Operative Treatment of midshaft clavicular fracture

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Recent observations emphasize that nonunion of the clavicle is more common than previously recognized, and that malunion with shortening can be associated with shoulder dysfunction.

**primary operative treatment is becoming more commonplace**

indications and techniques of operative treatment are evolving

Hill et al. JBJS(Br) 1997;79:537.
- S-shaped bone
- base for muscular attachments
- Strongly held with ligaments at both ends
- protects vital neurovascular structures
- cross-sectional anatomy changes along its course
Normal Clavicular Functions

- **Strut Function**
  - bracing the shoulder girdle optimal muscle-tendon unit length cosmesis and posture to the shoulder

- **Suspensory Function**
  - stabilization against inferior displacement as static mechanisms
  - (trapezius acts as a dynamic scapular elevator)
Incidence

- 4% of all fractures and 35% to 43% of shoulder girdle injuries
classification of clavicular fractures

Allman
Robinson
Neer
Craig

Group 1: middle third fractures
Group 2: lateral third fractures
Group 3: medial third fractures
classification of clavicular fractures

Allman

Robinson

Neer

Craig
classification of clavicular fractures

Distal clavicle fractures

Type 1: coracoclavicular ligaments intact
Type 2: coracoclavicular ligaments detached from the medial segment but trapezoid intact to distal segment
Type 3: intra-articular extension into the acromioclavicular joint
classification of clavicular fractures

<table>
<thead>
<tr>
<th>Group</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Fracture of the middle third</td>
</tr>
<tr>
<td>II</td>
<td>Fracture of the distal third</td>
</tr>
<tr>
<td></td>
<td>Type I—minimal displacement (interligamentous)</td>
</tr>
<tr>
<td></td>
<td>Type II—displaced secondary to fracture line medial to the coracoclavicular ligaments</td>
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<tr>
<td></td>
<td>(A) conoid and trapezoid attached</td>
</tr>
<tr>
<td></td>
<td>(B) conoid torn, trapezoid attached</td>
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<tr>
<td>III</td>
<td>Fractures of the articular surface</td>
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<tr>
<td>IV</td>
<td>Periosteal sleeve fracture (children)</td>
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<tr>
<td>V</td>
<td>Comminuted with ligaments attached neither proximally nor distally, but to an inferior comminuted fragment</td>
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<tr>
<td>III</td>
<td>Fractures of the proximal third</td>
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<td>Type I—minimal displacement</td>
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<tr>
<td></td>
<td>Type II—displaced (ligaments ruptured)</td>
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<td></td>
<td>Type III—intraarticular</td>
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<td></td>
<td>Type IV—epiphyseal separation (children and young adults)</td>
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<td></td>
<td>Type V—comminuted</td>
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</tbody>
</table>
- Lateral one-third more prone to nonunion if it is displaced and treated closed (50%)
- Most authors recommend operative treatment for displaced distal clavicle fx
OTA classification of midshaft clavicle fractures
Deforming forces

- Trapezius
- Sternocleidomastoid
- Sternoclavicular ligaments
- Pectoralis and latissimus

Weight of arm
Evaluation

- Physical exam
- X-Ray → frontal view - 45° cephalad tilt - Chest X-Ray
- CT Scan 3D
Nonoperative Treatment

Disadvantages

- difficulty to keeping the brace adjusted properly
- potential skin problems
- Impairment of patients' agility, personal hygiene needs, and comfort while sleeping
Disadvantages
Most midshaft clavicle fractures will go on to heal with any method of immobilization.

Which clavicular fractures require surgical intervention?
Factors associated with development of nonunion

Fracture shortening of ≥20 mm
Fracture displacement of >20 mm
Increasing patient age
Increasing severity of trauma
Refracture
Primary open reduction?
<table>
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<tr>
<th>Absolute</th>
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<tbody>
<tr>
<td>Shortening of $\geq 20$ mm</td>
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<tr>
<td>Open injury</td>
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<tr>
<td>Impending skin disruption and irreducible fracture</td>
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<tr>
<td>Vascular compromise</td>
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<tr>
<td>Progressive neurologic loss</td>
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<tr>
<td>Displaced pathologic fracture with associated trapezial paralysis</td>
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<td>Scapulothoracic dissociation</td>
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<table>
<thead>
<tr>
<th>Relative</th>
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<tbody>
<tr>
<td>Displacement of $&gt;20$ mm</td>
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<tr>
<td>Neurologic disorder</td>
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<tr>
<td>Parkinson’s</td>
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<tr>
<td>Seizures</td>
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<td>Head injury</td>
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<tr>
<td>Multitrauma</td>
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<tr>
<td>Expected prolonged recumbency</td>
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<tr>
<td>Floating shoulder</td>
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<td>Intolerance to immobilization</td>
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<tr>
<td>Bilateral fractures</td>
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<tr>
<td>Ipsilateral upper extremity fracture</td>
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<tr>
<td>Cosmesis</td>
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- Determining proportional length differences by taking a posteroanterior thorax radiograph
Methods of operative fixation

- Plate fixation
- Intramedullary devices
ORIF with plate

Fixation with three screws (six cortices) on each side

Advocates for open reduction and plate fixation argue that rigid fixation, cortical compression, and rotational control are worth the cost of increased soft-tissue stripping.
Disadvantages

- Skin scar
- Plate failure
Advances in plate technology and development of locking plate technology provided advantages for clavicular fixation.
Intramedullary Nail

- Less surgical dissection & soft tissue stripping
- less prominent hardware
Disadvantages

- No rotational stability
- Nail breakage
- Nail migration
the nail diameter should be two thirds of the narrowest diameter of the medullary canal
Technique

Not suitable for comminuted fx and old fx
Summary

- Most clavicular fx can be treated conservatively
- Conservative treatment → not good result in all
- Completely displaced fx → nonunion
- Think about fixing more clavicle fx

Thank you for attention