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Treatment of Acromioclavicular Joint Injuries in Athletes and in Young Active Patients

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Abstract

The latter generation of mankind is somehow evolved. The ordinary people under 50 years old are trying to live as professional sports guys. They all do various kinds of sports apart from their ordinary life. They all seek for a better body built and an active life. But most of them started active sports after 3rd decade. Improper physical background plus enthusiastic physical activity ends with various kinds of sports injuries. Our generation of orthopaedic surgeons starts to examine more and more sport related injuries in our daily practice. Acromioclavicular joint (ACJ) injuries are one of them. ACJ injuries rather frequent in athletes as well as the ordinary young, active people because of falls, sports injuries, and accidents. In this review, current treatment modalities for AC joint injuries in athletes and young active patients are given briefly. Those suggestions may also be beneficial for an ordinary person seeking for a faster recovery.

Keywords: Shoulder girdle; Acromioclavicular joint; Tightrope; Diarthrodial joint; Orthopaedic surgeons

Anatomy

The acromioclavicular joint (ACJ) is a diarthrodial joint between distal clavicle, and medial of acromion. It's stability maintained by joint capsule, AC, and coracoclavicular (CC) ligaments statically; deltoid, and trapezius muscles dynamically. The capsule is reinforced by the four AC ligaments, which are superior inferior, anterior, and posterior ligaments. The superior, and inferior ligaments are stronger than the anterior, and posterior ligaments. The AC ligaments are resistant especially to anteroposterior translation of clavicle. Vertical translation of clavicle is obstructed with CC ligaments, which are composed of conoid and trapezoid ligaments. There is a meniscal homolog discus between distal clavicle and acromion like in sternoclavicular joint.

Introduction

Acromioclavicular (AC) joint injuries are frequently diagnosed following an acute shoulder injury. Approximately 9% of shoulder girdle injuries involve various damages of AC joint [1,2]. These injuries occur commonly in active young adults with a direct fall onto the top of the shoulder while the arm is adducted, or with a direct blow over the shoulder.

For the classification of ACJ dislocations, Rockwood and Green classification is used mainly [3]. But lately, there is a subdivision of type III injuries suggested by the ISAKOS Terminology Project because of the unpredictability of treatment results [4]. This classification is given in Figure 1.

Patients commonly complain of pain around the anterosuperior part of the AC joint after a trauma. Physical examination must consist inspection of both shoulders; a simple comparative inspection may lead to diagnosis. In types I and II; some swelling, dermabrasion, and bruising can be visualized, and in other types a prominent clavicle is generally obvious.

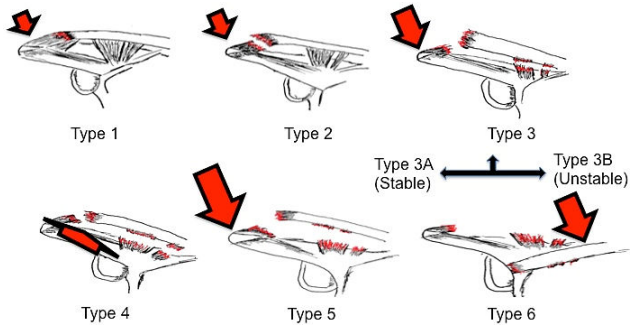

Figure 1: Rockwood and Green classification with ISAKOS terminology project modification.

With palpation, you can examine the tenderness, edema, and prominence at the joint. Positive drawer test, and piano key sign (translation at ACJ) can be observed. The range of motion of shoulder is limited and painful. An injection of a local anesthetic agent in the joint generally relieves the pain. In types III to VI, the patient presented with agony with an evident deformity. In those types, skin lacerations, open wounds, or an open fracture-dislocation can also be seen.

Imaging

The imaging begins with standard radiographs (anteroposterior, axillary, and lateral views if needed). Contralateral AP views may allow determination of the injury type, and degree of clavicular displacement. The AP view identifies the amount of vertical migration of the clavicle, while the axillary view identifies anterior or posterior

displacement of the distal clavicle. Alexander (Basamania) view is a 15° cephalic angle centered to the level of ACJ, projects the ACJ superior to the acromion, providing optimal visualization. Bilateral anteroposterior stress radiographs of the shoulders with 10 to 15 lbs. weights in each hand is an old but effective method, but it may result with aggravated pain afterwards. CT is the best imaging method to evaluate the bony structure of the AC joint. Spiral 3D modeling of both shoulders shows exact displacement type, and direction. MRI is an excellent imaging study to visualize the details of the injury, including bony edema, distal clavicle osteolysis, condition of meniscus, and the ligamentous tears.

In type I injuries, the standard radiographic examination is normal. Diagnosing type I injury, clinical examination is essential. If you need an imaging method, MRI is the right choice. In Figure 2, a typical MRI slice of a type I injury is shown.

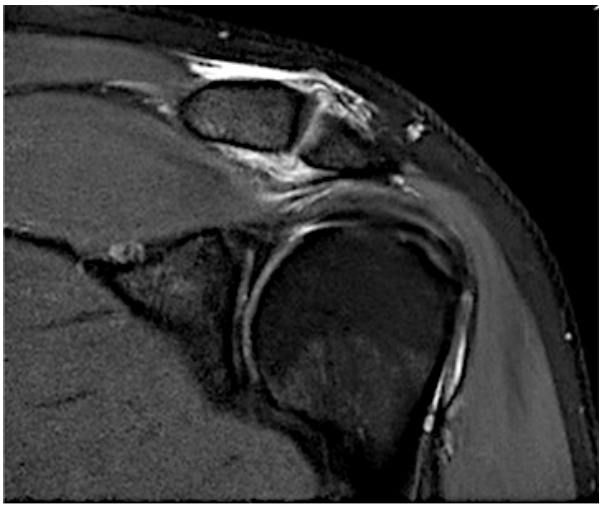

Figure 2: MRI slice of a type I injury.

In type II, the clavicle is partially elevated (up to a 50% vertical subluxation of the distal clavicle) on plain radiographs. Stress radiograph is useful to exaggerate the situation for an easier diagnosis but a keep in mind that this is a painful examination. In Figure 3, MRI slice and stress radiograph of a type II injury patient is shown. 3D CT and MRI scans are painless methods for screening. If the clavicle is completely elevated (as much as 100%) in a direct radiograph, this is type III injury. The axial view is important to differentiate a type III from a type IV. In the axial view of a type IV, the clavicle is displaced posteriorly. MRI and CT scans are also useful for distinguishing those types. In Figure 4, a typical MRI slice of coracoclavicular ligament rupture, and in Figure 5, posterior dislocation of clavicle with CT scan is shown. The radiographs of a type III and a type V are similar except that clavicular elevation is much more pronounced in type V injuries. Usually in type V, the clavicle's displacement to acromion level in AP view is between 100% and 300%. On type VI, the clavicle is displaced inferiorly subacromial or subcoracoid space, and a reversed CC interspace [5-7].

Treatment

The treatment of ACJ dislocations is one of the main debatable subjects in sports medicine [7-11]. No matter how it is treated, the aim is the same: A pain-free shoulder with normal range of motion, returned back to original strength, with better cosmetic outcome, and no limitations in activities. Most of those aims both may be reached with nonoperative and operative treatment. As we are dealing with the active patients, and athletes, we have to include "faster healing/ recovery time" into these aims. The final decision-making should be made for the needs and the expectations of the patient.

Figure 3: MRI slice and stress radiograph of a type II injury.

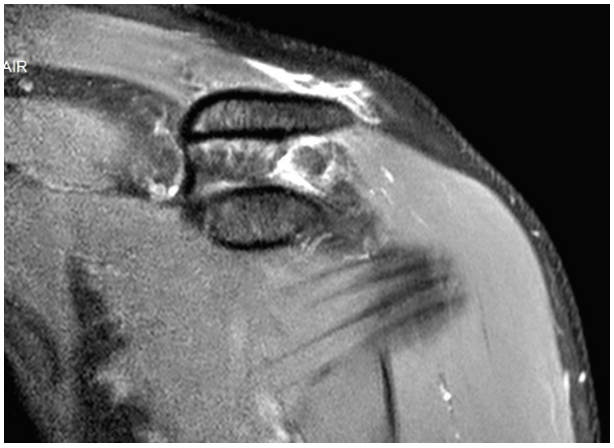

Figure 4: MRI slice of coracoclavicular ligament rupture.

Figure 5: Posterior dislocation of clavicle with CT scan.

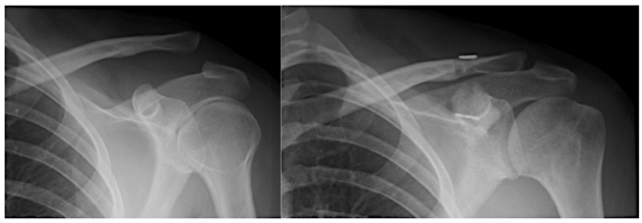

Figure 6: Surgical treatment of a type III unstable ACJ injury in professional basketball player.

Type I and II Injuries

Although treatment of SCJ injuries was mentioned as debatable, there is one main consensus that, type I, and II AC joint injuries are always treated nonoperatively [8,11]. After the injury, the patient can use a sling for comfort initially, and rehabilitation can be initiated as soon as the symptoms resolve. NSAI drugs with/without analgesic medications are used for pain relief. Medi-taping of the joint is also useful for pain relief. Cryotherapy is always in the treatment protocol to reduce swelling, and pain. As the pain, and swelling subside, early active, and passive motion and physiotherapy are recommended for faster healing.

Rehabilitation starts with pain control, and immediate protected ROM with isometric exercises, then strengthening exercises of rotator cuff, and periscapular muscles including the rhomboidei, levator scapulae, trapezius and latissimus dorsi muscles to stabilize the scapula actively with isotonic contractions, and proprioceptive neuromuscular facilitations, spino-scapulo-humeral function chain, and at last sport-specific functional exercises with endurance, power, and neuromuscular control regaining [12].

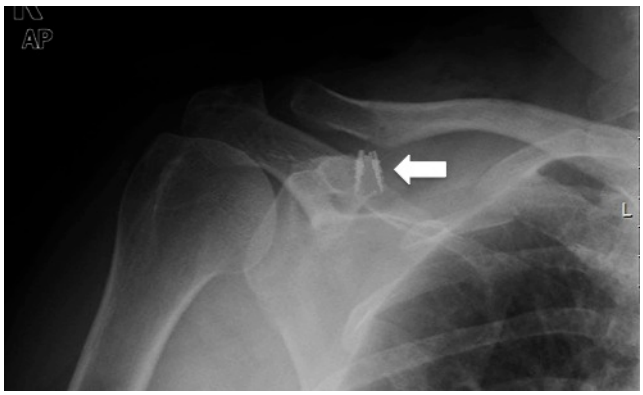

Figure 7: Primary repair of AC ligaments and coracoclavicular ligaments with suture anchors.

The only debatable treatment method of those injuries is local injections. Unlike knee, hip, or ankle; local anesthetic injections to the ACJ, without deteriorating the injury, may compromise the performance of the athlete. But before doing the injection, the patient should be warned that the pain is a protector of the body, and with another trauma in this healing process, the scenario would be worse by a potentially greater injury

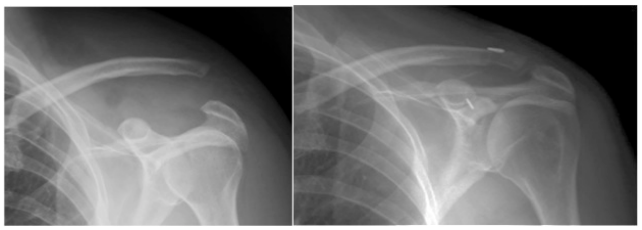

Figure 8: Type V ACJ injury treated with single TightRope device (Arthrex, Naples,FL) device.

Injecting local corticosteroids mixed with local analgesics may reduce the edema with pain relief, but it is not advised for their late cartilage and ligament destructions and may cause distal clavicle osteolysis (DCO). Most patients are able to return to normal activity in 1-4 weeks. An athlete or an active patient is ready to return to competitive sports once the following criteria are met: Full ROM, no pain or tenderness, satisfactory clinical examination, and demonstration of adequate strength on isokinetic testing [8,11].

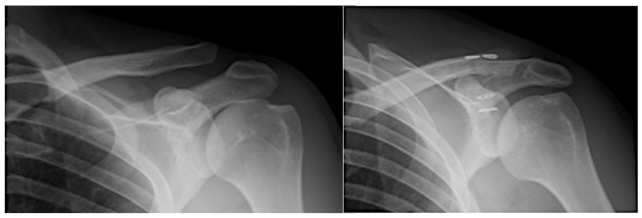

Figure 9: Type IV ACJ injury treated with Twin Tail TightRope device (Arthrex,Naples, FL) device.

Type III Injuries

The treatment of type III AC joint injury is still controversial. Management of the patient with type III AC separation remains controversial, with success rates ranging from 87% to 96% in both operative and nonoperative treatments [8,10,11]. There is variety of papers popularizing different surgical or conservative methods in the literature [7-15]. Treatments of shoulder girdle problems for years have taught us that scapula also plays a significant role in shoulder motion. The shortening of anterior border of the girdle may have negative effect of scapulothoracic function and scapulohumeral rhythm. Therefore, shortening of clavicle or instability in ACJ, or SCJ may rearrange the scapula protracted, and internally rotated position which is called as scapular dyskinesis [4]. Scapular dyskinesis may result with a limited shoulder ROM, glenohumeral, or lateral shoulder pain with persistent weakness. Regarding to this information, there is a subdivision of type III injuries suggested by the ISAKOS terminology project as type IIIA as stable, type IIIB as unstable ACJ. Type IIIB injuries may lead to the scapular dyskinesia, and chronic pain. Whether it is type IIIA or IIIB, the initial treatment starts with conservative methods as described before. At 3-6 weeks, patient has to be re-examined again both clinically, and radiologically. Nearly at this time 80% of the patients have regained full recovery [4,8]. If the patient presents with persistent complaints, or with abnormal scapular movement, or radiographic images in the Alexander (Basamania) view show an overriding clavicle

on the acromion; operative treatment is suggested [4]. Emergent operation of every type III injury may require a 2-12 weeks more recovery time than the ones treated with conservative methods [8]. With the comparable good results of conservative methods in the literature, every professional player requires a conservative treatment especially in the active season. If patient has complaints in the first re-examination, you may consider local injections (especially the athlete is in active season). Surgical treatment is advisable if the patient is a major league baseball thrower, a shot putter, or asks for an operation. In Figure 6, surgical treatment was applied to a type III ACJ unstable injury in professional basketball player.

Type IV, V, and VI Injuries

Those injuries involve rupture of the AC ligaments, the CC ligaments, and deltotrapezius disruption with severe displacement of the distal clavicle. In type IV, the posterior translation of the distal clavicle into the trapezius muscle that creates pain and discomfort. Type V, with severe superior migration of the clavicle, can potentially lead to skin compromise. Type VI, clavicle is displaced inferiorly subacromial or subcoracoid space, and a reversed CC interspace joint. Those injuries generally require operative intervention [7-18].

Surgical Management

Types IV, V, VI, some of III ACJ injuries, neurovascular involvement, and open ACJ injuries are absolute indications for surgical treatment. The orthopedic literature is filled with a wide variety of surgical approaches, and implants to treat these injuries. But all has a single goal that "stabilizing the distal clavicle to acromion". Those techniques involve primary fixations across the acromioclavicular joint, dynamic muscle transfers, ligament transfers with soft tissue reconstructions, and anatomic ligament reconstructions.

Primary Fixation across the Acromioclavicular Joint

The AC joint dislocation can be stabilized either closed or in a open fashion with various implants as K-wires, pins, screws, or hook plates. In association with the open methods, primary repair of the AC ligaments, coracoclavicular ligaments, or deltotrapezius fascia may also be added in fresh cases. In Figure 7, a primary repair of AC ligaments and coracoclavicular ligaments with suture anchors is shown. The complications and concerns of these procedures are risk for hardware migration, and breakage, an increased incidence of AC joint arthritis, and a second procedure for hardware removal.

The clavicular hook plate, is designed for primary fixation across the AC joint. The construct involves plate fixation of the distal clavicle with a hook component that slides under the acromion This technique is demanding and associated with a higher rate of wound infections, ACJ arthritis, healing problems, and nearly all patients require hardware removal as the hook component may erode into the acromion [19].

Coracoclavicular interval fixation, which is an extra-articular fixation, can be done with various implants and techniques. The surgery consists of an open reduction of the AC joint dislocation with the insertion of a screw from distal clavicle to the coracoid process (Bosworth technique). A concurrent repair of the coracoclavicular ligaments, and deltotrapezius fascia may be done. A second surgery is usually recommended between 8 and 12 weeks postoperatively for implant removal before breakage of the screw. The placement of the screw may be done percutaneous with a more demanding technique with more frequent complications. Apart from the screw, metallic cerclage, endobutton (flip-button) device, dacron grafts, sutures, suture anchors, allograft/autograft tendons, and bio-absorbable implants can be used [7-18]. Arthroscopic treatment also establishes successful results [20,21]. Complications associated with these techniques are hardware failures, osteolysis of the clavicle or coracoid by the devices, or fracture of the clavicle or coracoid process, infection, and neurovascular injury that can occur while looping around the coracoid process.

Dynamic Muscle Transfer

The tendon of the coracobrachialis and the short head of the biceps are both attach to the coracoid process. The surgical technique involves an osteotomy of the tip of the coracoid process, and transfer to the undersurface of the clavicle. The inferior pull of the conjoint tendon on the clavicle should dynamically hold the AC joint reduced. This technique had favorable outcomes in 81% and 79% of early, and delayed treatments, respectively [8]. Complications associated with this technique include traction injury to the musculocutaneous nerve, delayed/non-union, and excessive motion at the AC joint because of the dynamic nature of the reconstruction.

Ligament transfers with soft tissue reconstruction

The most common form is the Weaver-Dunn technique, which is a procedure consists of excision of the distal clavicle, release of the coracoacromial (CA) ligament from its acromial attachment, and transfer to the distal clavicle. There are various modifications of this technique since first description. Contemporary CA ligament transfer techniques include the addition of CC ligament reconstruction using tendon grafts, suture anchors, screws, or suture loops. Results have generally been good to excellent, but up to 20% loss of AC joint reduction has been reported [9].

Anatomic ligament reconstruction

Anatomic AC and CC ligament reconstruction techniques have become increasingly popular in the last years. Several clinical and biomechanical studies have shown superiority in reproducing the strength and stiffness of the native AC joint complex compared with other reconstructive techniques [7-15]. AC joint reconstruction with free-tissue graft of the CC, and AC ligamentous complex plus ACJ capsule repair, provides AC joint stability similar to an intact AC joint.

The CC an AC ligaments could be reconstructed with hamstring or anterior tibial allograft or with some non-absorbable materials fixed with either TightRope device (Arthrex, Naples, FL) or more anatomically with Twin Tail TightRope device (Arthrex, Naples, FL). This technique is favored also by arthroscopic appliance. Although reconstructive techniques seem to reconstruct both the AC and CC ligaments anatomically, their superior clinical results has not been proven by comparative outcome studies to other fixation techniques [9].

In Figure 8, a type V ACJ injury treated with single TightRope device (Arthrex, Naples, FL) device and in Figure 9, a type IV ACJ injury treated with Twin Tail TightRope device (Arthrex, Naples, FL) device. Although those techniques are rather easier to perform, there can also complications can occur. Radiologic control is essential while drilling coronoid process. If the tunnel is not in the strong bony part, implant failures with/without coronoid fractures are in evitable. In

Figure 10, a type V ACJ injury operated with single TightRope device (Arthrex, Naples, FL) device and ended with implant failure, reduction loss, and coronoid fracture.

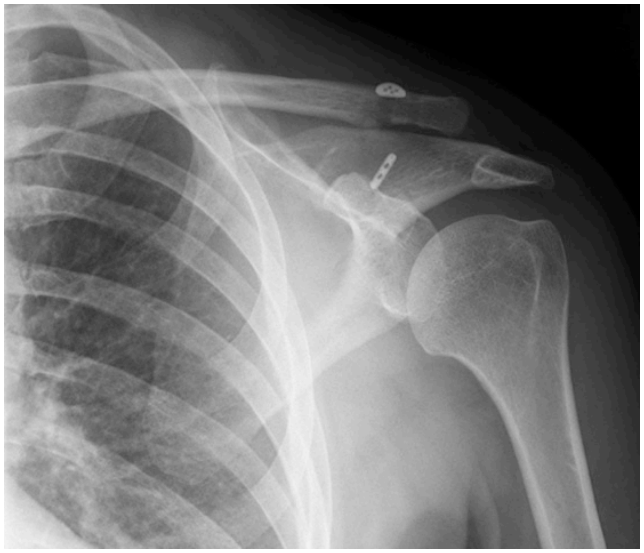

Figure 10: Type V ACJ injury operated with single TightRope device (Arthrex, Naples, FL) device and ended with implant failure, reduction loss, and coronoid fracture.

Postoperative follow-up

The patient is placed in a simple shoulder sling, and gentle pendulum exercises are started immediately. Active assisted exercises are delayed until after postoperative week 2-3. Active motion then follows at week 4-6, with resisted exercises started at week 6-8. Full return to contact sports or heavy labor typically occurs around weeks 12 to 16.

Conclusion

ACJ injuries are more common than we estimate. Therefore, we all must know at least the basics of treatment those injuries. The most important thing about those injuries is, selecting the patients whom will require surgery eventually. The outcome of a failed repair is more catastrophic then a missed ACJ dislocation for many patients. Therefore, precise patient selection with meticulous surgery is required for a successful treatment and outcome.

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