

FUNCTIONAL EVALUATION OF THE RESULTS OF REPAIR OF PARTIAL AND COMPLETE ROTATOR CUFF TEARS

AVALIAÇÃO FUNCIONAL DOS RESULTADOS DO REPARO DAS LESÕES PARCIAIS E COMPLETAS DO MANGUITO ROTADOR

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ABSTRACT

Objective: To perform a comparative analysis of the results of arthroscopic surgical treatment of partial and complete rotator cuff (RC) injuries. **Methods:** Eighty-four shoulders with partial or complete RC tear that underwent arthroscopic repair were retrospectively evaluated using UCLA and Constant scores, assessment of strength, and range of motion. Fifty-seven shoulders with complete injuries and 27 with partial injuries were identified. **Results:** Age ($p = 0.007$) was higher in those with complete lesions (mean 61.4 ± 7.9 years), compared to those with partial lesions (mean 56.5 ± 7.1 years). The complete injuries group showed a higher elevation difference in relation to the contralateral shoulder compared to the partial injuries group (partial injuries: -1.1% vs complete injuries: -16.5%), statistically significant difference ($p = 0.0004$). In addition, complete lesions presented 96.5% of excellent and good results and a median of 35 in the UCLA score and partial lesions presented 84.6% of good/excellent results and a median of 34. The Constant score showed 91.2% of satisfactory results in complete lesions and 77% in partial ones. **Conclusion:** Arthroscopic repair shows satisfactory functional results for both partial and complete rotator cuff injuries, with similar outcomes between groups. **Level of Evidence III, Retrospective Comparative Study.**

Keywords: Rotator Cuff. Arthroscopy. Injury.

RESUMO

Objetivo: Realizar análise comparativa dos resultados do tratamento cirúrgico artroscópico das lesões parciais e completas do manguito rotador (MR). **Métodos:** Foram avaliados retrospectivamente 84 ombros com ruptura parcial ou completa do MR submetidos ao reparo artroscópico, por meio dos escores UCLA e Constant, avaliação de força e amplitude de movimento. Foram identificados 57 ombros com lesão completa e 27 com lesão parcial. **Resultados:** A idade ($p = 0,007$) foi maior naqueles com lesões completas (média $61,4 \pm 7,9$ anos), em relação às lesões parciais (média $56,5 \pm 7,1$ anos). O grupo lesões completas demonstrou diferença de elevação em relação ao ombro contralateral maior comparado ao grupo de lesões parciais (lesões parciais: $-1,1\%$ vs lesões completas: $-16,5\%$), diferença estatisticamente significativa ($p = 0,0004$). Além disso, foi demonstrado 96,5% de resultados excelentes e bons e mediana de 35 no escore UCLA em lesões completas e 84,6% de resultados bons/excelentes e mediana de 34 nas lesões parciais. O escore Constant mostrou 91,2% de resultados satisfatórios nas lesões completas e 77% nas parciais. **Conclusão:** O reparo artroscópico mostra resultados funcionais satisfatórios tanto nas lesões parciais quanto nas completas do manguito rotador, com desfechos semelhantes entre os grupos. **Nível de Evidência III, Estudo Retrospectivo Comparativo.**

Descritores: Manguito Rotador. Artroscopia. Lesão.

Citation: Storti T, Ramos ABS, Faria RSS, Costa GBL, Paniago AF. Functional evaluation of the results of repair of partial and complete rotator cuff tears. Acta Ortop Bras. [online]. 2022;30(2): Page 1 of 5. Available from URL: <http://www.scielo.br/aob>.

INTRODUCTION

Rotator cuff (RC) injury is more frequent in the age group above 40-60 years and is considered the main cause of pain and dysfunction in the shoulder.¹

RC lesions can be classified in several ways: according to their thickness (partial and complete), the size of the lesion when complete (small < 1 cm; mean of 1-3 cm; large 3-5 cm; and

massive > 5 cm),^{2,3} chronology (acute, chronic, and acute-on-chronic), and etiology (degenerative, associated with instabilities, traumatic, and microtraumatic).³ Additionally, partial lesions can also be classified according to their location (intratendinous, articular or bursal) and according to their thickness and size (grade I $\leq 25\%$ or up to 3 mm; grade II = 50% or 3 to 6 mm; and grade III > 6 mm).^{3,4}

All authors declare no potential conflict of interest related to this article.

The study was conducted at Instituto Ortopédico Camanho.

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Article received on 08/10/2020, approved on 01/19/2021.



Partial lesions are approximately twice as common as complete lesions.⁵ They are generally symptomatic and there is a consensus that lesions affecting more than 50% of the tendon thickness should be treated surgically.⁶

Most authors argue that the repair of RC lesions leads to more definitive and satisfactory results.⁷ The repair of minor lesions is more likely to heal completely when compared to repair of larger lesions.⁸⁻¹⁰ However, even partial, or complete lesions, small and medium, have a rate of up to 20% of healing failure, which is often associated with poor clinical results.¹¹

According to the pathology natural history, partial RC lesions tend to evolve to complete lesions with time, if left untreated without definitive surgical repair.¹² In the study by Huberty et al.,¹³ in which they evaluated 489 consecutive arthroscopies for rotator cuff repair, a higher stiffness index was obtained in patients subjected to partial lesion repair (13.5%) and it was concluded that this type of lesion is one of the risk factors for stiffness.

Thus, our study aims to evaluate and compare the results of arthroscopic surgical treatment of partial and complete RC lesions. Our hypothesis is that the functional results will not be different between the two groups studied.

METHODOLOGY

Study design and participants

This is a retrospective cross-sectional study. During the period from 2011 to 2018, 465 patients underwent arthroscopic RC repair. Patients older than 18 years of age, with a minimum of 6 months of follow-up, and that agreed to participate were included in the study. Those who underwent other procedures during surgery, such as labrum repair, acromioplasty, biceps tenotomy and tenodesis, and cases of large or extensive complete lesions were excluded. After applying the criteria (inclusion and exclusion), 82 patients agreed to participate in the study and to attend the hospital to be reevaluated, totaling 84 shoulders.

Ethical approvals

All participants signed the informed consent form. This study was submitted to the evaluation and approval of the Human Research Ethics Committee, with opinion number 2,444,726, CAAE: 80401317.3.0000.0023.

Surgical procedure

The surgeries were performed by three specialist surgeons, with extensive experience in the field. The technique used was the single-row fixation, as described by Burkhart, in which the tendon is tied to anchors arranged in a single row.¹⁴ In the case of partial ruptures, the lesions were completed and fixed.

Postoperative rehabilitation

All patients followed the same standardized protocol. The movement of the elbow, wrist, and hand were stimulated from the immediate postoperative period. The patients remained immobilized with an arm sling for six weeks; after this period, they gradually began gaining the range of motion of the shoulder. Muscle strengthening began only after the 12th week.

Analysis outcomes

Data collection was performed in two moments. The following were evaluated: A) demographic, surgical, and RC lesion characteristics; B) functional variables, muscle strength, and pain.

The demographic and characterization data of the RC lesions were obtained through analysis of electronic medical records. The variables collected were age, gender, dominance and laterality, follow-up time, smoking habits, diabetes mellitus, pain at follow-up,

type of injury (total or partial), classification of the lesion (small or medium, for complete lesions and bursal, joint or intratendinous, for partial lesions), number of tendons addressed, and number of anchors. The size and classification of the lesions were obtained from preoperative magnetic resonance imaging (MRI) and/or surgical descriptions. When there was divergence between the MRI report and the surgical description, the intraoperative description was considered.

The second moment of evaluation was performed in person, where strength (kg) and amplitude (°) of the elevation, lateral rotation, and medial rotation of the shoulder were measured. Strength was measured by a digital dynamometer in Kg, while amplitude was measured by goniometry in degrees. Furthermore, during this evaluation, the functional capacity scores were applied according to the University of California at Los Angeles Shoulder Rating Scale (UCLA)¹² and the Constant-Murley Score (CONSTANT).¹⁵ The aforementioned scales (UCLA and CONSTANT) were translated into Portuguese and culturally adapted to the Brazilian population¹⁶ and are frequently used to assess upper limbs function in patients with rotator cuff injuries.^{17,18}

After tabulation of the data, the individuals were divided into two groups, based on the preoperative classification of the lesion: partial or complete (small and medium).

Statistics

The descriptive analysis presented the observed data in the form of tables, expressed by the measures of central tendency and of dispersion appropriate for numerical data and of frequency and percentage for categorical data.

The comparison between the two subgroups of lesion size (partial and complete), regarding clinical variables, surgery, amplitude and strength measurements, and the UCLA and Constant scores, were performed using the following tests: the Student's *t*-test was applied for independent samples; the Mann-Whitney test, for numerical variables; and the chi-square (χ^2) or Fisher's exact test, for categorical variables.

A nonparametric method was applied, since all variables, except age, presented non-Gaussian distribution, according to the rejection of the normality hypothesis by the Shapiro-Wilk test. The significance determination criterion adopted was of 5%. Statistical analysis was processed by statistical software SAS[®] System, version 6.11 (SAS Institute, Inc., Cary, North Carolina).

RESULTS

Demographic and surgical characteristics among the groups

The sample consisted of 84 shoulders (82 patients). Of these, 57 (67.86%) correspond to cases of complete lesions and 27 (32.14%) to partial lesions. When the demographic characteristics and the surgical profile were compared between the groups, a statistically significant difference was observed for age (partial lesions: 56.5 ± 7.1 vs complete injuries: 61.4 ± 7.9), higher in the group of complete lesions ($p = 0.007$); and for the number of anchors used (partial lesions: 2 vs complete lesions: 3), superior in the group of complete lesions ($p = 0.002$). Table 1 shows other variables, which were statistically similar.

Characteristics of rotator cuff lesions between groups

Among the partial ruptures, most were bursal-sided (77.7%). Regarding the size of the complete lesions, there was a slight predominance of the medium lesions (54.3%). The lesions were of traumatic etiology in 33.3% of partial lesions cases and in 30.9% of complete lesions (Table 1).

Table 1. Clinical and surgical variables.

Variable	total	partial	complete	p-value
Age (years)				
Mean ± Standard Deviation	59.8 ± 7.9	56.5 ± 7.1	61.4 ± 7.9	0.007
Operated shoulder				
Right	47 (56.0%)	14 (51.9%)	33 (57.9%)	0.60
Left	37 (44.0%)	13 (48.1%)	24 (42.1%)	
Dominant limb				
Right	76 (90.5%)	25 (92.6%)	51 (89.5%)	0.49
Left	8 (9.5%)	2 (7.4%)	6 (10.5%)	
Surgical position				
beach chair	47 (56.0%)	18 (66.7%)	29 (50.9%)	0.17
lateral decubitus	37 (44.0%)	9 (33.3%)	28 (49.15%)	
Type of injury				
degenerative	56 (68.3%)	18 (66.7%)	38 (69.1%)	0.82
traumatic	26 (31.7%)	9 (33.3%)	17 (30.9%)	
Number of anchors				
median (Q1-Q3)	3 2 - 4	2 2 - 4	3 3 - 4	0.002

Age (years) was expressed by mean and standard deviation and compared by Student's t-test for independent samples and number of anchors by median and interquartile range (Q1-Q3) and compared by Mann-Whitney test, since it did not present normal distribution. On the other hand, categorical data were expressed by frequency (n) and percentage (%) and compared by the chi-square (χ^2) or Fisher's exact test.

Comparison between the group's variables for motion range, muscle strength, and functional scores

A statistically significant difference was observed in the anterior elevation measure compared to the contralateral shoulder between the groups ($p = 0.0004$). The group of complete lesions showed a difference in elevation in relation to the greater contralateral shoulder compared to the group of partial lesions (partial lesions: -1.1% vs. complete lesions: -16.5%). The other variables of muscle strength and function (range of motion – ROM) were similar ($p > 0.05$) (Table 2). Regarding functional scores, it was observed that there was no significant difference, at the level of 5%, between the groups. In the UCLA score, the subgroup of complete lesions presented a median of 35, while the subgroup of partial lesions had a median of 34 ($p = 0.085$), with complete lesions showing 96.5% of good and excellent results, while partial lesions showed 84.6% of good/excellent results ($p = 0.13$). Regarding the Constant score, the complete lesions showed 91.2% of satisfactory results and a median of 87, while partial lesions showed 77% of satisfactory results ($p = 0.12$) and a median of 84 ($p = 0.67$) (Table 3).

DISCUSSION

It is widely accepted that arthroscopic surgical treatment of partial and complete RC lesions – smaller than 3 cm – brings excellent functional results with high healing index.¹⁹ However, some current studies have shown an inadequately high rates of a new rupture, even for minor lesions. Chung et al.²⁰ reported 27.3% of healing failure in patients with small rotator cuff lesions, partial and complete. Kamath et al.²¹ reported 12% of complete reruptures in the postoperative evaluation of patients with partial lesions subjected to arthroscopic repair, after evaluation with ultrasound.

In our study, we obtained 92.8% of good/excellent in the UCLA score and 86.7% of satisfactory results by constant score. Patients recovered 90.4% of the lifting force and 96.4% of the lateral rotation force in relation to the contralateral limb.

Moreover, we evaluated and compared the results of arthroscopic surgical treatment of partial and complete RC ruptures, which few studies in the literature have done, especially in the national literature, since there are no studies on the topic.

Table 2. Measurements of range of motion and strength in the total sample and according to the size of the lesion.

Variable	Total	Partial	Complete	p-value
Operated shoulder				
Elevation – ROM	170 146 - 180	165 130 - 180	170 151 - 180	0.46
External rotation – ROM	60 42 - 71	54 40 - 70	62 45 - 72	0.58
Internal rotation – ROM	68 45 - 80	70 45 - 80	65 48 - 80	0.66
Elevation – force	5 3 - 8	5 3 - 9	5 4 - 8	0.95
External rotation – force	5 3 - 7	4 3 - 7	5 4 - 7	0.50
Internal rotation – force	6 4 - 10	6 4 - 10	7 5 - 9	0.43
Contralateral shoulder				
Elevation – ROM	170 154 - 180	168 149 - 180	170 159 - 180	0.58
External rotation – ROM	70 50 - 80	70 49 - 80	70 51 - 80	0.74
Internal rotation – ROM	70 54 - 80	70 58 - 80	70 53 - 80	0.59
Elevation – force	6 4 - 8	6 4 - 9	6 4 - 8	0.86
External rotation – force	5 3 - 7	6 3 - 7	5 4 - 7	0.98
Internal rotation – force	7 4 - 9	6 4 - 10	7 4 - 9	0.84
Relative delta (%)*				
Elevation – ROM	-15.5 -21 - -2	-1.1 -16 - 0	-16.5 -21 - -11	0.0004
External rotation – ROM	-8.1 -25 - 0	-11.9 -27 - 0	-6.3 -18 - 0	0.45
Internal rotation – ROM	-4.5 -14 - 0	-4.0 -20 - 0	-4.9 -14 - 0	0.41
Elevation – force	-9.6 -24 - 11	-14.3 -20 - 0	-9.1 -27 - 11	0.73
External rotation – force	-3.6 -22 - 0	-11.1 -33 - 29	0 -21 - 0	0.76
Internal rotation – force	0 -12 - 16	0 -20 - 17	0 -9 - 16	0.27

Data were expressed by median and interquartile range (Q1-Q3) and compared by the Mann-Whitney test.

*Relative delta (%) expresses the variation between the operated and contralateral shoulder relative to the contralateral one: (operated-contralateral) / contralateral x100

ROM: range of movement in °.

Unit of force (kg).

Table 3. UCLA and Constant questionnaire in the total sample and according to the size of the lesion.

Variable	Total	Partial	Complete	p-value
UCLA				
median and (Q1-Q3)	35 33-35	34 31-35	35 33-35	0.085
UCLA class				
Excellent	51 (61.5%)	13 (50.0%)	38 (66.7%)	0.13
Good	26 (31.3%)	9 (34.6%)	17 (29.8%)	
Regular	5 (6.0%)	3 (11.5%)	2 (3.5%)	
Poor	1 (1.2%)	1 (3.9%)	0 (0%)	
Constant				
median and (Q1-Q3)	87 79-93	84 71-95	87 79-92	0.67
Constant class				
Excellent	30 (36.1%)	10 (38.5%)	20 (35.1%)	0.12
Good	26 (31.3%)	6 (23.1%)	20 (35.1%)	
Satisfactory	16 (19.3%)	4 (15.4%)	12 (21.0%)	
Regular	8 (9.7%)	3 (11.5%)	5 (8.8%)	
Poor	3 (3.6%)	3 (11.5%)	0 (0%)	

Data were expressed by median and interquartile range (Q1-Q3) and compared by the Mann-Whitney test. Categorical data were expressed as frequency (n) and percentage (%) and compared using Fisher's exact test.

According to Diebold et al.,¹⁷ the relationship between age and RC lesion is linear in patients between 50 and 69 years of age, with an increase of 5% between decades, and increases substantially after 70 years of age. In this study, age ($p = 0.007$) was significantly higher in the subgroup with complete lesions, with a mean of 61.4 ± 7.9 years, in relation to partial lesions, which have a mean age of 56.5 ± 7.1 . This is due to the natural history of rotator cuff pathology, in which lesions tend to progress with advancing age

and chronic involvement, resulting in the progression of partial lesions into complete lesions and a higher rate of complete lesions in the older population.¹¹

In our study, the range of motion showed no significant difference between the groups, whether in elevation or in lateral or medial rotation. As an exception, it was observed that the subgroup with complete lesion showed significantly lower comparative elevation of the contralateral shoulder ($p = 0.0004$) when compared with the subgroup with partial lesion. We also observed that in the group of partial lesions, the lifting force, lateral rotation, and medial rotation was of 85.7%, 88.9%, and 100% in relation to the contralateral shoulder, respectively. In the group of complete lesions, the lifting force was of 90.9% and the lateral and medial rotation forces were of 100% in relation to the contralateral shoulder. However, we observed no significant difference between the groups. Peters et al.,²² did not obtain significant differences between groups in limb elevation. They showed, however, a greater range of abduction and lateral rotation in the group of complete lesions 6 months after the surgical procedure ($p < 0.05$).

In the subgroup with complete lesions, our study presented 96.5% of excellent and good results with the UCLA score. Other studies showed similar results in patients with complete RC lesions, such as the study conducted by Miyazaki et al.⁹ that evaluated 163 patients aged 65 years or older who had complete RC lesions subjected to arthroscopic repair, presenting 96.4% of excellent and good results. In addition to these studies, one by Veado et al.,¹⁸ which evaluated 28 patients over 65 years of age, reported 89.28% of excellent and good results. In the group of partial lesions, we observed 84.6% of good and excellent results, showing no statistically significant difference compared to complete lesions (96.5%). In the study by Godinho et al.,²³ the authors

obtained 97% of good and excellent results with arthroscopic surgical treatment of partial RC lesions in 64 patients.

Although there was no significant difference, the index of satisfactory functional results was higher in the group of complete lesions, different from what we could assume. By the UCLA score, we obtained 84.6% of good/excellent results in partial lesions, while we obtained a score of 96.5% in the complete lesions. According to the constant score, we obtained 77% of satisfactory results in the group of partial lesions and 91.2% in the group of complete lesions. Surprisingly, some articles have shown a higher rate of healing failure in the repairs of partial lesions, compared to complete lesions < 3 cm. Chung et al.²⁰ obtained a healing failure rate observed by computed arthrotomography of 35.3% in partial lesions and 14.3% in complete lesions. They believe that this may be due to the higher degree of tendinosis observed in partial lesions in relation to complete lesions.

Among the limitations of our study are the fact that it is a retrospective study, with a relatively low number of evaluated patients, with a disproportional number of patients between the groups, making any type of comparison of their results difficult. Among the strengths, we highlight the postoperative analysis performed with several variables of shoulder functionality

CONCLUSIONS

Arthroscopic repair shows satisfactory results for the treatment of RC ruptures, both for partial and complete lesions, small and medium, without large functional differences between the two groups.

ACKNOWLEDGEMENTS

The board of directors of the HOME and IPE-HOME hospital, for all its institutional support, allowing for the accomplishment of this study.

AUTHORS' CONTRIBUTIONS: Each author contributed individually and significantly to the development of this article. TS: substantial contribution to the concept or design of the work, or acquisition, analysis or interpretation of the data for the study, writing of the study or critical revision of its intellectual content, final approval of the version of the manuscript to be published, agree to be held responsible for all aspects of the study to ensure that any matter related to the integrity or accuracy of any of its parts is properly investigated and resolved; ABSR: writing of the study or critical revision of its intellectual content, final approval of the version of the manuscript to be published, agreeing to be held responsible for all aspects of the study to ensure that any matter related to the integrity or accuracy of any of its parts is properly investigated and resolved; RSSF: final approval of the version of the manuscript to be published, agree to be held responsible for all aspects of the study to ensure that any matter related to the integrity or accuracy of any of its parts is properly investigated and resolved; GBLC: final approval of the version of the manuscript to be published, agree to be held responsible for all aspects of the study to ensure that any matter related to the integrity or accuracy of any of its parts is properly investigated and resolved; AFP: final approval of the version of the manuscript to be published, agree to be held accountable for all aspects of the study to ensure that any matter related to the integrity or accuracy of any of its parties is properly investigated and resolved.

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