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Acromioclavicular Joint Dislocation: Anatomic Coracoclavicular Ligament Reconstruction (ACCR) ☆

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The acromioclavicular (AC) and coracoclavicular (CC) ligaments are the principal stabilizers of the AC joint. AC joint injuries are common in contact sports and are graded according to the severity of injury to AC and CC ligaments and radiographic displacement of the AC articulation. Complete AC joint dislocation involves disruption of the AC and CC ligaments and the deltotrapezial fascia. Lower-grade injuries (types I and II) are initially managed nonoperatively and most patients do well. Operative treatment is indicated for higher-grade dislocations (types IV, V and VI). The management of type III AC joint dislocation is controversial and a matter of ongoing debate. A large number of surgical procedures and their modifications have been described in literature, but there is no consensus on the ideal procedure of choice for the treatment of AC joint dislocation. The anatomic coracoclavicular reconstruction (ACCR) restores stability to the AC joint by reconstructing the CC and AC ligaments. In this surgical technique, allograft or autograft tissue is used as biologic graft, and a suture or tape is used as a nonbiological method of fixation. Postoperative immobilization and rehabilitation is an essential component of the AC joint reconstructive process. In this article, we describe in detail the indications, surgical technique, postoperative rehabilitation, and outcomes of open anatomical CC ligament reconstruction for AC joint dislocation.
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Introduction

Acromioclavicular (AC) joint injuries are very common in contact sports (rugby, wrestling, ice hockey, and football) and most of these injuries are in the form of sprains.[1] The AC joint injury involves disruption of the AC ligaments, with complete dislocations involving injury to the coracoclavicular (CC) ligaments, the deltoid and trapezial muscles, and fascia. The common mechanisms of AC joint dislocation involve a direct trauma to the posterosuperior part of the shoulder or an indirect mechanism, which involves fall on an outstretched adducted arm or elbow driving the humeral head into the AC joint. The AC joint dislocation are classified by the severity of injury to the AC and CC ligaments, radiographic displacement of the AC articulation and CC space, and the position of the clavicle in relation to the acromion (Table).[2,3]

Relevant Surgical Anatomy

The AC joint is a diarthrodial joint and has dual innervation by the lateral pectoral and suprascapular nerves. Static and dynamic stabilizers contribute to the stability of the AC joint.[4,5] The static stabilizers include the AC ligaments (superior, inferior, anterior, and posterior), the CC ligaments (trapezoid and conoid), and the coracoacromial ligament. The dynamic stabilizers consist of the deltoid and trapezius muscles and overlying fascia.

Surgical reconstruction of the AC joint and CC space requires a thorough understanding of the relevant anatomy

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Table Rockwood Classification for AC Joint Injuries

Type	AC Ligaments	CC Ligaments	Deltopectoral Fascia	Radiographic CC Distance Increase	Radiographic AC Appearance	AC Joint Reducible
I	Sprained	Intact	Intact	Normal (1.1-1.3 cm)	Normal	N/A
II	Disrupted	Sprained	Intact	<25%	Widened	Yes
III	Disrupted	Disrupted	Disrupted	25%-100%	Widened	Yes
IV	Disrupted	Disrupted	Disrupted	Increased	Posterior clavicle displacement	No
V	Disrupted	Disrupted	Disrupted	100%-300%	N/A	No
VI	Disrupted	Intact	Disrupted	Decreased	N/A	No

N/A, not applicable.

and biomechanics of the AC joint and its stabilizers. The AC joint capsule and the capsular ligaments, more importantly the superior and posterior capsular ligaments, are the primary restraints to anterior-to-posterior translation of distal clavicle.[6] The trapezoid and conoid ligaments span the CC space and are the principal contributors to the vertical stability.[7] The trapezoid ligament attaches on the undersurface of the clavicle at an anterolateral position. The conoid ligament is a broad stout ligament located in a posterior and medial position (conoid tubercle) compared with the trapezoid ligament. Both the trapezoid and the conoid ligaments are attached distally to the base of the coracoid posterior to the pectoralis minor attachment on the coracoid. An osteologic analysis of 120 clavicles in our laboratory demonstrated that the medial edge of the conoid tubercle is at a mean length of 46.3 ± 5 mm from the lateral end of the clavicle.[8] Furthermore, the distance between the trapezoid laterally and the conoid medially was 21.4 ± 4.2 mm, which is a useful anatomical information when drilling bone tunnels in the clavicle for graft fixation to recreate the conoid and trapezoid attachment. In a cadaveric study, we have recently shown that the bone mineral density in the lateral third of the clavicle progressively increases from lateral to medial direction.[9] The optimal bone density was found in the anatomical insertion area of the CC ligaments between 20 and 50 mm from the lateral end of the clavicle. Furthermore, the graft pullout strength was proportionate to the distance of the graft tunnel from the lateral end of the clavicle. Therefore, we absolutely avoid making drill holes within 20 mm medial to the distal end of clavicle.

History and Physical Examination

Pain or deformity or both are the 2 principal presentations of AC joint injury in addition to other signs of acute trauma.[10] Pain due to acute AC joint injury may be difficult to differentiate in the setting of preexisting AC joint arthrosis or distal clavicle osteolysis. Mechanism of injury provides an important cue for AC joint injury. Complete AC joint dislocation results in inferior translation of the scapulohumeral complex, which presents as a prominence of the lateral end of clavicle. The patient can reduce this deformity by shrugging their shoulder. If the lateral end of the clavicle is buttonholed through the trapezial fascia, shrugging may not result in reduction of the deformity. A triad of point tenderness at the AC joint, worsening of pain at the AC joint with cross-arm adduction, and relief of symptoms by injection of a local anesthetic into the AC joint is diagnostic for AC joint injury and particularly useful when there is no deformity. A complete neurovascular examination should be performed.

Diagnostic Imaging

Plain radiographs of the AC joint include the anteroposterior view of the clavicle, the axillary and the supraspinatus outlet view of the shoulder and the bilateral Zanca view. The AC joint is better visualized if reduced penetration strength is used compared with the standard radiographs of the glenohumeral joint. Widening of the AC joint, step-off deformity at the AC joint, and increase in the CC distance (average 1.3 cm) are indicative of AC joint injury. A Zanca view is made by tilting the x-ray beam 10°-15° toward the cephalic direction. Increase of CC distance of 25%-50% over the normal side on Zanca view indicates complete CC ligament disruption. An axillary view of the shoulder is helpful in differentiating a posterior vs superior translation of the clavicle in relation to the acromion. A normal CC distance in conjunction with a complete dislocation of the AC joint may indicate a coracoid fracture and is better seen on a Stryker notch view.

Treatment

The main goals of treatment are to achieve a pain-free shoulder with full range of motion and strength and no limitations in activities.

Nonoperative Management

Most type I and type II AC joint injuries are treated nonoperatively.[11-13] Treatment begins with a sling, ice, and a brief period of immobilization only for pain control followed by rehabilitation as soon as tolerated. Currently, there is inconclusive evidence to support surgical treatment of type III AC joint dislocations.[14-18] For type III AC joint dislocation, one approach is to treat these injuries conservatively for 12 weeks and consider surgical stabilization if persistent pain and instability exist. In an alternative approach, a type III AC joint dislocation can be primarily treated surgically especially in athletes and high-demand patients to allow quicker return to work or play and limit the duration of painful disability.