Acromioclavicular joint dislocations are common injuries that are generally classified on routine radiography. However, classifying these lesions on MR imaging is different for two reasons. First, age-related acromioclavicular joint changes are almost universal in adults and, in some cases, cannot be reliably differentiated from acromioclavicular ligament sprains. Second, the supine position of the patient being scanned changes the relationship of the scapula to the clavicle and reduces the amount of gravity-assisted displacement classically used in radiographic classification schemes. The appearances of the surrounding soft tissues, rather than of the acromioclavicular joint itself, are useful in classification of acromioclavicular joint injuries and can be provided by MR imaging. In particular, the integrity of the coracoclavicular ligament plays a central role in this classification.

Anatomy

The coracoclavicular ligament is composed of the conoid and trapezoid parts (ligaments). The trapezoid ligament lies laterally to the conoid ligament and is separated from it by fat or a bursa. The two parts form a V with an opening facing posterosuperiorly [1] (Fig. 1A).

The trapezoid ligament is quadrilateral. It is attached to the superior aspect of the anterior border of the base of the coracoid process and extends in a posterosuperolateral, roughly straight course to the trapezoid line in the inferior surface of the clavicle (Figs. 1B and 1C). The trapezoid ligament is the primary restraint against posterior clavicular displacement [2] and also provides resistance against anterior, superior, and inferior forces. Individual fibers of the ligament are recognizable on 3-mm-thick T1-weighted images in the coronal plane because they are on anatomic sections (Figs. 1D and 1E).

The conoid ligament is triangular with an inferior apex that is attached to the medial border at the base of the coracoid process just medially and posteriorly to the origin of the trapezoid ligament and laterally to the scapular notch. The conoid ligament courses in a spiraling fashion, almost vertically in a superior direction. Its base attaches to the conoid tubercle in the inferior surface of the clavicle and, for a short distance, in a line proceeding medially from it. The conoid tubercle is located at the junction of the lateral and middle thirds of the clavicle [1]. The conoid ligament functions as the main restraint against anterior and superior displacement of the clavicle, as well as against anterior and superior rotation of the bone [3]. The individual fibers of the conoid ligament are difficult to distinguish on MR images (Fig. 1D).

Two muscles are attached to the scapular spine and acromium. The trapezius muscle inserts on the superior aspect of the scapular spine and acromium. The deltoid muscle has fibers originating from the inferolateral margin of the scapular spine and acromium.

Acromioclavicular Dislocation

Acromioclavicular dislocation is a common injury, occurring in greater than 10% of shoulder injuries. Most of these injuries occur when the subject falls and strikes the adducted shoulder against the ground [4]. The scapula is pushed downward and forward relative to the clavicle. This action results in stretching and tensile failure of the acromioclavicular ligaments, coracoclavicular ligament, and trapezius muscle insertion, in that order. Biomechanical studies have shown that the acromioclavicular ligaments contribute to a greater amount
Fig. 1.—Appearance of normal shoulder.
A, Drawing shows normal shoulder. Gap between conoid and trapezoid parts has been exaggerated in this and the subsequent drawings. Co = conoid ligament, Tr = trapezoid ligament, CA = coracoacromial ligament, CP = coracoid process.
B, T1-weighted oblique sagittal MR image (TR/TE, 600/22) of shoulder shows trapezoid part of coracoclavicular ligament (arrow) running posterosuperiorly from base of coracoid process (CP) to undersurface of clavicle (Cl). A = acromion.
C, Photograph of oblique sagittal anatomic section corresponding to B shows coracoclavicular ligament (arrow) running from base of coracoid process (CP) to undersurface of clavicle (Cl). A = acromion.
D, T1-weighted oblique coronal MR arthrogram (600/22) shows coracoclavicular ligament in left shoulder. Conical fibers (arrowheads) of conoid ligament insert into conoid tubercle, compared with more lateral trapezoid ligament fibers (arrow), which run parallel. Cl = clavicle, D = deltoid muscle, GHJ = glenohumeral joint distended with contrast material.
E, Photograph shows oblique coronal anatomic section of coracoclavicular ligament of left shoulder, corresponding to D. Conical fibers (arrowheads) of conoid ligament insert into conoid tubercle, compared with more lateral trapezoid ligament fibers (arrow), which run parallel. Cl = clavicle, D = deltoid muscle, H = humeral head.
of restraint at small degrees of acromioclavicular joint distraction, whereas the coracoclavicular ligament is the main restraint at larger degrees of acromioclavicular joint distraction [2]. The widely used Rockwood classification of acromioclavicular joint injuries is based on this mechanism of injury [4].

**MR Imaging Findings**

Our clinical images (Figs. 2–7) were obtained with 1.5-T MR scanners, using a standard shoulder coil. Oblique dual-echo coronal, oblique T2-weighted fat-saturated sagittal, and axial intermediate-weighted MR images were always obtained; some patients underwent additional gadolinium-enhanced T1-weighted imaging. Whereas the anatomy of the coracoclavicular ligament is best seen on T1-weighted images because of their inherently high signal-to-noise ratio (Fig. 1B), structures in T2-weighted fat-saturated images tend to be indistinct, although continuous ligamentous fibers are identified with some effort. With injury, edematous fluid around the coracoclavicular ligament makes the fibers more evident on T2-weighted fat-saturated (Fig. 3D) or intermediate-weighted MR images (Fig. 3E). Conversely, T1-weighted images are difficult to interpret because of the edematous fluid and blood products (Fig. 3C). Although not essential for diagnosis, IV gadolinium can delineate the extent and path of the soft-tissue damage exquisitely (Fig. 3F).

**Type I Acromioclavicular Joint Injury**

In a type I injury, a mild force at the acromion produces a sprain in the acromioclavicular ligament, but the coracoclavicular ligaments are not involved. In our experience, there are no specific MR imaging signs for this type of injury because signal abnormalities are common in the acromioclavicular joint of adult patients.

**Type II Acromioclavicular Joint Injury**

In a type II injury, a moderate force results in rupture of the acromioclavicular ligament (Figs. 2A and 2B). The coracoclavicular ligament is sprained, resulting in edema (Fig. 2C). Continuity of the coracoclavicular ligament fibers is maintained. There is also marrow edema in the lateral ends of the clavicle and acromion.

**Type III Acromioclavicular Joint Injury**

In a type III injury, a severe force results in complete acromioclavicular joint dislocation (Figs. 3A, 3B, and 3F). The coracoclavicular ligament is completely ruptured. Blood and fluid are seen in the coracoclavicular interspace. Images with long TRs are valuable because blood and fluid tend to obscure the fibers of the coracoclavicular ligament on short-TR images (Figs. 3C–3E). The deltoid and trapezius muscles may be detached from the distal end of the clavicle (Fig. 3G).

**Fig. 2.—Type II acromioclavicular joint injury.**

A, Drawing shows type II acromioclavicular joint injury. Acromioclavicular joint is disrupted; coracoclavicular ligaments are sprained but intact. Superior displacement of clavicle is minimal because of intact coracoclavicular ligaments.

B, Oblique sagittal T2-weighted fat-saturated MR image (TR/TE, 3000/99.9) of shoulder in 39-year-old woman shows type II acromioclavicular joint injury. Acromioclavicular joint capsule and superior and inferior acromioclavicular ligaments (arrow) are disrupted. Note stripping of clavicular periosteum (arrowheads) with inferior acromioclavicular ligament disruption. High signal in marrow of clavicle (Cl) and acromion (A) indicates edema. H = humeral head.

C, Oblique sagittal T2-weighted fat-saturated MR image (3000/99.9) shows same patient as in B but in more medial view. High signal in region of coracoclavicular ligament (arrow) indicates edema due to injury. Cl = clavicle, A = acromion, CP = coracoid process.
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A fracture of the coracoid process medial to the site of attachment of the coracoclavicular ligament associated with an acromioclavicular joint dislocation has the same implications as an injury classified by Rockwood [4] as type III or higher. This fracture should be suspected in all acromioclavicular joint dislocations in the first three decades of life [5] and may be missed on radiographic series in which an axillary view is not included. Even with the inclusion of this view, the fracture may still be difficult to recognize because there may not be any displacement of the fracture (Fig. 3H).

**Type IV Acromioclavicular Joint Injury**

In a type IV injury, the distal end of the clavicle is posteriorly dislocated as the scapula is driven anteroinferiorly (Fig. 4A). Therefore, this injury is more appropriately named anterior dislocation of the scapula [6]. A frontal radiograph will not show any vertical displacement at the acromioclavicular joint (Fig. 4B). Axial imaging is the optimal method and allows correct classification (Fig. 4C). The lateral end of the clavicle may be driven posteriorly through the trapezius muscle (Fig. 4D). Bipolar dislocation, in which both the acromioclavicular and sternoclavicular joints are dislocated, should be kept in mind in this type of acromioclavicular joint injury [7].

![Type III Acromioclavicular Joint Injury Diagram](image)

**Fig. 3.—** Type III acromioclavicular joint injury.  
**A,** Drawing of type III acromioclavicular joint injury shows acromioclavicular and coracoclavicular ligaments disrupted, effectively releasing major linkage mechanism of scapula to body. Acromioclavicular separation is moderate. Plane of dissection can be seen beginning laterally at acromioclavicular joint and running medially through trapezoid and conoid ligaments. Coracoacromial ligament is below this plane.  
**B,** Coronal T1-weighted MR image (TR/TE, 566/16) of coracoclavicular region shows type III acromioclavicular joint injury in 70-year-old man. Note disruption of acromioclavicular ligaments (arrow) and intervening hematoma. Cl = clavicle, A = acromion, CP = coracoid process, H = humerus.  
**C,** Oblique coronal T1-weighted MR image (566/16) of coracoclavicular region shows type III acromioclavicular joint dislocation (same patient as in B). Note low-signal-intensity mass (arrows) obscuring coracoclavicular ligament. Cl = clavicle, CP = coracoid process.  
**D,** Coronal T2-weighted fat-saturated MR image (3250/96) shows type III acromioclavicular joint dislocation (same patient as in B). Note disruption of all ligamentous fibers (arrow) and hematoma around acromioclavicular joint. Cl = clavicle, CP = coracoid process.  
(Fig. 3 continues on next page)
Type V Acromioclavicular Joint Injury

Type V acromioclavicular joint injury (Figs. 5A and 5B) is an exaggeration of the type III injury. The trapezius and deltoid muscle attachments on the clavicle and acromion are completely stripped (Figs. 5C–5E). The scapula has therefore lost all its major suspensory supports and droops inferiorly. The combination of loss of all the inferior soft-tissue attachments in the distal clavicle and an unopposed pull by the sternocleidomastoid muscle further accentuates the acromioclavicular joint displacement, resulting in the classic and grotesque superior displacement of the distal end of the clavicle. The clavicle may even penetrate the trapezius muscle.

Fig. 3.—(continued) Type III acromioclavicular joint injury.
E, Coronal intermediate-signal MR image (2200/48) shows type III acromioclavicular joint dislocation (same patient as in B). Note heterogeneous collection around disrupted (curly) ligamentous fibers (arrow). Cl = clavicle, CP = coracoid process.
F, Oblique coronal enhanced fat-saturated T1-weighted MR image (466/19) shows type III acromioclavicular joint dislocation in 35-year-old man. Note dissection plane beginning at disrupted acromioclavicular joint (large arrow), extending medially (arrowheads), and ending medially to disrupted coracoclavicular ligament (small arrows). Cl = clavicle, A = acromion, CP = coracoid process, H = humerus.
G, Sagittal fat-saturated T2-weighted MR image (2000/90) shows type III acromioclavicular joint dislocation (same patient as in F). Note rupture of coracoclavicular ligament, with its fibers mixed with blood and fluid (arrowheads). Tear extends to involve deltoid muscle. Anterior fibers of deltoid muscle (arrow) from clavicle (Cl) are partially torn. CP = coracoid process.
H, Oblique sagittal intermediate-signal MR image (2200/46) of 47-year-old man shows fracture of coracoid process at its base (arrowheads), acromioclavicular joint dislocation, and intact coracoclavicular ligament (arrow). This injury is also classified as type III when associated with acromioclavicular joint dislocation. Cl = clavicle, CP = coracoid process, A = acromion.
Type VI Acromioclavicular Joint Injury

Type VI acromioclavicular joint injury is a rare injury caused by a different mechanism. The injury is thought to be due to a severe direct force on the superior surface of the distal clavicle with abduction of the humerus and retraction of the scapular at the same time. As a result, the lateral end of the clavicle rests inferiorly to the acromion or coracoid process.

Prior Acromioclavicular Joint Injury

The telltale sign of a prior, often remote acromioclavicular joint injury is calcification or ossification of the coracoclavicular ligament (Figs. 6 and 7).

Discussion

The central role of the coracoclavicular ligament in the classification of acromioclavicular joint injury is that it serves as a dividing line between operative and nonoperative therapy. Rockwood types I and II acromioclavicular injuries are treated conservatively [4]. Types IV, V, and VI injuries are surgically treated operatively, with type VI injuries being the most severe and requiring a combination of internal fixation and soft tissue repair.

Fig. 4.—Type IV acromioclavicular joint injury.
A, Drawing shows type IV acromioclavicular joint injury. Acromioclavicular and coracoclavicular ligaments are disrupted, and lateral end of clavicle is posteriorly displaced. Clavicular displacement is in horizontal plane. Thus, frontal view may underestimate amount of acromioclavicular joint displacement.
C, Axial intermediate-weighted MR image (TR/TE, 3000/18) shows type IV acromioclavicular joint dislocation (same patient as in B). Note posterior dislocation (arrow) of lateral end of clavicle (Cl) at acromioclavicular joint. A = acromion.
D, Sagittal intermediate-weighted MR image (3000/18) shows type IV acromioclavicular joint dislocation (same patient as in B). Note tear of coracoclavicular ligament (arrowheads) and deltoid fibers (arrows). Note posterior displacement of lateral end of clavicle (Cl), which is penetrating trapezius muscle (asterisk). A = acromion, CP = coracoid process.
Fig. 5.—Type V acromioclavicular joint injury.
A, Drawing shows type V acromioclavicular joint injury. Acromioclavicular and coracoclavicular ligaments are disrupted, effectively releasing major linkage mechanism of scapula to body. In addition, accessory suspensor (trapezius muscle attachment) is also disrupted. Acromioclavicular separation is marked.
B, Coronal fat-saturated T1-weighted MR image (TR/TE, 816/16) shows type V acromioclavicular joint dislocation in 43-year-old man. Note rupture of acromioclavicular ligaments (arrowheads), hematoma, and approximately 100% shaft-width dislocation. This dislocation may represent type III or type V injury. Cl = clavicle, A = acromion, CP = coracoid process, H = humerus.
C, Oblique sagittal fat-saturated T1-weighted gadolinium-enhanced MR image (600/16) shows type V acromioclavicular joint dislocation (same patient as in B). Note stripping of deltoid muscle (arrows) from anterior aspect of clavicle (Cl) and rupture of coracoclavicular ligament (arrowheads), CP = coracoid process.
D, Axial fat-saturated T1-weighted MR image (750/15) shows type V acromioclavicular joint dislocation (same patient as in B). Note rupture and associated hemorrhage of trapezius muscle insertion (arrowheads) on acromion (A) and scapular spine.
E, Oblique sagittal fat-saturated T1-weighted gadolinium-enhanced MR image (600/16) of acromion (A) and scapular spine shows type V acromioclavicular joint dislocation (same patient as in B). Note rupture of trapezius muscle insertion (arrowheads). H = humeral head.
The treatment choice for Rockwood type III injury is controversial. Type III injuries, which account for approximately 40% of acromioclavicular injuries [4], are not well evaluated on radiographs, even with additional weighted views [8]. MR imaging, however, provides exquisite evaluation of the adjacent soft-tissue structures. Knowledge of coracoclavicular ligament anatomy and of the appearance of acromioclavicular injury on MR imaging aids physicians in determining the extent of the injury and the type of treatment that is most appropriate.

The goal of treatment is to reduce the ligaments in an anatomic manner to reproduce normal ligamentous mechanics and prevent acromioclavicular joint degeneration. There are many variations in the surgical approach [3], but the contemporary focus is to stabilize the scapula, using some form of fusion or reconstruction at the coracoclavicular level. Precise reconstruction is important to reduce pain, to improve range of motion of the acromioclavicular joint, and to reduce the possibility and extent of secondary joint degeneration. Failure of treatment may result in chronic incapacitating pain. With increasing expectations for improved cosmesis and minimal morbidity, arthroscopic reconstruction may play a prominent role in future treatment. This procedure would require the precise definition of the injury afforded by MR imaging performed before surgery. Presently, no defined role exists for MR imaging in acromioclavicular joint injury. Patients with type III or more serious injury would benefit from the additional information obtained on MR imaging, particularly when there is a choice among conservative, arthroscopic, and open surgical treatment.

**Conclusion**

MR imaging provides exquisite visualization of the soft-tissue structures of the shoulder girdle. The sequential manner of damage to these supporting structures in injuries of the acromioclavicular joint results in the clinical and radiographic classification systems that are currently in use. This soft-tissue injury to the supporting structures is well seen with MR imaging, allowing a direct method of classification rather than relying on measurements afforded by routine radiography. The coracoclavicular ligament plays a central role in maintaining acromioclavicular joint stability, and its appearance should be carefully scrutinized in all patients undergoing shoulder MR imaging.

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**Fig. 6.—** Oblique coronal gradient-echo MR image (500/15; flip angle, 30°) in 54-year-old man shows ossification of trapezoid (arrow) and conoid ligaments due to previous acromioclavicular joint injury. CI = clavicle, CP = coracoid process.

**Fig. 7.—** Radiograph of 49-year-old man shows coracoclavicular ligamentous ossification (arrows) (similar to that in Figure 6) from previous acromioclavicular dislocation.
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