Proximal Humeral Fractures
ORIF with Locking Plates

Trauma 101
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Disclosures
- Consultant with Stryker
- Educational stipend Smith Nephew

Indications
- Younger patients
- Good bone stock
- Healthy rotator cuff
- Multiple trauma
- Caution in pts >70, studies tending to recommend RTSA better than hemi
Classification

- Codman originally described the 4 parts in 1934.

Classification

- Neer 1970 JBJS
  - Codman 1934
  - Widely used standard
  - Provides treatment guidelines
  - 4 parts
  - >1cm or 45 deg

Classification

- Varus angulation
  - Original angulation or reduction
  - Associated with higher risk of failure in recent literature on ORIF
  - Not accounted for in Neer classification
Fracture Patterns

- 3 and 4 part fxs
- Fx – dislocations
  - Tuberosity fxs
  - Proximal fx with shaft extension

3-Part Fractures

- Usually fracture through surgical neck and greater tuberosity
- CT useful for surgical planning

3 and 4-Part Fractures

- Historical treatment recommendations
  - ORIF in young
  - Elderly, hemiarthroplasty
  - We need to learn to fix in the young population
Valgus Impacted 3 & 4-Part

- Not to be confused with valgus impacted surgical neck
- Reduced AVN rate
  - 4 part 21 to 75%
  - Valgus impacted 8 to 26%
- More common than previously recognized

Valgus Impacted 3 & 4-Part

- Treatment
  - Court-Brown JBJSB 02 most managed nonop
  - Most can be anatomically reduced and fixed
  - Some amenable to minimally invasive techniques
  - CT useful
Valgus Impacted 4 part

- Beach chair position
- Mini C-arm

Plating Technique

- Beach chair position
  - Mini C-arm
- Deltopectoral approach
Plating Technique

- Beach chair position
- Mini C-arm
- Deltopectoral approach
- Tag the tuberosities

- Provisional fixation
- Definitive fixation
Recent Studies on ORIF with Locking Proximal Humerus Plate

- Thenasus et al, JSES 2009
  - Review of 12 studies, no comparisons
  - Included 2, 3, & 4 part fxs
  - Constant score avg 74.3
  - AVN 7.9% overall, 14.5% in 4 part fxs
  - Reoperation 14%
  - Screw cutout 12%
  - Nonunion 1.6%

Recent Studies on ORIF with Locking Proximal Humerus Plate

- Solberg et al, JBJS 2009, Compared 3 and 4 part fxs treated with ORIF vs hemiarthroplasty
  - Nonrandomized, pts > 55yo
  - ORIF 38 pts, Hemi 48 pts
  - Constant scores
    - ORIF 69, 3 part=72, 4 part=65
    - Hemi 61, 3 part=60, 4 part=60
  - ORIF outcomes dependent on initial fx displacement, poorer for varus fxs

Recent Studies

- PROFHER study, JAMA 2015
  - PRS, PH fxs to nonop vs op (ORIF or hemi)
  - 270 pts, no diff in outcomes
  - Much higher costs in op
  - Higher complication rate
  - No diff in revision rate
Recent Studies

- ORIF better vs HA, RTSA
- ORIF higher reop rate
- 15% tub NU rate in HA

**Recent Studies**

- Predicting Failure after Surgical Fixation of Proximal Humerus Fractures
  - Krappinger et al, Injury 2011
  - Parameters associated with failed fixation
    - Age, BMD, nonanatomic reduction, lack of medial support

**Proximal Humerus Cage**

- New device
- Expandable cage
- Design to improve support for head
- Screws can purchase cage
- Can decrease secondary screw penetration
- Promising for valgus impacted fxs
62 yo female, fall
Displaced 2 part, ORIF

62 yo F
Failed ORIF

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3 & 4 Part Fx – Dislocations

- Very challenging
- Some of the most difficult surgeries
- CTs on most all
- Not middle of the night cases
3 & 4 Part Fx – Dislocations

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Segmental Humeral Fractures

Locking Proximal Humeral Plate Complications
- Primary screw penetration 15%
- Secondary 8%
- Screw loosening
- Check screw position fluoroscopically in OR
Locking Proximal Humeral Plate Complications

- Loss of fixation up to 13%
- Associated with
  - Initial varus angulation > 60°
  - Varus malreduction > 20°
  - Lack of screws in inferior head

AVN
- Much lower than originally stated
- Overall around 8%
- 3 & 4 part fxs 15-18%

Summary

- High energy, fx-dislocations common in young
- Appropriate imaging
- Stable fixation with locking implants
- Be aware of complications, failed fixation, screw penetration
- Good luck!
Bibliography

4. Sudkamp, N et al, Open reduction and internal fixation of proximal humeral fractures with use of the locking proximal humerus plate. JBJSA 2009, 91:120