

Indiana University Health


**Treatment of
Proximal Humeral Fractures
with IM Nails**


14th Annual "Trauma 101"
FRACTURE CARE FOR THE COMMUNITY ORTHOPEDIST AND
ORTHOPAEDIC PA & NP
Clearwater, FL Apr 29, 2016

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Disclosures 


- Stryker Trauma
 - Research and Design Consultant
 - Speaker Board
 - Stock Ownership
- DepuySynthes
 - Stock Ownership, J&J



5/3/2016

Epidemiology 

- 4-5% of all fxs occur in the proximal humerus
- Injuries to the shoulder girdle change with time
 - Children
 - 85% clavicle fractures
 - Result of play or sports
 - Adults
 - 30% clavicle fractures
 - 30% proximal humerus fractures
 - 18% shoulder dislocations
 - Result of higher energy trauma







Epidemiology 


- Elderly
 - 80% proximal humerus fractures
 - Result of low energy falls
 - High incidence due to age-related increase in osteoporosis
 - Proximal humeral fractures more reliably correlate to poor bone quality than fractures of the pelvis, distal radius, or proximal femur
 - Approximately 75% of all surgical neck fractures occur in patients >65yo

(Stimson, Manual of Fractures and Dislocations, 2nd Ed. 1947)
(Wentworth, NYJ Med, 1940)




Anatomic Considerations 

- Humeral head is retroverted 35-40° relative to the epicondylar axis of the distal humerus
- The shoulder joint is neither in the sagittal or coronal plane of the body; the scapular plane of motion is 35-40° anterior to the coronal plane

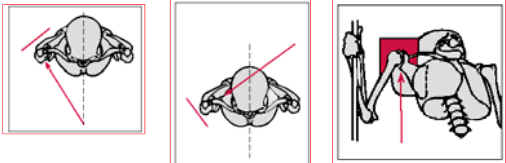


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Radiographic Considerations 

- Trauma series includes three views
 - AP Shoulder
 - Lateral (“Y”) view
 - Axillary view
 - Only useful as an adjunct to assess glenohumeral relationship – not effective in assessment of fracture orientation

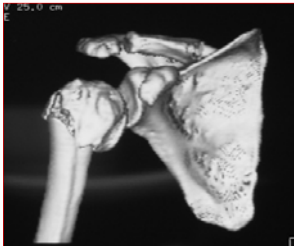
(Simon, et al, Orthopedics, 2004)



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Radiographic Considerations 

- CT scan
 - Useful in delineating comminution, articular extension
 - Glenoid rim fractures
 - Hill-Sachs lesions
- MRI
 - Integrity of rotator cuff
 - Capsule
 - Labrum




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Associated Injuries 


- Rotator Cuff Tears
 - Not common
 - Usually pre-morbid
- Ipsilateral Fractures
- Nerve Injuries
 - 30-50% axillary nerve injury
 - Noted primarily in displaced fractures
 - Effect on Rehab?
 - 5-7% brachial plexus injury, noted primarily with 4-part fractures (Visser, et al, J Shoulder Elbow Surg, 2001)
- Vascular Injuries
 - Rare



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Classification 

- Neer added to Codman's '4-Part' classification by determining association of displacement and its effect on blood supply
 - 1 cm
 - 45° angulation (Neer, CS, JBJS, 1970)
- Displacement considerations may be dated, but the shoulder can tolerate significant deformity




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Classification




Nonminimally displaced		Displaced fractures and fracture-dislocations			
Articular	Non-articular	Two-part	Three-part	Four-part	Articular separation
Articular	Non-articular	Articular	Non-articular	Articular	Non-articular
Articular	Non-articular	Articular	Non-articular	Articular	Non-articular
Articular	Non-articular	Articular	Non-articular	Articular	Non-articular



Poor inter-observer agreement on fracture type and displacement
(Brorson, et al, Int Orthop, 2002)




Treatment Options





- Conservative Management
 - 50-80% of proximal humeral fractures are non-displaced
 - Closed reduction?
 - Sling, shoulder immobilizer, hanging arm cast


Surgical Treatment Options





- Percutaneous Pinning
 - Pin infection, migration ...
- ORIF
 - Traditionally associated with AVN, malunion, hardware failure, etc.
- IM Nailing
 - Enders, Rush
 - Standard locked nail
 - Proximal humeral nail
- Arthroplasty
 - Usually reserved for displaced 4-part fractures


Proximal Humeral Nailing




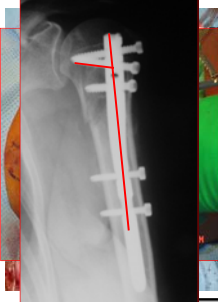
- Traditional devices provide unique locking options for the proximal humerus
- Fixation in the proximal segment an issue with this mode of fixation as it is with most others




Proximal Humeral Nailing




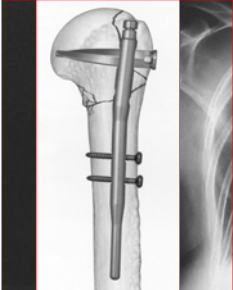
- Advantages of intramedullary devices
 - Minimally invasive compared to ORIF
 - Indirect reduction
 - Less soft-tissue stripping
 - Less blood loss?
 - Earlier transition to rehab?
 - Biomechanic advantage over pinning or plating with diminished moment arm
 - Cost



Proximal Humeral Nailing



- Complications with *traditional* intramedullary devices
 - Loss of fixation
 - Failure of fixation
 - Lack of adequate locking options to accommodate different fracture patterns
 - No locking technology to compete with locking plates



Proximal Humeral Nailing



- Literature Review, Polarus Device
 - Rajasekhar, et al, *J Shoulder Elbow Surg*, 2001
 - 27 fractures - 23 pt's 2-part, 4 pt's 3-part
 - equal number of pt's < 60 yrs as > 60
 - 80% excellent results; 1 non-union
 - "... satisfactory device with good functional results in the young and the elderly"
 - Adedapo and Ikpeme, *Injury*, 2001
 - 23 fractures – 3 and 4-part fractures, 7 with shaft involvement
 - 1 year Neer score 89 (3-part) and 60 (4-part)
 - *Noted issue of proximal crosslock loosening*



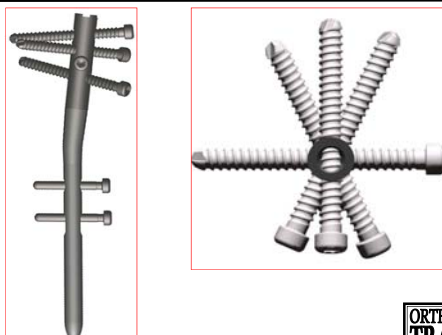
Proximal Humeral Nailing




- Literature Review, Polarus Device
 - Agel, et al, *J Shoulder Elbow Surg*, 2004
 - 20 fractures
 - 11 healed without complications
 - 3 patients (15%) had evidence of proximal fixation loosening
 - 2 patients (10%) underwent revision surgery for proximal fixation failure
 - Question use in unstable fracture patterns

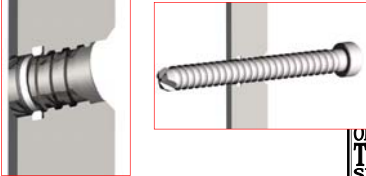


The Next Generation




Locking Proximal Humeral Nails 

- Concept
 - Provide stable internal fixation for proximal humeral fractures
 - Ability to encourage immediate PROM in rehab
 - Maintain principles of minimal fracture exposure and indirect reduction
 - Reduce proximal fixation failure
 - Proximal crosslocks thread into the nail
 - Orientation of proximal crosslocks allow multi-plane fixation




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Proximal Humeral Nailing 

- Zhu, et al. *JBJS*, 2011.
 - Prospective, randomized study, 51 pts
 - 2-part fractures
 - Minimum 3 year followup
 - Locking IM nail (25) vs locking plate (26)
 - No difference in healing
 - Significant difference noted in complications at one year {plate 31%, nail 4%}
 - Although functional scores/supraspinatus strength were better in plate group at one year, by three years there was no significant difference

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Proximal Humeral Nailing 

- Von Ruden, et al. *Unfallchirurg*. 2014.
 - Retrospective
 - 72 pts with at least 3 years of followup
 - 31 3-part fractures (23 PHN, 8 LP)
 - 41 4-part fractures (21 PHN, 20 LP)
 - No differences in functional, clinical, and radiographic outcomes between locked nails and locked plates

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Locking Proximal Humeral Nails



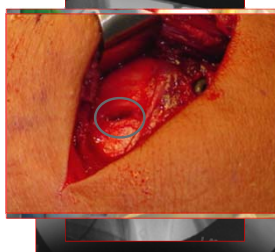
- Pearls for insertion
 - Jackson Table
 - Supine with small bump
 - Fluoroscopy position vital
 - Incision based on anterolateral corner of acromion
 - Extending the shoulder vs the acromion can improve the ability to get starting point
 - Limited acromioplasty ok



Locking Proximal Humeral Nails




- Pearls for insertion
 - Use joysticks or other devices to indirectly reduce fracture
 - Consider articular starting point
 - Moves nail entry away from rotator cuff insertion
 - Side-to-side simple repair
 - Always maintain reduction during insertion
 - Proximal screws should lie within central subchondral bone of humeral head



Locking Proximal Humeral Nail



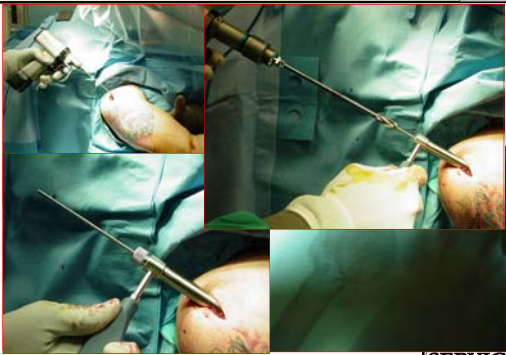
Locking Proximal Humeral Nail



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Locking Proximal Humeral Nail



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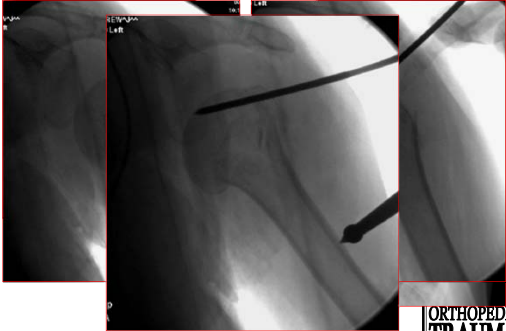
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Locking Proximal Humeral Nail



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Locking Proximal Humeral Nail

- Consider a long device when treating an obese patient with surgical neck comminution



8 months post op


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Case Review



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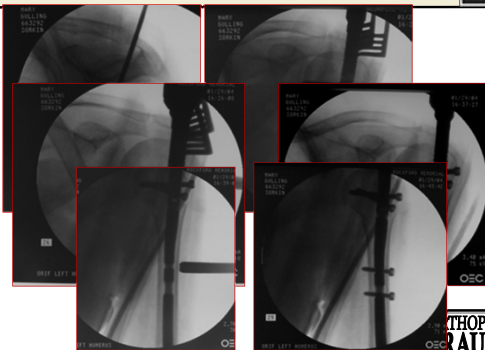
Case #1: 84yo female, s/p fall



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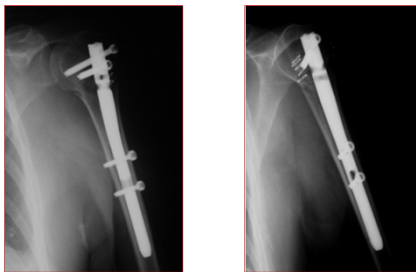
Case #1: 84yo female, s/p fall



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Case #1: 84yo female, s/p fall



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Case #1: 84yo female, s/p fall

3 weeks post op

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Case #1: 84yo female, s/p fall

9 weeks post-op

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Case #2: 69yo female s/p fall

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