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Shoulder and Rotator Cuff Repair: Single vs Double Row

Michael T. Freehill, MD, Jason P. Rogers, MD, and Sandeep Mannava, MD, PhD

Rotator cuff tears are a common cause of upper extremity pain and dysfunction. The purpose of this article is to briefly review the preoperative assessment of patients with rotator cuff tears, including history, physical examination, and imaging of the shoulder. Its emphasis is to outline both the single-row and double-row arthroscopic rotator cuff repair techniques. Although there is no universally accepted best technique for arthroscopic rotator cuff repair, a surgeon's experience, patient' expectation, and technical considerations—including available equipment, tissue quality, and the size of the tear—are key to the success of the repair. At the conclusion of the article, the general principles of postoperative rehabilitation are briefly discussed.
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Introduction

Rotator cuff tears are a common cause of upper extremity pain and disability in the elderly patient population[1-4], but they can be seen with any age group. The prevalence of rotator cuff tears rises from 4% for patients aged 40 years or younger to more than 50% for those 60 years or older.[5] Rotator cuff tears account for nearly 4.5 million medical evaluations yearly in the office and emergency department setting,[2] with 250,000 rotator cuff surgeries being performed annually in the United States.[6]

Although nonoperative management—including activity modification, physical therapy, oral administration of nonsteroidal anti-inflammatory drugs, injections, and pain medication—can be successful in the treatment of some rotator cuff tears, many tears are recalcitrant to conservative management and may ultimately require surgical repair. The purpose of this article is to discuss the preoperative assessment, surgical planning, and arthroscopic surgical technique for the single- or double-row repair of rotator cuff tears.

The choice of using a single-row vs double-row technique for rotator cuff repair is dictated by surgeon experience, patient factors (such as age and chronicity of the tear), and intraoperative findings (size of tear, tissue quality, and degree of retraction). Recent clinical meta-analysis literature suggests single- and double-row repairs have equivocal clinical results[7,8]; however, some biomechanical studies suggest superior restoration of the anatomical footprint rotator cuff and better cadaveric initial load to failure with the double-row repair when compared with single-row repair.[9] Further, there are clinical meta-analyses that suggest single-row repairs have a higher re-tear rate when compared with double-row arthroscopic rotator cuff repair techniques.[7,8,10] The justification for double-row repair is based on our attempt to reconstitute the anatomical footprint dimensions of the rotator cuff, as this surgical technique may, in theory, help maximize the potential for healing. In our practice, small tears (<0.5 cm) are usually repaired using a single-row technique, medium-sized tears (1-2.5 cm) are addressed using either a single-row or a double-row technique, and large tears (>2.5 cm) are most often fixed using a double-row technique. Specifics of this decision-making process regarding single- vs double-row repair have been addressed later in the article.

History and Physical Examination

When evaluating a patient with shoulder pain, a detailed assessment of medical history is paramount. This includes the chief concern, history of present illness, hand dominance, current profession or sports participation, medical history, surgical history, family history, social history (eg, smoking),

Division of Sports Medicine and Shoulder Surgery, Wake Forest University School of Medicine, Winston-Salem, NC.
Address reprint requests to Michael T. Freehill, MD, Division of Sports Medicine and Shoulder Surgery, Wake Forest University School of Medicine, Winston-Salem, NC 27157. E-mail: freehill@wakehealth.edu

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current medications, allergies, and a complete review of systems. Previous shoulder surgery with associated operative notes should essentially be noted for preoperative planning. Particular care should be taken in elucidating whether the nature of the patient's concerns include pain, weakness, or both. To help establish realistic patient expectation, it is important to specifically ask about the types of activities the patient finds most difficult and exacerbate the symptoms (eg, overhead activity and repetitive activity). Other important pain parameters include pain at rest, what level the pain reaches on the visual analog scale at its worst, and if pain wakes the patient from sleep. A subjective shoulder value should also be obtained.[11]

A prior history of comorbid medical conditions, such as cerebrovascular events, heart failure, or need for oxygen support secondary to chronic obstructive pulmonary disease, and the use of blood thinning anticoagulative medications influence surgical planning. A previous cerebrovascular event may preclude a patient from being positioned in the beach-chair position[12] and the use of antithrombotic medication may result in increased difficulty with visualization during the arthroscopic procedure. The overall health assessment helps counsel the patient regarding their perioperative risk and ability to participate in postoperative physical therapy, as well as with estimated return to work and postoperative restrictions.

A detailed and documented shoulder examination should be performed bilaterally. The examination consists of inspection of the shoulder girdle and overlying skin with a detailed neurovascular evaluation. Range of motion is assessed both passively and actively in forward flexion, abduction, external rotation, and internal rotation up the posterior thorax. Muscle strength is assessed using Jobe's test[13] and external rotation against resistance. The subscapularis is assessed with 3 tests: the belly press, bear hug, and lift off. These tests are performed using manual grading or dynamometer. Testing for external and internal impingement is also carried out with Hawkins and Kennedy[14] and Neer[15] provocative maneuvers, as is the assessment of lag signs at 0° and 90° of abduction.

In addition, to the evaluation of history and physical examination, we also prefer to track our patient outcomes using validated shoulder metrics. A patient can be given a validated outcomes metric quantifying their improvement after surgical intervention. Some of the shoulder-specific outcome metrics that can be used are the American Shoulder and Elbow Score, Disabilities of the Arm, Shoulder, and Hand Questionnaire, Western Ontario Rotator Cuff Score, and Simple Shoulder Test.[16]

Radiographic Evaluation

Radiological evaluation of the shoulder is valuable for both diagnosis and preoperative planning purposes. We routinely obtain a plain film radiographic series including anterior-posterior or Grashey (taken in the plane of the scapula); internal rotation or external rotation; scapular-y; and axillary views on each patient. Roughening or osseous changes at the greater tuberosity or superior migration of the humeral head can be indicative of a repairable rotator cuff tear vs a massive irreparable tear. Advanced imaging most often consists of magnetic resonance imaging (MRI). An MR arthrogram and contrasted studies are not routinely used for rotator cuff assessment and often reserved for tumor or infection assessment and for select overhead athletes. Computer tomography (CT) arthrogram is most useful in those who are precluded from undergoing MRI assessment (eg, previous metal anchors in the humeral head, heart pacemaker, or shrapnel injury). Ultrasound is another modality with which the shoulder can be evaluated, both statically and dynamically. The downside of ultrasound is the operator dependence,[17] and it is an imaging modality that generally provides a more limited assessment of the entire shoulder.

All osseous structures of the shoulder joint (glenohumeral joint, acromioclavicular joint, and acromial shape) are assessed using plain film radiographs. Advanced imaging allows evaluation of the rotator cuff, labrum, long head of the biceps tendon, joint capsule, and glenohumeral ligaments. The presence and location of cysts are determined. Detailed evaluation of the rotator cuff includes the presence of a tear. Coronal, sagittal, and axial views are the best for assessing rotator cuff pathology. Tearing can occur in full-thickness or partial-thickness patterns; and partial tears can be further classified as articular sided or bursal sided. The size of the tendon tear is generally related to the width. Massive tears are defined as full-thickness rotator cuff tears of 2 or more rotator cuff tendons. Tear size is somewhat subjective, but for the purposes of this article, the authors define a small tear as <1 cm, a medium tear as 1-3 cm, and a large tear as >3 cm. Sagittal views are critical in determining atrophy and fatty infiltration, as originally described by Goutallier et al.[18] on computer tomography scan and later modified by Fuchs et al.[19] on MRI. All radiographic views and correlation to physical examination findings allows for appropriate preoperative planning for repair. In all, rotator cuff tears can be classified based on the various criteria listed previously and amount of tendinous retraction, it is thought that various characteristics of the rotator cuff tear may be correlated with repair outcome—with poorer outcomes associated with chronic, full-thickness, retracted tears with a high grade of fatty infiltration and atrophy.[20-23]

Arthroscopic Rotator Cuff Surgical Technique

Patient Positioning and Operating Room Setup

Endotracheal or anesthesia via laryngeal mask airway is administered. The patient is positioned in the beach-chair or lateral decubitus position. An advantage of the lateral positioning is the relatively fast setup time and the reduced risk for cerebrovascular events during times of hypotensive anesthesia; in general, lateral positioning may be better tolerated in certain elderly patients with medical comorbidities. All things being equal, positioning is a surgeon-dependent decision. When