Disclosures

• Arthrex: Consultant
• DJO: Education
• Smith Nephew: Education
• American Journal of Sports Medicine
• Journal of Bone and Joint Surgery
• Journal of Shoulder and Elbow Surgery
• Orthopaedic Journal of Sports Medicine
• The Physician and Sports Medicine
• American Orthopaedic Society for Sports Medicine (AOSSM): Education and Industry Relations Committee

Anatomy of the AC Joint

• Diarthrodial joint
• ROM: 5-8 degrees
• Thin capsule stabilized on all sides by ligaments
• AC ligaments
  • Primarily control anterior/posterior displacement
  • Superior > Inferior
  • 55% of posterior-directed force
Coracoclavicular Ligaments

- Suspensory ligaments of the upper extremity
- Primary restraint to superior translation
- 2 ligaments
  - Medial: conoid (46 mm)
  - Lateral: trapezoid (26 mm)

Pathology

- Relatively uncommon in baseball
- Fielders more likely to experience traumatic injury (e.g. sprain)
- Pitchers can develop DJD, distal clavicular osteolysis (DCO)

Diagnosis

- Careful History
  - Mechanism of Injury
  - Level of Activity
  - Previous Shoulder/AC Joint injuries

- Physical Exam
  - Contour of shoulder
  - Palpate joint, assess mobility
  - Cross-arm Adduction sign
  - Check Neurovascular status
DJD/DCO Treatment

- Limit excessive cross body activities
- Oral NSAIDS
- Topicals work well here
- Kinesiotape
- CSI very useful and safe
  - US guided best

Accuracy of Acromioclavicular Joint Injections

Bradley R. Stepanowicz, MD, Sarah Peterson, MD, Lathi M. Jaram, MD, Joseph D. Zavacki, MD, and Andrew S. Moataz, MD

- Level IV Case series (2013)
- 30 patients injected with 1% lidocaine and Isovue
  - Radiographs taken after injection
  - 13 IA, 7 partial, 10 EA

Distal clavicle excision

- Effective in treating refractory AC joint pain due to arthrosis or osteolysis due to stable grade 1 or 2 AC joint separations
- Technique may accentuate instability when present
  - Increased horizontal clavicular motion in 10/23 type I and II injuries (Tibone AJSM 1988)
Arthroscopic Versus Open Distal Clavicle Excision
A Comparative Assessment at Intermediate-Term Follow-up
William J. Robinson, MD, Matthew H. Griffiths, MD, Kalvin Carol, MD, Thomas O’Donovan, MD, and Thomas J. Ox, MD
32 arthroscopic, 17 open
Mean follow-up ~ 5 years
Results:
Less pain in arthroscopy cohort at final follow-up
No difference: ASES, amount resected, operative time

Ligamentous anatomy of the distal clavicle
Kevin J. Reinhalt, MD, Michael K. Riley, MD, Donna Wheeler, ROY, Joseph G. Hess, MS, and Thomas W. Wright, MD, Scobacle, AZ, and Corinth and Greensville, VA

Superior AC ligament
- Women:
  - 5.2 mm distal clavicle
  - 4.7 mm medial acromion
- Men:
  - 7.6 mm distal clavicle
  - 8 mm medial acromion

Coracoclavicular ligaments
- 24 mm- conoid
- 11 mm- trapezoid

The Biomechanical Stability of Distal Clavicle Excision Versus Symmetric Acromioclavicular Joint Resection
Neil G. Pratavelli, DO, MPH, Amanda D. Tengen, RN, Jason S. Harte, MD, and A. Andrew Bouchard, MD, PhD
3) Evaluate ant to post load to failure and stiffness of AC joint after DCE as symmetric ACJR
Peak load to failure
- DCE: 387.8 N, ACJR 468.5 N
Average stiffness
- DCE: 35.2 N/mm, ACJR 37.4 N/mm
Authors conclude that ACJR may improve joint stability and lead to fewer complications
Acromioclavicular Sprains

Mechanism of Injury
- Direct—fall onto shoulder with adducted arm
- Indirect—fall onto outstretched hand with force transmission up arm through humeral head into the acromion
- Continuum of ligament injury
  - AC ligament → CC ligament → Deltoid and trap muscles → fascial tears

Radiographic Evaluation
- Initial views
  - Anteroposterior views
  - Zanca views (15 deg cephalic tilt)
- Other views
  - Axillary: AP displacement
  - Stress views: minimal impact on treatment decisions
Type I

- AC ligament sprain
- AC joint tenderness
- Minimal pain with arm motion
- No pain in coracoclavicular interspace
- XR normal

Type II

- AC ligament disruption, CC ligament sprain
- AC Joint widening
- XR: Distal clavicle slightly superior to acromion, −CC distance inc ~25%

Type III

- AC and CC ligament disruption
- AC Joint dislocation
- Deltoid and Trapezius detached from distal clavicle
- CC distance increased 25-100%
Type IV

- Type III injury w distal clavicle driven posterior into/through trapezius
- Axillary XR: posterior displacement of distal clavicle

Type V

- Type III injury w distal clavicle superiorly displaced
- Tenting of skin
- CC distance increased 100-300%

Type VI

- AC joint dislocated with distal clavicle driven beneath coracoid or acromion
- Deltoid and Trapezius detached
- Brachial plexus injury common
Treatment

- Type I and II: non-operative
  - rest, ice, sling, progressive therapy
  - Chronic pain—CSI, DCE

- Type IV, V, and VI: early surgical stabilization
  - Open reduction and repair/recon CC ligaments
  - Restore vertical stability

- Type III: ideal treatment remains controversial

Grade III

Treatment guidelines much less clear;

WHO do we fix?
WHEN do we fix?
HOW do we fix?

The literature doesn’t help much!

Acromioclavicular Joint Injuries in the National Football League

Epidemiology and Management

T. Sean Lynch, MD, Matthew D. Sutzman, MD, Jason H. Genuario, MD, Karl Y. Blinnman, MD, Mark R. Brown, MD, and Gordon W. Ruben, MD

- Descriptive epidemiologic study—
  all positional players
- AC joint injuries made up 30% of all shoulder injuries
  - Majority of injuries were type I, II, III
- QB and ST most susceptible to these injuries
- Mean time lost 9.8 days; QB’s longer: 17.3 days
- 13 athletes requires surgical intervention
Shoulder Injuries to Quarterbacks in the National Football League

Bryan T. Kelly, MD, Ronnie P. Barnes, MS, ATC, John W. Powell, PhD, ATC, and Russell F. Warren, MD

• Descriptive epidemiologic study—only QBs
• AC Joint injuries #1 shoulder injury (40%)
  – Type 1 44%
  – Type 2 20%
  – Type 3 20%
• Mean time lost was 12.5 days
• Majority treated without surgery

Survey of MLB team physicians
69% would manage player non-op
60% surveyed actually had the scenario
• 63% of players were treated non-op
• >80% players regained normal ROM, pain relief and function


Historical Literature Review: Operative vs. Non-operative

<table>
<thead>
<tr>
<th>Study (year)</th>
<th>Patients, No.</th>
<th>Length of follow-up</th>
<th>Treatment</th>
<th>Surgical vs. Non-surgical</th>
<th>Total or excluded, n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>65</td>
<td>15 min</td>
<td>Surgical</td>
<td>AC joint fixation</td>
<td>32 (19%)</td>
</tr>
<tr>
<td>1987</td>
<td>45</td>
<td>N/A</td>
<td>Surgical</td>
<td>AC joint fixation</td>
<td>23 (13%)</td>
</tr>
<tr>
<td>1989</td>
<td>28</td>
<td>N/A</td>
<td>Non-surgical</td>
<td>AC joint fixation</td>
<td>15 (9%)</td>
</tr>
<tr>
<td>1989</td>
<td>28</td>
<td>N/A</td>
<td>Non-surgical</td>
<td>AC joint fixation</td>
<td>13 (8%)</td>
</tr>
<tr>
<td>1981</td>
<td>48</td>
<td>N/A</td>
<td>Surgical</td>
<td>AC joint fixation</td>
<td>24 (15%)</td>
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<td>24 (15%)</td>
</tr>
</tbody>
</table>

The winner is...

THE COCHRANE LIBRARY
Surgical versus conservative interventions for treating acromioclavicular dislocation of the shoulder in adults

Rehabilitation

- **Phase I:** Pain control, protected ROM, isometric exercises
- **Phase II:** Strengthening with isotonic exercises and proprioceptive neuromuscular facilitation
- **Phase III:** Unrestricted functional participation with a goal to increase power, endurance and neuromuscular control
- **Phase IV:** Return to activity with sport-specific drills
Surgical Options

• Primary fixation across the AC joint
  • K-wires (1940)
  • AC ligament repair/augmentation
  • Hook plate

• Fixation between the clavicle and coracoid
  • Bosworth screw (1941)
  • Dacron Tape; other non-absorbable sutures

• Primary CC ligament reconstruction
  • CA ligament transfer
  • CC ligament repair

• Dynamic muscle transfer
  • Conjoint tendon to the inferior clavicle

• Ligament reconstruction with graft or synthetic tissue

• Combinations

Techniques I have tried….

• "Weaver Dunn" with CA ligament transfer:
  ✔ with and without bone block
  ✔ with and with out material back up (fiber wire, fiber tape, dacron tape, braided PDS; +/-cuff link gromets)
  ✔ with and with out repair of CC ligaments

• "Weaver Dunn" with free tendon graft:
  ✔ Around the coracoid; through the coracoid
  ✔ Single bundle; double bundle anatomic
  ✔ Interference screws; suture anchors
  ✔ Arthrex Tight Rope and Graft Rope; Biomet Toggle Lock
  ✔ Augmentation/reconstruction of AC ligament

Current Method
My Opinion

- Position player with Grade III sprain:
  - Individualized approach
  - Ok to treat non-op
  - RTP based on symptoms and function
  - If able to RTP but still having symptoms can fix off season
  - Arthroscopically assisted with graft

- Grade III + injury in the dominant arm of a pitcher likely not tolerated very well
  - Acute arthroscopic repair without need for graft

Case

Return to Play after Nonoperative Treatment of Type III Acromioclavicular Injury in a Professional Baseball Player


29 yo R/R MLB catcher
Fell directly onto the shoulder tripping over first base
## Recovery Progression

<table>
<thead>
<tr>
<th>Post-Injury Day</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Sling, cryotherapy, oral methylprednisolone, MicroCurrent, and passive rotation</td>
</tr>
<tr>
<td>5</td>
<td>Sling discontinued</td>
</tr>
<tr>
<td>8</td>
<td>Active motion and isometric exercises</td>
</tr>
<tr>
<td>15</td>
<td>Table-height push-ups, rotation with resistance bands</td>
</tr>
<tr>
<td>27</td>
<td>Two-handed swings</td>
</tr>
<tr>
<td>32</td>
<td>Batting front flips</td>
</tr>
<tr>
<td>33</td>
<td>Interval throwing program</td>
</tr>
<tr>
<td>43</td>
<td>Batting practice on field</td>
</tr>
<tr>
<td>47</td>
<td>Two-handed swings</td>
</tr>
<tr>
<td>52</td>
<td>Medically cleared from injury</td>
</tr>
</tbody>
</table>

## Final Thoughts

- No “best” way to reconstruct CC ligaments
- Why do they “fail”?  
  - Non-anatomic placement  
  - Insufficient materials (biologic and manufactured)  
  - Poor healing potential (blood supply??)  
  - Biomechanics not reproducible; difficult to control vertical and horizontal translation
- Best surgical candidate: high grade, unstable AC sprain (mobile distal clavicle); dominant side; individualized timing (probably best to fix early if you decide to fix it)
Thank You!

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