ACROMIOCLAVICULAR AND STERNOCLAVICULAR JOINT INJURIES

ACROMIOCLAVICULAR JOINT INJURY

Epidemiology

- It is most common in the second decade of life, associated with contact athletic activities.
- Acromioclavicular (AC) dislocations represent 9% to 10% of acute traumatic injuries to the shoulder girdle.
- It is more common in males (approximately 5:1).

Anatomy (Fig. 12.1)

- The AC joint is a diarthrodial joint, with fibrocartilage-covered articular surfaces, located between the lateral end of the clavicle and the medial acromion.
- Inclination of the plane of the joint may be vertical or inclined medially 50 degrees.

![Diagram of the AC joint with labels for coracoclavicular ligament, trapezoid ligament, conoid ligament, coracoacromial ligament, lesser tuberosity, bicipital groove, coracoid process, and trapezoid ligament.](image)

**FIGURE 12.1** Normal anatomy of the AC joint. (From Bucholz RW, Heckman JD, Court-Brown C, et al., eds. Rockwood and Green’s Fractures in Adults. 6th ed. Philadelphia: Lippincott Williams & Wilkins; 2006.)
The AC ligaments (anterior, posterior, superior, inferior) strengthen the thin capsule. Fibers of the deltoid and trapezius muscles blend with the superior AC ligament to strengthen the joint.

The AC joint has minimal mobility through a meniscoid, intra-articular disc that demonstrates an age-dependent degeneration until it is essentially nonfunctional beyond the fourth decade.

The horizontal stability of the AC joint is conferred by the AC ligaments, whereas the vertical stability is maintained by the coracoclavicular ligaments (conoid–medial, trapezoid–lateral).

Deltoid and trapezius fascial attachments reinforce the superior AC ligament contributing to vertical stability as a secondary stabilizer.

The average coracoclavicular distance is 1.1 to 1.3 cm.

**Mechanism of Injury**

**Direct:** This is the most common mechanism, resulting from a fall onto the shoulder with the arm adducted, driving the acromion medial and inferior.

**Indirect:** This is caused by a fall onto an outstretched hand with force transmission through the humeral head and into the AC articulation (Fig. 12.2).

**FIGURE 12.2** An indirect force applied up through the upper extremity (e.g., a fall on the outstretched hand) may superiorly displace the acromion from the clavicle, thus producing injury to the AC ligaments. However, stress is not placed on the coracoclavicular ligaments. (From Bucholz RW, Heckman JD, Court-Brown C, et al., eds. *Rockwood and Green’s Fractures in Adults.* 6th ed. Philadelphia: Lippincott Williams & Wilkins; 2006.)
Associated Fractures and Injuries

- **Fractures:** clavicle, acromion process, and coracoid process
- Pneumothorax or pulmonary contusion with type VI AC separations

Clinical Evaluation

- The patient should be examined while in the standing or sitting position with the upper extremity in a dependent position, thus stressing the AC joint and emphasizing deformity.
- The characteristic anatomic feature is a downward sag of the shoulder and arm.
- A standard shoulder examination should be performed, including assessment of neurovascular status and possible associated upper extremity injuries. Inspection may reveal an apparent step-off deformity of the injured AC joint, with possible tenting of the skin overlying the distal clavicle. Range of shoulder motion may be limited by pain. Tenderness may be elicited over the AC joint.

Radiographic Evaluation

- A standard trauma series of the shoulder (anteroposterior [AP], scapular-Y, and axillary views) is usually sufficient for the recognition of AC injury. The Zanca view is taken with the x-ray beam in 10 to 15 degrees of cephalic tilt. This view allows better visualization of the distal clavicle.
- Ligamentous injury to the coracoclavicular joints may be assessed via stress radiographs, in which weights (10 to 15 lb) are strapped to the wrists, and an AP radiograph is taken of both shoulders to compare coracoclavicular distances (difficult to do in the acute setting).

Classification

- This injury is classified depending on the degree and direction of displacement of the distal clavicle (Table 12.1 and Fig. 12.3).

Treatment

**Type I:** Rest for 7 to 10 days, ice packs, sling. Refrain from full activity until painless, full range of motion (2 weeks).

**Type II:** Sling for 1 to 2 weeks, gentle range of motion as soon as possible. Refrain from heavy activity for 6 weeks. More than 50% of patients with types I and II injuries remain symptomatic at long-term follow-up.

**Type III:** For inactive, nonlaboring, or recreational athletic patients, especially for the nondominant arm, nonoperative treatment is indicated: sling, early range of motion,
<table>
<thead>
<tr>
<th>Type</th>
<th>Anatomy</th>
<th>Clinical Examination</th>
<th>Radiographic Examination</th>
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<tbody>
<tr>
<td>I</td>
<td>Sprain of the AC ligament</td>
<td>AC joint tenderness, minimal pain with arm motion, no pain in coracoclavicular interspace</td>
<td>No abnormality</td>
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<tr>
<td>II</td>
<td>AC ligament tear with joint disruption, coracoclavicular ligaments sprained</td>
<td>Distal clavicle slightly superior to acromion and mobile to palpation; tenderness in the coracoclavicular space</td>
<td>Slight elevation of the distal end of the clavicle; AC joint widening. Stress films show coracoclavicular space unchanged from normal shoulder.</td>
</tr>
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<td>III</td>
<td>AC and coracoclavicular ligaments torn with AC joint dislocation. The deltoid and trapezius muscles are usually detached from the distal clavicle.</td>
<td>The upper extremity and distal fragment are depressed and the distal end of the proximal fragment may tent the skin. The AC joint is tender, and coracoclavicular widening is evident.</td>
<td>Radiographs demonstrate the distal clavicle superior to the medial border of the acromion; stress views reveal a widened coracoclavicular interspace 25% to 100% greater than the normal side.</td>
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<tr>
<td>IV</td>
<td>Distal clavicle displaced posteriorly into or through the trapezius. The deltoid and trapezius muscles are detached from the distal clavicle.</td>
<td>There is more pain than in type III; the distal clavicle is displaced posteriorly away from the acromion.</td>
<td>Axillary radiograph or computed tomography scan demonstrates posterior displacement of the distal clavicle.</td>
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<td>V</td>
<td>Distal clavicle grossly and severely displaced superiorly (&gt;100%). The deltoid and trapezius muscles are detached from the distal clavicle.</td>
<td>Typically associated with tenting of the skin</td>
<td>Radiographs demonstrate the coracoclavicular interspace to be 100% to 300% greater than the normal side.</td>
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<td>VI</td>
<td>The AC joint is dislocated, with the clavicle displaced inferior to the acromion or the coracoid; the coracoclavicular interspace is decreased compared with normal. The deltoid and trapezius muscles are detached from the distal clavicle.</td>
<td>The shoulder has a flat appearance with a prominent acromion; associated clavicle and upper rib fractures and brachial plexus injuries result from high-energy trauma.</td>
<td>One of two types of inferior dislocation: subacromial or subcoracoid</td>
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</tbody>
</table>
FIGURE 12.3 Classification of ligamentous injuries to the AC joint. **Top left:** In the type I injury, a mild force applied to the point of the shoulder does not disrupt either the AC or the coracoclavicular ligaments. **Top right:** A moderate to heavy force applied to the point of the shoulder will disrupt the AC ligaments, but the coracoclavicular ligaments remain intact (type II). **Center left:** When a severe force is applied to the point of the shoulder, both the AC and the coracoclavicular ligaments are disrupted (type III). **Center right:** In a type IV injury, not only are the ligaments disrupted, but also the distal end of the clavicle is displaced posteriorly into or through the trapezius muscle. **Bottom left:** A violent force applied to the point of the shoulder not only ruptures the AC and coracoclavicular ligaments but also disrupts the muscle attachments and creates a major separation between the clavicle and the acromion (type V). **Bottom right:** This is an inferior dislocation of the distal clavicle in which the clavicle is inferior to the coracoid process and posterior to the biceps and coracobrachialis tendons. The AC and coracoclavicular ligaments are also disrupted (type VI). (From Bucholz RW, Heckman JD, Court-Brown C, et al., eds. *Rockwood and Green's Fractures in Adults.* 6th ed. Philadelphia: Lippincott Williams & Wilkins; 2006.)
strengthening, and acceptance of deformity. Younger, more active patients with more severe degrees of displacement and laborers who use their upper extremity above the horizontal plane may benefit from operative stabilization. Repair is generally avoided in contact athletes because of the risk of reinjury.

Types IV–VI: These are generally treated with open reduction and surgical repair or reconstruction of the coracoclavicular ligaments is performed for vertical stability, although no level-one evidence for this treatment exists.

Complications
- **Coracoclavicular ossification**: Not associated with increased disability
- **Distal clavicle osteolysis**: Associated with chronic dull ache and weakness
- **AC arthritis**

**STERNOCLAVICULAR JOINT INJURY**

**Epidemiology**
- Injuries to the sternoclavicular (SC) joint are rare; Cave et al. reported that of 1,603 shoulder girdle dislocations, only 3% were SC, with 85% glenohumeral and 12% AC dislocations.
- Approximately 80% of dislocations of the SC joint are caused by either motor vehicle accident (47%) or are sports related (31%).

**Anatomy (Fig. 12.4)**
- The SC joint is a diarthrodial joint, representing the only true articulation between the upper extremity and the axial skeleton.
- The articular surface of the clavicle is much larger than that of the sternum; both are covered with fibrocartilage. Less than half of the medial clavicle articulates with the sternum; thus, the SC joint has the distinction of having the least amount of bony stability of the major joints of the body.
- Joint integrity is derived from the saddle-like configuration of the joint (convex vertically and concave anteroposteriorly), as well as from surrounding ligaments:
  - The intra-articular disc ligament is a checkrein against medial displacement of the clavicle.
  - The extra-articular costoclavicular ligament resists rotation and medial–lateral displacement.
  - The interclavicular ligament helps to maintain shoulder poise.
- Range of motion is 35 degrees of superior elevation, 35 degrees of combined AP motion, and 50 degrees of rotation around its long axis.
The medial clavicle physis is the last physis to close. It ossifies at 20 years and fuses with the shaft at 25 to 30 years. Therefore, many supposed SC joint dislocations may actually be physeal injuries.

**Mechanism of Injury (Fig. 12.5)**

- **Direct**: Force applied to the anteromedial aspect of the clavicle forces the clavicle posteriorly into the mediastinum to produce posterior dislocation. This may occur when an athlete is in the supine position and another athlete falls on him or her, when an individual is run over by a vehicle, or when an individual is pinned against a wall by a vehicle.
- **Indirect**: Force can be applied indirectly to the SC joint from the anterolateral (producing anterior SC dislocation) or posterolateral (producing posterior SC dislocation) aspects of the shoulder. This is most commonly seen in football “pileups,” in which an athlete is lying obliquely on his shoulder and force is applied with the individual unable to change position.

**FIGURE 12.4** Cross sections through the thorax at the level of the SC joint. (A) Normal anatomic relations. (B) Posterior dislocation of the SC joint. (C) Anterior dislocation of the SC joint. (From Bucholz RW, Heckman JD, Court-Brown C, et al., eds. *Rockwood and Green’s Fractures in Adults*. 6th ed. Philadelphia: Lippincott Williams & Wilkins; 2006.)
Clinical Evaluation

- The patient typically presents supporting the affected extremity across the trunk with the contralateral, uninjured arm. The patient’s head may be tilted toward the side of injury to decrease stress across the joint, and the patient may be unwilling to place the affected scapula flat on the examination table.
- Swelling, tenderness, and painful range of shoulder motion are usually present, with a variable change of the medial clavicular prominence, depending on the degree and direction of injury.
- Neurovascular status must be assessed, because the brachial plexus and major vascular structures are in the immediate vicinity of the medial clavicle.
- With posterior dislocations, venous engorgement of the ipsilateral extremity, shortness of breath, painful inspiration, difficulty swallowing, and a choking sensation may be present. The chest must be auscultated to ensure bilaterally symmetric breath sounds.

Radiographic Evaluation

- AP chest radiographs typically demonstrate asymmetry of the clavicles that should prompt further radiographic evaluation. This view should be scrutinized for the presence of pneumothorax if the patient presents with breathing complaints.
- **Hobbs view**: In this 90-degree cephalocaudal lateral view, the patient leans over the plate, and the radiographic beam is angled behind the neck (Fig. 12.6).
- **Serendipity view**: This 40-degree cephalic tilt view is aimed at the manubrium. With an anterior dislocation, the medial clavicle lies above
the interclavicular line; with a posterior dislocation, the medial clavicle lies below this line (Fig. 12.7).

- **Computed tomography (CT) scan**: This is the best technique to evaluate injuries to the SC joint. CT is able to distinguish fractures of the medial clavicle from dislocation as well as delineate minor subluxations that would otherwise go unrecognized.

### Classification

#### Anatomic

- **Anterior dislocation**: More common
- **Posterior dislocation**

#### Etiologic

- Sprain or subluxation
  - **Mild**: joint stable, ligamentous integrity maintained
  - **Moderate**: subluxation, with partial ligamentous disruption
  - **Severe**: unstable joint, with complete ligamentous compromise
- **Acute dislocation**: complete ligamentous disruption with frank translation of the medial clavicle
- **Recurrent dislocation**: rare

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Unreduced dislocation

Atraumatic: may occur with spontaneous dislocation, developmental (congenital) dislocation, osteoarthritis, condensing osteitis of the medial clavicle, SC hyperostosis, or infection

Treatment

Mild sprain: Ice is indicated for the first 24 hours with sling immobilization for 3 to 4 days and a gradual return to normal activities as tolerated.

Moderate sprain or subluxation: Ice is indicated for the first 24 hours with a clavicle strap, sling and swathe, or figure-of-eight bandage for 1 week, then sling immobilization for 4 to 6 weeks.

Severe sprain or dislocation (Fig. 12.8)

Anterior: As for nonoperative treatment, it is controversial whether one should attempt closed reduction because it is usually unstable; a sling is used for comfort. Closed reduction may be accomplished using general anesthesia, or narcotics and muscle relaxants for the stoic patient. The patient is placed supine with a roll between the scapulae. Direct, posteriorly directed pressure usually results in reduction. Postreduction care consists of a clavicle strap, sling and swathe, or figure-of-eight bandage for 4 to 6 weeks. Some advocate a bulky anterior dressing with elastic tape to maintain reduction.

FIGURE 12.7 Serendipity view: positioning of the patient to take the “serendipity” view of the SC joints. The x-ray tube is tilted 40 degrees from the vertical position and is aimed directly at the manubrium. The nongrid cassette should be large enough to receive the projected images of the medial halves of both clavicles. In children, the tube distance from the patient should be 45 inches; in thicker chested adults, the distance should be 60 inches. (From Bucholz RW, Heckman JD, Court-Brown C, et al., eds. Rockwood and Green’s Fractures in Adults. 6th ed. Philadelphia: Lippincott Williams & Wilkins; 2006.)
Posterior: A careful history and physical examination are necessary to rule out associated pulmonary or neurovascular problems. Prompt closed or open reduction is indicated, usually under general anesthesia. Closed reduction is often successful and remains stable. The patient is placed supine with a roll between the scapulae. Closed reduction may be obtained with traction with the arm in abduction and extension. Anteriorly directed traction on the clavicle with a towel clip may be required. A clavicle strap, sling

**FIGURE 12.8** Technique for closed reduction of the SC joint. (A) The patient is positioned supine with a sandbag placed between the two shoulders. Traction is then applied to the arm against countertraction in an abducted and slightly extended position. In anterior dislocations, direct pressure over the medial end of the clavicle may reduce the joint. (B) In posterior dislocations, in addition to the traction, it may be necessary to manipulate the medial end of the clavicle with the fingers to dislodge the clavicle from behind the manubrium. (C) In stubborn posterior dislocations, it may be necessary to prepare the medial end of the clavicle in sterile fashion and to use a towel clip to grasp around the medial clavicle to lift it back into position. (From Bucholz RW, Heckman JD, Court-Brown C, et al., eds. *Rockwood and Green’s Fractures in Adults*. 6th ed. Philadelphia: Lippincott Williams & Wilkins; 2006.)
and swathe, or figure-of-eight bandage is used for immobilization for 4 to 6 weeks. A general or thoracic surgeon should be available in the event that the major underlying neurovascular structures are inadvertently damaged.

- **Medial physeal injury:** Closed reduction is usually successful, with postreduction care consisting of a clavicle strap, sling and swathe, or figure-of-eight bandage immobilization for 4 to 6 weeks.

- Operative management of SC dislocation may include fixation of the medial clavicle to the sternum using fascia lata, subclavious tendon, or suture, osteotomy of the medial clavicle, or resection of the medial clavicle. The use of Kirschner wires or Steinmann pins is discouraged, because migration of hardware may occur.

**Complications**

- Poor cosmesis is the most common complication with patients complaining of an enlarged medial prominence.

- Complications are more common with posterior dislocations and reflect the proximity of the medial clavicle to mediastinal and neurovascular structures. The complication rate has been reported to be as high as 25% with posterior dislocation. Complications include the following:
  - Pneumothorax
  - Laceration of the superior vena cava
  - Venous congestion in the neck
  - Esophageal rupture
  - Subclavian artery compression
  - Carotid artery compression
  - Voice changes