Evidence Based Management of Mid-shaft Clavicle Fractures

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DISCLOSURES

• None
Clavicle Fractures

• The Clavicle
  – “…a relatively agreeable and cooperative bone....requiring little more than symptomatic treatment [when fractured]…”
    • David Ring, Jesse Jupiter, ~2002

• “If you want to get into trouble, then fix a clavicle fracture....”
  – JC, Professor of Orthopaedic Surgery, NJMS, ~2004

• “Primary operative intervention is meddlesome and only makes things worse....”
  – Skeletal Trauma, 3rd Ed, 2003
Mid-shaft Clavicle Fractures

• Traditional Management
  – Simple sling
  – Figure-of-8 strap
  – Reduction maneuvers not helpful or necessary
  – Patients typically self-regulate their activity until healing has progressed
    • 3-4 weeks in children, 6-8 weeks in adults
Midshaft Clavicle Fracture
Clavicle Fracture
Clavicle Fractures: Non-operative Treatment

“…..they all do fine!”
Clavicle Fractures: Non-operative Treatment

“…..they all do fine!“

???
Clavicle Fractures: Non-operative Treatment

  - “Deficits following non-operative treatment of displaced mid-shaft clavicle fractures”
    - 30 patients with displaced fractures
    - 4.5 year clinical f/u
  - Results:
    - Residual deficits in strength and endurance persist with non-operative treatment
    - Fracture shortening >2cm may be predictive of worse outcome
      - Level III study
    - *Should we be fixing more of these?*
Management of Mid-shaft Clavicle Fractures: What’s the Evidence?

Clinical Questions:

• What are the outcomes with non-operative vs operative treatment?
• What are the non-union rates?
• Does malunion effect outcome?
• Complication rate of treatment options?
Displaced Mid-shaft Clavicle Fractures: The Evidence

- Canadian Orthopaedic Society, 2007
- Multicenter, prospective, randomized trial
- ORIF vs Non-Op treatment
- Level I
- 111 patients with 1 year f/u
- Results:
  - Constant and DASH scores significantly improved in ORIF group
  - Faster union (16 weeks vs 28 weeks)
  - Lower non-union in ORIF group, few symptomatic malunions
Canadian Orthopaedic Society

- **Non-union rate**
  - Non Op: 14%, Op: 1.6%

- **Malunion rate***
  - Non Op: 18%, Op: 0%

- **Complications**
  - Infection/Wound--Op: 3/62, Non-op 0/62
  - Hardware removal—Op: 5/62
  - CRPS--Non-op: 1pt
The Evidence

- Kulshrestha, *JOT*, 2011
  - Prospective cohort study, ORIF vs Non-Op
  - Level II study; excellent f/u (100% at 6 mos, 90% at 18mos)
  - 73pts; 6, 12, 18mos f/u
  - Results:
    - Non-union: Op 0%, Non-Op 29%
    - Malunion: Op 4%, Non-Op 36%
    - Constant scores significantly better in ORIF group at all time points
The Evidence

- Robinson, *JBJS*, 2013
- ORIF vs Non-op Tx of displaced midshaft clavicle fxs
- Multi-center RCT, Level I
- 200pts, 1 year clinical and CT f/u
- DASH and Constant Scores.....
The Evidence

- Robinson, *JBJS*, 2013

**Results:**
- ORIF statistically significantly better than non-op tx, both clinically and radiographically
- DASH and Constant scores significantly better in ORIF group
- Non-union: Non-op 26% (14% requiring ORIF); Op 1.2%
- Non-Op group much more “dissatisfied”
- Non-Op group that healed their fractures did as well as ORIF group
- Need for secondary procedures
  - ORIF group 18.6%
  - Non Op group 18.5%

**Conclusions:**
- ORIF decreases rate of non-union, giving better results
The Evidence

- Virtanen, *JBJS*, 2012
  - RCT, level I, ORIF vs Non-Op
- 1 yr f/u, DASH, Constant scores, x-rays
- Results:
  - NO DIFFERENCE IN DASH OR CONSTANT SCORES AT 3 MOS AND 1 YEAR!
The Evidence

- Virtanen, *JBJS*, 2012
  - RCT, level I, ORIF vs Non-Op
- 1 yr f/u, DASH, Constant scores, x-rays

Results:
- NO DIFFERENCE IN DASH OR CONSTANT SCORES AT 3 MOS. AND 1 YEAR!
- NON UNION RATE FOR NON-OP, 24%
  - These patients had worse DASH scores at 1 year, but Constant scores similar to Op group
  - Displacement of >150% associated with non-union; shortening not associated with non-union
  - No significant complications in Operative group
  - None of the patients with non-union opted for ORIF later!!?
The Evidence

• Xu, *JSES*, 2014
• Meta-analysis of RCTs
  – Op vs Non-Op tx
• 471 pts, 8 studies

• Results:
  – Operative tx leads to fewer non-unions and fewer symptomatic malunions
  – Operative tx lead to better DASH, Constant scores
  – Operative tx leads to better perceived cosmesis
  – Complications *higher* in Non-Op group
Risk Factors for Non-Union

• Murray, *JBJS*, 2013
  – Risk Factors for Non-union after Non-operative Treatment of Displaced Mid-shaft Fractures of the Clavicle
  – Level II Prognostic Study
  – 941 patients treated non-operatively, minimum 6 mos f/u

• Results:
  – 125/941pts non-union **13.3%**
  – Risk Factors for Non-union: Smoking (33%), Comminution, Displacement (>2cm??)

• NNT (Number Needed to Treat)
  – 7.5 ORIF to prevent 1 Non-Union; however, 1.7 ORIF if I.D. those at highest risk
Anteroposterior radiograph illustrating the methods for determining overlap, translation, and overall displacement.

Clavicle Fixation: Plate vs Nail

- Andrade-Silva, *JBJS*, 2015
- Prospective RCT
- 6 month DASH, Constant, Radiographic f/u
- Results:
  - Recon plates and elastic nails had *equivalent* results in function, time to union, patient satisfaction
Complications ??

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Complications

• Canadian Orthopaedic Trauma Society, JBJS, 2007

• Op: 37%
  – Wound infection 4.8%
  – Removal of hardware 8%
  – Neuritis 13%
  – Non-union 1.6%

• Non-Op: 63%
  – Non-union 14%
  – Malunion 18%
  – CRPS 2%
  – Neuritis 14%
Clinical Case
44 year old, right hand dominant, orthopaedic surgeon, injured playing in charity Thanksgiving flag football tournament
44M ORS, flag football injury

- RTW POD#3, no sling
- Return to OR POD#10
- 3mos PO, full function, no significant pain
- Hardware noticeable
The Evidence: Return to Function

- Smekal, *JOT*, 2009
  - IM Nail vs Non-Op (sling)
- RCT level I, 60 pts, 2 yr f/u, weekly DASH scores

Results:
- Operative group: lower rate of non-union and delayed union, faster time to union, faster return to function, and a better functional outcome
Early Return of Function Post-Op
Smekel, JOT, 2009
Displaced Mid-shaft Clavicle Fractures: Summary

- Most displaced mid-shaft clavicle fractures can be successfully treated non-operatively.
- Non-union rate for non-operative treatment is ~15%,
  - Op: ~1%
- Risk Factors for non-union include smoking, comminution and amount of displacement (specific # not yet defined; ≥20mm)
- Completely displaced mid-shaft clavicle fractures treated with ORIF have a lower non-union and malunion rate, and better functional outcomes than non-op treatment.

- Complications with ORIF: need for hardware removal, wound infx (rare)
- Complications with non-op: need for ORIF non-union/malunion

- Plate vs nail, to date no difference