Diaphyseal Humerus Fractures

Daniel Dziadosz MD
Orthopaedic Trauma Institute
Navicent Health
Macon, GA
Disclosures

• ZimmerBiomet – Consultant
• AO North America – Faculty

• No influence on content
Objectives

1. Management Techniques
2. Surgical Options
3. Operative Comparison
Treatment Goals

1. Union
2. Restore Function
3. Minimize Deformity
Treatment Goals

1. Union
2. Restore Function
3. Minimize Deformity

Better than 90% Regardless of treatment
How the humerus is different...

- Exceptional healing potential
- Tolerant of deformity
- Not (typically) weightbearing
How the humerus is different...

- Exceptional healing potential
- *Tolerant of deformity*
- Not (typically) weightbearing

20° Angulation
2-3cm Shortening
Outcomes

• Long term = Similar
• Operative treatment generally results in better early function
Nonoperative Treatment

*Pro’s:*  
1. Infection risk  
2. >90% healing  
3. Nerve injury

*Con’s:*  
1. Extended immobility  
2. Impaired shoulder function\(^1\)  
3. Nonunion in simple fractures\(^2\)
Nonoperative Treatment

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1. Infection risk  
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*Con’s:*  
1. Extended immobility  
2. Impaired shoulder function\(^1\)  
3. Nonunion in simple fractures\(^2\)
Nonoperative Treatment

- Coaptation Splint
- Initial intervention (Historically?)
  - Seated patient
  - Gentle valgus mold
  - Extend over lateral deltoid
  - Pad the axilla but don’t bunch splint material

Beware!!!
Nonoperative Treatment

- Functional Brace
- Can be placed immediately
- Tighten as tolerated
- Encourage mobility of shoulder and elbow

Sandberg et al OTA 2015
Nonoperative Treatment

- Functional Brace
- Can be placed immediately
- Tighten as tolerated
- Encourage mobility of shoulder and elbow

10-12 weeks in the brace
• 620 patients
• 465 closed fractures
• 491 < 16° varus angulation
• 442 < 16° anterior angulation
• 98% had shoulder limitation of 25° or less
Operative Treatment

Pros:
• Alignment
• Mobility
• Weightbearing
• Earlier functional use

Cons:
• Infection (1%)
• Radial nerve injury (8%)
• Cost???
Operative Treatment

Pros:
- Alignment
- Mobility
- Weightbearing
- Earlier functional use

Cons:
- Infection (1%)
- Radial nerve injury (8%)
- Cost???
Operative Indications

• Open Fractures
• Vascular injury
• Ipsilateral forearm or elbow injury
• Failed nonoperative treatment
• Polytrauma
• Body habitus
• Neurologic injury
Surgical Options

- Plate osteosynthesis
- Intramedullary Nail
- External Fixator
Plate Osteosynthesis

- Extensile approach
- MIPO technique
- Direct Reduction
- Absolute or Relative stability constructs
- Immediate weightbearing
Plate Osteosynthesis

- Plate Length → Longer is Better\(^5\)
- Plate Size:\(^6\)
  - 3.5 vs 4.5 mm
- Conventional plates often sufficient
- Locking Implants for short/end segment fractures
Surgical Exposure

Anterolateral
- Proximal $\frac{2}{3}$
- Supine position
- Splits brachialis
- Distal radial nerve

Posterior
- Distal $\frac{3}{4}$
- Lateral or prone position
- Triceps sparing
- Best visualization of radial nerve
Surgical Exposure

Anterolateral
- Supine position
- Deltopectoral proximally
- Split brachialis distally
  - Denervation?
  - Functional deficit?
Surgical Exposures

**Posterior**

- Lateral or prone position
- Triceps sparing
- Best visualization of radial nerve

Dictate where the Radial nerve crosses the plate!!
Intramedullary Nail

- Limited Exposure
- Minimize soft tissue stripping
- No visualization of the nerve
- Shoulder pain and weakness
Intramedullary Nail

- Pathologic Fractures
- Proximal fractures
- “Long” fractures
- Segmental fractures
- Body Habitus
- Poly-traumatized patient
Intramedullary Nail

- Supine
- Bump under the scapula
- Deltoid split
- Split rotator cuff/interval
Intramedullary Nail

- Countersink the nail
- Avoid distraction
- Minimize cuff damage
- Repair the rotator cuff/interval
- Respect neurological structures
Plate vs Nail
Randomized Prospective Study of Humeral Shaft Fracture Fixation: Intramedullary Nails Versus Plates
Chapman, Jens R.; Henley, M. Bradford; Agel, Julie; Benca, Paul J.*

- PRCT
- 84 patients
- 38 → IMN
- 46 → PLT
- F/U 13 months
- 93% healed in PLT
- 87% healed in IMN
- **IMN → Significantly greater shoulder pain and decreased ROM**
- **PLT → Significantly impaired elbow ROM**
Fixation of fractures of the shaft of the humerus by dynamic compression plate or intramedullary nail

A PROSPECTIVE, RANDOMISED TRIAL


From the Royal Columbian Hospital, New Westminster, British Columbia, University of Calgary and Foothills Medical Centre, Calgary and St Michael’s Hospital, Toronto, Canada

- PRCT
- 44 patients
- Plate $\rightarrow$ 23
- IMN $\rightarrow$
- Complications
  - Plate $\rightarrow$ 3
  - IMN $\rightarrow$ 13

### Table IV. Details of the complications in both groups

<table>
<thead>
<tr>
<th>Complication</th>
<th>Plate</th>
<th>Nail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iatrogenic palsy of the radial nerve</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Late fracture</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Nonunion</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Intraoperative comminution</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Infection</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Severe impingement</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Adhesive capsulitis (shoulder)</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Minimal loss of fixation</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>3</td>
<td>13</td>
</tr>
</tbody>
</table>
Shoulder function after surgical treatment of displaced fractures of the humeral shaft: a randomized trial comparing antegrade intramedullary nailing with minimally invasive plate osteosynthesis.

Benegas E1, Ferreira Neto AA1, Gracitelli ME2, Malavolta EA1, Assunção JH1, Prada Fde S1, Bolliger Neto R1, Mattar R Jr3.


• PRCT
• 41 fractures
• Plate → 21
• IMN → 19
• No significant difference in shoulder function
Nonoperative Treatment

**Pro’s:**
1. Infection risk
2. >90% healing
3. Nerve injury

**Con’s:**
1. Extended immobility
2. Impaired shoulder function\(^1\)
3. Nonunion in simple fractures\(^2\)
Plate Osteosynthesis

**Pro’s:**
1. Visualization of Nerve
2. Direct Reduction
3. Immediate Weightbearing

**Con’s:**
1. Blood Loss
2. Open exposure
3. Operative Time
4. Positioning
## Intramedullary Nailing

### Pro’s:
1. Soft tissue friendly
2. Smaller Incisions
3. Closed technique
4. Immediate WB

### Con’s:
1. Rotator Cuff Injury
2. Shoulder Pain
3. Reoperations
4. Radial nerve
Summary

• Do what’s best for the patient
• Operative treatment likely results in better early function but few differences at union
• When you operate, use long implants
• Know multiple approaches, understand the nuances of each
Thank You
References


