Evidence Based Management of Mid-shaft Clavicle Fractures

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Sept 29, 2022

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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

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

- McKee, *J Bone Joint Surg*, 2006
  - "Deficits following nonoperative treatment of displaced midshaft 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?***


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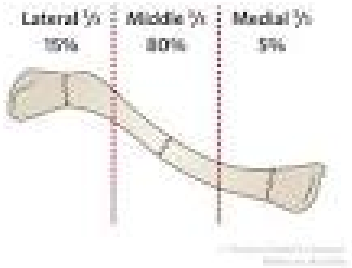
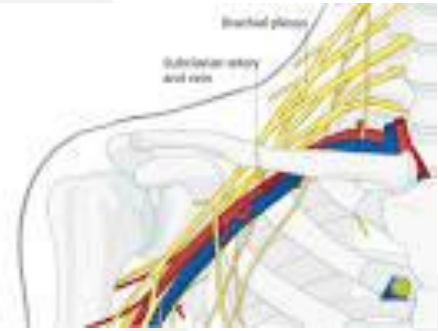
Management of Mid-shaft Clavicle Fractures: What's the Evidence?

- What are the outcomes with non-operative vs operative treatment?
- What is the non-union rate?
- Does malunion effect outcome?
- Complication rate of treatment options?


Lateral ⅓
15%
Middle ⅓
80%
Medial ⅓
5%



Displaced Midshaft Clavicle Fractures: The Evidence

- Canadian Orthopaedic Society, *JBJS*, 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**

The Evidence

- Virtanen, *JBJS*, 2012
- 1 yr f/u, DASH, Constant scores, xrays
- 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, xrays
- 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
    - None of the patients with non-union opted for ORIF later!!?
    - Displacement of >150% associated with non-union; shortening not associated with non-union
    - No significant complications in Operative group

Canadian Orthopaedic Society

- **Non-union rate**
  - **Non Op: 14%, Op: 1.6%**
- **Malunion rate (requiring further treatment)**
  - **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

- 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 "dissastisfied"
  - 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

- 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

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

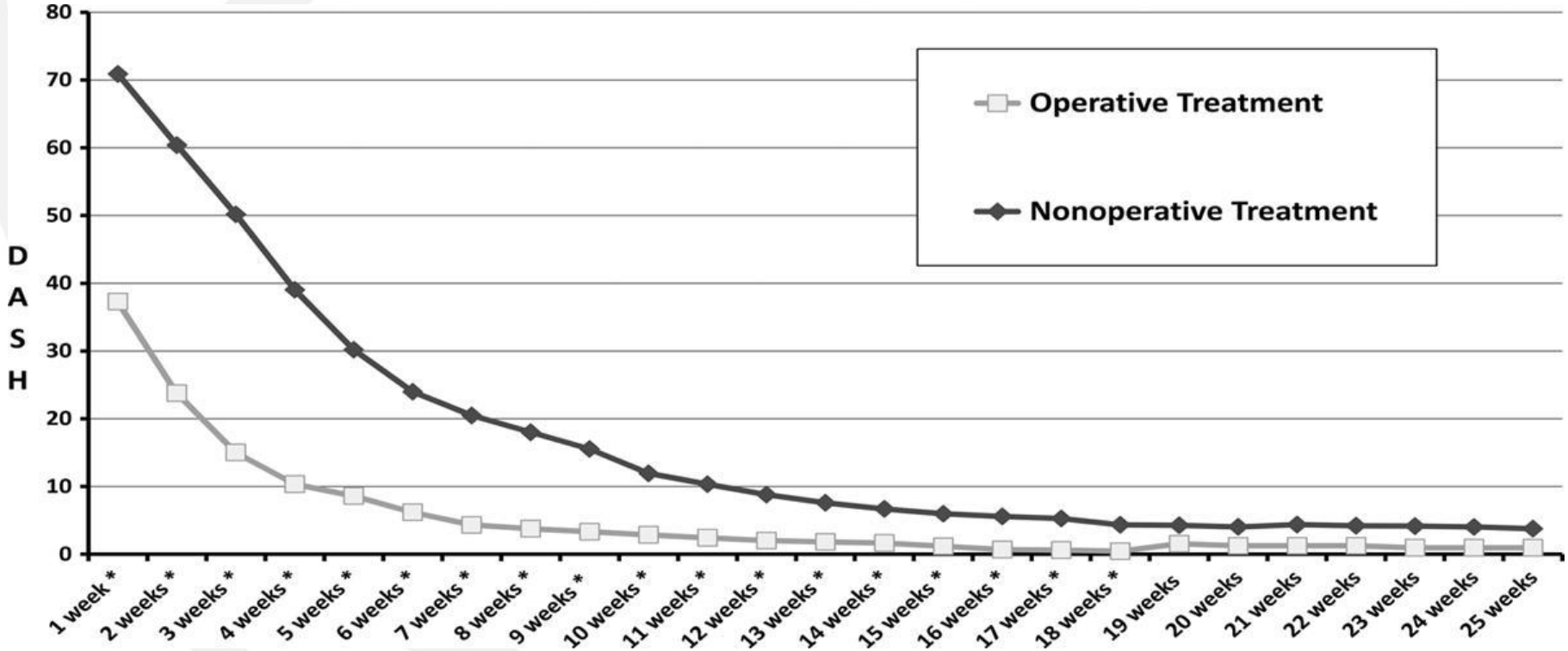
- Results:
  - Operative tx leads to fewer non-unions and fewer symptomatic malunions
  - Operative tx lead to better DASH, Constant scores
  - Opertative tx leads to better perceived cosmesis
  - Complications **higher** in Non-Op group

The Evidence

- 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**
  - ***Clavicular shortening*** more common in non-op group and associated with worse outcome
    - % of c/l side, not cm

Early Return of Function Post-Op

Smekel, *JOT*, 2009



What about Adolescents?

- Is operative treatment recommended for displaced clavicular fractures in teenagers?
  - No!
- Heworth, *Am J Sports Med*, 2022
  - No benefit of surgery in patients aged 10-18yrs old with midshaft clavicular fractures
  - Non-union rate “exceedingly rare”, 0.4%
  - Level II study

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 ??

- “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

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%

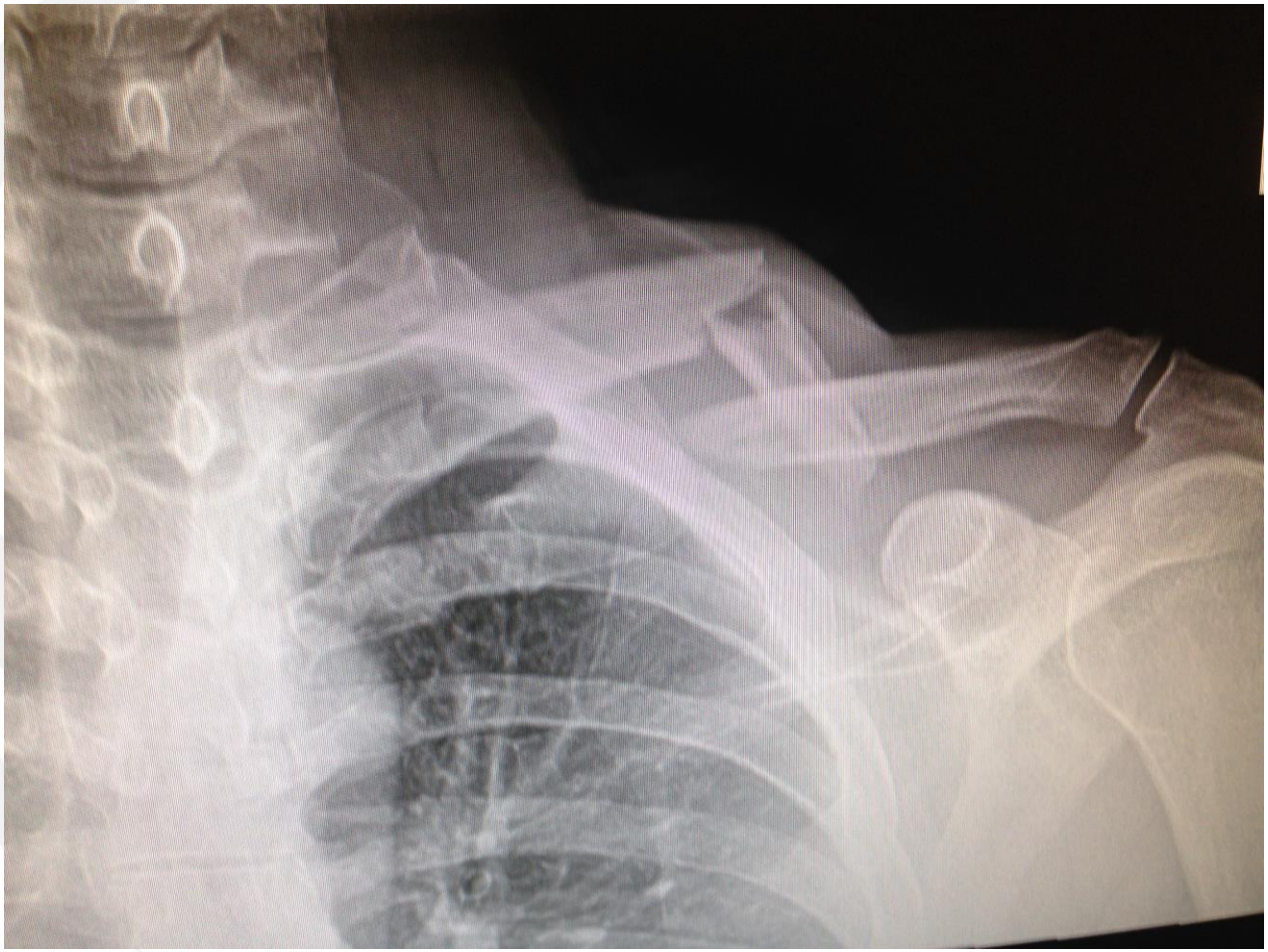
Nonunion

- Nonunion rate for nonoperative treatment approximately 10%

- Risk Factors for Nonunion
  - Smoking
  - Comminution
  - Displacement

Murray, *J Bone Joint Surg*, 2013 (level II)
Liu, *Orthop Traum*, 2014 (level III)

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
- 4mos PO, full function, no significant pain

Mid-shaft Clavicle Fractures: Summary

- Most mid-shaft clavicle fractures can be successfully treated non-operatively
- Non union rate for non-operative treatment is ~15%
- Completely displaced mid-shaft clavicle fractures treated with ORIF have a lower non-union and malunion rate, and better functional outcomes
- Complications with ORIF: need for hardware removal, wound infx (rare)
- Complications with non-op: need for ORIF non union/malunion
- Fracture shortening unclear significance
- Plate vs nail, to date no difference

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