Complications of Operative and Nonoperative treatment of AC injuries in 2017
How these influence my decisions

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Anatomy of AC joint

- Diarthroidal joint of variable inclination
- Intra-articular disk
  - Degenerates after 40yrs
- Clavicular articular surface smaller than acromial facet
Disk Anatomy

• Articular disk
  • Variable and often incomplete or missing

• Effect of disk anatomy on arthritis development
  • Unknown

AC ligament

- AC ligaments prevent horizontal displacement of the clavicle
  - Superior AC ligament 56%
  - Posterior AC ligament 25%

- CA ligament does not play a significant role in AC stability

Klimkiewicz et al 1999 JSES
Fakuta et al 1986 JBJS
CC Ligaments (coracoclavicular)

- The trapezoid ligament provides resistance to acromioclavicular joint compression.
- The conoid ligament responsible for 60% of the restraint to anterior and superior clavicular displacement and rotation.

Trapezoid: 25.4mm (M), 22.9mm (F)
Conoid: 47.8mm (M), 42.8mm (F)

CC (coracoclavicular) Ligaments

- CC ligaments prevent vertical displacement and secondarily prevent horizontal displacement

Conoid ligament is a posterior structure
Clavicular Rotation

Clavicle rotates 40-50 degrees on its long axis in synchrony with scapular motion in arm elevation
Only 5-8 degrees of motion at A-C joint
Mechanism of Injury

- **Direct Force**: Direct trauma to the shoulder from a fall or in contact sports when the arm is in an adducted position

- **Indirect Force**: A fall on an outstretched hand or flexed elbow may transmit direct forces superiorly to the acromioclavicular joint through the humeral head into the acromion
Pathology of AC injuries

- Superior or postero-superior migration of distal clavicle
- Changes in the orientation of the scapula and the rotator cuff
- Chronic painful Scapular dyskinesis or SICK scapula syndrome

# Classification of ACJ dislocation (Rockwood)

<table>
<thead>
<tr>
<th>Type</th>
<th>Acromioclavicular Ligaments</th>
<th>Coracoclavicular Ligaments</th>
<th>Deltopectoral Fascia</th>
<th>Coracoclavicular Interspace Distance*</th>
<th>Radiographic Appearance of Acromioclavicular Joint</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Sprained</td>
<td>Intact</td>
<td>Intact</td>
<td>Normal</td>
<td>Normal</td>
</tr>
<tr>
<td>II</td>
<td>Disrupted</td>
<td>Sprained</td>
<td>Intact</td>
<td>&lt;25%</td>
<td>Widened</td>
</tr>
<tr>
<td>III</td>
<td>Disrupted</td>
<td>Disrupted</td>
<td>Disrupted</td>
<td>25% to 100%</td>
<td>Widened</td>
</tr>
<tr>
<td>IV</td>
<td>Disrupted</td>
<td>Disrupted</td>
<td>Disrupted</td>
<td>Increased</td>
<td>Clavicle posteriorly displaced (axillary)</td>
</tr>
<tr>
<td>V</td>
<td>Disrupted</td>
<td>Disrupted</td>
<td>Disrupted</td>
<td>100% to 300%</td>
<td>N/A†</td>
</tr>
<tr>
<td>VI</td>
<td>Disrupted</td>
<td>Disrupted</td>
<td>Disrupted</td>
<td>Decreased</td>
<td>Clavicle displaced inferior to coracoid</td>
</tr>
</tbody>
</table>

*Distance between the superior aspect of the coracoid process and the inferior aspect of the clavicle as measured radiographically.

†N/A = information not available.
Physical Examination

- Limited by concomitant problem (RC, SLAP, BT, Labrum, etc)
- Most Specific ___ O’Brien Active Compression Test
- Most Sensitive ___ Cross-Body Adduction Stress Test

Arthroscopic or arthroscopically assisted reconstruction of ACJ separations

- Associated glenohumeral lesions (SLAP RCT) 18-30%

Strongly Consider Diagnostic Shoulder Arthroscopy before AC Repair

Tischer and Imhoff et al 2009 AJSM

Type III AC dislocation

• Patients have changed
  – More active

• Surgical techniques have changed
  – Arthroscopic or arthroscopically assisted
    • Cosmesis

• Modified Rockwood classification
  – Grade IIIA (therapy)
  – Grade IIIB (Surgical)

Beitzel K et al ISAKOS upper extremity committee consensus statement on the need for diversification of the Rockwood classification for acromioclavicular joint injuries. Arthroscopy 2014
Chronic type III AC dislocation

- 34 patients
- 24 (70.6%) had scapular dyskinesis with the arms at rest, and 14 of these (58.3%) had SICK scapula syndrome
- Dyskinesis might be due to loss of the stable fulcrum of the shoulder girdle represented by the AC joint and due to the superior shoulder pain caused by the dislocation

Gumina S et al. Scapular Dyskinesis and SICK Scapula Syndrome in Patients With Chronic Type III Acromioclavicular Dislocation. Arthroscopy 2009
CC Repair

- **Bosworth Screw**
- Good Clinical Results
- Complications
  - Screw loosening
  - Malposition
  - Screw Breakage
  - Destruction of Coracoid
  - Bosworth BM Ann Surg 1948
  - Ballmer F JBJS B:1991
  - Asaghir JM, J Trauma 2011

- **Cerclage (Ethibond, PDS, Dacron tape etc)**
- Good Clinical Results
- Complications
  - Redislocation 44%
  - Infection Rate
  - Marecchiani GM, KSSTA:2014
  - Stam L, Injury:1991
**CC Repair**

- **Anchors**
- **Good Clinical Results**
- **Complications**
  - Pull out
    - Morrison DS, AJSM:1995
    - Choi SW, AJSM:2008

- **Buttons (Endobutton, Tight rope, MINAR...)**
- Single strand
- Double strand (Anatomical repair)
- Complications
  - Destroy every ligament remnants
  - Coracoid or clavicle fractures
  - Hardware migration
  - Tunnel widening
    - Cook JB, JSES:2012
    - Petersen W, Oper Orth Trauma:2010
    - Salzmann M, AJSM:2010
Acute: AC Repair

- **Hook Plate**
  - Good Clinical Results
  - Complications
    - 10-22% Vertical loss
    - Acromion erosion
    - Secondary operation (Removal)
      - Eslola A, J Orthop Trauma: 1991
      - Liam S, Acta Orth Belg: 2008
      - Chiang CL, JSES: 2010

- **Pin/Cerlage Fixation**
  - Good Clinical Results
  - Complications
    - 10-22% Vertical loss
    - Pin migration,
    - AC joint destruction
    - 4%-15%
      - Eslola A, J Orthop Trauma: 1991
      - Leidel BA, J Trauma: 2009
AC Dislocation associated with coracoid fracture
**Chronic AC dislocation**

- **CC/AC ligaments may lack healing potential 3 weeks after the injury**
- **Therapeutic approach for chronic ACJ instability should be different from that for acute ACJ instability**
- **Management of chronic ACJ instability must involve biological augmentation except mechanical fixation**

Chronic AC dislocation

Coracoacromial (CA) ligament transposition

- Classical method
  - Original Weaver-Dunn.
  - Modified Weaver-Dunn

- Modified Weaver-Dunn (Dr. Jiang CY)
  Transposition of lateral part of joint tendon

Arthroscopy-assisted Vs Open surgery

• Infection rates
  – Arthroscopy 3.8%
  – Open surgery 5%
  – Open tendon grafting 8%

Anatomical reconstruction of the CC and AC ligaments

- New trends addresses both planes
  - CCD difference
  - Horizontal instability
- Reduce the lateral as well as inferior scapular displacement to provide scapular rotatory stability

Reconstructions

Anatomical Vs non-anatomical

- It is currently clear that anatomical procedures are superior to the classical or modified Weaver–Dunn technique by taking into consideration the biomechanics and the resistance of the reconstruction.


Synthetic Grafts

- LARS, Dacron, etc

- Many authors reported in their study that they are currently rejecting the use of synthetic graft, and advising against its use.

- The high failure rate of graft tears, clavicular osteolysis, re-dislocations

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Autograft or Allograft

- Semitendinosus tendon
- Palmaris longus
Fixation method of the tendinous graft in the coracoid process

- Subcoracoid suture loops
  - A shear deleterious effect on the bone
  - Tend to dislocate anteriorly if pass the graft around the caudal portion of the coracoid

- If there is no contact between the cancellous bone and the collagen of the tendon graft, integration of the graft might not be developed

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Mumford procedure
Distal clavicle Resection (DCR)

- Degenerative changes in the articular disc and lateral end of the clavicle always be found during surgery and might be a source of pain in high-grade injuries.

- Resection of only 5 mm of the distal third of the clavicle to avoid injuring the insertion of trapezoid ligament.

- The key is adequate resection without creating iatrogenic ACJ instability.

Making decisions based on avoiding complication

- Conservative treatment
  - Most Type I - II and stable Type III

- Surgical treatment
  - Unstable Type III and Type IV - VI

- Repair CC ligament and/or AC ligament for acute patients

- Biological augmentation except mechanical fixation must be considered for chronic cases
My suggestion

1. Technique: anatomical → non-anatomical.

2. Procedure: arthroscopy-assisted → open.


4. Distal clavicle: resection(<5mm) → remain.
Thank you for your attention