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Epidemiology Of Sports Injuries

Critical review

Rotator cuff tears, evaluation and treatment: a critical review

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Abstract

Introduction

Rotator cuff tears are a common cause for shoulder pain in the older population. The aetiology and pathophysiology are not fully understood. Theories for tear evolvement are divided into intrinsic (e.g. recurrent microtrauma) and extrinsic (e.g. subacromial impingement). The subacromial bursa is probably the source of pain in symptomatic patients with rotator cuff tears. It is uncertain whether the tear itself can produce pain because of the high prevalence of asymptomatic tears. Typically, there is a gradual increase in shoulder pain and weakness; however, it can present acutely due to an injury. Difficulties in overhead activities and night pain are common. Imaging such as ultrasound and magnetic resonance are required for accurate evaluation of RCTs in patients with ongoing pain and limitations. Primary treatment includes activity modifications, pain relief and physical therapy. Surgery is advised for acute tears in active patients or chronic symptomatic tears in patients that fail to improve. This article discusses the evaluation and treatment of rotator cuff tears.

Conclusion

Symptoms of pain and weakness about the shoulder imply on rotator cuff tear. There are typical impingement signs in physical evaluation together with limited range of motion and weakness. Plain radiography is required to rule out other pathologies and observe acromion morphology, while ultrasound and magnetic resonance imaging are used to define the tear and tendon quality before surgical intervention. Most repairs are currently performed in an all-arthroscopic minimally invasive technique with easier rehabilitation and less pain compared to the traditional open surgery.

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Introduction

Shoulder pain is a very common complaint. Studies report on about one-third of the population that suffer from shoulder symptoms during their lifetime. One of the main causes for shoulder pain in the older population is rotator cuff tears (RCTs). The prevalence of RCTs in the general population is 20%[1]. Without appropriate evaluation and treatment, the pain may persist for a long period of time. Since the early 1990s, there was a significant progress in arthroscopic surgery techniques for symptomatic tears of the rotator cuff. Currently, selected patients are treated with these techniques with high success and low morbidity rates. The aim of this review was to discuss the methods for evaluation and the treatment techniques for RCTs.

Anatomy

There are two synovial spaces in the shoulder—the glenohumeral and subacromial spaces. Between those spaces is the rotator cuff complex of four tendons together with the underlined joint capsule[2]. These are the supraspinatus, infraspinatus and teres minor, which originate from the posterior scapula and insert into the greater tuberosity of the proximal humerus, and the subscapularis that originate from the anterior scapula and insert into the lesser tuberosity. The RC moves and stabilises the humeral head in the centre of the glenoid by the principle of coupling forces. The subacromial bursa is localised in between the RC below and the acromion with thecoracoacromial ligament (CAL) above. The normal separation between the glenohumeral and subacromial spaces is violated when there is a full-thickness tear of the RC. The most common tear of the RC involves the supraspinatus tendon. This tendon has a unique structure of several parallel independent fibre units that allows for wide-ranging mobility[3]. During movement, some units are elongated, while others are shortened. The sheering forces that are produced can cause pathology.

Tear types

Accurate description of RCTs is essential for clinical and academic purposes. Measurements can be done by imaging or at surgery. It is usually defined by the tendon involved, its thickness (partial or complete) and size (anterior to posterior). Crescent shape tear is the most common full-thickness configuration.

Pathophysiology

Codman[4] described a hypovascularised zone adjacent to the supraspinatus insertion site. Although the pathological process is not fully understood, it is degenerative and deteriorates with age. Imaging studies have shown that the prevalence of asymptomatic RCTs is 30% and 65%

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FOR CITATION PURPOSES: *Haviv B.* Rotator cuff tears, evaluation and treatment: a critical review. OA Sports Medicine 2013 Oct 01;1(2):20.

Competing interests: none declared. Conflict of interests: none declared.
All authors contributed to conception and design, manuscript preparation, read and approved the final manuscript.
All authors abide by the Association for Medical Ethics (AME) ethical rules of disclosure.

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in people older than 60 and 70 years, respectively[5].

Traditionally, the pathophysiological theories are divided into intrinsic and extrinsic.

Intrinsic tendinopathy

The pathological process involves the tendon tissue. The main model is degenerative with age-related deterioration into partial- and then full-thickness tendon rupture. Because of recurrent micro-trauma, inflammatory mediators alter the local environment and oxidative stress causes tenocyte loss with further degeneration. Both histological examinations of tendon tissue and overload animal models have demonstrated changes in blood supply and also in concentrations of cells, collagen and proteoglycans. In addition, studies have shown loss of fibrous organisation, tissue weakening and high level of inflammatory markers[6–9]. Shoulder abduction causes a relatively high mechanical stresses in the articular side compared to bursal side fibres of the suprasinatus tendon[10]. These forces produce cartilage tissue near the insertion of the supraspinatus tendon into the greater tuberosity as was demonstrated in other parts of the body[11]. This cartilaginous tissue has weaker load resistance.

Burkhart et al.[12] have described the 'rotator cuff cable', a thick crescent-like structure adjunct to humeral insertion site of the RC. The cable is perpendicular to the tendon fibres where the medial fibres between it and the humerus are thinner and localised in the hypovascular critical zone described by Codman[4]. Although the cable has biomechanical advantages derived from the suspension bridge mechanical principle, these medial fibres tend to wear and tear.

The vascular supply to the supraspinatus tendon has been studied for many years. The common theory suggests a critical hypovascular zone at 10–15mm from its insertion site into the humerus. However, several studies have contradicted this theory, and thus the relationship between vascular supply and degeneration is not entirely clear[13]. Nevertheless, the tear margins are often avascular with limited healing potential.

Extrinsic tendinopathy

The pathological process is external to the tendon tissue. Neer has suggested the coracoacromial arch as the primary offender[14]. The recurrent attrition of the tendons against the inferior part of an aberrant acromion causes tissue damage. According to Bigliani et al.[15], there are three morphological types of acromion. Of these, curved or hooked acromion morphologies are found in most patients with RCTs. Based on the above assumptions, one of the most popular surgical techniques of the shoulder is acromioplasty (resurfacing the lower edge of the acromion), although its correlation with clinical results is currently debatable[16]. Pain receptors have been found at the CAL, and some authors believe that it may cause external impingement[17], while others claim that the pathological changes within the CAL are secondary to chronic mechanical tension[18] and do not cause RCTs. Surgical detachment of the CAL may cause superior migration of the humeral head, and therefore it is important to try and preserve it.

Theoretically, subacromial impingement should trigger a partial tear at the subacromial tendon side; however, there are many reports on partial supraspinatus tear at its articular side[19]. This has led to the internal (or superior posterior) impingement theory in which the RC is compressed between the posterior glenoid margins and the greater tuberosity.

Several demographic factors have been implied to be correlated with RCTs. For example, it would be logical to assume higher tear rates in the dominant shoulder; still, about one-third of the patients with symptomatic tears have asymptomatic contralateral full-thickness tears, and most patients with symptomatic tears are not manual labourers[20]. Another example is the negative effect of smoking on tendon healing, which was evident after surgical repair and in animal studies[21].

The source of pain

The source of pain in rotator cuff abnormalities is still unclear. Ruptured RC does not cause pain directly since there are many asymptomatic full-thickness tears. It is generally believed that the subacromial bursa is a major source of pain and discomfort as it undergoes some friction during shoulder movement and has sensory nerve endings[22]. In addition, the pain level was found to be correlated with the subacromial bursitis. The bursa is innervated anteriorly by the suprascapular nerve and posteriorly by the lateral pectoral nerve[23]. It contains nociceptors and proprioceptors. These receptors and the presence of mechanoreceptors under the CAL imply a reflex system that coordinates the rotator cuff maintenance of humeral head position.

High levels of pain-associated proteins (e.g. substance P), inflammatory cytokines (e.g. IL1) and collagen-catabolic proteins were found in patients with shoulder impingement syndrome[24].

Diagnosis

The RC may rupture acutely due to trauma, but often the clinical presentation is gradual with progressive pain and weakness around the shoulder. Pain increases with shoulder elevation, internal rotation and at night. Shoulder strength depends on the tear size and the overall function of other intact tendons. Physical findings that are suggestive of tear are muscle atrophy, subacromial tenderness and crepitation. Strength and motion may be limited depending on the muscle involved.

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Competing interests: none declared. Conflict of interests: none declared.
All authors contributed to conception and design, manuscript preparation, read and approved the final manuscript.
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Massive tears may cause shoulder instability, and thus when trying to elevate the arm, the humeral head subluxates anteriorly. In this position, the deltoid muscle cannot efficiently abduct the arm. This clinical presentation is called pseudo-paralysis. Imaging techniques are required if an acute tear is suspected or whenever the pain does not resolve. Plain radiographs are recommended as the primary modality to rule out other pathologies such as arthritis and to observe acromial morphology with its distance from the humeral head (decreased in massive tears); however, ultrasound (US) and magnetic resonance imaging (MRI) are used to define RCTs. Studies that have compared imaging modalities to arthroscopic findings have found similar accuracy of MRI and US in detecting RCTs with sensitivity of 97% and specificity of 67%[25].

Discussion

Treatment

Despite numerous publications regarding the treatment of RCTs, the number of high-level, evidence-based studies is scarce[26]. Many studies are limited because of variations in control groups, outcome measures, short follow-ups and the ability to generalise outcomes of large referral medical centres to peripheral ones. Therefore, treatment is based on clinical experience, understanding the anatomy and management of other tendon ruptures in the body such as those of the hand.

Acute full-thickness tears

This should be repaired in up to 6 weeks from the injury, especially in relatively young and active patients; otherwise it might retract and atrophy with irreversible changes. If not repaired early, these tears may be hard to fix with bad outcome.

Partial tear

Many patients improve without surgery. Patients should be treated with exercises and stretches in order to gain range of motion. Unresolved pain may benefit from arthroscopic debridement.

Chronic full-thickness tears

Many patients improve without surgery. Conservative treatment includes modifying activities, exercises, physical therapy, analgesics and non-steroidal anti-inflammatory medications. Subacromial steroid injections temporarily relieve pain. Recurrent injections should be avoided as they may impair tendon tissue, unless surgery is not considered and prior injections have helped.

Persistent pain and dysfunction may improve with surgical repair of the torn tendon. Factors that are correlated with good outcome after repair are age under 60 years, traumatic tear, short duration of symptoms (less than 2 months), no smoking, good general health, few injections (less than 4), primary repair, stable shoulder with good range of motion, no muscle atrophy, single tendon involvement (supraspinatus) and experienced surgeon[27].

The probability for recurrent tears after repairs increases with larger tears and atrophied tendons. The rehabilitation after surgery depends on the tear size and the quality of the repair. In many cases, active range of motion is forbidden for 6 or more weeks while the overall rehabilitation time may last longer than 6 months.

Surgical repair

Rotator cuff tendon repair is one of the most common procedures performed in the shoulder[28]. During the past two decades, the traditional open approach has shifted to mini open and eventually to an all-arthroscopic minimally invasive technique[29]. Open repairs have had good results but required partial deltoid muscle detachment. All arthroscopic techniques allow the treatment of concurrent intra-articular pathologies. It requires small incisions, less soft tissue damage, no deltoid impairment and shorter postoperational pain and rehabilitation. Arthroscopic repairs have good long-term results but also have a steep learning curve.

Many studies have showed better results with non-recurrent (healed) tears after repairs. Therefore, there is much interest and recruitment of resources in order to achieve a successful repair by modifying important factors such as smoking cessation and enriching the biological environment at the tear site; however, the most dominant factor according to the literature is an anatomical stable fixation of the RCT[30].

Currently, an all-arthroscopic technique is utilised to perform anatomical anchoring of the rotator cuff to the proximal humerus. Common configurations of fixations are single or double row. Double-row fixations were found to have biomechanical advantages over single-row fixations; yet, there were no differences in clinical outcomes[30].

Conclusion

Symptoms of pain and weakness about the shoulder imply on RCT. There are typical impingement signs in physical evaluation together with limited range of motion and weakness. Plain radiography is required to rule out other pathologies and observe acromion morphology while US and MRI are used to define the tear and tendon quality before surgical intervention. The primary treatments involve activity modification, pain relief and exercises for a few months before considering surgical repair followed by prolonged rehabilitation. Acute repairs are suggested in traumatic tears in relatively young and active patients. At present, an all-arthroscopic technique is usually used to repair RCTs with good long-term results.

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Competing interests: none declared. Conflict of interests: none declared.
All authors contributed to conception and design, manuscript preparation, read and approved the final manuscript.
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