Single-Row Versus Double-Row Arthroscopic Rotator Cuff Repair: A Prospective Randomized Clinical Study

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Purpose: The purpose of this study was to compare the clinical outcome of arthroscopic rotator cuff repair with single-row and double-row techniques. **Methods:** Eighty patients with a full-thickness rotator cuff tear underwent arthroscopic repair with suture anchors. They were divided into 2 groups of 40 patients according to repair technique: single row (group 1) or double row (group 2). Results were evaluated by use of the Disabilities of the Arm, Shoulder and Hand (DASH) and Work-DASH self-administered questionnaires, normalized Constant score, and muscle strength measurement. On analyzing the results at a 2-year follow-up, we considered the following independent variables: baseline scores; age; gender; dominance; location, shape, and area of cuff tear; tendon retraction; fatty degeneration; treatment of biceps tendon; and rotator cuff repair technique (anchors or anchors and side to side). Univariate and multivariate statistical analyses were performed to determine which variables were independently associated with the outcome. Significance was set at $P < .05$. **Results:** Of the patients, 8 (10%) were lost to follow-up. Comparison between groups did not show significant differences for each variable considered. Overall, according to the results, the mean DASH scores were 15.4 ± 15.6 points in group 1 and 12.7 ± 10.1 points in group 2; the mean Work-DASH scores were 16.0 ± 22.0 points and 9.6 ± 13.3 points, respectively; and the mean Constant scores were 100.5 ± 17.8 points and 104.9 ± 21.8 points, respectively. Muscle strength was 12.7 ± 5.7 lb in group 1 and 12.9 ± 7.0 lb in group 2. Univariate and multivariate analysis showed that only age, gender, and baseline strength significantly and independently influenced the outcome. Differences between groups 1 and 2 were not significant. **Conclusions:** At short-term follow-up, arthroscopic rotator cuff repair with the double-row technique showed no significant difference in clinical outcome compared with single-row repair. **Level of Evidence:** Level I, high-quality randomized controlled trial with no statistically significant differences but narrow confidence intervals. **Key Words:** Rotator cuff repair—Arthroscopy—Double row—Clinical outcome.

Arthroscopic repair of rotator cuff tears is a common surgical procedure. Better surgical techniques and improved materials and instrumentation provided clinical results similar to those reported with open techniques, with less morbidity.[1,2] Nevertheless, the potential for recurrence of a rotator cuff tear is very high and worrisome. Imaging studies have reported recurrence rates with arthroscopic rotator cuff repair varying from 30% to 94%, with especially high recurrence rates for massive tears and older patients.[3,4] One of the most important limits of arthroscopic rotator cuff repair has been related to the use of suture anchors in a single-row fashion, which partially reproduces the native tendon-to-bone insertion.[5] For this reason, surgical procedures for restoring the original tendon footprint of the rotator cuff were recently developed, based on a double-row fixation technique.[6,7] Since the first reports of these techniques, many au-

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thors have analyzed the mechanical properties of double-row rotator cuff repair, showing a greater tendon-to-bone contact area and fixation strength than with standard single-row repair.[8-14] However, most of these studies were performed on cadaveric or animal models, and they did not investigate the effects of restoration of the tendon footprint on the clinical outcome of rotator cuff repair. Some clinical studies reported very low percentages of structural failure after double-row rotator cuff repair[15-19]; however, there is poor evidence in the literature on the advantages of this technique in comparison with standard single-row repair.[20-23] The purpose of this study was to compare the clinical outcome of single-row and double-row arthroscopic rotator cuff repair. The null hypothesis of the study was that there is no association between surgical procedure and outcome variables. The alternative hypothesis (2-sided) was that the association between surgical procedure and outcomes is significant.

METHODS

For this study, we enlisted 80 patients with a full-thickness rotator cuff tear who accepted our invitation to enter the study and who signed an agreement disclosure form. In all cases the lesion was diagnosed preoperatively with a magnetic resonance imaging (MRI) study of the affected shoulder. Inclusion criteria for the study group were patients with a repairable full-thickness tear of the supraspinatus or the posterior-superior rotator cuff. Patients with rotator interval involvement or biceps pathology were also included. We excluded patients with a partial-thickness or irreparable full-thickness tear, extension of the tear to the subscapularis tendon, an isolated subscapularis tear, labral pathology amenable to surgical repair, degenerative arthritis of the glenohumeral joint, symptomatic arthritis of the acromioclavicular joint, rotator cuff arthropathy, previous surgery on the same shoulder, or Workers' Compensation claims.

We confirmed patient inclusion at the time of arthroscopy, after verifying that the tear pattern matched the inclusion criteria. Patients were divided into 2 groups including 40 cases each, according to the repair arrangement used. In group 1 arthroscopic rotator cuff repair was performed with a single-row repair technique; in group 2 we used a double-row technique. Patients were randomly assigned to 1 of the 2 groups. Randomization was performed with statistical software (SPSS, version 10.1.3; SPSS, Chicago, IL) through a random selection of 50% of the cases. The randomization list was kept by an independent researcher (not involved in the study), and the assignment code of each patient to 1 of the 2 groups was revealed to the surgeon at the time of surgery. All the operations were performed in a standardized manner by 2 surgeons (A.G. and G.M.), using the same randomization list.

During surgery, we documented the pattern of rotator cuff tear, according to the following criteria: location, shape, size, and retraction. The location of the tear was classified into 6 segments, according to Patte,[24] as follows: 1, subscapularis; 2, rotator interval; 3, supraspinatus; 4, supraspinatus and part of infraspinatus; 5, supraspinatus and infraspinatus; and 6, massive rupture (extending to subscapularis). The tear shape was classified as crescent shaped, L shaped, inverse L shaped, V shaped, or U shaped. The area was calculated by measuring anterior-to-posterior diameter tear width (base) and medial-to-lateral width (height), expressed in millimeters, and applying the right formula according to the shape of the tear. Retraction was graded according to Patte (1, not retracted; 2, retracted to humeral head; or 3, retracted to glenoid). Fatty degeneration of rotator cuff muscles was documented on MRI and classified according to Fuchs et al.[25] (grade 0, no fatty infiltration; grade 1, some fatty streaks; grade 2, more muscle than fat; grade 3, as much muscle as fat; or grade 4, less muscle than fat).

Surgical Technique

After induction of regional anesthesia by interscalene block, the patient was assessed in the beach-chair position. The operated limb was held by use of a Star Sleeve (Arthrex, Naples, FL) with 3 kg of traction. Diagnostic arthroscopy was performed in a conventional fashion by use of a 30° arthroscope and standard portals with an arthroscopic pump at 50 mm Hg of inflow pressure. After debridement of the tear edges, the greater tuberosity was decorticated with a motorized shaver. The rotator cuff was repaired with 2 different techniques, according to tear pattern. We used a tendon-to-bone repair technique with suture anchors in crescent-shaped tears. In more retracted and larger tears, we used a combined technique consisting of tendon-to-bone repair with suture anchors and side-to-side repair with No. 2 polyester braided sutures. In all cases we used 5.0-mm metal suture anchors (Corkscrew; Arthrex) double loaded with No. 2 FiberWire (Arthrex).

For single-row repair, the anchors were placed at the articular margin of the superior face of the humeral head. The number of anchors varied from 1 to 4 according to the size of the cuff tear. Each suture was passed through the tendon approximately 15 mm medial to the tear margin and tied in a simple configu-