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Operative Techniques in
Orthopaedics

Open Rotator Cuff Repair

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Open rotator cuff repair remains the gold standard for addressing large, retracted rotator cuff tears. Despite advances in arthroscopic techniques, to date, there is a lack of consistent evidence that one technique is superior. We review anatomical considerations in rotator cuff tear development as well as clinical examination and useful investigations. Open approach to rotator cuff repair is used in combination with arthroscopic assessment and preparation. Indications for an open approach relate to size, mobility, and configuration of the tear. The open approach to cuff repair cannot compensate for irreparable, chronic, immobile tears. In this article, we review the technical considerations of open rotator cuff repair.
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Introduction

The aims of rotator cuff repair are to improve shoulder pain and weakness by restoring the function and overall biomechanics of the glenohumeral joint. In patients in whom nonoperative measures fail, surgical repair of the torn rotator cuff is indicated. Arthroscopic techniques of rotator cuff repair are commonly used; however, there are certain circumstances where an open technique may be required[1] to ensure adequate reduction of the tendon to the footprint, optimization of the tendon and bone interface via a transosseous technique, and adequate suture tension. Open rotator cuff repair is the traditional method of repair and is still the gold standard against which arthroscopic techniques are compared in the literature. As yet, arthroscopic techniques have not consistently shown a long-term benefit over open techniques.[2,3] In certain circumstances, we prefer to use a combined arthroscopic and open technique, with the decision to use an open technique made on the basis of intraoperative assessment, using a combination of suture anchor and transosseous technique to obtain a sound tendon repair.

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Anatomy

Specific features of shoulder anatomy are pertinent to repair of the rotator cuff. These include coracoacromial arch morphology, subacromial bursa, and the rotator cuff footprint. Coracoacromial arch morphology may influence the development of impingement symptoms and rotator cuff tears, particularly in the presence of os acromiale.[4] Multiple variations of arch morphology are recognized and are contributed by the coracoid, acromion, and coracoacromial ligaments.[5]

The anterior and humeral insertion of the supraspinatus insertion is a relative vascular watershed and may contribute to the development of cuff pathology.[6] In the development of pain and impingement symptoms in association with cuff tears, there is a relative mismatch between the strength and function of the intact deltoid muscle and the torn rotator cuff, with contributions from pectoralis major and latissimus dorsi in the biomechanical model.[7] Biomechanically anterior supraspinatus tears are more likely to be associated with greater displacement and tendon stiffness, which is thought to be related to the rotator cuff "cable."[8] Thus rotator cuff tears may progress, depending on the biomechanical forces of the muscle causing medial propagation, particularly in the anterior cable disruption,[8] though this is debated in the literature.[9] Yamaguchi et al[10,11] have shown both symptom and tear size progression over time. More recent anatomical descriptions of the cuff footprint highlight the relatively small anterior supraspinatus attachment to the greater tuberosity and the relatively large trapezoidal infraspinatus attachment, in contrast to the traditional thinking of cuff footprint anatomy.[12]

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Clinical Examination

A thorough evaluation of history and physical examination would direct the clinician to the diagnosis of rotator cuff tear and help to exclude other pathology. Numerous clinical tests have been described for the shoulder examination, and it is not the remit of this article to describe and précis all of them. Instead, we describe the examination that we routinely perform in the outpatient setting. The senior author (G.A.H.) follows the system of "look, feel, move" that was originally described by Apley.[13] The patient is observed from the front, side, and back to note any asymmetry or muscle wasting of the shoulder girdle. The shoulder girdle is palpated for the presence of pain and the insertion of supraspinatus is palpated to feel the presence of a defect. Palpation of the footprint ("rent" test) has been shown to have a sensitivity and specificity of 97% and 97%, respectively.[14] The biceps groove is palpated to detect any long head of biceps tendinitis. The remainder of the examination is performed from behind the patient. The arm is moved actively and passively through a range of motion to detect a painful arc, stiffness, or scapulothoracic dyskinesia. Resisted abduction of the arm is tested for strength and to observe any abnormal scapula motion. The rotator cuff is then tested using Jobe's test (supraspinatus),[15] Gerber's lift-off test[16] (subscapularis), and testing power against resisted external rotation (infraspinatus). For completion, a brief examination of the neck is performed to exclude the presence of referred pain from cervical nerve root impingement.

Imaging

If a rotator cuff tear is suspected clinically, various investigations can help to reach a diagnosis. Plain film radiographs of the affected shoulder are mandatory to exclude other pathology and detect the presence calcifying tendinitis, fracture, arthritis, and neoplasm. The 3 views that are mandatory in our practice are the anteroposterior through the plane of the glenohumeral joint, scapular lateral, and axillary view. The morphology of the acromium is assessed and classified according to Bigliani et al[17] to allow us to plan the extent of the acromioplasty.

To confirm the presence of a rotator cuff tear, either ultrasound (USS) or magnetic resonance imaging (MRI) can be used as they have both been shown to have similar sensitivity and specificity.[18,19] USS has been shown to have a sensitivity and specificity of 84% and 89%, respectively, for partial-thickness tears and 96% and 93%, respectively, for full-thickness tears.[18] MRI has been shown to have a sensitivity and specificity of 80% and 95%, respectively, for partial-thickness tears and 91% and 97%, respectively, for full-thickness tears.[19] In our practice, we prefer to use MRI as it allows us to evaluate the degree of fatty infiltration and muscle atrophy, as described by Goutallier et al[20] and enables us to estimate the probability of a successful repair. In addition, USS may be dependent on the skill of the technician performing the study, and hence MRI is utilized more commonly in the senior author's practice.

Indications

Rotator cuff repair is indicated in patients with a clinical evidence of a symptomatic rotator cuff tear. The treatment of asymptomatic tears is controversial, despite the natural history of rotator cuff tears slowly being established.[10,11] Current recommendations suggest 6-monthly to yearly review of asymptomatic cuff tears.[11] The decision to undertake an all-arthroscopic technique or an open technique is based on various intraoperative factors. It is the practice of the senior author (G.A.H.), that small, minimally displaced tears and unretracted tears are managed with an all-arthroscopic rotator cuff repair using a single-row, suture anchor technique. Large or significantly displaced tears are managed with an open technique to ensure adequate suture tension and reduction of the tear to the rotator cuff footprint with transosseous fixation. Large or retracted tears that are suitable for an open technique are those in which arthroscopic grasping and lateralization of the tendon produces excessive medial tension. In addition, avulsed and retracted subscapularis tears are managed with an open technique. In cases of failed rotator cuff repair and revision, we assess the cuff using the same criteria, to determine the most appropriate surgical technique. Despite the potential advantages of an open technique, it cannot compensate for poor tissue quality, inelasticity of tissue, fatty atrophy, and excessive retraction.

Surgical Technique

Position

The patient is placed in the beach-chair position at sitting upright at approximately 80°. The arm is placed in a pneumatic arm holder to position the arm intraoperatively and to assist with viewing of the rotator cuff (Figs. 1 and 2). Our usual technique of anesthesia is using interscalene local anesthetic blockade with conscious sedation[21] or a general anesthetic.

Arthroscopy

Arthroscopy is used for concurrent procedures and cuff preparation. Standard arthroscopic portals are placed (Fig. 3). The posterior portal is medial and inferior to the posterolateral corner of the acromion. The anterior portal is lateral to the coracoid and placed under direct vision. Arthroscopy is performed in the usual manner, addressing concurrent pathology: biceps tendinopathy, acromioclavicular joint pathology, and labral pathology. With regard to the rotator cuff, the cuff is assessed from the intra-articular space and also from the subacromial space. The subacromial bursa is debrided and a subacromial decompression is performed if required, as along with release of the coracoacromial ligament. The cuff tear is debrided of degenerative or friable edges and the cuff footprint is prepared, leaving cortical bone intact. The mobility of the cuff is assessed using an arthroscopic grasper. The torn cuff tendons are mobilized arthroscopically, as this is more effectively achieved through arthroscopic means by better