CE

Rotator Cuff Tears
An Overview

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Rotator cuff tears are a common contributing factor of shoulder pain and occupational disability. Tears of the rotator cuff are becoming increasingly prevalent in today's musculoskeletal population. Accurate recognition and successful treatment of patients with rotator cuff tears require thorough comprehension of the normal and pathologic anatomy of the rotator cuff. This article will provide an overview of the rotator cuff that consists of normal anatomy, pathology, physical assessment, diagnostic imaging, and recommended treatment. This article also discusses the importance of providing adequate and straightforward patient education and the role it plays in positive outcomes of rotator cuff tear rehabilitation.

The modern understanding related to anatomy and pathology of the rotator cuff began during the late 1800s. The first rotator cuff repair was published in detail in 1911 (Lin, Krishnan, & Burkhead, 2008). To date, many studies that have been conducted related to the incidence of rotator cuff tears reveal that this type of shoulder pathology is becoming more common in the fifth and sixth decades of life and almost 30% of patients visit an orthopaedic clinic as a result of rotator cuff pathology (McCarron, Derwin, & Iannotti, 2008).

According to Kibler, Warme, Sciascia, Kuhn, and Wolf (2009), more than 50% of individuals older than 60 years have at least a partial-thickness rotator cuff tear and procedures done to treat rotator cuff disease are among the most common of all orthopaedic procedures. The impact a rotator cuff tear has on patients' quality of life and impairment is comparable to that of congestive heart failure, diabetes, myocardial infarction, and depression (Mighell, 2008). Because of the current aging population and the fact that a large percentage of older individuals maintain a very active lifestyle, it is important for advanced practice orthopaedic clinicians to be able to accurately identify and appropriately treat patients with rotator cuff tears using an evidence-based approach; therefore, it is imperative that the advanced practice orthopaedic clinician have a thorough understanding of the rotator cuff in regards to anatomy, normal function, pathogenesis, and current literature regarding treatment and management of rotator cuff tears.

Anatomy

The rotator cuff is composed of four muscles and their tendons: supraspinatus, infraspinatus, teres minor, and subscapularis. Collagen bundles from the tendons essentially form a cover that inserts around the humeral head and allows for rotation of the arm. The four muscles and tendons also allow for stabilization of the humeral head against the glenoid (Figure 1). Table 1 shows that the muscles and tendons of the rotator cuff can be easily remembered by the mnemonic SITS.

The four muscles and tendons of the rotator cuff each play an important role in the motion of the shoulder. The main function of the supraspinatus tendon is the initiation of the first 30° of forward flexion and assistance of the deltoid with the first 90° of abduction. It also assists with external rotation of the humerus. The infraspinatus and teres minor both externally rotate the proximal humerus. The role of the subscapularis is to internally rotate the humeral head in relation to the scapula (see Table 2).

The tendons of the rotator cuff are different in composition and structure when compared with other tendons. The rotator cuff tendons are composed of Type I and Type III collagen but predominately Type I collagen, which is 85% of the tendons' dry weight (Brinker & O'Connor, 2004). The amount of Type III collagen increases with the presence of rotator cuff tendon degeneration, age, and tearing. The rotator cuff tendons also contain a high level of glycosaminoglycan, which is primarily composed of hyaluronic acid.

Pathogenesis

Rotator cuff tears are classified as partial-thickness tears or full-thickness tears. According to Gramstad and Yamaguchi (2008), the pathogenesis of rotator cuff tears is multifactorial and is still the subject of debate since no unified theory exists regarding the etiology of atraumatic rotator cuff disease. The determining causes of rotator cuff tears include intrinsic, extrinsic, or traumatic factors (Wolff et al., 2006). Examples of intrinsic factors would be degenerative changes due to normal aging and overuse from repetitive activities. Extrinsic factors include anatomical findings such as coracoacromial arch narrowing or mechanical impingement resulting from

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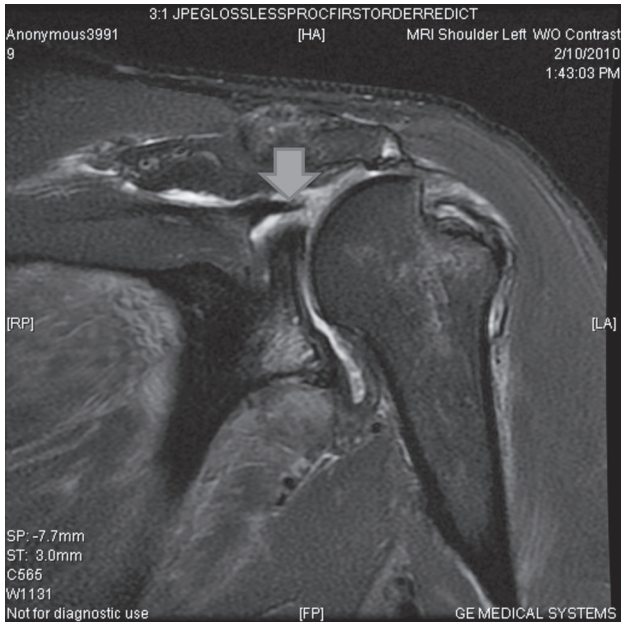

FIGURE 1. Left shoulder T2 image of a full-thickness rotator cuff tear with retraction to glenoid margin (down arrow).

the distal clavicle. The existence of a large lateral extension of the acromion has been shown to have a strong association with full-thickness rotator cuff tears (Gramstad & Yamaguchi, 2008).

According to Keener (2008), most rotator cuff tears involve the supraspinatus tendon followed more commonly by the infraspinatus and upper subscapularis tendons. In regards to the supraspinatus tendon, the articular surface has roughly half the strength of the bursal surface that means that the articular surface is more vulnerable to tearing. The presence of tearing or rupture within the anterior supraspinatus or superior subsapularis may also lead to injury of the biceps and instability of the long head of the biceps. In addition, long head of the biceps dislocations is commonly associated with lesions of the rotator cuff.

Physical Assessment

There are key factors to address when performing a physical assessment of a patient who presents with a possible rotator cuff tear. From a subjective standpoint, it is important to allow patients to describe the shoulder pain in detail and how it is affecting their activities of daily living. It is also beneficial to obtain information from the patients regarding the possibility of any traumatic events to the shoulder, how long the pain has been present, what elicits or relieves the pain, and their pain scale rating in numeric or visual analogue form. Patients with possible rotator cuff tears commonly present with complaints of shoulder pain, stiffness, weakness, or loss of active motion. Pain that is characteristic of rotator cuff tears is more intense at night and with overhead activities. Partial-thickness tears are often more painful than full-thickness tears (Wolff et al., 2006). Full-thickness rotator cuff tears result in more pronounced weakness and loss of active motion than partial-thickness tears.

Points to address during the physical examination of the rotator cuff include the loss of active or passive range of motion, painful range of motion, presence of muscle atrophy, weakness, swelling, or tenderness. There are specific tests that can be conducted during the physical examination to evaluate the functional status and strength of the rotator cuff (see Table 3.). Pain is not always present in patients with rotator cuff tears. A painless rotator cuff tear is a frequent occurrence and has been linked to chronic tearing and advancing age. This is a common finding in patients who are usually older than 60 years (Lin et al., 2008).

An evaluation of the cervical spine is recommended in addition to the shoulder examination so that any

TABLE 1. ROTATOR CUFF ANATOMY MNEMONIC: SITS

Tendon
Supraspinatus
Infraspinatus
Teres minor
Subscapularis

TABLE 2. FUNCTIONS OF THE ROTATOR CUFF TENDONS

Tendon	Function
Supraspinatus	Forward flexion, initiates abduction and assists with external rotation
Infraspinatus	Primarily external rotation
Teres minor	Primarily external rotation
Subscapularis	Primarily internal rotation

TABLE 3. SPECIFIC TESTS FOR EVALUATING ROTATOR CUFF STRENGTH

Test	Description
Lateral jobe test	Evaluates the supraspinatus tendon: Arm is held in the scapular plane at a comfortable angle as if pouring a can of soda; test is positive if pain or weakness is present with resisted downward pressure
Belly-press	Evaluates the subscapularis tendon: Have patient press on belly while keeping elbow in the coronal plane and avoiding wrist flexion; test is positive if patient can not maintain the elbow forward in the coronal plane
Lift-off	Evaluates the subscapularis tendon: Have the patient position the arm behind his or her back and attempt to lift the hand away from his or her back. Inability to do so indicates weakness and is a positive test
External rotation	Evaluates the infraspinatus and teres minor tendons: With patients' arm by their side have them flex their elbow to 90° and externally rotate their arm against resistance. Positive if weakness is present.

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underlying cervical pathology may be ruled out. This is due to the fact that underlying cervical pathology can produce symptoms similar to that of rotator cuff tears. The cervical evaluation can involve the clinician inquiring about the presence of numbness and tingling in the upper extremities and assessing for increasing pain with cervical motion.

Imaging Studies

Radiographs

An initial routine radiograph of the affected shoulder should always be obtained. The radiograph should include anteroposterior, axillary, and scapular Y views. The soft tissues of the rotator cuff are not able to visualized on plain radiographs; however, radiographs may provide information regarding the condition of the rotator cuff (Lin et al., 2008). Radiographs in patients with rotator cuff tears will frequently reveal subacromial spurs and elevation of the humeral head in relation to the glenoid. The presence of superior migration of the humeral head is indicative of a massive rotator cuff tear, which is usually chronic in nature (Mair, 2010).

Magnetic Resonance Imaging

The imaging study that provides excellent soft tissue visualization and is very effective for evaluation of the rotator cuff is magnetic resonance imaging (MRI). An MRI can reveal if the rotator cuff tear is partial or full thickness, the size and location of the tear, and if biceps pathology is involved. MRI offers a more complete evaluation of the shoulder (Wolff et al., 2006). MRI arthrography should be considered in young, symptomatic patients such as overhead throwing athletes or patients with previous rotator cuff surgery. Active patients are more prone to partial-thickness rotator cuff tears along with injury to other structures such as the labrum. A magnetic resonance arthrogram is the diagnostic imaging of choice to evaluate these types of tears while assessing for the presence of other pathology such as labral tears (Wolff et al., 2006). If symptoms of cervical pathology are present, the clinician should consider ordering an MRI of the C-spine in addition to the MRI of the shoulder.

Ultrasonography and Computed Tomography

Other available imaging techniques that can be performed to evaluate the rotator cuff include ultrasonography and computed tomography. Ultrasonography offers an inexpensive evaluation of the rotator cuff but accurate results are operator dependent and it does not provide information regarding concomitant pathologies; therefore, this method is not widely used (Lin et al., 2008). Computed tomography reveals excellent visualization of the bony anatomy along with information regarding the rotator cuff but does not provide the detailed evaluation that is produced by MRI.

Treatment and Management

Nonsurgical

Nonsurgical treatment is the appropriate initial plan of care for partial-thickness rotator cuff tears. Nonsurgical management of full-thickness rotator cuff tear should not be considered until the risk of irreversible change versus the risk of surgery has been assessed. The goals of nonsurgical treatment are to achieve pain control and to maintain function. Patients with rotator cuff tears who are not experiencing severe pain and significant weakness are most often treated nonsurgically. It is important to explain to the patient that nonsurgical treatment does not lead to healing of the rotator cuff tear but the remaining intact portion of the tendon may compensate for the torn portion that may lessen the symptoms. Patients should be made aware that nonsurgical conservative modalities may not lead to improvement for 6 months and improvement may continue for up to 18 months after conservative modalities have been initiated (Wolff et al., 2006).

Nonsurgical treatment of rotator cuff tears includes the use of nonsteroidal anti-inflammatory drugs, intermittent steroid injections, activities of modification, and physical therapy. The main purpose for the use of nonsteroidal anti-inflammatory drugs is to alleviate the pain and decrease the inflammation. According to Keener (2008), there is not sufficient data available to determine the efficacy of these medications when treating rotator cuff tears. Subacromial and intra-articular steroid injections are useful in nonsurgical management but should be limited to two to three a year because of the potential harmful side effects steroids can have on the articular cartilage and soft tissue structures of the shoulder (Keener, 2008). The patient should be instructed to modify their activities by avoiding motions that are overhead or painful.

Physical therapy is recommended initially to help decrease pain and improve the range of motion of the shoulder. Physical therapy will also involve the use of other modalities such as ice, heat, ultrasound, and electrical stimulation. These modalities are used to decrease pain and reduce muscle spasms. The physical therapy protocol slowly progresses to focusing on increasing the strength and endurance of the rotator cuff and the muscles that are involved in scapular stabilization.

Surgical Treatment

Surgical intervention should be considered for patients who have failed 3 to 6 months of conservative nonsurgical treatment. The recommendation of surgery should involve the consideration of patient-specific factors. These factors include the magnitude of current symptoms, level of physical activity, size of the rotator cuff tear, and rate of improvement with nonsurgical modalities. The clinician should also consider the patient's goals, desired outcomes, and willingness to be compliant with the postoperative course of rehabilitation following rotator cuff repair.

Surgical techniques for rotator cuff tears include open, mini-open, and arthroscopic procedures that are preformed on an outpatient basis. The procedure may involve debridement without rotator cuff repair, debridement along with acromioplasty, or repair of the rotator cuff. The factors taken into consideration when deciding which repair technique to use include the depth, size, and location of the rotator cuff tear along

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with the quality of the rotator cuff tissue that is remaining. Massive rotator cuff tears may require additional surgical techniques such as a tenotomy of the long head of the biceps or a tuberoplasty.

It is important to discuss the surgical procedure and course of postoperative rehabilitation with the patient prior to surgery. The patient should be made aware of the intensity of the rehabilitation process following repair of the rotator cuff. A patient's commitment to the rehabilitation process before surgery will hopefully serve as motivation to remain compliant with physical therapy sessions and produce a more desirable outcome.

Conclusion

It is important that nurses and advanced practice clinicians in the orthopaedic setting be aware of the increasing incidence of rotator cuff tears among today's musculoskeletal population. Therefore, it is imperative that healthcare providers increase their knowledge base regarding the normal anatomy, pathology, and assessment of the rotator cuff. It is also essential for clinicians to be familiar with current literature pertaining to the treatment options and regimens recommended for patients with rotator cuff tears.

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