

Original Article With Video Illustration

Arthroscopic Partial Repair of Irreparable Large to Massive Rotator Cuff Tears

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Purpose: The aim of this study was to evaluate the outcome of arthroscopic partial repair and margin convergence of irreparable large to massive rotator cuff tears. **Methods:** Between January 2003 and July 2008, 27 patients who met the inclusion criteria underwent arthroscopic partial repair and margin convergence of irreparable large to massive rotator cuff tears. An irreparable tear was defined as a tear with a minimum anterior-to-posterior width of 3 cm or larger, where it was not feasible to completely cover the humeral head with the cuff at the time of surgery. **Results:** The mean preoperative tear size was 42.1 ± 6.2 mm. The mean size of the postoperative residual defect in the repaired tendon along the medial margin of the greater tuberosity was 12.0 ± 5.5 mm. All shoulder scores showed improvement. The Simple Shoulder Test improved from 5.1 ± 1.2 to 8.8 ± 2.1 ($P < .001$), the Constant score from 43.6 ± 7.9 to 74.1 ± 10.6 ($P < .001$), and the University of California, Los Angeles score from 10.5 ± 3.0 to 25.9 ± 5.0 ($P < .001$). Both Constant and University of California, Los Angeles shoulder scores also showed an inverse correlation with defect size. We compared muscle strength between the affected and contralateral sides and found that the strength of the affected side was not restored to the same level as the contralateral side ($P < .001$). **Conclusions:** Arthroscopic partial repair and margin convergence showed satisfactory short-term outcomes in irreparable large to massive rotator cuff tears. Thus it is suggested that, even in a large to massive tear that appears irreparable, attempting to repair it as much as possible to possibly convert it into a functional rotator cuff tear by re-creating a balanced forced couple can be helpful in reducing pain, as well as improving functional outcomes. **Level of Evidence:** Level IV, therapeutic case series.

Despite remarkable advances in arthroscopic rotator cuff repair over the past few decades, arthroscopic repair of large to massive rotator cuff tears

is still challenging, especially in cases of inelastic and severely retracted torn tendons due to muscle atrophy, fatty degeneration, and adhesion. Although mobilization of the torn tendon can be obtained through the release of adhesion and the interval slide technique,¹ poor tissue quality sometimes precludes complete reattachment of the torn tendon to its anatomic footprint and leaves a residual defect in the cuff.

There are several treatment options for irreparable large to massive rotator cuff tears²⁻¹⁰: partial repair, simple debridement, tendon transfer, and biologic augmentation. One should select the most appropriate option by taking into consideration the patient's age, degree of comorbidities, level of activity, and physical demand. In elderly patients with low physical demands, a simple debridement may be indicated. In selected younger patients, tendon transfer may be feasible. The use of biologic augmentation such as tissue-engineered matrix or allograft patch has shown fair to

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poor clinical results. Partial or incomplete repair also seems to have less favorable outcomes than complete repair. However, Burkhart¹¹ introduced the concept of “functional rotator cuff tear” and the biomechanical rationale of the “suspension bridge system.” Thus partial rotator cuff repair attempts to re-create the transverse force couple of the rotator cuff and provide a stable fulcrum for the glenohumeral joint. Despite this concept, there have been a few studies regarding partial or incomplete arthroscopic repair of large to massive rotator cuff tear and its results.^{2,3,11}

The aim of our study was to evaluate the outcome of arthroscopic partial repair of irreparable large to massive rotator cuff tears. We hypothesized that although overall functional outcomes would improve after surgery, muscle strength would not be restored to the same level as the contralateral shoulder.

METHODS

Study Population and Demographics

Between January 2003 and July 2008, 37 patients underwent arthroscopic partial repair and margin convergence of irreparable large to massive rotator cuff tears and their medical reports including radiologic findings were reviewed retrospectively. An irreparable tear was defined as a tear with a minimum anterior-to-posterior width of 3 cm or larger, where it was not feasible to completely cover the humeral head with the cuff at the time of surgery. Of the patients in the initial study population, 27 met the inclusion criteria. The inclusion criteria were (1) irreparable large to massive rotator cuff tear (≥ 3 cm in diameter) accompanied by pain and functional disability refractory to conservative treatment; (2) arthroscopic partial rotator cuff repair (failed attempt to completely cover the humeral head with the cuff, leaving the defect in the repaired rotator cuff); and (3) available for a minimum 2-year follow-up after surgery. Ten patients were excluded according to the exclusion criteria, which were (1) a subscapularis tear requiring repair; (2) near complete fatty replacement of the supraspinatus, infraspinatus, and teres minor tendon; (3) prior surgery on the affected shoulder; (4) moderate to severe rotator cuff arthropathy (Hamada classification III, IV, or V)¹²; (5) existing shoulder pain on the contralateral side; and (6) Workers' Compensation claim. The mean patient age at the time of the operation was 62.3 years (range, 54 to 72 years), and the mean follow-up period was 41.3 months (range, 36 to 52 months). Approval for this study was obtained from our institutional review

board, and informed consent was obtained from all patients.

Surgical Procedure and Postoperative Rehabilitation

Under general anesthesia, all patients underwent arthroscopic rotator cuff repair in the lateral decubitus position with 10 lb of longitudinal traction. Typically, the senior author used 4 routine portals: posterior, lateral, posterolateral, and anterior portal. If necessary, additional portals were created to obtain an optimal insertion angle of the anchors, as well as to appropriately release adhesion. By use of the posterolateral or lateral portal as a viewing portal, the status and mobility of the retracted torn tendon were evaluated (Video 1, available at www.arthroscopyjournal.org). After release of adhesions and mobilization of the tendon, it still could not be completely advanced to the greater tuberosity. The surgeon tried to repair it as well as possible and converge the margins to help restore the transverse force couple and reduce the size of the tear (Fig 1). A single-row repair was performed with insertion of the suture anchors within the footprint of the greater tuberosity or less than 1 cm medial to the junction between the articular cartilage and greater tuberosity. After the partial repair and margin convergence had been performed, the residual defect was measured along the junction between the articular cartilage and greater tuberosity. Arthroscopic acromioplasty was performed limited to the impingement site, with preservation of the coracoacromial ligament as much as possible (Fig 2).

With regard to coexisting lesions of the long head of the biceps or SLAP lesions, unless the SLAP lesion had severe degeneration in the superior labrum or long head of the biceps, arthroscopic SLAP repair was performed with suture anchors. In the case of a lesion of the long head of the biceps, if the lesion involved more than one-fourth of the tendon or was subluxated or dislocated, tenotomy was performed in patients aged older than 60 years and tenodesis in patients aged younger than 60 years. If the biceps lesion involved less than one-fourth of the tendon, a simple debridement was performed.

After the operation, the shoulder was kept in an abduction brace for 6 weeks. Every 4 hours, the patient was encouraged to remove the brace and to perform pendulum exercises, starting the day after surgery. Self-assisted passive range-of-motion exercise as tolerated was begun at 4 to 5 weeks postoper-

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