

Rotator cuff tears: functional outcomes of open surgery

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Research article

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Abstract

Background: The aim of the present study was to evaluate the clinical and radiological outcomes of the patients who underwent open surgical repair with the diagnosis of rotator cuff rupture.

Methods: Twenty-eight rotator cuff tear patients refractory to conservative treatment and underwent open rotator cuff repair between April 2012 and April 2017 were retrospectively included in the study. Patients were assessed radiologically and clinically before and after surgery. Patients' age, gender, duration of complaints, the type of the rupture, the data obtained during operation (rupture size, shape, affected tendon, the presence of retraction if any), postoperative complications were recorded. Functional assessments of the patients were performed at 6th and 12th months preoperatively and postoperatively with objective assessments using Constant and UCLA scoring. All patients' operated shoulders were evaluated with MRI during their recent follow-up.

Results: The mean postoperative follow-up period of the patients was 30.4 (range: 13-72) months. Preoperative and postoperative mean UCLA scores of the patients were 10.85 ± 1.89 , and 28.8 ± 3.34 , respectively ($p < 0.001$). Pre-, and postoperative average Constant scores were 38.1 (range, 7.0 to 56.0), and 72.4 (range, 52.0 to 98.0), respectively ($p < 0.001$). Rotator cuff continuity was assessed in shoulder MRIs obtained during recent follow-ups of patients, and four recurrent tears were observed. Correlation tests revealed that tear size observed during surgery showed a significant ($p = 0.002$) and a weakly negative ($r = -0.468$) correlation with preoperative Constant scores, and a significant ($p = 0.0001$) and moderately negative ($r = -0.645$) relationship with postoperative Constant scores. UCLA and Constant functional outcomes were worse in patients over 60 years of age, than younger patients and recurrent tears were more often observed in the elderly population. A significant relationship was revealed between the age of the patients and tendon healing ($p < 0.05$).

Conclusion: The results of this study suggest that open repair is a reasonable and successful treatment option in patients with rotator cuff tears. Overall satisfactory clinical outcomes could be achieved.

Background

The third most common cause of shoulder pain after waist and knee pains of the musculoskeletal system is shoulder pain [1]. The most common causes of shoulder pain are diseases caused by rotator cuff pathologies. Most daily life activities require normal shoulder joint range of motion. A robust rotator cuff is also required for normal shoulder movements. The rotator cuff muscles and extrinsic shoulder muscles are situated in a special rotational motion around the shoulder. There is a balance in itself, and this balance is broken by tears. Although the mechanism of the rotator cuff tears in the shoulder is not fully explained, generally accepted theories involve the development of ruptures after acute trauma or recurrent chronic traumas [2].

The incidence of asymptomatic ruptures is reported to be 22–23%, although the incidence of full-thickness rotator cuff tear increases with the age of 50 years. The incidence of tears is increasing even

further in each decade after the age of 50 [2, 3]. Rotator cuff tear can be seen in young people and athletes, although its incidence increases with age, and the form of ruptures can vary from full tear to partial tear.

Treatment of patients with rotator cuff tears should be planned based on the age of the patient, the onset and severity of the complaints, the patient's expectancy, lifestyle and many other factors. The goal in rotator cuff repair is to repair the rotator cuff tendons to the proximal humerus and to decompress the subacromial area without damaging the coracoacromial arch. The reparability of tears generally depends on the severity and chronicity of the tears. There is no strong evidence to support the superiority of arthroscopy or open surgery for repair [4].

Our study aims to evaluate the clinical and radiological outcomes of the patients who underwent open surgical repair with the diagnosis of rotator cuff rupture.

Methods

Study design

Twenty-eight patients with rotator cuff tears refractory to conservative treatment and underwent open rotator cuff repair between April 2012 and April 2017 were retrospectively included in the study. Approval of the local institutional review board was obtained. Necessary permission was obtained in using the hospital records of the patients.

All patients were diagnosed based on physical examination and observation of rupture in magnetic resonance imaging (MRI). Rotator cuff tears were on one shoulder in all patients. No additional shoulder pathology was detected in MRI of the patients. Conservative treatment and physiotherapy were applied to all of the patients for an average of 4 months, and the patient's surgical decision was made on the fact that these treatments were not beneficial. All patients were operated under general anesthesia and in the sunbed position. After surgery, all patients were treated with 30° padded shoulder arms. Passive shoulder elevation and isometric exercises of deltoid muscle were initiated in addition to active elbow movements for the first six weeks postoperatively. Active assisted shoulder exercises were started after the sixth week after the operation, and muscle strengthening exercises were started at the third month. The magnitude of the rotator cuff rupture was assessed by measuring the widest gap of the tear. Accordingly, tears were evaluated as small (< 1 cm), moderate (1–3 cm), large (3–5 cm) or massive (> 5 cm) [5].

Outcome Parameters

Patients' age, gender, systemic diseases, complaints, duration of complaints, the type of the rupture, the data obtained during operation (rupture size, shape, affected tendon, the presence of retraction if any), postoperative complications (re-rupture, wound infection) were recorded. Patients were assessed clinically and radiologically before and after surgery. Functional assessments of the patients were

performed at 6th and 12th months preoperatively and postoperatively with objective assessments using University of California, Los Angeles (UCLA) and Constant scoring systems. All patients' operated shoulders were evaluated with MRI during their recent follow-up. Tendon continuity or recurrent tear was assessed in short inversion recovery sequences in addition to T2-weighted coronal oblique and proton density-weighted images.

UCLA (University of California, Los Angeles) score: University of California, Los Angeles scores were used to assess pain, function, the range of motion, and patient satisfaction in the evaluation of functional outcomes and determinants [6]. Excellent (34–35 points) and good (28–33 points) scores were interpreted as satisfactory, while moderate (21–27 points) and poor (0–20 points) scores as unsatisfactory results.

The Constant score: The Constant score has a 100-point scoring system that is divided into 4 domains: pain (maximal 15 points), daily life activities (maximal 20 points), painless range of motion (maximal 40 points), and abduction strength evaluation (maximal 25 points) according to the methods described by Constant et al. [7].

Statistical Analysis

Data were analyzed using the IBM Statistical Package for Social Sciences v21 (SPSS Inc., Chicago, IL, USA). A normal distribution of the quantitative data was checked using the Kolmogorov-Smirnov test. Parametric tests were applied to data of normal distribution, and non-parametric tests were applied to data of questionably normal distribution. To calculate the correlation coefficients Pearson's *r* was used. The results for all items were expressed as mean \pm SD, assessed within a 95% reliance and at a level of $p < 0.05$ significance.

Results

Sixteen of the patients were female, 12 were male, and their mean age was 57.2 ± 5.4 (range: 33–71) years. The mean symptom duration was 36.8 ± 12.4 (range: 6–52) months. The mean postoperative follow-up period of the patients was 30.4 ± 16.8 (range: 13–72) months. Twenty-one of the 28 patients were operated on the right shoulder, and seven were operated on the left shoulder. Small (0–1 cm: $n = 2$), moderate (1–3 cm: $n = 20$), large (3–5 cm: $n = 3$), and massive (> 5 cm; $n = 3$) tears were detected in respective number of patients (Table 1).

Table 1
Demographic and operative characteristics.

Factor	Value
Age (years)	57.2 ± 5.4 (33–71)
Gender (male:female)	16:12
Symptom duration (months)	36.8 ± 12.4 (6–52)
Side of involvement (right:left)	21:7
Postoperative follow-up (months)	30.4 ± 16.8 (13–72)

Preoperative and postoperative mean UCLA scores of the patients were 10.85 ± 1.89 , and 28.8 ± 3.34 , respectively ($p < 0.001$). According to the UCLA scoring, there were excellent results in 20 patients, good in 7 patients and moderate in 1 patient. Pre-, and postoperative average Constant scores were 38.1 (range, 7.0 to 56.0), and 72.4 (range, 52.0 to 98.0), respectively ($p < 0.001$) (Table 2). According to Constant scoring, there were excellent results in 19 patients, good in 8 patients and moderate in 1 patient. Twenty-eight of the 28 patients were satisfied with the result. Correlation tests revealed that tear size observed during surgery showed a significant ($p = 0.002$) and a weakly negative ($r = -0.468$) correlation with preoperative Constant scores, and a significant ($p = 0.0001$) and moderately negative ($r = -0.645$) relationship with postoperative Constant scores. According to our results, UCLA and Constant functional outcomes were worse in patients over 60 years of age than younger patients and recurrent tears were more often found in the elderly population. A significant relationship was seen between the age of the patients and tendon healing ($p < 0.05$).

Table 2
Clinical outcomes for open rotator cuff repair in 28 shoulders.

	Preoperative	Postoperative	p Value
UCLA score	10.85 ± 1.89	28.8 ± 3.34	$p < 0.001$
Constant score (maximum, 100) (points)	38.1	72.4	$p < 0.001$
UCLA score: University of California, Los Angeles score			

Rotator cuff continuity was assessed in shoulder MRIs obtained during recent follow-ups of patients, and it was seen that four patients had recurrent tears. It was seen that 3 of the four patients who were diagnosed with recurrent tears had a massive tear and 1 had a large tear. In patients with recurrent tears, the mean UCLA score was 29.6 ± 2.38 , and the average Constant score was 70 at the last follow-up visits of the patients. Functional scores of recurrent minor tears were not significantly affected. Also, two patients with large recurrent ruptures had massive ruptures before surgery.

No postoperative wound infection developed in any of the patients.

Discussion

In this study, 28 patients who underwent open rotator cuff repair were followed up for a mean of 30.4 months, and data that could affect the healing results were collected and analyzed.

The most common complication after open rotator cuff repair is recurrent tears with the incidence rate ranging between 13–68% [8–16]. Adamson and Tibone reported in a study of 30 patients who underwent open surgery and rotator cuff repair, the success rate was 80% after ten years of follow-up [8]. Bigliani et al. repaired 61 patients who had massive rotator cuff tears with open surgical treatment found a success rate of 85% on an average follow-up period of seven years [9]. Harryman et al. reported recurrent tears in 20% of the rotator cuffs they repaired and indicated that the type of lesion detected during the procedure was more important than that observed during surgery, and the tissue quality affected the functional outcome [10]. Gazielly et al. performed rotator cuff repair on 100 patients and detected recurrent tears in 24% of the cases [11]. Knudsen et al. found recurrent tears after surgery in 32% of 31 patients and could not detect a significant association between tendon integrity and patients' functional outcomes [12]. Gerber et al. found that recurrent ruptures were smaller than the first tear, and that although the patients had ruptures their pain decreased in comparison with the preoperative pain levels and that the functional outcomes of the patients improved in 20 patients with recurrent tears [13]. Castagna et al. [14], Jost et al. [15] and Hanusch et al. [16] reported that functional results of the patients significantly improved, and also indicated that recurrent tears did not mean surgical failure and recurrent tears were smaller in size than the first tears. The results of these authors were consistent with our results, and we found recurrent rupture in 14.3% of our patients during long-term follow-ups.

Motycka et al. evaluated the results of 79 patients who underwent open rotator cuff repair, and found the mean postoperative Constant and Murley score of 71.5; they found a strong correlation between the Constant and Murley score and the subjective satisfaction of the patients [17]. In the present study, the mean Constant score increased from 38.1 points before surgery to 72.4 points after surgery. The increase in Constant and Murley scores in the postoperative period was found to be significant for small, medium, large and massive tears ($p = 0.0001$). In the postoperative period, the significant increase in average Constant and Murley scores over the preoperative period ($p = 0.0001$) demonstrates high success rate of the open surgical repair.

In the literature, information about prognostic factors is quite complex. Successful results have been reported in young patients with small tears and early repair. Poor results have been reported in patients with abductor muscle weakness and limitation of joint motion. One of the factors affecting the results of rotator cuff repair is the tear size. Romeo et al. performed the open surgical repair for patients with full-thickness rotator cuff ruptures and achieved better postoperative results in patients who were operated within six weeks at the onset of symptoms [18]. In the same study, there was a negative correlation between the tear size and Constant and Murley scores. In the present study, there was a significant ($p = 0.0001$) and moderately negative ($r = -0.645$) relationship between the tear size and postoperative Constant and Murley scores. These findings are in support of the literature. In our study, it has also been

reported that advanced age has negative effects on rotator cuff healing and that the size of the defect in elderly patients leads to poor clinical outcomes [19–21]. Rotator cuff delamination and poor tissue quality are more common in patients over 65 years of age, although high recurrent rupture rates are seen in patients over 65 years of age, even a successful repair has been achieved [10, 19]. In these patients, increased fat degeneration in supraspinatus muscle is associated with poor clinical outcomes [15, 22].

The main limitation of our study was the small sample size which may cause a high probability of a type 1 error. The second limitation is the experience restricted to the outcomes of a single institution. Third, some details of history and factors that may influence the outcome may not be completely documented. Due to these restrictions, associations should be interpreted with caution.

Conclusions

The results of this study suggest that open repair is a reasonable and successful treatment option in patients with rotator cuff tears. Overall satisfactory clinical outcomes could be achieved.

Abbreviations

MRI

Magnetic resonance imaging

UCLA

University of California, Los Angeles

Declarations

Ethics approval and consent to participate: The approval of the Beykent University Institutional Review Board was obtained prior to the study. Necessary permission was obtained in using the hospital records of the patients. The need for consent was waived by the institutional IRB as the study was retrospective.

Consent for publication: Not applicable.

Availability of data and material: The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests: The authors declare that they have no competing interests.

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Authors' contributions: Z.V.G. analyzed and interpreted the data, and was a major contributor in writing the manuscript. Z.V.G. read and approved the final manuscript.

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