Acromioclavicular Osteoarthritis: A Common Cause of Shoulder Pain

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Abstract: Osteoarthritis of the acromioclavicular joint is a frequent cause of shoulder pain and can result in significant debilitation. It is the most common disorder of the acromioclavicular joint and may arise from a number of pathologic processes, including primary (degenerative), posttraumatic, inflammatory, and septic arthritis. Patients often present with nonspecific complaints of pain located in the neck, shoulder, and/or arm, further complicating the clinical picture. A thorough understanding of the pertinent anatomy, disease process, patient history, and physical examination is crucial to making the correct diagnosis and formulating a treatment plan. Initial nonoperative management is aimed at relieving pain and restoring function. Typical treatments include anti-inflammatory medications, physical therapy, and injections. Patients who continue to exhibit symptoms after appropriate nonsurgical treatment may be candidates for operative resection of the distal clavicle through either open or arthroscopic techniques.

Key Words: acromioclavicular arthritis, acromioclavicular joint, acromioclavicular osteoarthritis, shoulder pain

Anatomy

The acromioclavicular (AC) articulation is a diarthrodial joint that unites the distal clavicle and medial end of the acromion, with an average size of 9×19 mm.[1] A fibrocartilaginous intra-articular disk of variable size and shape is interposed between the bony articulation, which functions to correct bony incongruities between the concave acromial surface and convex distal clavicle. It also acts as a cushion to share and distribute forces generated through the joint. Disk degeneration may begin as early as the second decade of life, often resulting in little more than a fibrocartilaginous remnant by early adulthood.[2]

Stability of the AC joint is conferred by a number of capsular ligaments, extracapsular ligaments, and attachments from the surrounding musculature. The AC ligaments comprise superior, inferior, anterior, and posterior components,[3] which are confluent with the joint capsule and provide the majority of stability in the anteroposterior (AP) plane. In addition, the superior AC ligament is responsible for up to 68% of restraint to vertical translation of the distal clavicle at small physiological loads.[4]

Extracapsular stabilizers include the coracoclavicular and coracoacromial ligaments. The coracoclavicular ligament complex consists of the conoid and trapezoid ligaments. These ligaments extend from the coracoid to the inferior surface of the clavicle in a V-shaped configuration, acting to primarily resist vertical displacement under high-load conditions and axial translation. The coracoacromial ligament travels in an oblique orientation from the coracoid process to the inferior aspect of the acromion, but plays a much less significant role in AC stability.[5]

Muscular attachments surrounding the AC joint act as dynamic stabilizers and help distribute forces imparted through the shoulder girdle, although their specific contributions remain unknown.[6] The deltoid and trapezius muscles attach over the lateral clavicle and acromion, and their fibers over the AC joint blend with those of the superior AC ligament. Innervation of the

Key Points

- Shoulder pain can have multiple causes. A common but often misdiagnosed source of pain is the acromioclavicular (AC) joint.
- The AC joint can develop osteoarthritis for many different reasons and multiple ages and demographic groups can be affected.
- The proper diagnosis of AC arthritis depends upon knowledge of the condition and appropriate workup.
- Most cases of AC arthritis can be managed with anti-inflammatory medication, therapy, and, occasionally, injection therapy.
- Severe or refractory cases can be treated with open or arthroscopic resection of the distal end of the clavicle.

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AC joint is supplied by branches of the suprascapular and lateral pectoral nerves, and blood supply occurs through branches of the suprascapular and thoracoacromial arteries.[7]

Pathology

Osteoarthritis is the most common cause of pain in the AC joint and can arise from a number of potential causes, including degenerative, posttraumatic, septic, and inflammatory processes.[7a] Primary osteoarthritis is caused by degenerative changes that accumulate during the aging process. Gradual damage and subsequent loss of protective cartilage can lead to painful bone-on-bone contact. In a study assessing age-related changes of the AC joint, DePalma et al found that a majority of specimens demonstrated degenerative changes by the fourth decade of life.[8] Horvath and Kery further supported these findings by showing that both the incidence and the severity of degenerative changes within the AC joint increased significantly with age[9]; however, the true prevalence of AC arthritis is largely unknown because of variability in the criteria used to define arthritis in the literature.[10]

The AC joint is prone to injury and can develop posttraumatic arthritis. Trauma such as AC separations or distal clavicle fractures can accelerate degeneration of the joint by altering the biomechanics of the articulation and/or causing direct damage to the joint. The sequelae of these injuries may be long-term pain and dysfunction. In a study assessing the AC joint following first- and second-degree sprains, radiographic changes were seen in 29% to 48%, abnormal physical examination findings in 43% to 71%, and residual symptoms in 39% to 65% of patients.[11] Repetitive microtrauma also can damage the joint and lead to arthritis. This damage is seen commonly with certain activities, including weight lifting, throwing, and other overhead activities that place repeated stress across the joint.[12–14]

Inflammatory arthropathies also can lead to AC joint degeneration and subsequent arthritis. Septic arthritis is relatively rare in this location,[15] although it is an important diagnosis to consider in the setting of acute onset pain, fever, joint effusion, and elevated inflammatory markers. In the absence of trauma or recent surgery, hematogenous seeding with either *Staphylococcus* or *Streptococcus* bacteria is the most common cause of this condition,[16–18] and high suspicion for intravenous drug abuse must be maintained in these cases. A definitive diagnosis is made by joint aspiration and synovial fluid analysis. The inflammatory cascade and proteolytic enzymes cause destruction of articular cartilage leading to degenerative arthritis.

In addition to pain around the joint, AC osteoarthritis can result in further sequelae to surrounding structures. Subacromial impingement of the rotator cuff may occur secondary to hypertrophy or osteophyte formation on the undersurface of the joint. Such impingement, termed extrinsic impingement, can result in pain and weakness and can even affect the integrity of the cuff tendons.[19] A detailed history, physical examination, and appropriate imaging should be performed to assess the AC joint and differentiate other potential etiologies.

Evaluation

Patients with AC arthritis generally present with complaints of progressively worsening shoulder pain, although minor trauma or strenuous activity may cause an acute exacerbation of this chronic degenerative condition. The pain is typically localized over the anterior aspect of the shoulder in the region of the AC joint or referred throughout the shoulder and upper arm. Radicular-type pain that radiates into the base of the neck or arm may be present and some patients may complain of associated headaches.[20] Overhead activities, weight lifting, and cross-body movements using the affected arm often are associated with worsening symptoms.[21,22] Pain at night is common when patients lay on the affected side, and difficulty sleeping can be the factor driving patients to seek treatment. In addition, patients may complain of popping, clicking, grinding, or a catching sensation with movement of their shoulder. A careful history of trauma or injuries should be elicited to raise suspicion for instability or other associated pathologies.

A thorough physical examination of both the affected and nonaffected shoulders should be performed, noting differences between the two. The shoulder is first inspected, assessing for enlargement or asymmetry of the AC joint, muscular atrophy, or evidence of prior trauma. Tenderness directly over the joint is seen with palpation, and the patient's pain exacerbated by provocative maneuvers.[23] Stability of the clavicle in relation to the acromion is evaluated by holding the distal aspect of the clavicle with one hand and noting the amount of translation while stabilizing the acromion with the other hand.

A number of provocative tests have been described to specifically evaluate the AC joint.[24] The cross-body adduction test is performed by passively bringing the patient's arm into 90 degrees of forward flexion and maximal adduction, thus causing compression across the joint. With the AC resisted-extension test, the patient's arm is placed in 90 degrees of forward flexion and the patient is asked to actively extend against resistance. Lastly, the O'Brien active compression test is performed with the arm placed in 90 degrees of forward flexion with 10 degrees of adduction.[25] With the arm in maximal internal rotation (thumb pointed downward) the patient resists a uniform downward force applied by the examiner. The arm is then externally rotated (palm facing upward) and the maneuver repeated. The test is considered positive if pain is present with internal rotation but decreases or resolves with external rotation. Pain localized to the AC region during this test is indicative of AC joint pathology, whereas pain located deep inside the shoulder may indicate labral pathology. In a study of these tests, Chronopoulos et al found the cross-body adduction test to be the most sensitive (77%), although the O'Brien active compression test was found to be the most specific (95%).[24]

Initial imaging should include a modified AP view, scapular Y-view, and Zanca view radiographs (Figs. 1–4). These x-rays help the clinician to assess the degree of AC arthropathy and any other underlying abnormalities. In contrast to a standard AP radiograph of the glenohumeral joint, the x-ray voltage

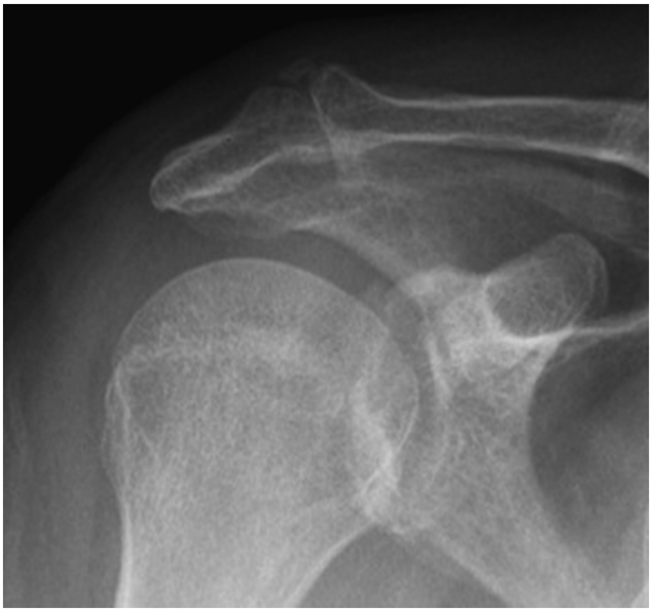

Fig. 1. **Modified anteroposterior view of a right shoulder with advanced acromioclavicular osteoarthritis.**

should be reduced by approximately 50% to better visualize the AC joint. If full voltage is used, then the resultant image of the distal clavicle and acromion will appear dark and overexposed. In an effort to provide optimal visualization of the AC joint, Zanca described a technique in which the x-ray beam is angled with 10 degrees of cephalic tilt, commonly known as the Zanca view.[10,26] This technique eliminates overlap from the scapula and other tissues seen on standard AP radiographs, thereby creating an unobstructed view of the joint. In some cases, a bilateral Zanca view also may be useful to measure the side-to-side difference in the superior displacement of the clavicle and the relative extent of degenerative changes. If a patient has experienced trauma to the affected shoulder, then an axillary lateral x-ray also should be obtained to assess for posterior displacement of the clavicle.

Magnetic resonance imaging (MRI) can be used to further characterize the degree of arthrosis when radiographs are

Fig. 2. **Scapular Y-view of a right shoulder with advanced acromioclavicular osteoarthritis. Note the impingement effect of the inferior osteophyte formation on the relative space available for the rotator cuff in the outlet.**

Fig. 3. **Modified anteroposterior view of a right shoulder with advanced glenohumeral and acromioclavicular osteoarthritis. Note the spurring in both joints, including the distal clavicle, as well as the inferior humerus and glenoid.**

Fig. 4. **Zanca view of a left shoulder 2 years after rotator cuff repair (note metal anchor) and open distal clavicle excision. Note the residual gap between the lateral clavicle and the acromion, as well as postoperative calcification in the area.**

equivocal, and its use is increasing in prevalence in the evaluation of shoulder pain. MRI should be obtained only after a careful history and physical examination have been performed because it is sensitive in identifying pathology but has poor specificity. Shubin-Stein et al demonstrated reactive bone edema to be a more reliable predictor of symptomatic AC pathology than degenerative changes on MRI (Fig. 5).[27] It is important to note that a patient's pain may not correlate clinically with his or her radiographic findings because it has been shown that up to 82% of patients with AC joint arthritis based on MRI are asymptomatic.[28]

When arthritis of the AC joint is suspected to be the cause of a patient's symptoms based on history, physical examination, and imaging, an injection into the joint may serve both diagnostic and therapeutic purposes.[12,29,30] A combination of local anesthetic and corticosteroid commonly is preferred. The joint is located by palpation and a superior approach is recommended. Accurate needle placement into the joint may prove difficult because of variations in joint anatomy, osteophyte formation, and other degenerative changes. Radiographic evaluation in advance of injection can help delineate the local anatomy to aid in successful joint entry. Ultrasound guidance also has been shown to further improve the accuracy of proper intraarticular needle placement.[31]

Nonoperative Treatment

The main goal of treatment for acromioclavicular arthritis is to reduce pain, allowing full range of motion and strength.

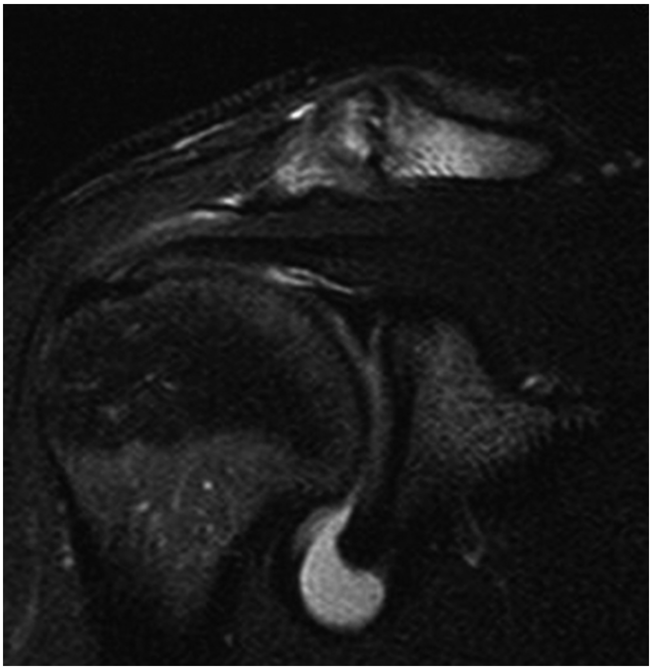

Fig. 5. **Right shoulder with acute acromioclavicular posttraumatic osteoarthritis in a 19-year-old football player with continued severe shoulder pain 6 months after a partial acromioclavicular separation. Note the bone edema in the lateral clavicle and the medial acromion, as well as the irregularity of the joint surface.**

The first line of treatment is nonoperative management, and options include rest, activity modification, nonsteroidal anti-inflammatory medications, corticosteroid injections, and physical therapy. Patients who present after an acute exacerbation of their symptoms often will benefit from an initial period of rest, brief immobilization in a sling, and periodic application of ice or moist heat.[7]

Activity modification involves avoidance of repetitive, overhead, and cross-body movements and is paramount in preventing reaggravation of symptoms. Physical therapy is aimed at improving strength and range of motion of the shoulder girdle, specifically the periscapular and rotator cuff musculature[32]; emphasis should be placed on the pectoralis minor, trapezius, and deltoid muscles. Additional modalities, including cryotherapy, stretching programs, and ultrasound, offer further potential benefits. Although therapy may not be as effective for isolated AC osteoarthritis, studies have shown positive results in individuals with concomitant impingement or rotator cuff arthropathy.[10]

Corticosteroid injection into the joint is another adjunct used to relieve pain and inflammation. Jacob and Sallay demonstrated short-term improvement in pain and function in 93% of patients who received an AC joint injection.[33] Hossain et al further supported these findings, showing significant improvement in patient outcome scores at 12 months when compared with preinjection levels. Although the amount of pain relief following steroid injection was shown to diminish with time, long-term benefits were reported at 5-year follow-up.[34] Frequency of injections are typically limited to one every 3 to 4 months as a result of potential complications such as fat atrophy and dermal thinning; however, these injections should be considered only when other methods have failed.[35] In cases in which the speed of return to work or return to play is at a premium, an injection may have great value.[30]

Operative Management

Surgical intervention is considered when a patient with AC osteoarthritis has persistent symptoms despite undergoing an appropriate course of conservative management. Distal clavicle excision is the standard operative treatment and can be performed through either open or arthroscopic techniques. It is important to note that associated pathology is common in patients with AC osteoarthritis. Brown and colleagues found that 213 of 218 shoulders (98%) with symptomatic AC degeneration had concomitant pathologic conditions, including rotator cuff tears (81%), labral tears (33%), biceps tendon abnormalities (22%), and glenohumeral degeneration (14%).[36] These findings led to the recommendation that all patients also undergo shoulder arthroscopy at the time of AC surgery.

The first descriptions of open distal clavicle excision were reported in 1941 by Mumford[37] and Gurd.[38] The open procedure involves a small skin incision centered over the AC joint, followed by removal of the distal end of the clavicle through direct visualization. The AC ligaments are identified during the dissection, protected during the resection, and repaired along with the capsule at the end of the procedure. Benefits of the open approach include its relative ease and speed, ability to ensure adequate bone removal, and successful results reported in the literature. Disadvantages are injury to the surrounding soft tissues, increased postoperative recovery time, and possible increased risk of infection.[10,39]

Although open surgical treatment has a long history of positive outcomes, the trend is increasingly toward the use of arthroscopic techniques (Figs. 6 and 7). Arthroscopic resection of the distal clavicle was first described by Johnson[40] and offers the advantages of less rehabilitation, better pain relief at 3 months, less potential risk of infection, and a faster return to activity.[41,42] There are two common arthroscopic approaches, subacromial (indirect) and superior (direct). Both differ from an open approach in that resection of the distal clavicle and a small amount of the medial acromion is performed. Outcomes between the direct and indirect approaches have been shown to be similar, although the direct approach may have a higher incidence of damage to the superior AC ligaments, potentially leading to instability.[43]

Although improved cosmesis and early return to activity make arthroscopic techniques attractive, the long-term clinical outcomes of pain relief and function are comparable between open and arthroscopic techniques.[44] The results for both are universally considered to be good to excellent; however, complications may occur with either technique and lead to failure of the procedure. Complications include underresection with residual bone, overresection with resultant instability, infection, heterotopic ossification, fracture, suprascapular nerve injury, or neglected concomitant shoulder pathology.[45]

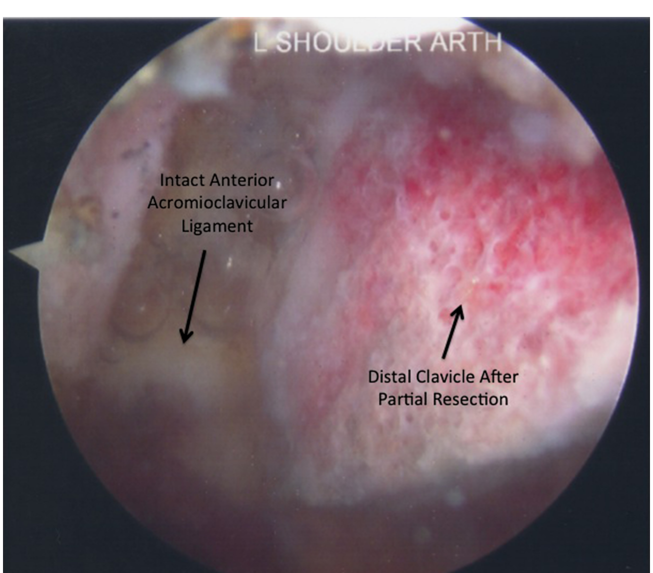

Fig. 6. **Completed distal clavicle excision. Note the increased distance between the clavicle and acromion, as well as the intact anterior acromioclavicular ligament.**

Fig. 7. **Modified anteroposterior view of a left shoulder after completed arthroscopic distal clavicle excision. Note the increased distance between the clavicle and the acromion.**

Conclusions

Osteoarthritis of the AC joint is a common cause of shoulder pain. It can have multiple causes and affects patients young and old alike. Appropriate history and physical examination coupled with correct radiographs usually lead to an accurate diagnosis. Additional shoulder problems often are present and may or may not be contributors to a patient's pain. There are myriad conservative treatment options that usually are successful in reducing pain and improving function. For some patients, however, surgery may be necessary. Both open and arthroscopic options exist, and both techniques have a good history of excellent results with low rates of complications.

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