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Original article

# Rotator cuff injuries and factors associated with reoperation☆

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ABSTRACT

*Objective:* To evaluate the prevalence of rotator cuff tears and describe the profile of reoperated patients, causes of repeated tendon tears, tear evolution and range of times between surgical procedures.

*Method:* This was a cross-sectional study involving 604 surgical procedures performed at two regional referral hospitals between January 2006 and December 2012. After approval by the ethics committee, data describing the patients' epidemiological profile were gathered at a single time, using Cofield's classification to measure the extent of the tears, all of which underwent arthroscopic surgery. The data were entered into Epi Info 3.5.3 and were analyzed using SPSS version 18.0.

*Results:* Among the 604 surgical procedures, females were affected in more cases (351; 58.1%). When the dominant limb was the right limb, it was affected in 90% of the cases ($p < 0.05$). The supraspinatus tendon was affected in 574 cases (95%) and the tears were of medium size in 300 cases (49.7%). Eighteen reoperations were performed (2.98%) and the upper right limb was the most affected (66.6%). The cause was non-traumatic in 12 patients. The repeated tears were mostly smaller (44%), and the length of time between the two surgical procedures ranged from 6 to 298 weeks.

*Conclusion:* Female gender, smaller extent in the second procedure and non-traumatic cause were found in most of the cases analyzed.



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## Lesões do manguito rotador e fatores associados à reoperação

*Palavras-chave:*
Lesão do manguito rotador
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RESUMO

*Objetivo:* Avaliar a prevalência de LMR, descrever o perfil do paciente reoperado, a causa da rerruptura tendínea, a evolução da lesão e a variação de tempo entre os procedimentos cirúrgicos.

*Métodos:* Estudo com delineamento transversal, que envolveu 604 eventos cirúrgicos feitos entre janeiro de 2006 e dezembro de 2012, em dois hospitais de referência regional. Após aprovação pelo comitê de ética, os dados foram coletados em um único momento, descreveu-se o perfil epidemiológico dos pacientes e usou-se a classificação de Cofield para mensurar a extensão das lesões, as quais foram operadas por via artroscópica em todos os pacientes. Os dados foram digitados no programa Epinfo versão 3.5.3®, e analisados no SPSS versão 18.0®.

*Resultados:* Entre os 604 procedimentos, o sexo feminino esteve predominantemente acometido com 351 (58,1%) e quando o membro dominante foi o direito ele esteve acometido em 90% dos casos (p < 0,05). O tendão supraespinhal foi acometido em 574 (95%) casos e as lesões foram de tamanho médio em 300 (49,7%) casos. Foram 18 (2,98%) reoperações e o membro superior direito foi o mais acometido (66,6%), com causa não traumática em 12 pacientes. As relesões foram em sua maioria menores (44%), com o tempo entre os dois procedimentos cirúrgicos que variou entre seis e 298 semanas.

*Conclusão:* Sexo feminino, extensão menor no segundo procedimento e causa não traumática foram encontrados na maior parte dos casos analisados.



## Introduction

Rotator cuff injuries (RCI) are common in orthopedic practice, and account for nearly 70% of the events of shoulder pain.[1] Its complete tear is associated to traumatic situations in young individuals, whereas it has the tendon fragility as an etiology in old patients, with repetitive micro traumas associated with acromial anatomy and poor tendon vascularization.[2–4]

Depending on the type of injury, as in patients with signs of subacromial impingement, the clinical treatment with physical therapy and lifestyle changes can postpone the functional impairment of the rotator cuff. However, in individuals who suffered complete rupture of a cuff tendon, clinical treatment does not achieve good results and the surgical repair is indicated.[5]

The worst complication that a patient operated for RCI can develop is the re-rupture of the tendon, which needs new surgical intervention.

There are few studies that address reoperations of the rotator cuff. Nevertheless, data available in the literature demonstrate that the obtained results are inferior to the results of the primary procedure, with improvement of the pain, but no significant recovery of cuff function.

This study aimed to evidence the prevalence of rotator cuff reoperations in a established period and the associated factors that led to the failure of the primary surgery.

## Materials and methods

This was an observational, retrospective, cross-sectional study, using descriptive and analytical statistics, conducted with patients who underwent surgery due to RCI between January 1, 2006 and December 31, 2012. In the reported period, 604 surgeries for the correction of symptomatic RCI were conducted, all arthroscopically, by the same specialist surgeon, accompanied by the same orthopedic team. Of these, 36 surgeries were conducted in a philanthropic hospital and 568 in a private hospital. The inclusion criteria were patients undergoing shoulder surgery due to RCI in the aforementioned period and institutions. Exclusion criteria were patients with incomplete medical records and those who were re-operated by the team, but underwent their first surgery in another hospital.

Data was collected through the assessment of medical records and filling of a protocol prepared by the researchers. The Cofield classification was used to categorize the extent of the injuries as: small (<1 cm), medium (1–3 cm), large (3–5 cm), massive (>5 cm), or irreparable (>5 cm, involving two or more tendons of the rotator cuff, which cannot be repaired without excessive tension after the release of intra- and extra-articular adhesions, of the coracohumeral ligament and the rotator interval, and the incision of the capsule). The period from first symptoms to the first surgery and the period until reoperation were recorded in weeks and months, respectively. The reasons for intervention were categorized as traumatic and

non-traumatic. Regarding the affected tendon, injuries in the supraspinatus, infraspinatus, teres minor, and subscapularis were observed. Regarding the size of the injury in the second procedure, they were classified as larger, smaller, or of the same size relative to the primary surgical procedure.

Regarding the associated procedures, acromioplasty, bursectomy, and long head of biceps tenotomy or tenodesis, were eventually used.

The sociodemographic variables recorded were age and gender. As for comorbidities, the presence of hypertension, diabetes mellitus, smoking, and other co-morbidities were considered.

In the statistical analysis, data were entered in Epinfo® version 3.5.3 and analyzed in SPSS version 18.0.

The quantitative variables were described as mean and standard deviation, and the qualitative variables as absolute and relative frequency. To compare the means, Student's *t*-test was used. Fisher's chi-squared or Fisher's exact test were used when appropriate, to test the statistical significance of the differences observed in the proportions of categorical variables. Two-tailed *p*-values <0.05% were considered as statistically significant.

This study was submitted to and approved by the Research Ethics Committee under the Protocol No. 12.416.4.01.III.

## Results

Among the 604 surgeries for RCI corrections, there was a predominance of procedures in female patients (351; 58.1%). The mean age was 55.2 years (SD ± 10.89 years) and 18 (2.98%) patients underwent reoperation (Table 1).

The dominant and predominantly affected limb was the right one (Table 2).

Regarding the pattern of onset and extent of lesions, most patients presented medium lesion size. The most affected tendon was the supraspinatus (Table 3).

Assessing only patients who underwent reoperation, it was observed that the mean age was 57.5 years (±12.3); 13 (72.3%) patients had some comorbidity. The period between the onset of symptoms and date of the first reconstructive surgery was on average 12.1 months, with a minimum of two and maximum of 36. In turn, the time interval between the first and second surgery was from six to 298 weeks, with a median of 78.5 weeks (approximately 20 months; Table 4).

Regarding the reason for reoperation, non-traumatic causes were the most frequent: 12 (66.6%). Regarding the extent of the injury, medium lesions were the most prevalent (Table 4).

**Table 1 – Patients with rotator cuff injuries characteristics. *Source*: Prepared by the author, 2014.**

| Variables | *N* (604) |
|---|---|
| *Gender (%)* | |
| Male | 253 (41.9) |
| Female | 351 (58.1) |
| *Age (years)* | 55.2 ± 10.5 |
| *Reoperation (%)* | 18 (2.98) |

**Table 2 – Relationship between the affected limb and dominant limb. *Source*: Prepared by the author, 2014.**

| Dominant limb | Right *n* (%) | Left *n* (%) | *p*-Value[a] |
|---|---|---|---|
| Right (*n* = 387) | 350 (90.4) | 37 (9.6) | <0.01 |
| Left (*n* = 217) | 67 (30.9) | 150 (69.1) | >0.05 |

[a] Pearson's chi-squared test.

**Table 3 – Involvement pattern and extent of injuries. *Source*: Prepared by the author, 2014.**

| | *n* (%) |
|---|---|
| *Lesion size* | |
| Small | 95 (15.7) |
| Medium | 300 (49.7) |
| Large | 146 (24.2) |
| Massive | 62 (10.3) |
| Irreparable | 1 (0.14) |
| *Affected tendons* | |
| Supraspinatus | 574 (95) |
| Subscapularis | 225 (37.3) |
| Infraspinatus | 28 (4.6) |
| Teres minor | 1 (0.14) |

## Discussion

RCI reoperation rate is varied; depending on the population studied and the approach used in the first procedure, it may range from 3% to 12%.[6–8] In seven years, the orthopedic team responsible for the present study obtained a rate of 2.98% patients with symptomatic recurrences of RCI.[9]

Isolate imaging exams are not sufficient to indicate a second surgery. According to Iannotti et al.,[10] magnetic resonance imaging (MRI) of the operated shoulder performed four weeks after surgery for rotator cuff repair discloses fibrous scarring that was difficult to differentiate from an injury. Considering this information, a detailed history and physical examination are essential, as asymptomatic patients do not have an indication for surgery, despite presenting changes in imaging tests.[10–12] In line with such reasoning, all 18 cases of reoperation in the present study had some degree of pain and limitation of movement and, in accordance with the abovementioned parameters, an adequate imaging exam was requested only after detailed orthopedic assessment of the affected limb.

A wide variety of factors can cause failure of the primary repair and re-injury.[6–10] The main cause of failure in RCI surgical treatment are previous large and massive injuries.[6,7,10] However, it was not possible to verify such relation in this study.

Another cause of symptomatic RCI recurrence is failure to decompress the subacromial space.[13] In 2011, a Canadian study led by MacDonald et al.[14] compared the results of arthroscopic repair of the rotator cuff with and without acromioplasty, and did not observe differences in functional rehabilitation and quality of life in both groups. However, the higher recurrence rate was observed in the group of patients who did not undergo acromioplasty. This fact was observed in

**Table 4 – Description of reoperations. *Source*: Prepared by the author, 2014.**

| N | Age | Gender | Affected dominant limb | Extent 1st surgery | Extent 2nd surgery | ΔT1 (months) | ΔT2 (no) | Reason | A Proc. | Com. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 58 | M | Yes | Massive | Massive | 2 | 20 | Traum. | Yes | Yes |
| 2 | 64 | F | No | Large | Medium | 24 | 86 | Non t. | Yes | Yes |
| 3 | 61 | F | Yes | Small | Medium | 8 | 176 | Non t. | Yes | Yes |
| 4 | 40 | M | Yes | Medium | Small | 24 | 79 | Non t. | Yes | No |
| 5 | 50 | M | No | Massive | Medium | 18 | 32 | Non t. | Yes | Yes |
| 6 | 67 | F | Yes | Medium | Medium | 9 | 52 | Traum. | Yes | No |
| 7 | 60 | M | No | Large | Medium | 8 | 298 | Non t. | Yes | Yes |
| 8 | 69 | F | Yes | Medium | Medium | 10 | 78 | Traum. | Yes | Yes |
| 9 | 53 | F | Yes | Medium | Medium | 6 | 91 | Non t. | Yes | No |
| 10 | 66 | F | Yes | Medium | Large | 7 | 99 | Non t. | Yes | Yes |
| 11 | 69 | F | Yes | Large | Medium | 9 | 26 | Non t. | No | Yes |
| 12 | 62 | M | Yes | Large | Irreparable | 24 | 224 | Non t. | Yes | Yes |
| 13 | 30 | F | No | Medium | Small | 36 | 27 | Traum. | Yes | No |
| 14 | 33 | M | Yes | Medium | Medium | 18 | 26 | Traum. | Yes | No |
| 15 | 52 | F | Yes | Medium | Medium | 6 | 60 | Non t. | Yes | Yes |
| 16 | 66 | F | Yes | Large | Small | 4 | 174 | Non t. | Yes | Yes |
| 17 | 69 | F | Yes | Large | Medium | 3 | 6 | Traum. | No | Yes |
| 18 | 66 | F | No | Large | Medium | 2 | 123 | Non t. | Yes | Yes |

M, male; F, female; ΔT1, time between symptom onset and first surgery; ΔT2, time interval between both procedures; Traum, traumatic; Non t., non traumatic; A Proc., associate procedure; Com., comorbidities.

the present study, since in 18 reoperations, acromioplasty was necessary in the vast majority (88.9%).

Trauma is another reported cause of re-injury of the rotator cuff.[7,15–17] In a study assessing 63 patients under 50 years old, an age group in which trauma is more prevalent as an RCI trigger, Miyazaki et al.[18] observed that trauma was the cause of two out of the four re-ruptures, with an interval from eight to 24 weeks after the first surgery. In the present sample, trauma was informed by the patients as the causative factor of the recurrence of symptoms and consequent re-injury of the rotator cuff in six cases (33.3%): three of them (50%) by fall on the limb and three (50%) by moving the limb beyond bearable. Of these six patients, as in Miyazaki et al.[19] study, two (33%) were aged below 50 years, and the interval between the two surgical procedures was 26 and 27 weeks (cases 14 and 13, respectively). Despite the fact that the sample in the present study was approximately ten times greater than that of the aforementioned São Paulo (Brazil) study, similar results were obtained in the age group reported.

Inappropriate postoperative care and infection were not observed as a cause of re-injury in the present study. George et al.[7] found 1.9% of infection leading to re-injury of the rotator cuff in 360 patients, who were treated with antibiotics, debridement, and resuture, and progressed to satisfactory results.

The influence of co-morbidities as indirect causes of healing impairment has been studied. Almeida et al.[20] analyzed the relationship between smoking and failed arthroscopic suture in patients operated for RCI and reported that smokers have worse outcomes when compared to non-smokers, but only in case of large and massive lesions. In the present study, among the 18 reoperations, only three (16.6%) were on smokers. Similarly to the data presented by Almeida et al.,[20] two had massive lesions and one had a large lesion (cases 1, 5, and 7, respectively). Case 1 reported trauma as a causal factor of the recurrence of symptoms.

Patients with chronic injuries present substitution of muscle tissue by fatty bands; such anatomical change is crucial for prognosis. The longer a patient has an RCI, the higher the fatty degeneration, a determining factor on the prognosis and on the possibility of reoperation.[7] The interval from RCI to fatty degeneration onset is unclear. However, chronic cases (>six months) have a higher trend.[7] In the present study, most reoperated patients had chronic injuries, therefore presented at least one poor prognostic factor to the attempted surgical repair.

Considering size of the injury to be reoperated, the present data are similar to those in the literature regarding the tendency of the second injury to be smaller than the original injury.[6–10]

Regarding the surgical approach for a recurrent RCI, the arthroscopic technique has demonstrated good postoperative results since its appearance and improvements.[6] As for the procedure used for the second operation, George et al.,[7] in a revision study, reported better results when the arthroscopic approach was used for reintervention. In this topic, Miyazaki et al.[19] observed approximately 80% of bad results when used an open approach for the reoperation. DeOrio et al.,[21] also had higher number of bad results using the open approach, giving scientific support to the arthroscopic approach, which was used for surgical intervention in the 18 cases here reported.

## Conclusion

A rate of 2.98% of reoperations for RCI was observed in the present study. Most reoperated patients were female, with a dominant and predominantly affected right limb, and the vast majority presented a systemic comorbidity.

In most cases, re-injuries were attributed to non-traumatic causes, and traumatic causes were associated to young adults. In general, the extent of the lesion remained the same or

was smaller when compared to the first surgery. The interval between the two surgical procedures was extremely varied; nevertheless, it was smaller when the reason for the intervention was traumatic.

## Conflicts of interest

The authors declare no conflicts of interest.

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