SOCIEDADE BRASILEIRA DE ORTOPEDIA E TRAUMATOLOGIA

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Original Article

Arthroscopic rotator cuff repair: single-row *vs.* double-row – clinical results after one to four years

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ARTICLE INFO

Article history:
Received 2 December 2016
Accepted 4 May 2017
Available online 10 June 2018

Keywords:
Rotator cuff
Shoulder
Bursitis
Arthroscopy

ABSTRACT

Objective: Evaluate and compare the results of single-row (SR) *vs.* double-row (DR) arthroscopic rotator cuff repair.

Methods: From December 2009 to May 2013, 115 arthroscopic rotator cuff repairs were performed using suture anchors. After applying the exclusion criteria, there were 75 patients (79 shoulders) to be evaluated, retrospectively, of whom 53 (56 shoulders) attended re-evaluation. The patients were divided into two groups: SR with 29 shoulders, and DR) with 27 shoulders. The scoring systems for clinical evaluation were those of the University of California at Los Angeles (UCLA) and the American Shoulder and Elbow Surgeons (ASES).

Results: The mean follow-up period in the SR group was 37.8 months *vs.* 41.0 months in the DR group. The average UCLA score was 30.8 in the SR group *vs.* 32.6 in the DR group. This difference was not statistically significant ($p > 0.05$). The averages measured by the ASES score also showed no significant difference – 82.3 and 88.8 in the SR and DR groups, respectively.

Conclusion: No statistically significant difference was found between SR and DR arthroscopic rotator cuff repair performed by a single surgeon in the comparative analysis of UCLA and ASES scores.

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https://doi.org/10.1016/j.rboe.2018.05.010

Reparo artroscópico do manguito rotador: fileira simples *versus* fileira dupla – Resultados clínicos após um a quatro anos

Palavras-chave:
Manguito rotador
Ombro
Bursite
Artroscopia

RESUMO

Objetivo: Avaliar e comparar os resultados do reparo artroscópico de lesões do manguito rotador feito pelas técnicas da fileira única (FU) e da fileira dupla (FD).

Métodos: De dezembro de 2009 até maio de 2013 foram feitos 115 reparos artroscópicos do manguito rotador com o uso de âncoras de sutura. Após a aplicação dos critérios de exclusão, restaram 75 pacientes (79 ombros) para serem avaliados retrospectivamente, dos quais 53 (56 ombros) compareceram para reavaliação. Os pacientes foram divididos em dois grupos: FU, com 29 ombros, e FD, com 27 ombros. A avaliação dos pacientes foi feita pelas escalas de pontos da *University of California at Los Angeles* (UCLA) e da *American Shoulder and Elbow Surgeons* (ASES).

Resultados: O tempo médio de seguimento no grupo FU foi de 37,8 meses e no grupo FD, de 41,0 meses. A média dos pontos obtidos pela escala de UCLA foi de 30,8 no grupo FU e de 32,6 no grupo FD. Essa diferença não foi estatisticamente significativa ($p > 0,05$). As médias obtidas pela escala da ASES também não apresentaram diferença estatística, ficaram em 82,3 no grupo FU e 88,8 no grupo FD.

Conclusões: Não foi encontrada diferença estatisticamente significativa entre os métodos FU e FD pela análise comparativa das médias dos escores UCLA e ASES em pacientes submetidos ao reparo artroscópico do manguito rotador por um único cirurgião.

Introduction

Rotator cuff injuries are common. A Japanese study observed full-thickness lesions in 20.7% of patients undergoing routine exams.[1] In cases in which the symptoms warrant surgical intervention, an arthroscopic approach is preferred by most American surgeons.[2] Many authors believe that the development of suture anchors has allowed the evolution and popularization of the arthroscopic technique; nonetheless, there is still controversy as to how the anchors should be placed. The two most commonly used are single-row (SR) and double-row (DR) techniques.[3] More modern techniques, which have modified the concept of DR, such as the transosseous equivalent, are already being used.[4] The original DR fixation method has been extensively studied in the laboratory. Several studies[5–7] have demonstrated its biomechanical superiority when compared with the SR method. In addition to its superiority in the laboratory, the literature has already demonstrated lower rates of *in vivo* re-rupture with the use of the new technique.[8] Nonetheless, there is no consensus regarding its superiority in functional results. In a magnetic resonance study, Tudisco et al.[5] observed lower rates of re-rupture with the use of DR, but those authors did not observe clinical differences between the patients operated by that technique and those who underwent SR fixation. The integrity of the rotator cuff after its repair is related to postoperative functional results.[9] As lower re-rupture rates have been observed, better clinical outcomes would be expected. However, in addition to Tudisco et al.,[5] other authors did not observe differences in clinical scores when comparing these two fixation techniques, as shown in a recently published meta-analysis.[3] Therefore, there is still controversy regarding the best arthroscopic fixation methods for the rotator cuff. In Brazil, no clinical studies comparing these methods have been retrieved.

The present study is aimed at comparing the clinical results obtained by two groups of patients who underwent arthroscopic repair of the rotator cuff. In one group, only one row of anchors was used; in the other, two rows were used.

Methods

This is a retrospective comparative study of two arthroscopic repair techniques for the rotator cuff (SR and DR repair), through summons for clinical evaluation of patients previously operated by a single surgeon. This study was approved by the Ethics Research Committee of this institution before the clinical records were reviewed and the patients contacted.

From December 2009 to May 2013, the author RFB performed 115 arthroscopic repairs of the rotator cuff using suture anchors. During that period, this surgeon routinely requested the necessary quantities of anchors to allow DR repair. However, the requested number of anchors was not always available. The cost of implant material, such as suture anchors, has been a limiting factor in Brazil. In these cases, when the number of anchors allowed only SR repair, this technique was used.

Only patients with lesions that could be repaired by either SR or DR were included in this study. Therefore, patients with extensive, over retracted lesions in whom it would not be possible to perform DR repair were excluded. Those with an associated diagnosis of any local comorbidity that required surgical intervention were also excluded. Thus, cases

of glenoid labrum tear, biceps tenotomy, and lateral resection of the clavicle were not included. Patients who underwent acromioplasty were also excluded; this procedure was only performed in selected cases with clear arthroscopic signs of subacromial impingement, characterized by the presence of coracoacromial ligament fibrillation. After applying the exclusion criteria, 75 patients (79 shoulders) remained to be evaluated; of these 53 (56 shoulders) turned up for reassessment.

The clinical-functional evaluation of the patients who responded to the summons was conducted by a single examiner (LFS), who had no prior knowledge of which technique (SR or DR) had been used for rotator cuff fixation. During the interview and the physical examination of each patient, the University of California at Los Angeles (UCLA) and the American Shoulder and Elbow Surgeons (ASES) scores were applied; both instruments had already been translated and adapted to Brazilian Portuguese.[10,11] Information was also recorded regarding individual data that could interfere with the clinical outcome, namely: age, gender, injury size, smoking habits, and presence of diabetes. This information had been obtained prior to surgery and was recorded in the medical charts. Lesion size was measured with preoperative magnetic resonance imaging (performed in all patients) and followed the criteria of DeOrio and Cofield.[12] The examiner was informed of which technique had been used for each case only after the patients who responded to the summons had been examined and the scores calculated. The patients were then divided into two groups: the SR group, with 29 shoulders, and the DR group, with 27 shoulders.

For statistical analysis of the differences between the means of the scores of each group (SR and DR), Stata/MP 13.1™ was used. The difference between the means was calculated using Student's t-test. The null hypothesis was that the means of the ASES and UCLA scores would be the same. Regression analysis was also performed to evaluate the possible interference of factors that might alter clinical outcomes, namely: age, gender, diabetes, smoking, injury size, follow-up time, and the presence or absence of labor issues.

Surgical technique

All patients included in this study were operated by a single surgeon in lateral decubitus position, under general anesthesia and brachial plexus block. Portals were created in accordance with the standardization proposed by Snyder,[13] and did not differ between both groups. The bone bed was prepared with a smooth soft tissue shaver blade until reaching the cancellous bone. In all cases from both groups, 5 mm Ti Screw Suture Anchor with EasySlide™ (Warsaw, IN) titanium anchors were used, loaded with two Maxbraid # 2 sutures. For SR repair, the anchors were placed in the greater tubercle or immediately medial to the tubercle, so that the tendon suture never placed excessive tension on it (Fig. 1).

For the DR technique, one or more anchors were placed adjacent to the articular cartilage (medial row) in the anatomical neck, and the remaining anchors were placed laterally to these (lateral row) in the greater tubercle, following the technique described by Lo and Burkhart[14] (Fig. 2). According to the guidelines provided by those authors, the sutures pass through the medial anchors in a U-shaped configuration, and then the lateral anchor sutures are passed with simple sutures. It is only after the passing of the lateral sutures that the knots of the medial sutures are tied. Finally, the knots of the lateral anchors are tied. As previously mentioned, cases in which acromioplasty was also performed were excluded from this study.

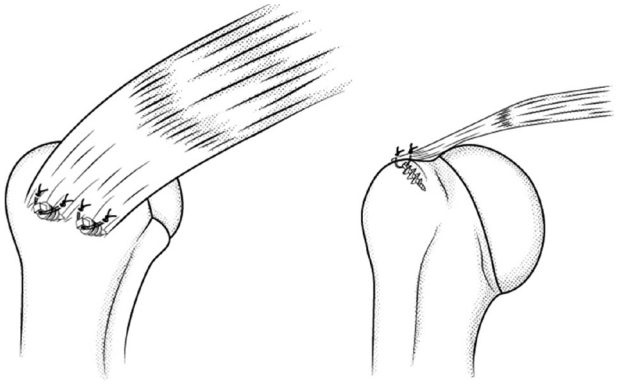

Fig. 1 – Schematic drawing representing the single-row repair technique. Lateral view (on the left) and anterior view (on the right).

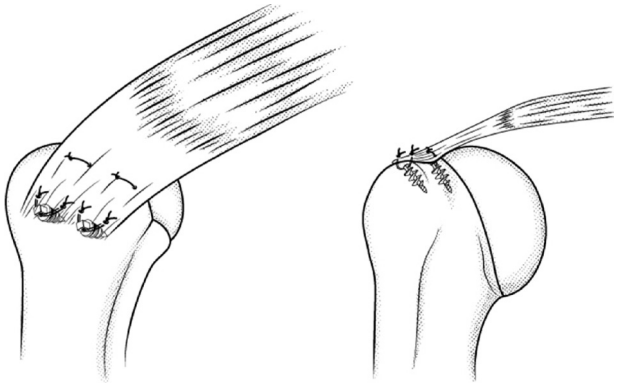

Fig. 2 – Schematic drawing representing the double-row repair technique. Lateral view (on the left) and anterior view (on the right).

All patients used a Velpeau sling for six weeks after surgery; during this period, the sling was removed only for bathing and for performing elbow flexion and extension exercises. Postoperative physical therapy was initiated after this period and was standardized for both groups, in accordance with the protocol of Burkhart et al.[14]

Results

Table 1 summarizes the results. The minimum follow-up time was 17 months and the maximum, 58 months. The mean follow-up time of the SR group was 37.8 months and that of the DR group was 41.0 months. The mean age was 57.5 years in the SR group and 55.7 years in the DR group. Of the 29 shoulders of the SR group, 16 were of female patients, while of the 27 shoulders of the DR group, 19 were female. Nine

Table 1 – Patients and summary of results.

Case	G-A	Diabetes	Tobacco	Size (cm)	SR DR	T (months)	UCLA	ASES	Satisfaction	Return to work	Labor claims
1	M-55	Yes	No	3	SR	41	33	90	Yes	Yes	No
2	M-58	Yes	No	2	SR	37	35	100	Yes	Yes	No
3	M-57	No	No	2	SR	30	35	100	Yes	Yes	No
4	M-66	Yes	No	3.5	SR	35	35	100	Yes	Yes	No
5	F-65	No	No	3	SR	36	33	67	Yes	Yes	No
6	M-66	No	No	1.5	SR	33	35	100	Yes	Yes	No
7	M-65	No	No	2.8	SR	33	32	93	Yes	Yes	No
8	M-53	Yes	No	4	SR	22	31	80	Yes	Yes	No
9	F-74	No	No	3	SR	39	35	100	Yes	Yes	No
10	F-59	Yes	No	3	SR	38	16	40	Yes	No	No
11	F-59	Yes	No	2	SR	25	16	40	Yes	No	No
12	F-58	No	No	2	SR	56	35	98	Yes	Yes	No
13	F-53	No	No	1	SR	47	35	100	Yes	Yes	No
14	M-51	No	No	2	SR	48	35	95	Yes	Yes	No
15	F-50	No	No	2	SR	23	13	17	No	No	No
16	F-56	No	No	3	SR	43	33	90	Yes	Yes	No
17	M-38	No	No	1	SR	37	17	55	Yes	No	Yes
18	M-53	No	No	1	SR	54	32	65	Yes	Yes	No
19	F-53	No	No	4	SR	33	35	100	Yes	Yes	No
20	M-56	Yes	No	1	SR	34	32	92	Yes	Yes	No
21	F-64	No	No	2.5	SR	53	35	100	Yes	Yes	No
22	F-48	No	No	2	SR	31	33	78	Yes	Yes	No
23	F-48	No	No	2	SR	15	31	73	Yes	Yes	No
24	F-67	No	No	3	SR	23	34	100	Yes	Yes	No
25	M-56	No	No	4	SR	32	29	70	Yes	Yes	No
26	F-59	No	No	2.5	SR	40	35	100	Yes	Yes	No
27	F-54	Yes	No	3	SR	30	29	72	Yes	Yes	No
28	F-54	Yes	No	2	SR	17	29	72	Yes	Yes	No
29	M-73	No	No	1	SR	53	35	100	Yes	Yes	No
30	F-50	No	No	3	DR	36	35	100	Yes	Yes	No
31	M-57	No	No	2	DR	31	35	100	Yes	Yes	No
32	F-66	No	No	2	DR	22	35	100	Yes	Yes	No
33	F-57	No	No	1.5	DR	30	35	100	Yes	Yes	No
34	M-59	Yes	No	3	DR	50	35	100	Yes	Yes	No
35	F-64	No	No	3.5	DR	53	28	63	Yes	Yes	No
36	F-40	No	No	3	DR	36	33	83	Yes	Yes	No
37	F-56	No	No	1.5	DR	56	33	100	Yes	Yes	No
38	F-44	No	No	1	DR	40	30	77	Yes	Yes	No
39	M-48	No	No	1.5	DR	56	14	18	Yes	Yes	Yes
40	M-55	Yes	No	3	DR	41	33	90	Yes	Yes	No
41	M-59	No	No	5	DR	54	35	100	Yes	Yes	No
42	F-57	No	No	1.5	DR	53	35	100	Yes	Yes	No
43	F-53	No	No	1	DR	31	30	73	Yes	Yes	No
44	F-51	No	Yes	2	DR	30	23	32	No	No	Yes
45	F-48	No	No	2	DR	52	35	100	Yes	Yes	No
46	F-48	No	No	1	DR	30	35	100	Yes	Yes	No
47	F-48	No	No	2	DR	23	35	100	Yes	Yes	No
48	F-72	No	No	2	DR	22	34	100	Yes	Yes	No
49	F-56	No	No	3	DR	30	35	95	Yes	Yes	No
50	F-50	No	Yes	3	DR	35	35	100	Yes	Yes	No
51	F-60	No	No	3	DR	30	35	100	Yes	Yes	No
52	M-44	No	No	3	DR	43	30	80	Yes	Yes	No
53	F-72	No	No	1.5	DR	55	35	100	Yes	Yes	No
54	F-57	No	No	2.5	DR	48	35	100	Yes	Yes	No
55	F-65	No	No	5	DR	36	32	87	Yes	Yes	No
56	F-68	No	No	2	DR	31	35	100	Yes	Yes	No

DR, double row; SR, single row; G-A, gender and age; T, follow-up time.

shoulders belonged to diabetic patients in the SR group and four to the DR group. Only two patients declared to be smokers, both of whom belonged to the DR group. Injury size ranged from 1.0 cm to 5.0 cm, with a mean of 2.4 cm in both groups (2.37 cm in the SR group and 2.39 cm in the DR group; Table 1).

The mean UCLA scores were 30.8 in the SR group and 32.6 in the DR group. This difference was not statistically significant ($p = 0.25$). The null hypothesis, that the means would be equal, could not be rejected. Likewise, the mean ASES scores showed no statistical difference between the two groups: 82.3

in the SR group and 88.8 in the DR group ($p = 0.27$). The multivariate analysis (regression) did not indicate a relationship between the previously mentioned factors (age, gender, diabetes, smoking, injury size, follow-up time, and presence of labor issues involved) and the results of each group.

Discussion

Arthroscopic rotator cuff repair is often performed in Brazil. When they occur, re-ruptures impair the functional outcome and the degree of patient satisfaction.[9] In order to improve the coverage area of the insertional footprint of the rotator cuff and decrease the chances of a rupture, a new arthroscopic repair technique with anchors was developed – the double row method.[14]

Several laboratory studies have demonstrated the biomechanical advantages related to the use of DR for repair of rotator cuff injuries when compared with SR.[5–7,14,15] In a cadaver study, Kim et al.[15] observed that the presence of gap (abnormal space formation) under cyclic loads after DR repair was significantly lower than that observed in SR. Ma et al.,[16] also assessing cadaveric samples, calculated that DR repair had a higher traction strength. Brady et al.,[17] in a study using *in vivo* arthroscopy, observed that DR provided, on average, more than twice the native rotator cuff footprint coverage than that observed with SR. More recently, Tudisco et al.[5] conducted a retrospective, *in vivo* study in which they used 3-Tesla magnetic resonance imaging to analyze re-rupture rates after rotator cuff repair. The re-rupture rate in the SR group was 60%, while in the DR group it was 25%.

Even in the face of all these factors, which have demonstrated the laboratory and *in vivo* superiority of DR, many studies have failed to demonstrate a difference in the scores obtained in the standardized scales for the clinical evaluation of patients.[3,5,6] Nonetheless, DR is still popular among orthopedic surgeons. Through the application of a questionnaire to orthopedists, a recent study in Brazil showed that 26.1% of the consulted surgeons have DR as their method of choice. The most popular method in this study was SR repair (preferred by 50.4% of the research participants). The transosseous repair and the transosseous-equivalent technique were preferred by 16% and 7.6% of the interviewees, respectively.[18]

Tudisco et al.,[5] despite having observed an important difference in the re-rupture rate when analyzed by magnetic resonance imaging, did not find any difference in the clinical evaluation scores of their patients. In 2013, Sheibani-Rad et al.[19] conducted a meta-analysis study that included only randomized trials with level I evidence. After applying the exclusion criteria, five studies were retrieved in the literature in which the Constant, UCLA, and ASES scores had been used to evaluate the patients who underwent surgery. That study did not find a statistically significant difference in the clinical evaluation scores between the SR or DR groups. Likewise, the present study also did not observe any statistical differences between the UCLA and ASES scores obtained through clinical-functional evaluation of patients who underwent those rotator cuff repair techniques after a minimum period of one year.

In another systematic review of the literature, Saradakis and Jones[20] concluded that despite the lack of statistical differences when comparing all SR results with DR, a statistical difference was observed when only injuries larger than 3.0 cm were taken into account. In another meta-analysis, Millett et al.[21] calculated that there was no statistical difference between the scores obtained after SR or DR, but observed that studies that stratified the results by the size of the injury were able to demonstrate a difference in the clinical results. Finally, Denard et al.[22] conducted a retrospective study with extended follow-up (minimum of five years) to compare the results obtained by SR and DR, analyzing only large rotator cuff lesions (greater than 5.0 cm); 107 patients were available for evaluation and were clinically compared using the UCLA and ASES scores. Those authors concluded that, in large rotator cuff lesions, DR was 4.9 times more likely than SR to lead to good and excellent results.

The present study had some limitations. The analyzed groups were not paired and the selection criterion was not randomized. This is a retrospective study that evaluated the original technique of DR, although more modern techniques, such as the transosseous equivalent, are now available. Furthermore, no postoperative imaging methods were used.

Conclusions

In the present study, it was not possible to observe a significant statistical difference between the SR and DR methods in the comparative clinical analysis of the UCLA and ASES scores in patients who underwent arthroscopic repair of the rotator cuff.

Conflicts of interest

The authors declare no conflicts of interest.

Acknowledgments

To Professor Fernando de Holanda Barbosa Filho, a researcher at the Brazilian Institute of Economics of the Getúlio Vargas Foundation (IBRE-FGV), for the statistical analysis.

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