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Rotator cuff tendon surgery and postoperative therapy

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Introduction

Rotator cuff tear is a prevalent problem in the aging population and is the most common tendon injury in the adult population.[1] Tears can be categorized based on their size (in the anteroposterior plane), the amount of retraction (in the mediolateral plane), their chronicity (acute or chronic), and their thickness (partial or full thickness).[2] A partial thickness rotator cuff tear will involve fraying of the bursal side of the tendon or more commonly the articular side of the tendon, while preserving continuity in the lateral attachment on the greater tuberosity. It has been shown that the size of a full thickness tear can influence the loss of strength of the patient.[3] Many full thickness tears will increase in size if not repaired, but the clinical implications of this remain unclear.[4] In our experience, the chronicity of the tear and the amount of retraction might render the surgical repair impossible or overtensioned. Massive rotator cuff tears have had many definitions over the years, but the 2 most frequently cited are tears over 5 cm and tears involving more than 1 tendon.[5-7]

Pathology of the rotator cuff can be a consequence of tendon degeneration resulting from microtrauma (repetitive motion and/or overload) or acute injury such as a fall.[8-10] Extrinsic compression of the rotator cuff by the acromion has been the most widely accepted cause of rotator cuff disease, but this is now being disputed since most degenerative cuff disease is observed on the articular rather than the bursal tendon surface.[11,12] Acute injury to the rotator cuff tendons occurs more commonly in younger patients and results from a fall on the outstretched hand with the shoulder in external rotation and abduction.[13]

The presence of a rotator cuff tear does not always warrant treatment. In fact, the prevalence of rotator cuff tears in asymptomatic populations ranges from 10% to 39% [14-25] and increases with advancing age.[26] When individuals develop symptomatic rotator cuff disease, rehabilitation interventions have been shown to be effective for a spectrum of rotator cuff pathologies, including full thickness tendon defects.[21] Notwithstanding the effectiveness of rehabilitation intervention as a primary method of management, a minority of patients still require rotator cuff surgery when a course of nonoperative treatment does not provide symptom relief.[27,28] The purpose of this article was to provide a clinical commentary on the management of this subset of patients. We will discuss the main types of rotator cuff repair and the factors that affect clinical decision-making for therapists after surgical intervention for rotator cuff disease. These factors include the type of surgery, characteristics of the tear including chronicity and location, tension on the repair, amount of medial retraction, and patient factors.

Rotator cuff surgery

Recent studies have demonstrated a significant rise in the number of procedures performed and a transition from open repair to arthroscopic repair. Colvin et al reported that the rate of surgery for all types of rotator cuff repairs increased from 41 per 100,000 capita to 98 per 100,000 capita between 1996 and 2006. During this same period, arthroscopic repair increased by 600%, whereas open repair increased by 34%.[29] Indications for surgery include unsuccessful nonoperative treatment or large acute tears in younger patients.[30]

Open rotator cuff repairs

An open rotator cuff repair consists of a 3- to 6-cm incision made over the anterior-superior aspect of the shoulder parallel to a line drawn to the lateral border of the acromion (Fig. 1). The origin of the anterior deltoid muscle is then carefully detached from the acromion at the acromioclavicular joint and split longitudinally to improve exposure. The bursa is incised and the rotator cuff defect is mobilized and reattached to the greater tuberosity with transosseous sutures. At the end of the surgery, the deltoid muscle is reattached to the anterior acromion and the longitudinal split is repaired.[31]

The mini-open rotator cuff repair technique was developed to decrease the risk of iatrogenic injury to the deltoid muscle and coincided with advances in shoulder arthroscopy.[32] The mini-open repair consists of a diagnostic arthroscopic examination of the shoulder joint, mobilization of the damaged tendon, and preparation

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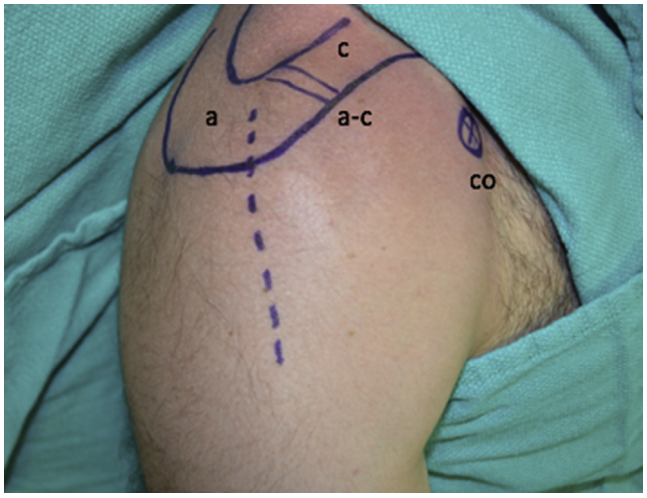

Fig. 1. Preoperative markings of anatomic landmarks of the right shoulder (a: acromion, c: clavicle, a-c: acromio-clavicular joint, and co: tip of the coracoid) and incision for a mini-open rotator cuff repair (*dashed line*).

of the repair site.[31-34] After completion of the arthroscopic portion of the procedure, the anterolateral portal is extended 2 cm to facilitate longitudinal splitting of the deltoid muscle without detaching the deltoid from the acromion[31,33,35] (Fig. 2). The open and mini-open techniques have declined in popularity and have been steadily replaced by arthroscopic repair techniques.[29,36] Despite this trend, several authors have reported good-to-excellent clinical outcomes with open and mini-open techniques.[37-42] Systematic reviews have demonstrated similar outcomes comparing open to arthroscopic repairs,[43] and with the smaller incision, most surgeons are using the arthroscopic approach. We do not modify the rehabilitation protocol based on the surgical techniques: open, mini-open, or all arthroscopic surgery. We are not concerned about the partial deltoid detachment considering we are applying a delayed active motion protocol, described later in this manuscript.

Arthroscopic rotator cuff repairs

With the use of an arthroscope, visualization of a full thickness tear is reliable, and mobilization of the ruptured tendon can be

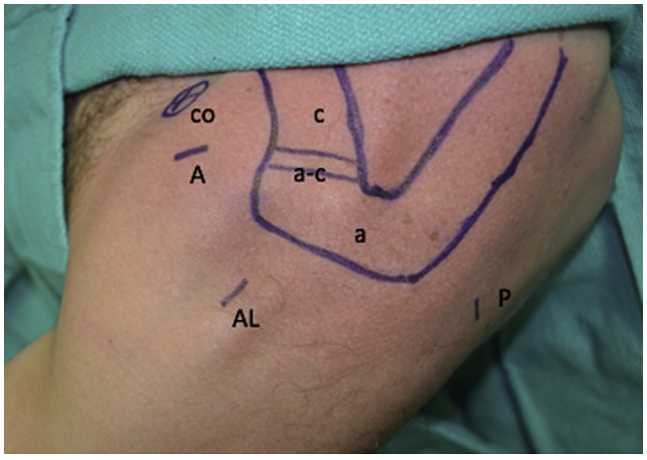

Fig. 2. Preoperative markings of anatomic landmarks of the right shoulder (a: acromion, c: clavicle, a-c: acromio-clavicular joint, and co: coracoid) and an example of incisions for an arthroscopic rotator cuff repair (A: anterior portal, AL: antero-lateral portal, and P: posterior portal).

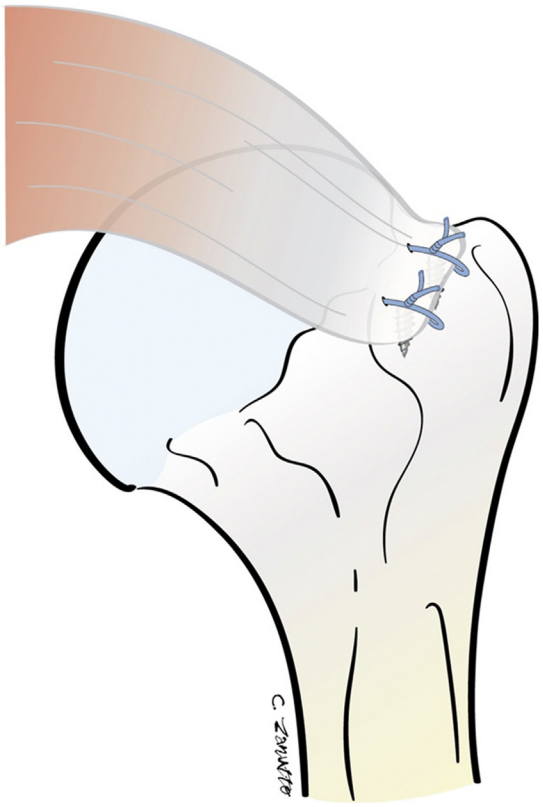

Fig. 3. Drawing of a proximal humerus with a repaired supraspinatus tendon on the footprint of the greater tuberosity using a single row construct.

easily evaluated to choose the optimal type of repair. Full thickness defects of the rotator cuff are usually repaired with a single- or double-row repair. (Figs. 3 and 4) There are no clear recommendations to guide surgical decision-making, and the technical experience of the surgeon, proximal humerus bone quality, tendon quality, defect size and defect configuration are factors to consider when selecting a repair technique. The single-row repair places a row of suture anchors in the mid-to-lateral portion of the greater tuberosity rotator cuff footprint.[44] The double-row repair technique augments the single-row repair with a second medial row of anchors placed adjacent to the articular margin. Clinical trials generally report higher healing rates with a double-row repair technique,[45-49] but the outcomes related to pain reduction, strength improvement, functional scores, and patient satisfaction between the 2 procedures are similar.[45-47,49-54] The use of one construct or another does not change our approach to the post-operative rehabilitation. The primary goal was to obtain sufficient clinical strength on the repair when tested during surgery. As mentioned, clinical trials have yet to prove that a stronger construct would permit faster rehabilitation.

The arthroscope is also a great tool to evaluate a partial defect in rotator cuff tendons. The residual thickness of the tendon is not always easy to assess preoperatively, and we tend to evaluate it intraoperatively by palpating and probing the tendon; only then, we decide on which technique to use to repair the partial tear. Two arthroscopic surgical techniques have been described to repair partial thickness rotator cuff defects.[55] The first technique involves creation of a full thickness defect from the partial defect. This technique requires elevation of the partial tendon defect followed by a formal repair of the iatrogenic full thickness defect using standard repair techniques. This technique provides excellent