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Acromioclavicular joint injuries, Acromioclavicular separation

Acromioclavicular joint: The diagnosis and treatment of acromioclavicular injuries in athletes

Acromioclavicular joint injuries most commonly occur in athletic young adults involved in collision sports, throwing sports, and overhead activities such as upper-extremity strength training. They account for 3% of all shoulder injuries and 40% of shoulder sports injuries. Athletes in their second and third decade of life are more commonly affected⁽¹⁾, and men are injured more commonly than women (5:1 to 10:1) ^(1,2).

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Acromioclavicular dislocation was recognised as early as 400 BC by Hippocrates⁽³⁾. He cautioned against mistaking it for glenohumeral (shoulder joint) dislocation and recommended treating with a compressive bandage in an attempt to hold the distal (outer) end of the clavicle in a reduced position. Nearly 600 years later Galen (129 AD) diagnosed his own acromioclavicular dislocation, which he sustained while wrestling⁽³⁾. He soon abandoned the tight bandage holding the clavicle down as it was too uncomfortable. In the modern era this injury is better recognised, but its

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treatment remains a source of great controversy.

Anatomy

The acromioclavicular joint joins the collarbone to the shoulder blade and hence links the arm to the axial skeleton. The articular surfaces are initially hyaline cartilage, which changes to fibrocartilage toward the end of adolescence. The average joint size is 9mm by 19mm⁽⁴⁾. The acromioclavicular joint contains an intra-articular, fibrocartilaginous disc that may be complete or partial (meniscoid). This helps absorb forces in compression. There is marked variability in the plane of the joint.

Stabilisers

There is little inherent bony stability in the AC joint. Stability is provided by the dynamic stabilisers – namely, the anterior deltoid muscle arising from the clavicle and the trapezius muscle arising from the acromion.

There are also ligamentous stabilisers. The acromioclavicular ligaments are divided into four – superior, inferior, anterior and posterior. The superior is strongest and blends with muscles. The acromioclavicular ligaments contribute approximately two-thirds of the constraining force to superior and posterior displacement; however, with greater displacement the coracoclavicular ligaments contribute the major share of the resistance. The coracoclavicular ligament consists of

the conoid and trapezoid. The conoid ligament is fan-shaped and resists forward movement of the scapula, while the stronger trapezoid ligament is flat and resists backward movement. The coracoclavicular ligament helps couple scapular and glenohumeral (shoulder joint) movement and the interspace averages 1.3cm.

Mechanism of injury

The athlete who sustains an acromioclavicular injury commonly reports either one of two mechanisms of injury, direct or indirect.

Direct force: This is when the athlete falls on to the point of the shoulder, with the arm usually at the side and adducted. The force drives the acromion downwards and medially. Nielsen⁽⁵⁾ found that 70% of acromioclavicular joint injuries are the result of a direct injury.

Indirect force: This is when the athlete falls onto an outstretched arm. The force is transmitted through the humeral head to the acromion, therefore the acromioclavicular ligament is disrupted and the coracoclavicular ligament is stretched.

On examination

The athlete presents soon after the acute injury with his arm splinted to his side. The patient may state that the arm feels better with superiorly directed support on it. Most movements are restricted secondary to pain at the top of the shoulder; the degree varies with the grade of sprain. The hallmark finding is localised tenderness and swelling over the acromioclavicular joint.

In dislocations, the outer part of the collarbone appears superiorly displaced with a noticeable step deformity (in fact, it is the shoulder that sags below the clavicle). Occasionally, the deformity may only be apparent later, if initial muscle spasm reduces acromioclavicular separation. Forced cross-body adduction (pulling the affected arm across the opposite shoulder) provokes discomfort. The clavicle can often be moved relative to the acromion.

Acromioclavicular visualisation

The normal joint width measures 1-3mm. It is regarded as abnormal if it is greater than 7mm in men, and 6mm in women.

Routine anteroposterior views of the shoulder show the glenohumeral joint; however, the acromioclavicular joint is overpenetrated and therefore too dark to interpret. Reduced exposure improves visualisation. The patient stands with both arms hanging unsupported, both acromioclavicular joints on one film. Weighted views (stress X-rays) are taken with 10-15lb weights not held but suspended from the patient's wrists. They help distinguish type II-III injuries, but are of little clinical value and are no longer recommended in our practice.

Classification of AC separation

The importance of identifying the injury type cannot be overemphasised because the treatment and prognosis hinge on an accurate diagnosis. The injuries are graded on the basis of which ligaments are injured and how badly they are torn.

Allman⁽⁶⁾ classified acromioclavicular sprains as grades I, II and III, representing respectively, no involvement, partial tearing, and complete disruption of the coracoclavicular ligaments. More recently, Rockwood⁽¹⁾ has further classified the more severe injuries as grades III- VI.

The injuries are classified into six categories:

- **Type I** This is the most common injury encountered. Only a mild force is needed to sustain

such an injury. The acromioclavicular ligament is sprained with an intact coracoclavicular ligament. The acromioclavicular joint remains stable and symptoms resolve in 7-10 days. This injury has an excellent prognosis.

- **Type II** The coracoclavicular ligaments are sprained; however, the acromioclavicular ligaments are ruptured. Most players can return to their sport within three weeks. There is anecdotal evidence to suggest that steroid injections into the acromioclavicular joint speed up the resolution of symptoms, but this practice is not universal.
- **Type III** The acromioclavicular joint capsule and coracoclavicular ligaments are completely disrupted. The coracoclavicular interspace is 25-100% greater than the normal shoulder.
- **Type IV** This is a type III injury with avulsion of the coracoclavicular ligament from the clavicle, with the distal clavicle displaced posteriorly into or through the trapezius.
- **Type V** This is type III but with exaggeration of the vertical displacement of the clavicle from the scapula-coracoclavicular interspace 100-300% greater than the normal side, with the clavicle in a subcutaneous position.
- **Type VI** This is a rare injury. This is type III with inferior dislocation of the lateral end of the clavicle below the coracoid.

Treatment

The treatment of acromioclavicular joint injuries varies according to the severity or grade of the injury.

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Initial treatment: These can be very painful injuries. Ice packs, anti-inflammatory and a sling are used to immobilise the shoulder and take the weight of the arm. As pain starts to subside, it is important to begin moving the fingers, wrist and elbow to prevent stiffness. Next, it is important to begin shoulder motion to prevent shoulder stiffness.

Undisplaced injuries only require rest, ice, and then gradual return to activity over a 2-6 week period. Major dislocations require surgical stabilisation in athletes if

their dominant arm is involved, and if they participate in upper-limb sports.

Type I & II: Ice pack, anti-inflammatory agents and a sling are used. Early motion based on symptoms is introduced. Pain usually subsides in about 10 days. Range-of-motion exercises and strength training to restore normal motion and strength are instituted as the patient's symptoms permit. Some symptoms may be relieved by taping (taking stress off acromioclavicular joint).

The length of time needed to regain full motion and function depends upon the severity or grade of the injury. The sport and the position played determine when a player can return to a sporting activity. A football player, who does not have to elevate his arm, can return sooner than a tennis or rugby player.

When a patient returns to practice and competition in collision sports, protection of the acromioclavicular joint with special padding is important. A simple 'doughnut' cut from foam or felt padding can provide effective protection. Special shoulder injury pads, or off-the-shelf shoulder orthoses, can be used to protect the acromioclavicular joint after injury.

Some type II injuries may develop late degenerative joint changes and will need a resection of

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the distal end of the clavicle for pain relief. It is important to note that after a resection of the distal end of the clavicle, particularly in a throwing athlete, there may be formation of heterotopic bone on the under surface of the clavicle which can cause a painful syndrome which presents like shoulder impingement.

Type III: The treatment of type III injury is less controversial than in past years. In the 1970s, most orthopaedic surgeons recommended surgery for type III acromioclavicular sprains ⁽⁷⁾. By 1991, most type III injuries were treated conservatively ⁽⁸⁾. This change in treatment philosophy was prompted by a series of retrospective studies ⁽⁹⁾. These showed no outcome differences between operative and nonoperative groups. Furthermore, the patients treated nonoperatively returned to full activity (work or athletics) sooner than surgically treated groups ^(10, 11). The exceptions to this recommendation include those who perform repetitive, heavy lifting, those who work with their arms above 90°, and thin patients who have prominent lateral ends of the clavicles. These patients may benefit from surgical repair ⁽¹²⁾.

Any discussion on the management of acute injuries to the AC joint must confront not only which of the many methods of surgical treatment described is best, but whether surgery should be considered at all. Surgery is generally avoided in athletes participating in contact sports as they will often reinjure the shoulder in the future.

Type IV-VI: Account for more than 10-15% of total acromioclavicular dislocations and should be managed surgically. Failure to reduce and fix these will lead to chronic pain and dysfunction.

Surgery

Surgical repair can be divided into anatomical or non-anatomical, or historically into four types:

- Acromioclavicular repairs (intra-articular repair with wires/pins, percutaneous pins, hook plates)
- Coracoclavicular repairs (Bosworth screws ⁽¹³⁾, Cerclage, Copeland and Kessel repair)
- Distal clavicular excision
- Dynamic muscle transfers

Disadvantages of surgery are that there are risks of infection, a longer time to return to full function and continued pain in some cases.

For the patient with a chronic AC joint dislocation or subluxation that remains painful after 3 to 6 months of closed treatment and rehabilitation, surgery is indicated to improve function and comfort.

For sequelae of untreated type IV-VI, or painful type II and III injuries, the Weaver Dunn technique is advocated. This involves removing the lateral 2cm of the clavicle and reattaching the acromial end of the coracoacromial ligament to the cut end of the clavicle, thus reducing the clavicle to a more anatomical position.

Postoperatively, the arm is supported in a sling for up to 6 weeks. After the first 2 weeks, the patient is allowed to use the arm for daily activities at waist level. After 6 weeks, the sling or orthosis is discontinued, overhead activities are allowed, formal passive stretching is instituted, and light stretching with elastic straps is started. Stretching and strengthening are progressed gradually. The athlete should not return to sport without restriction until full strength and range of motion have been recovered. This usually occurs 4 to 6 months after surgery.

Conclusions

AC joint injuries are an important source of pain in the shoulder region and must be evaluated carefully. The management of these injuries is nonoperative in the majority of cases. Type I and II

injuries are treated symptomatically. The current trend in uncomplicated type III injuries is a non-operative approach. If the athlete develops subsequent problems, a delayed reconstruction may be undertaken. In athletes involved in heavy lifting or prolonged overhead activities, surgery may be considered acutely. Type IV-VI injuries are generally treated operatively.

No matter what form of treatment is chosen, the ultimate goal is to restore painless function to the injured AC joint in order to return the athlete safely and as quickly as possible back to their sport. This is possible in the majority of acromioclavicular joint injuries.

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