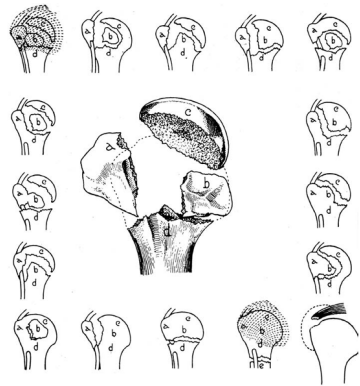
### CT

- Assess degree of osteopenia, presence/location of bone impaction, and fx comminution extent
- Axial cuts- displacement of lesser/greater tuberosity fragments.
- Coronal cuts- alignment of humeral head, assessment of calcareous comminution, extent of metaphyseal comminution
- Sagittal cuts- flexion or extension deformity of proximal humerus
  - Using soft tissue window (fatty atrophy of RTC muscles analyzed)
- 3D recon

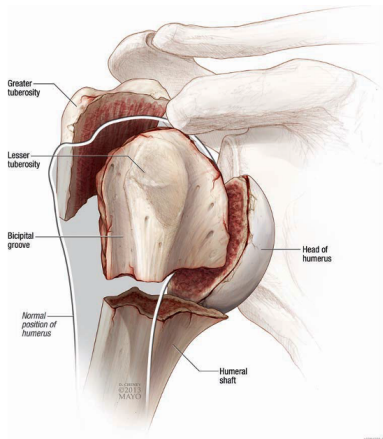


Classification

- Codman- 4 parts of proximal humerus



- Neer 1970
  - Displaced = 1cm or 45deg angle

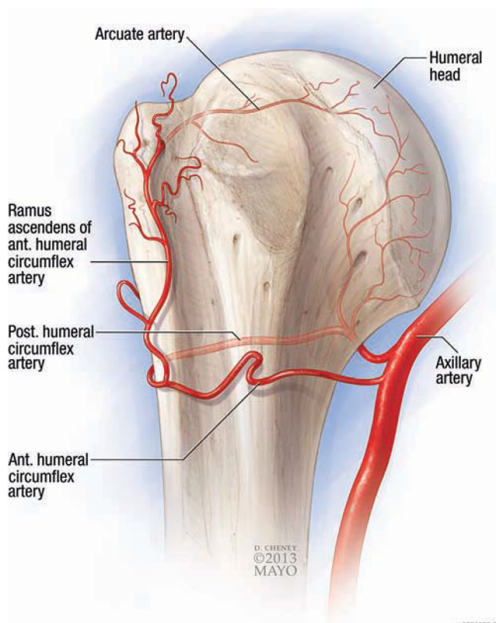


Pathoanatomy

- Greater tuberosity
  - Important in establishing rotator cuff function
  - Supraspinatus tendon attaches and pulls superiorly
  - Infraspinatus- posterior superior pull
  - Teres Minor- posterior pull
- Lesser tuberosity-
  - Subscap attachment
- Rotator interval
  - Medial border- coracoid
  - Superior- supra.
  - Inferior- subscap.
  - Lateral- biceps
  - RTC tears may start through this interval in proximal humerus fx
- Pec major-
  - Pulls shaft medially
- Bicipital groove
  - In between tuberosities
  - Strong cortical bone & only fractured in cases w/ high energy trauma
  - Can serve as useful landmarks for fx reduction
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### Vascularity

- Axillary artery > anterior hum circumflex (behind conjoined tendon) + posterior circumflex
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- ACHA > AL branch > arcuate arteries to HH
- PCHA- @ lower border of subscap- travels posterior w/ axillary artery > PM branches to HH\*
- Main blood supply



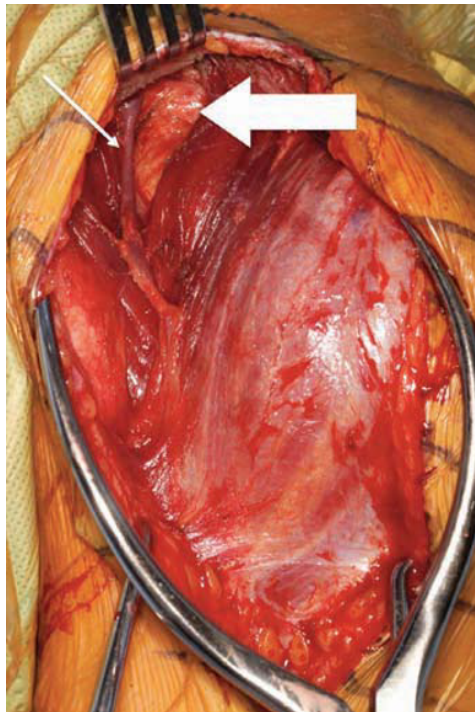
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## AVN risk

- Posterior circumflex humeral a- main supply
- Predictors of humeral head ischemia
  - Distal metaphyseal extension of head fragment of 8mm or less
  - Disruption of medial hinge between HH and shaft at level of calcar
  - 4 part fx
  - >>1cm displacement & angulation >45 degrees (less important)
  - Fx through the anatomic neck

## Common approaches:

- Deltoprec
  - Coracoid - advanced along deltopectoral groove w/ identifying + lateral reflection of cephalic
  - Around level of coracoid- a fat triangle is found w/ base at clavicle that can help determine interval
  - Identifying LHB can assist in orientation
  - Advantages- true internervous plane + allows conversion to arthroplasty if needed



- Deltoid splitting
  - Raphe between middle/anterior deltoid
  - Axillary nerve runs P-A 5cm distal to acromion (3.5cm distal to GT)

## Treatment-

#### Non displaced/ minimally displaced 1 part fx

- Non op
- Abduction pillow sling + wrist & elbow AROM
- Early PT- 2 weeks. ROM + pendulum exercises

#### Greater tuberosity fx

- >1cm translation or 45 deg angulation
- In active patients: 3-5mm displacement
  - Symptomatic union in displacement >5mm- limited ER, impingement sx
- Tx- heavy suture fixation + RTC repair through deltoid splitting

#### 2 part GT fx + Fx dislocations

- Old pts w/ limited functional expectations can be tx non op
- Operative tx:
  - Younger pts (<65), active patients w/ fx, or displaced >5mm
  - Select older patients >65, w/ >1cm displacement- offered op intervention
- Threaded 3.5mm screws through mini open approach

#### 2 part LT + fx dislocations

- MC -Younger/middle aged pts
- ORIF through deltopec approach
- 3.5 cancellous screws. Bicortical. Transosseous sutures
- Biceps usually dislocated- +/- tenodesis

#### 2 part surgical neck fx

- Impacted fx into shaft/neck- can be tx nonop
- Operative tx w/ locked plating:
  - severe varus angulation of head fragment in physiologically younger individual
  - Restore medial calcar support to prevent acute fixation failure
  - Structural graft or low inferomedial screw through plate
- Operative tx w/ IM nail:
  - If high metaphyseal comminution + shortening is there and poor bone quality
- Locking plate- minimize risk of later RTC dysfunction

#### 3 and 4 part fx

- Non-op tx:
  - Older patients w/ residual cortical continuity of HH fragment on shaft, not too much displacement of tuberosities, + humeral head is viable. Good function
- In younger patients, osteonecrosis risk is determined by fx characteristics (hertel)
- Unconstructable fx
  - Younger patients- cemented humeral head replacement
  - Older- R-TSA

#### Hemiarthroplasty

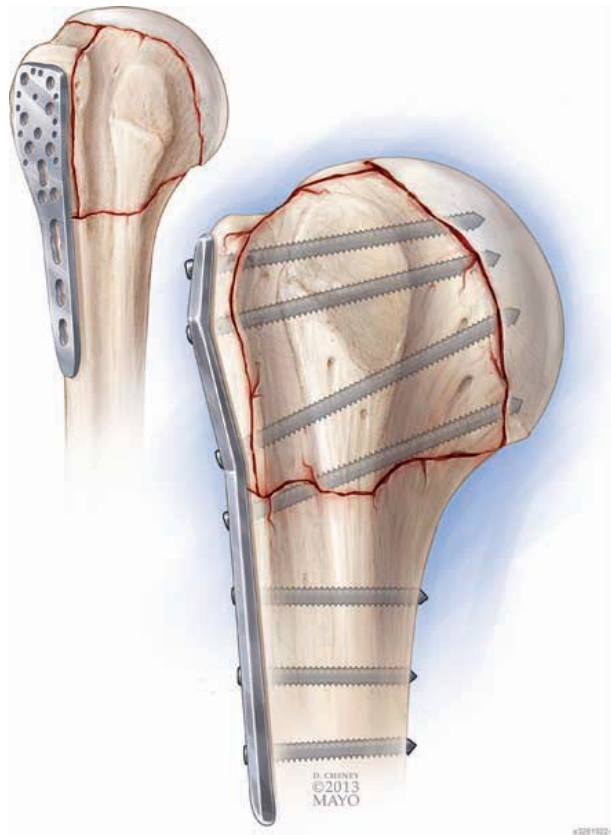
- Comminuted head splitting fracture + head depression fx involving >40% of articular surface in younger patient

#### R TSA

- Tx complex acute proximal humerus fx, malunion + nonunion
- Better functional results than TSA
- Rotation occurs w/ GH joint through deltoid activation, tuberosity healing is not important
- Medialization of center of GH rotation- improves lever arm of deltoid

#### Implant Fixation

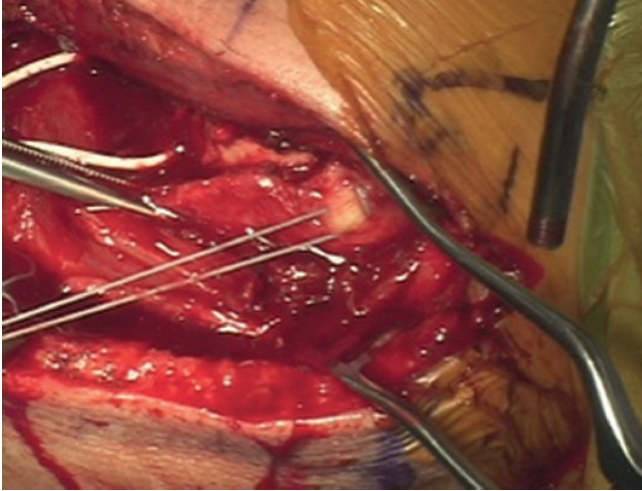
- Locking plate- allows for angular stability



- Plate positioning
  - Too proximal: subacromial impingement
  - Position for inferomedial portion of femoral head
- Head screw fixation- drill lateral cortex only- screws in subchondral bone.
  - Screw 4mm less than measured to avoid screw penetration
- Tension band
- Perc screw fixation

#### Reduction + implant techniques

- Fx dislocation- reduce humeral head w/ manual manipulation/K wire/ 2.5 threaded schanz pin
- Metaphyseal fx deformity- often apex anterior @ surgical neck and varus (not in 3/4part)
- Nonabsorbable suture through entheses of SS/IS/TM tendons to mobilize and stabilize GT fragments



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- K wires from anterior to posterior- allows lateral plate placement
- In 3 and 4 part fx
  - Strategy is to clamp GT + LT & provisionally reduce.
  - Disimpact HH fragment
- In GT fx, esp if large fragment
  - Can put 2.4 or 2.7 screws posterior to plate and reinforce cuff w/ sutures tied to plate
- Universal distractor use?

### Complications

- MC- nonunion, malunion, implant failure, HH collapse, infection, arthritis, hardware penetration