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Anatomy, Rotator Cuff

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Introduction

The rotator cuff includes the following muscles: [1][2][3]

- Subscapularis
- Infraspinatus
- Supraspinatus
- Teres Minor
 - Helpful mnemonic to remember these muscles/tendons is "SITS"

These muscles arise from various anatomic portions of the scapula and insert on the proximal humerus, from anterior to posterior, beginning with the subscapularis (on the lesser tuberosity), followed by the supraspinatus, infraspinatus, and teres minor inserting on the greater tuberosity from anterior to posterior, respectively.

The glenohumeral joint is a ball and socket joint and comprises a larger, round humeral head and a shallow glenoid cavity. It is highly mobile and thus, needs structures to stabilize it. This stabilization is provided collectively by the rotator cuff as a dynamic stabilizer, and capsule, labrum complex, and glenohumeral ligaments as static stabilizers. The cuff gives strength to the capsule of the shoulder all around the joint except inferiorly. This explains why dislocations of the humerus most commonly occur in a downward direction. The subacromial space lies beneath the coracoid process, the coracoacromial ligament, the acromion and the acromioclavicular joint and the bursa in the subacromial space is called subacromial bursa. It provides lubrication for the muscles.

Structure and Function

The rotator cuff muscles arise from the scapula and insert into the humerus, thus stabilizing the glenohumeral joint. They hold the humerus over the small glenoid cavity. During abduction of the arm, the rotator muscles prevent the up-sliding of the head of the humerus, thus allowing the large deltoids to elevate the arm further. Additionally, they also help in the mobility of the shoulder joint by facilitating abduction, internal rotation, and external rotation.

- Subscapularis
 - Internal rotator of the shoulder
 - Anterior stability of the shoulder
- Supraspinatus
 - Abducts (primarily) and externally rotates the arm

- Important for the initial 0 to 15 degrees of shoulder abduction motion when the arm is adducted against the side of the trunk
- Beyond 15 degrees of abduction, the deltoid moment arm acts synergistically to assist in shoulder/arm abduction
 - Along with the other rotator cuff muscles provides dynamic stabilization of the shoulder
- Infraspinatus
 - External rotator of the shoulder
 - Along with the other rotator cuff muscles provides dynamic stabilization of the shoulder
- Teres Minor
 - External rotator of the shoulder
 - Along with the other rotator cuff muscles provides dynamic stabilization of the shoulder

Embryology

The primary germ layers are ectoderm, endoderm, and mesoderm. Mesoderm lies between the ectoderm and endoderm and gives rise to the muscles and ligaments in the body. Other structures arising from the mesoderm are connective tissue, cartilage, bone marrow, blood vessels, and its lining endothelium.

Blood Supply and Lymphatics

The vascular supply to the rotator cuff muscles is chiefly via the suprascapular (a branch of the thyrocervical trunk) and subscapular (a branch of the axillary artery) arteries and their relevant branches- Anterior and posterior humeral circumflex, thoracoacromial artery, and suprahumeral artery.

Lymph drains into the axillary lymph nodes.

Nerves

- The subscapular nerve (upper and lower branches) innervates the **subscapularis**
- The suprascapular nerve innervates the **infraspinatus and supraspinatus**
- The axillary nerve innervates **teres minor**

Muscles

The **subscapularis** is a triangular muscle which arises from the subscapular fossa of the scapula and inserts into the lesser tubercle of the humerus and to the capsule of the shoulder joint anteriorly. A large bursa separates the muscle from the neck of the scapula. It is a large muscle protecting the shoulder joint anteriorly and preventing its anterior dislocation during abduction.

The **supraspinatus** arises from the medial two-thirds of supraspinatus fossa of the scapula, passes above the glenohumeral joint and inserts into the superior and middle impression of the greater tuberosity of the humerus. It acts as the upper stabilizer of the joint.

The **infraspinatus** occupies a major part of the infraspinatus fossa, passes posteriorly to insert on the posterior impression of the greater tubercle of the humerus immediately below the supraspinatus. The tendon of this muscle is sometimes separated from the capsule of the shoulder joint by a bursa.

The **teres minor** is a narrow and long muscle, which takes origin from the dorsal surface of the lateral border of the scapula and insert on the inferior impression of the humerus below the infraspinatus.

Clinical Significance

Rotator Cuff Syndrome [1][4][5][6]

Rotator cuff syndrome (RCS) describes a spectrum of clinical pathology ranging from minor injuries such as acute rotator cuff tendinitis, to advanced/chronic rotator cuff tendinopathy and degenerative conditions.

Rotator cuff injuries represent a common cause of shoulder pain. The rotator cuff tendons, particularly the supraspinatus tendon, are uniquely susceptible to the compressive forces of subacromial impingement. Improper athletic technique, poor posture, poor conditioning, and failure of the subacromial bursa to protect the supporting tendons results in a progressive injury from acute inflammation, to calcification, to degenerative thinning, and finally to a tendon tear.

Rotator cuff (RC) tendonitis/tendinosis

Acute or chronic tendinopathic conditions that result from a vulnerable environment for the RC secondary to repetitive eccentric forces and predisposing anatomical/mechanical risk factors.

Shoulder impingement

A clinical term often used nonspecifically to describe patients experiencing pain/symptoms with overhead activities. Shoulder impingement is best subdivided into internal and external conditions:

- **Internal impingement**[5]: common in overhead-throwing athletes such as baseball pitchers and javelin throwers. Impingement occurs at the posterior/lateral articular side of the cuff as it abuts the posterior/superior glenoid rim and labrum when the shoulder is in maximum abduction and external rotation (i.e., the “late cocking” phase of throwing)
 - The term, "thrower's shoulder" refers to a common set of anatomic adaptive changes that occur over time in this subset of athletes.
 - These adaptive changes include but are not limited to increased humeral retroversion and posterior capsular tightness.
 - Glenohumeral internal rotation deficit (GIRD) is a condition resulting from these anatomic adaptations, and GIRD is known to predispose the thrower's shoulder to internal impingement.
- **External impingement**: a term used synonymously with SIS. External impingement (EI) encompasses etiologies of external compressive sources (i.e. the acromion) leading to subacromial bursitis and bursal-sided injuries to the RC. [7]

History and Physical for RCS

The primary complaint is shoulder pain localized on the lateral aspect. It worsens with overhead activities, and patients often describe a painful arc during flexion and abduction at 60 degrees to 120 degrees and report pain at night due to lying on the same side. The presentation can be acute or chronic in onset. Young patients usually have acute presentation because of a recent traumatic event or significant overexertion (e.g., lifting a heavy box). The function is often significantly impaired. Older patients or patients with repetitive overhead activities present chronically, and the loss of strength and function occurs gradually. The range of motion is normal with positive provocative tests like Hawkins. Neer test rules in impingement syndrome. Drop arm test is confirmatory. If weakness is present on shoulder abduction, a rotator cuff tear should be suspected (MRI is the best test for diagnosis of rotator cuff tear).

Treatment for RCS [8]

American Academy of Orthopedic Surgeons (AAOS) suggests patients with rotator cuff problems without tears can be treated conservatively with exercise and NSAIDs. Patient must be advised to limit overhead activities and to use ice packs or heating pads. Proper physical therapy effectively treats most patients without subacromial

decompression. No difference in outcome has been reported for surgery over physical therapy in several trials. Subacromial injection with steroids showed a short-term benefit in some trials and may improve a patient's compliance with physical therapy. Surgical consultation is considered if symptoms do not improve three months after conservative management. Arthroscopic acromioplasty may be discussed.

Partial- versus Full-Thickness Rotator Cuff Tears

Etiologies and underlying causes are known to be multifactorial. Degeneration, impingement, and tension overload due to trauma may all lead to rotator cuff tears. Most often the tears initially begin with as partial tears of the supraspinatus tendon. Eventually, they can progress to full-thickness tears to include all the four muscles.

It is primarily seen in middle-aged to older patients. Repetitive overhead activities are commonly the reason in younger athletes.

History and Physical

Pain and weakness are the presenting symptoms. Pain is prominent over the lateral deltoid, worsens with overhead activities and by lying on the side at night. The absence of pain, however, does not exclude the diagnosis because a chunk of patients may also be asymptomatic. In fact, partial thickness tears cause more pain and disability than full-thickness tears. Painful arc test, drop arm test, and weakness in the external rotation are most common observations on physical examination.

X-rays are usually normal and can help in diagnosing large rotator cuff tears if imaging shows humeral migration over the glenoid and the patient has a symptomatic shoulder.

MRI can provide a degree of muscle tear, tendon retraction, and muscle atrophy which is critical in planning for rotator cuff repair.

Treatment

Conservative treatment with NSAIDs, and most importantly, physical therapy, is tried first. Surgical therapy with arthroscopy is done in cases of both acute or chronic full-thickness tears since delay can result in significant muscle atrophy, tendon retraction, and poorer surgical results.

Questions

To access free multiple choice questions on this topic, [click here](#).

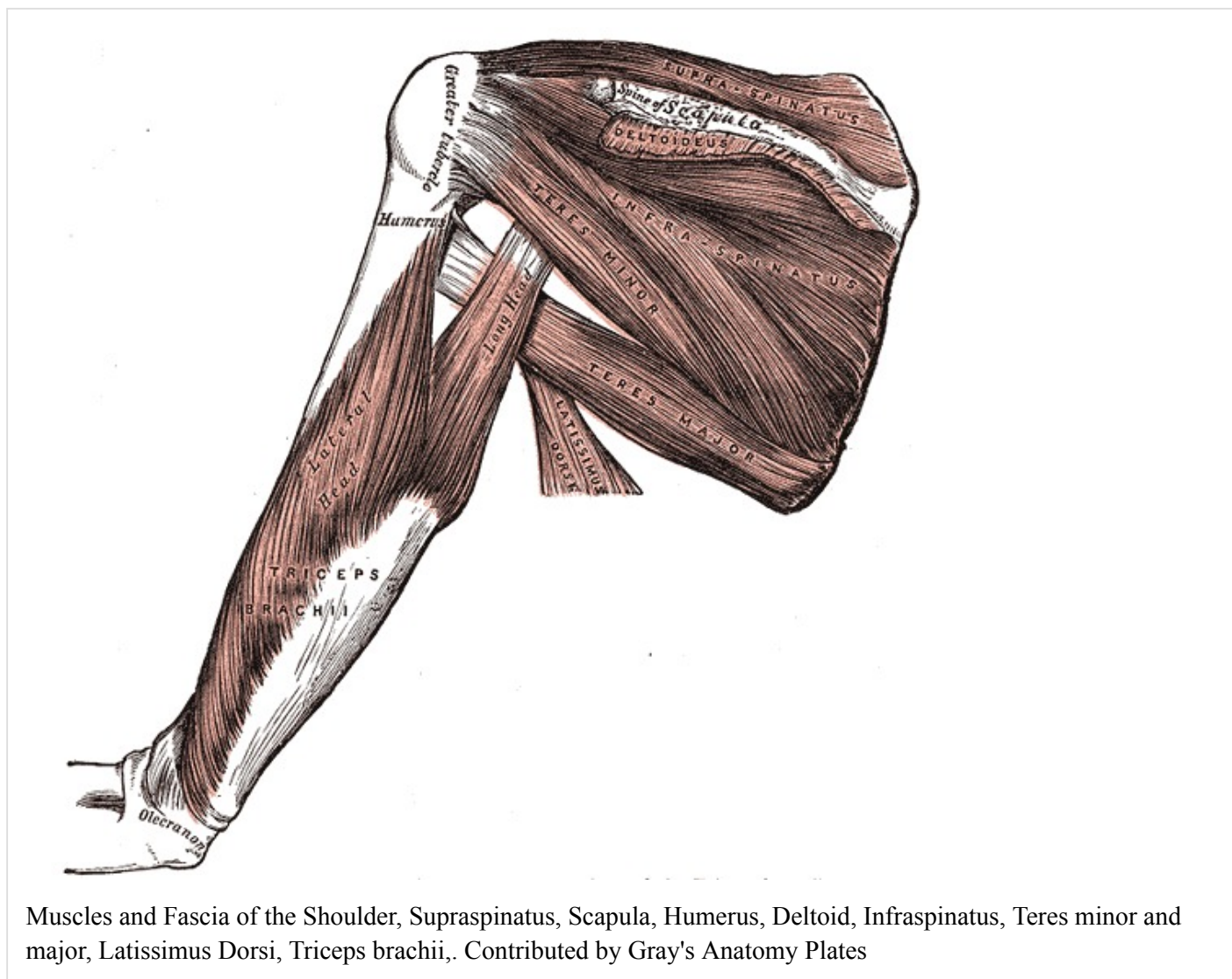
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Figures



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