

Advances In Management Of Rotator Cuff Tears

An Essay Submitted For Fulfillment Of Master Degree In
Orthopedic Surgery

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Abstract

The entity of " Rotator cuff tears " describes a condition in which there is an acute or Chronic cuff tear whether this tear is partial or full –thickness and is associated with Restricted painful shoulder motion .

The goal of treatment is to restore comfort . motion. Strength & stability of the Shoulder .

Many options were suggested to treat the condition but none of them succeeded to Reach the expected satisfying results .

The arthroscope succeeded to regain a functional range of motion with considerable Pain relieve in the cases of full – thickness rotator cuff tears also did the reversed Shoulder prosthesis in the cases of rotator cuff arthropathy .

Key Words :

Management of Rotator cuff tears – The rotator cuff .

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INTRODUCTION

The rotator cuff muscles, a group of four muscles that surround the shoulder, are the: supraspinatus, infraspinatus, teres minor and subscapularis. The four rotator cuff muscle tendons combine to form a broad, conjoined tendon, called the rotator cuff tendon, and insert onto the bone of the humeral head in the shoulder. The humeral head is the ball side of the “ball and socket” shoulder joint; the socket is called the glenoid fossa. The rotator cuff stabilizes the humeral head and enables the arm to rotate. Rotator cuff tear is a common cause of pain and disability among adults. Most tears occur in the supraspinatus muscle, but other parts of the cuff may be involved.

Tears are known to have an increasing incidence with increasing age. The most frequent cause of rotator cuff damage is age related degeneration and less frequently by sports injuries or trauma. Partial and full thickness tears have been found on post mortem studies and on MRI studies, in people who do not have a history of shoulder pain or symptoms. The rotator cuff can be torn from a single traumatic injury. A cuff tear may also happen at the same time as another injury to the shoulder, such as a fracture or dislocation. Most tears, however, are the result of overuse of these muscles and tendons over a period of years.

Symptoms of a rotator cuff tear may develop after a trauma, such as a lifting injury or a fall on the affected arm. When the tear occurs with an injury, there may be sudden acute pain, a snapping sensation and an immediate weakness of the arm. Symptoms may also develop gradually with repetitive overhead activity or following long-term wear. Pain in the front of the shoulder radiates down the side of the arm. At first, the pain may be mild and only present with overhead activities, such as reaching or lifting. It may be relieved by medication such as aspirin or ibuprofen. Over time the pain may become noticeable at rest or with no activity at all. There may be pain when lying on the affected side and at night.

Diagnosis of a rotator cuff tear is based on the symptoms and physical examination. X-rays and imaging studies, such as ultrasound, magnetic resonance imaging is helpful. Plain X-rays of a shoulder with a rotator

cuff tear are usually normal or show a small spur. For this reason, it preferred to order an additional study, such as an ultrasound or MRI. These can better visualize soft tissue structures such as the rotator cuff tendon.

MRI is preferred than ultrasound because it tells how large the tear is, as well as its location within the tendon itself or where the tendon attaches to bone.

In many instances, nonsurgical treatment can provide pain relief and can improve the function of the shoulder. Nonsurgical treatment options may include, rest and limited overhead activity, use of a sling, anti-inflammatory medication, steroid injection, strengthening exercise and physical therapy.

Surgery is recommend if nonsurgical treatment does not relieve symptoms, the tear has just occurred and is very painful, the tear is in the shoulder of the dominant arm of an active person or if maximum strength in the arm is needed for overhead work or sports.

Until the nineties the approaches that were available for surgical repair were **Mini-Open Repair and Open Surgical Repair**. But now **Arthroscopic Repair** is the most recent method because it is minimally invasive procedure, less painful and has less blood loss, shorter hospital stays, and a generally easier rehabilitation period.

For massive tears the treatment may be through subacromial decompression \pm acromioplasty, soft tissue augmentation by tendon graft, autogenous or allograft tendon grafts that promote growth of new tissue in the body.

Plates & washers are added for osteoporotic bone also anchors may be used in these cases.

In cases of rotator cuff arthropathy delta prosthesis (reversed shoulder arthroplasty) is considered the most modern method for the treatment of these cases.

Lastly, all repair methods appear equal in outcomes when the surgery is well performed.

CHAPTER 1

Anatomy and function of rotator cuff

Anatomy of the rotator cuff

Although the rotator cuff is made up of four separate muscles, the rotator cuff is a complex arrangement. The muscles may appear separate superficially, but in their deeper regions, they are associated with each other, with the capsule underneath, and with the tendon of the long head of the biceps in their deeper regions, the tendons send fascicles into their neighbors. The most complex of this sharing occurs at the bicipital groove, where the fascicles of the supraspinatus destined for the insertion of the subscapularis cross over the groove and create a roof. Conversely, the fascicles of the subscapularis tendon that are headed for the supraspinatus insertion create a floor for the groove. The rotator cuff is generally defined as the complex of four muscles Subscapularis, Supraspinatus, Infraspinatus, Teres minor, which arise from the scapula, attach to the tuberosities of the humerus, along with the subjacent capsule that blends in these tendons near their insertion, and surround the glenohumeral joint.(1)

1. **Subscapularis:** - This muscle is the anterior portion of the rotator cuff. The muscle takes a fleshy origin from the subscapularis fossa, which covers most of the anterior surface of the scapula. In its upper 60%, it inserts through a collagen-rich tendon into the lesser tuberosity of the humerus. In its lower 40%, it has a fleshy insertion into the humerus below the lesser tuberosity cupping the head and neck. The internal structure of the muscle is multipennate, and the collagen is so dense in the upper subscapularis that it is considered to be one of the passive stabilizers of the shoulder. It is bound anteriorly by the axillary space and the coracobrachialis bursa. Superiorly, it passes under the coracoid process and the subscapularis recess, or bursa. The axillary nerve and posterior humeral circumflex artery and veins pass deep below the muscle into the quadrilateral space.

The circumflex scapular artery passes into the medial triangular space. Laterally the anterior humeral circumflex vessels mark the division between the upper 60% and the lower 40%.

The subscapularis functions as an internal rotator and passive stabilizer to anterior subluxation and serves in its lower fibers to depress the humeral head. By this last function, it resists the shear of the deltoid to help with elevation. Compression of the glenohumeral joint also adds to this function. (2)

In common with the insertions of the other rotator cuff muscles, the subscapularis has parallel collagen superficially and more divergent fascicles deep. This aids the surgeon by allowing the tendon to hold suture better.

This divergent structure is probably related to containment of the humeral head and upward and downward rotation of the head on the glenoid.

Innervation is usually supplied by two sources, the upper subscapular nerves (C5) supply the upper 50% and the lower subscapular nerves (C5 and C6) supply the lower 20%. The nerve supply to the intervening 30% varies. The upper subscapular nerves, usually two comparatively short nerves in the axilla, come off the posterior cord. Because of the greater relative motion of the lower portion of the scapula, the lower subscapular nerves, also two in number, are longer in their course. Blood supply is usually described as originating from the axillary and subscapular arteries; venous drainage is via two veins to the circumflex scapular vein. (See fig. 1-1)

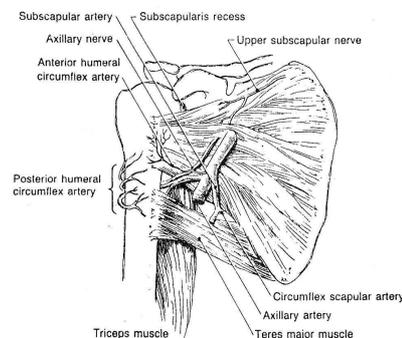


Figure 1-1: the anterior and inferior relationships of the subscapularis muscle. (3)

2. **Supraspinatus:** - The supraspinatus muscle lies on the superior portion of the scapula. It takes fleshy origin from the supraspinatus fossa and overlying fascia and inserts into the greater tuberosity. Its tendinous insertion is in common with the infraspinatus posteriorly and the coracohumeral ligament anteriorly. This Complex tendon formation is common to the rotator cuff. The superficial fibers are longitudinal and give the tendon the appearance of a more discrete structure. These more superficial fibers have larger blood vessels than the deeper fibers. The deeper fibers run obliquely creating a nonlinear pattern that holds sutures more effectively.

(3)

This tendon sends fibers anteriorly over the bicipital groove to the lesser tuberosity. The anterior edge of the tendon is enveloped by the coracohumeral ligament.

A portion of the coracohumeral ligament runs on the articular surface of the supraspinatus tendon perpendicular to the orientation of the tendon. This creates a laterally based arch that is visible from within the joint running all the way to the infraspinatus insertion. Inferiorly, the muscular portion is bound by its origin off the bone, the rim of the neck of the glenoid, and the capsule itself, which is not divisible from the deep fibers of the tendon. (2)

Innervation of the supraspinatus is supplied by the suprascapular nerve (C5 with some C6). The main arterial supply is the suprascapular artery. These structures enter the muscle near its midpoint at the suprascapular notch at the base of the coracoid process. The nerve goes through the notch and is bound above by the transverse scapular ligament. There is no motion of the nerve relative to the notch.

The artery travels above this ligament. The suprascapular vessels and nerve supply the deep surface of the muscle. There is also a branch between the bone of the scapular spine and the muscle. The medial portion of the muscle receives vessels from the dorsal scapular artery.

The function of the muscle is important because it is active with any motion involving elevation. Its length-tension curve exerts maximum effort at about 30 degrees of elevation. Above this level,

the greater tubercle increases its lever arm . Because the muscle circumscribes the humeral head above and its fibers orient directly toward the glenoid, it is important for stabilizing the glenohumeral joint.

The supraspinatus, together with the other accessory muscles, the infraspinatus, subscapularis, and biceps, contributes equally with the deltoid in the torque of the scapular plane elevation and in forward elevation when tested by selective axillary nerve block. (See figure 1-2)

- 3. Infraspinatus:** - The infraspinatus is the second most active rotator cuff muscle it takes a fleshy, collagen-poor origin of the Infraspinatus fossa of the scapula, overlying dense fascia and the spine of the scapula. Its tendinous insertion is in common with the supraspinatus anterior superiorly and teres minor inferiorly at the greater tuberosity. On its superficial surface, it is bounded by an avascular fascial space on the deep surface of the deltoid. The infraspinatus is one of the two main external rotators of the humerus and accounts for as much as 60% of external rotation force. It functions as a depressor of the humeral head. An interesting aspect of muscle action at the shoulder is that a muscle may have opposing actions in different positions. (4)

The infraspinatus muscle stabilizes the shoulder. against the subluxation in internal rotation by Circumscribing the humeral head, creating a forward force. The infraspinatus is a pennate muscle with a median raphe, often mistaken at surgery for the gap between the infraspinatus and teres minor muscles. The infraspinatus is innervated by the suprascapular nerve. Its blood supply is usually described as coming from two large branches of the Suprascapular artery.

4. **Teres minor:** - has a muscular origin from the middle portion of the lateral border of the scapula and the dense fascia of the Infraspinatus. It inserts into the lower portion of the posterior greater tuberosity of the humerus. On its deep surface is the adherent posterior capsule, and on the superficial surface is a facial plane between it and the deep surface of the deltoid. On the inferior border lie the quadrilateral space laterally and the triangular space medially. In the quadrilateral space, the posterior humeral circumflex artery and the axillary nerve border the teres minor. In the triangular space, the circumflex scapular artery lies just inferior to this muscle. On its deep surface, in the midportion, lies the long head of the triceps tendon, loose alveolar fat, and the subscapularis. The teres minor is one of the two external rotators of the humerus. It provides up to 45% of the external rotation force and is important in controlling stability in the anterior direction. It also probably participates in the short rotator force, coupled in abduction with the inferior portion of the subscapularis. The posterior branch of the axillary nerve (C5 and C6) innervates Teres minor. The blood supply derives from several vessels in the area, but the branch from the posterior humeral scapular circumflex artery is the most constant. (2)

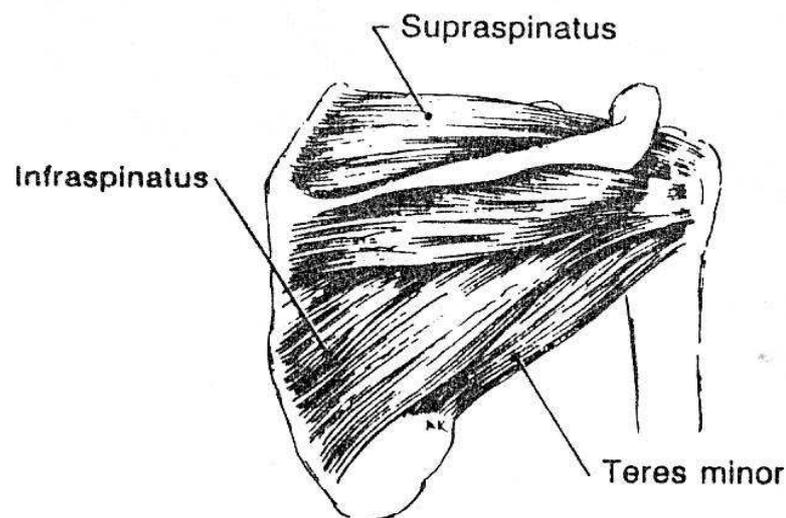


Figure 1-2: the two external rotators of the humerus, the infraspinatus and teres minor muscles, which are also the posterior wall of the rotator cuff. (3)

The acromion, the coracoid and the coracoacromial

The acromion is a scapular process arising from three separate centers of ossification, a preacromion, a mesoacromion, and a meta-acromion, which are usually united by age 22. When these centers fail to unite, the ununited portion is referred to as an *os acromiale*. Most commonly, the lesion is a failure of fusion of the *mesoacromion* to the *meta-acromion*. It was found that the axillary view is the most helpful in revealing the condition. The size of the unfused fragment may be substantial, up to five by two centimeters. Resection of a fragment creates a serious challenge for deltoid reattachment. (2)

An additional anatomical feature of importance is the acromial branch of the thoracoacromial artery. This artery runs in close relation to the coracoacromial ligament and often is transected in the course of an acromioplasty and coracoacromial ligament section. (3)

The coracoid arises from two or three ossification centers. It provides the medial attachment site for both the coracohumeral and coracoacromial ligament. In that their muscle bellies lie medial to it, the neighboring supraspinatus and subscapularis tendons must be able to glide by the coracoid with their full excursion during shoulder movement. Scarring of one or both these tendons to the coracoid can inhibit passive and active shoulder motion. While the coracoid does not normally contact the anterior subscapularis tendon, forced internal rotation, particularly in the presence of a tight posterior capsule, can produce such contact due to obligate translation. (4)

The coracoacromial ligament spans from the undersurface of the acromion to the lateral aspect of the coracoid and is continuous with the less dense clavipectoral fascia. It forms a substantial part of the superficial aspect of the humeroscapular motion interface. This ligament may be thought of as the spring ligament of the shoulder, maintaining the normal relationships between the coracoid and the acromion. (See figure 1-3) (5)