The Clinical Outcomes and Their Associated Factors in Staged Bilateral Arthroscopic Rotator Cuff Repair

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Purpose: To compare perioperative characteristics and postoperative outcomes of both shoulders in patients who underwent arthroscopic bilateral rotator cuff repair sequentially and to assess the associated factors that would affect the anatomic healing in staged bilateral rotator cuff repair. **Methods:** The study enrolled 64 patients who underwent bilateral rotator cuff repair with follow-up imaging at least 12 months postoperatively. We allocated the shoulders operated on first to the surgery I group and those operated on second to the surgery II group. Visual analog scale (VAS) pain and satisfaction scores, range of motion, the American Shoulder and Elbow Surgeons score, the Simple Shoulder Test score, and healing failure were evaluated. **Results:** Range of motion improved with no significant between-group differences (all $P > .05$). In the surgery II group, VAS pain and VAS satisfaction scores were significantly worse at 6 months postoperatively ($P = .048$ and $P = .041$, respectively) but were comparable at final follow-up ($P = .598$ and $P = .065$, respectively). American Shoulder and Elbow Surgeons and Simple Shoulder Test scores at 6 months were worse in the surgery II group ($P = .038$ and $P = .048$, respectively) but similar at final follow-up ($P = .786$ and $P = .087$, respectively). Tear size was similar between the 2 surgical procedures ($\kappa = 0.537$, $P < .001$). Of the 11 patients with nonhealing in the surgery I group, 7 (63.6%) had subsequent failure in the other shoulder, and if one shoulder had healing failure, the other shoulder had a high possibility of healing failure as well ($\kappa = 0.373$, $P = .004$). **Conclusions:** Bilateral arthroscopic rotator cuff repair showed good outcomes at final follow-up on both sides. Tear size was closely related in both shoulders, and healing failure after the first rotator cuff repair was an associated factor with healing failure after the second operation. **Level of Evidence:** Level IV, case series.

With the increasing elderly population and incidence of rotator cuff tears, a growing number of patients undergo rotator cuff repair on both shoulders.[1] Tempelhof et al.[1] reported that 31% of patients aged 70 to 79 years and 51% of patients older than 80 years had rotator cuff tears in asymptomatic shoulders. Furthermore, Yamaguchi et al.[2] reported that 35% of patients with symptomatic rotator cuff tears had full-thickness tears on the contralateral side. They recommended that surgeons should examine the opposite shoulder to detect hidden rotator cuff tears that can be enlarged silently.[2]

However, few studies have evaluated the functional outcomes of bilateral rotator cuff repair.[3-5] In 1999 and 2000, Ogawa et al.[6] and Asami et al.,[7] respectively, reported on patients with bilateral rotator cuff tears but did not describe detailed functional outcomes or anatomic healing. Moreover, 1 study reported that patients who underwent staged bilateral rotator cuff repair had similarly good clinical outcomes with excellent healing rates in both shoulders.[3] However, the study focused solely on functional outcomes without assessing related factors that affect their anatomic healing.[3] To achieve a better outcome, it is necessary to assess the incidence of rotator cuff tears on both sides, as well as to gain better knowledge regarding prognostic factors.

The purpose of this study was to compare perioperative characteristics and postoperative outcomes of both shoulders in patients who underwent arthroscopic

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bilateral rotator cuff repair sequentially and to assess the associated factors that would affect the anatomic healing in staged bilateral rotator cuff repair. We hypothesized that the first and second operations would have similar outcomes at the final follow-up after surgery and assumed that patients would have similar healing failure of the rotator cuff in both shoulders.

Methods

Patient Enrollment

Prospectively collected data from 2,580 primary rotator cuff repairs performed by a single surgeon (S.M.R.) between October 2003 and January 2015 were retrospectively reviewed. Data collection and all protocols were approved by the institutional review board of the senior author's (J.H.O.) institution (Seoul National University Bundang Hospital Institutional Review Board No. B-1708/417-102). Among these cases, 99 of 2,481 total patients (4%) underwent bilateral rotator cuff repair (198 shoulders). Fifteen patients had trauma in their shoulder at the first operation, and 10 had trauma at the second operation. Six patients had a trauma history in both shoulders before surgery. Only those with symptoms in the contralateral shoulder underwent radiologic evaluation and underwent the operation. Of the 99 patients, 34 had symptoms present in both shoulders at the time of the first operation, and the remaining 65 patients had pain in their contralateral shoulder during the recovery period after the first operation. The more symptomatic shoulder was operated on first, and if symptoms were comparable in both shoulders, surgery was performed on the dominant arm first. We excluded 35 patients for the following reasons: less than 1 year of follow-up in both shoulders (n = 26), patients had a surgical interval of less than 1 year between the 2 surgical procedures and underwent reoperation because of retears less than 1 year postoperatively after the first operation owing to their possible effect on outcomes or rehabilitation of the contralateral shoulder after the second operation (n = 3), osteoarthritis (n = 1), rheumatoid arthritis (n = 1), avascular necrosis (n = 1), partial repair (n = 2), and open repair (n = 1). Finally, 64 patients who returned for evaluation at least 25 months after the second operation and underwent magnetic resonance imaging (MRI), computed tomography arthrography (CTA), or ultrasonography (USG) at least 12 months after the operations on both shoulders were evaluated. Six patients had trauma in their shoulder at the first operation, and 5 had trauma at the second operation. Two patients had a trauma history in both shoulders before surgery. Of the 64 patients, 17 had symptoms present in both shoulders at the time of the first operation, and the remaining 47 patients had pain in their contralateral shoulder during the recovery period after the first operation.

Intraoperative tear size and concomitant lesions, including subscapularis (SSC) tears, acromioclavicular joint arthritis, SLAP lesions, and biceps lesions, were also evaluated. We allocated the shoulders operated on first to the surgery I group and those operated on second to the surgery II group. According to a previous study that reported a minimal clinically important difference (MCID) of 6.4 for the American Shoulder and Elbow Surgeons (ASES) score,[8] power analysis using an equivalence test of means using two 1-sided tests on data from a paired design showed that the minimum sample size required was 30 patients to show no difference in ASES score in paired data with statistical power of 0.80 ($\alpha = 5\%$).

Surgical Techniques and Rehabilitation

All arthroscopic procedures were performed by a senior surgeon (J.H.O.) with patients in the lateral decubitus position under general anesthesia. After assessment of intra-articular lesions using the posterior portal as the viewing portal, the arthroscope was inserted into the subacromial space and subacromial decompression and acromioplasty were performed if the patient had any evidence of subacromial or outlet impingement. After removal of inflamed bursal tissues and adhesions, debridement was performed at the edge of the torn cuff, and the anteroposterior size and retraction of the tear were measured with a calibrated probe. The bleeding surface of bone was prepared to enhance bone-to-tendon healing. Typically, a double-row suture-bridge technique was performed as the standard procedure for rotator cuff repair. A modified Mason-Allen suture technique was performed if patients had small rotator cuff tears (<1 cm), and a single-row repair was performed in patients who had large to massive tears (>3 cm). Postoperatively, shoulders were immobilized for 4 to 6 weeks depending on tear size. Shrugging of both shoulders, active elbow flexion-extension, active forearm supination-pronation, and active hand and wrist motion were encouraged immediately after surgery. Early passive range-of-motion (ROM) exercise was recommended for patients who had preoperative stiffness, diabetes, or calcific tendinitis during the brace-wearing period. After weaning from the abduction brace, active and active-assisted shoulder ROM exercises were conducted for the next 5 to 6 weeks. If patients achieved satisfactory shoulder ROM, muscle-strengthening exercise was started 9 to 12 weeks after surgery. Athletic activities were allowed 6 months postoperatively.

Outcome Assessment

Preoperative baseline pain was assessed on a visual analog scale (VAS) from 0 to 10. Patients were also