The Superiority of Surgery in Caring for Clavicle Fractures

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Nonoperative treatment for clavicle fractures
Surgery for Clavicle fractures
Topics to Cover

- Pertinent anatomy
- Why is surgery indicated??
- Surgical technique
- Post-operative management
- Cases
Why Clavicle Fractures

- Comprise 2-10% of all fractures
- Frequently seen in cycling, contact sports, simple falls
Osseous anatomy
Anatomy

- Pertinent Soft tissue
- Divisions of brachial plexus
  - Direct/Indirect
- Subclavian artery
- Upper lobe of lung
Lateral Clavicular anatomy

- Normal ligament anatomy
- Acromioclavicular ligament
- Acromion
- Coracoacromial ligament
- Trapezoid ligament
- Conoid ligament
- Clavicle
- Humerus
- Coracoid process
- Short head of biceps
- Pectoralis minor
- Coracobrachialis
Function

- Stabilizes shoulder girdle
- Aids in abduction and forward elevation
- Most assistive >90 deg
Why Surgical Treatment??

- Relative Indications:
  - >2 cm shortening
  - >100% displacement
  - Z-type fracture\(^{(1)}\)
  - Notable comminution
  - Displacement
    >100%: strongest predictor of (-)symptoms/sequelae\(^{(9)}\)
Why Surgical Treatment??

- Open injuries
  - Imply higher energy injury
  - Greater displacement—need to stabilize to protect soft tissues
- “Threatened” skin
- Bone displacement can cause soft tissue necrosis
Why Surgical Treatment?

- Improve union rates
  - Initial nonunion rates of midshaft clavicle fractures: 0.1-0.8% (1)
  - Recent studies: rates increase to 15-20% (2,3)
- Established nonunions
  - Significant decreases in deltoid FE endurance when treated in delayed fashion (11)
  - No significant difference in DASH scores (11)
Who Doesn’t Heal??

- Risk Factors for Nonunion: \textsuperscript{(26,27)}
  - Female
  - Comminution
  - Advanced age
  - Fracture displacement
  - Smoking
- NNT: 7.5 to avoid nonunion \textsuperscript{(7)}
- Decreases to 1.7 in those >40% risk nonunion \textsuperscript{(7)}
Why Surgical Treatment??

- Maximize shoulder function
- Faster rehabilitation/recovery
- Athletes
- Return to work
Why Surgical Treatment??

- Maximize shoulder function

- Non-op N=92: (10)
  - 24% of patients had fair or poor DASH score
  - 53% reported residual pain at 2.7 yrs.

- >1.5-2 cm shortening, >100% displacement:

  - Correlated with pain, worse outcomes (1)
Why Surgical Treatment??

- COTS: RCT in 2007 (1)

- N=132

- ORIF: better functional outcomes (DASH)

- Shorter time to union: (16.4 vs. 28.4 weeks)

- Lower nonunion rates (3 vs. 14.2%)

- Lower malunion rates
Why Surgical Treatment??

• Professional athletes:
  • Jack et al.: \((4,6)\)
    • Retrospective review NFL players
      • 32 non-op, 17 op:
        • Avg. return to play:
          • Non-op: 245 days
          • Op: 211 days
Why Surgical Treatment??

- Herbert-Davies et al. (5)
  - 15 NHL athletes (10/5)
  - Avg. return:
    - Op: 65 days
    - Non-op: 97.6 days
<table>
<thead>
<tr>
<th>Year</th>
<th>Study</th>
<th>Number of Patients/ Studies</th>
<th>Method</th>
<th>Results</th>
<th>Level of Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>Woltz et al&lt;sup&gt;21&lt;/sup&gt;</td>
<td>160</td>
<td>Plate and screws</td>
<td>23.1% nonunion rate in nonoperative group versus 2.4% in operative group. No difference in DASH or Constant scores between groups at all times points.</td>
<td>I</td>
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<tr>
<td>2015</td>
<td>Devji et al&lt;sup&gt;24&lt;/sup&gt;</td>
<td>15 RCTs</td>
<td>Plate and screws, IMNs</td>
<td>No difference in outcomes between operative and nonoperative groups. In both groups, 1 in 4 patients had complications. Functional outcomes trended towards operative fixation.</td>
<td>I</td>
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<tr>
<td>2014</td>
<td>Xu et al&lt;sup&gt;25&lt;/sup&gt;</td>
<td>7 RCTs</td>
<td>Plate and Screws, IMNs</td>
<td>Operative treatment resulted in lower nonunion rate with plate favored over IMN in subgroup analysis. ORIF resulted in better outcomes than nonoperative treatment.</td>
<td>II</td>
</tr>
<tr>
<td>2013</td>
<td>Robinson et al&lt;sup&gt;16&lt;/sup&gt;</td>
<td>200</td>
<td>Superior precontoured plate</td>
<td>Found a 17% nonunion rate in nonoperative group versus 1% in operative group. Statistically significant improved DASH and Constant scores in operative group compared with nonoperative group at all time points.</td>
<td>I</td>
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<td>2012</td>
<td>McKee et al&lt;sup&gt;7&lt;/sup&gt;</td>
<td>6 RCTs</td>
<td>Plate and Screws, IMNs</td>
<td>Statistically significant lower nonunion rate with operative (1.4%) versus nonoperative (14.5%) treatment. Operative intervention results in better short term return to function and activity but no longer term studies to see if difference is sustained.</td>
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<td>2012</td>
<td>Virtanen et al&lt;sup&gt;20&lt;/sup&gt;</td>
<td>60</td>
<td>Anterior-inferior plating</td>
<td>No difference in pain scores. DASH scores or Constant scores at one year follow up. Had 24% nonunion rate in nonoperative group compared with no nonunions in the operative group.</td>
<td>I</td>
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<tr>
<td>2009</td>
<td>Smekal et al&lt;sup&gt;22&lt;/sup&gt;</td>
<td>68</td>
<td>IMN</td>
<td>Shorter time to union with operative intervention (12.1 versus 17.6 weeks) with no nonunions in operative group and a 10% nonunion rate in the nonoperative group. Sustained improvements in DASH and Constant scores at six months and two years in operative group.</td>
<td>I</td>
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<tr>
<td>2009</td>
<td>Judd et al&lt;sup&gt;23&lt;/sup&gt;</td>
<td>57</td>
<td>IMN</td>
<td>Found no difference in SANE or L’Insalata scores with two groups of military personnel. Found a 3% nonunion rate in operative group and 4% in nonoperative group. High rate of complications (48%) in operative group because of pin prominence and irritation.</td>
<td>I</td>
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<td>2007</td>
<td>Canadian Orthopaedic Trauma Society&lt;sup&gt;3&lt;/sup&gt;</td>
<td>111</td>
<td>Plate and screws</td>
<td>Had statistically significant improved DASH and Constant scores in the operative group at all time points. Operative group had shorter time to union (16.4 versus 28.4 weeks) and lower nonunion rate (2.8% versus 14.2%). Had nine symptomatic malunions in nonoperative group that required subsequent surgery.</td>
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</table>
Why Surgical Treatment??

- Level I Study support:
- Faster healing times
- Lower nonunion risk
- Higher functional scores
Surgical Options

- Plate and screws
  - Most accepted form
  - Most stability to displacement
- Intra-medullary pin
  - Minimally invasive
  - Problems with pin irritation
  - Must be removed

Wiesel B et al. JAAOS 2018
Post-op Course

- Sling for comfort/discourage use
- ROM first two weeks
- Strengthening at 6 weeks
- Full return may take 4-6 mo.
Complications

- Symptomatic non/malunion
  - Both op/nonop Rx:
  - Supraclavicular numbness
  - Infection (2.6%)
- Revision surgery rates:
  - Nonunion (2.6%)
  - Malunion (1.1%) \(^{(12)}\)
CASE #1

- 12/17
- 18 yof tripped and fell
- Left shoulder deformity
- Skin intact
- No other abnormalities
CASE #1
CASE #1

- 12/17
- Performed ORIF with plate and lag screw fixation
CASE #1

6 weeks post op
CASE #2

- 6/14
- 32 yom involved in MCC
- Right shoulder deformity
- Had multiple abrasions
- Otherwise healthy
- Closed injury, NVI
CASE #2
CASE #2

- 7/14
- ORIF right clavicle fracture
- Plate and screw fixation
CASE #2

2 weeks post op
CASE #2

3 months post op
CASE #2

- 10/14
- No evidence of bridging bone
- Hardware failing
- No likelihood to bridge
- Obtained CT scan
- Decided to revise
CT scan
CASE #2
In Summary

• Surgery is an effective means of treatment

• It has potential to do provide earlier return to sport/work

• Has definite indications where it is superior to non-op treatment

• X-rays look a lot cooler
Surgery for Clavicle fractures
Thank You!!


