



## Original article

# Long-term functional evaluation of videoarthroscopic treatment of partial injuries of the rotator cuff<sup>☆</sup>



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## ABSTRACT

**Objective:** To compare the functional results from high and low-grade isolated partial lesions of the supraspinatus tendon of bursal and articular types, after arthroscopic treatment.

**Methods:** Sixty-four patients with isolated partial lesions of the supraspinatus tendon were evaluated. The mean length of follow-up was 76 months (range: 29–193). The mean age was 59 years (range: 36–82). The dominant side was affected in 44 patients (68.8%). There were 35 bursal lesions (54.7%) and 29 articular lesions (45.3%). We used the Ellman classification and characterized the lesions as low or high-grade according to whether they affected less than or more than 50% of the tendon thickness, respectively. Debridement was performed in 15 patients (23.5%), repair without completing the lesion in 11 (17%) and repair after completing the lesion in 38 (59.5%). The functional assessments on the patients were done using the Constant & Murley and UCLA scores.

**Results:** The mean Constant & Murley score among the patients with bursal lesions was  $82.64 \pm 6.98$  (range: 59.3–99) and among those with articular lesions,  $83.57 \pm 7.58$  (range: 66–95), while the mean UCLA score in the bursal lesions was  $33.37 \pm 2.85$  (range: 21–35) and in the articular lesions,  $32.83 \pm 2.95$  (range: 22–35).

**Conclusion:** Videoarthroscopic treatment of partial lesions of the rotator cuff presents good or excellent results when the low-grade lesions are debrided and the high-grade lesions are completed and repaired. These results are maintained over the long term, with a high satisfaction rate and few complications.

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## Avaliação funcional em longo prazo do tratamento videoartroscópico das lesões parciais do manguito rotador

### R E S U M O

**Palavras-chave:**  
Ombro  
Artroscopia  
Manguito rotador

**Objetivo:** Comparar os resultados funcionais, após o tratamento artroscópico, das lesões parciais isoladas do tendão supra-espinal dos tipos bursal e articular nos graus alto e baixo. **Métodos:** Foram avaliados 64 pacientes com lesões parciais isoladas do tendão supra-espinal. Seguimento médio de 76 meses (29 a 193). A média de idade foi de 59 anos (36 a 82). O lado dominante foi acometido em 44 pacientes (68,8%). Observadas 35 lesões bursais (54,7%) e 29 articulares (45,3%). Usamos a classificação de Ellman e caracterizamos as lesões como baixo e alto grau quando acometiam menos ou mais de 50% de sua espessura, respectivamente. Foi feito desbridamento em 15 pacientes (23,5%), reparo sem completar a lesão em 11 (17%) e reparo após completar a lesão em 38 (59,5%). A avaliação clínica funcional dos pacientes foi feita com o uso dos escores de Constant & Murley e UCLA.

**Resultados:** A média dos escores de Constant dos pacientes com lesão bursal foi de  $82,64 \pm 6,98$  (59,3 a 99) e com lesão articular foi de  $83,57 \pm 7,58$  (66 a 95), enquanto que a média do UCLA nas lesões bursais foi de  $33,37 \pm 2,85$  (21 a 35) e nas lesões articulares foi de  $32,83 \pm 2,95$  (22 a 35).

**Conclusão:** O tratamento videoartroscópico das lesões parciais do manguito rotador apresenta resultados bons/excelentes quando as lesões de baixo grau são desbridadas e as lesões de alto grau são completadas e reparadas. Esses resultados se mantêm em longo prazo, com alto índice de satisfação e poucas complicações.

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## Introduction

Partial lesions of the rotator cuff are a frequent cause of pain and functional limitation of the shoulder. They can occur on either the articular or the bursal side, or may be intrasubstantial.<sup>1</sup> The incidence of articular lesions is three times that of bursal lesions.<sup>2</sup> It has been observed that the footprint of the supraspinatus tendon has a mean thickness of 12 mm.<sup>3</sup> Interfingering of the fibers of the rotator cuff tendons occurs at this location, such that the deepest fibers present oblique orientation, while the superficial fibers are parallel to the axis of the muscle.<sup>4</sup>

Ellman<sup>1</sup> described a classification system for partial lesions based on their locations and depths, as measured during arthroscopy. In this system, articular lesions (A) or bursal lesions (B) are described as grade I if their depth is less than 3 mm, grade II if it is between 3 and 6 mm and grade III if it is more than 6 mm. Grade I and II lesions compromise up to 50% of the tendon surface (low grade), while grade III lesions compromise more than 50% of the thickness (high grade). Intrasubstantial lesions are described as (C).

Some partial lesions of the rotator cuff do not heal, despite conservative treatment with physiotherapy and use of anti-inflammatory drugs, and require surgical treatment.<sup>5-11</sup> Several methods of surgical treatment have been described, including acromioplasty alone,<sup>12,13</sup> debridement of the lesion with or without acromioplasty,<sup>7,14,15</sup> transtendon repair,<sup>16-21</sup> conversion to a complete lesion followed by repair<sup>11,22,23</sup> and transosseous repair.<sup>24</sup> There is still no consensus regarding the best treatment for each type of lesion, but it has been shown in the literature that debridement, with or without associated

acromioplasty, provides satisfactory results in cases of low-grade lesions, while high-grade lesions respond better to repair.<sup>25</sup>

The main objectives of our study were to evaluate the functional results following videoarthroscopic treatment of partial lesions of the rotator cuff and compare the types and grades of lesions. We believed that when low-grade lesions were debrided and high-grade lesions were repaired, the results would remain satisfactory over the long term, with low failure and complication rates.

## Materials and methods

This was a retrospective study with functional evaluations on patients who underwent videoarthroscopic treatment of partial lesions of the rotator cuff. Between January 1995 and December 2010, 704 patients with partial lesions of the rotator cuff were operated by means of videoarthroscopy at the Orthopedic, Belo Horizonte and Lifecenter hospitals, by the BH Orthopedic Surgery Group.

The lesions were diagnosed by means of magnetic resonance imaging (MRI) or arthro-MRI and the diagnoses were confirmed through arthroscopy. The patients included presented partial lesions (articular or bursal) solely of the supraspinatus tendon, with a minimum of 2 years of post-operative follow-up. The patients had failed to respond to conservative treatment over a period of at least 4 months before undergoing surgery. The exclusion criteria comprised previous surgery on the shoulder; sequelae of fractures in the region of the shoulder or the scapular belt; presence of glenohumeral arthrosis with advanced joint degeneration;

**Table 1 – Topography of the lesions.**

	N	%
Supraspinatus, bursal	35	54.7
Supraspinatus, articular	29	45.3

rheumatoid arthritis; involvement in employment lawsuits; and failure to locate the patient or insufficient documentation.

The functional evaluation was made by means of the scores of Constant and Murley<sup>26</sup> and the University of California at Los Angeles (UCLA).<sup>27</sup> The validation of Boehm<sup>28</sup> for the Constant score was used. In this, the quantitative values are expressed qualitatively, as follows: excellent (91–100), good (81–90), satisfactory (71–80), fair (61–70) or poor (<60). Using the UCLA score, the results could be assessed as excellent (34–35), good (28–33), fair (21–27) or poor (0–20).

Limb dominance, any association with professional and/or leisure activities and the type and grade of the lesion were noted. The surgical parameters taken into consideration were: (1) technique applied (debridement, debridement in association with repair or repair after completion of the lesion); (2) presence of associated pathological alterations and their concomitant treatment; and (3) whether acromioplasty was performed.

Sixty-four patients were included (64 shoulders): 31 males (48.4%) and 33 females (51.6%). The mean follow-up was 76 months (range: 29–193). The mean age at the time of the surgery was 53 years (range: 26–76) and it was 59 years at the time of the assessment (range: 36–82). The dominant side was affected in 44 patients (68.8%) and the non-dominant in 20 (31.2%).

Partial bursal lesions were presented by 35 patients (54.7%) and partial articular lesions by 29 (45.3%) (Table 1). In 19 cases (29.7%), associated lesions were present.

The surgical procedures performed were as follows: debridement in 15 patients (23.5%); repair without completion of the lesion in 11 (17%); and repair after completion of the lesion in 38 (59.5%). The associated procedures were as follows: acromioplasty in 61 cases (95%); total Munford in one case (1.5%); partial Munford in two cases (3%); repair of SLAP lesion in six cases (9.3%); and repair of Bankart lesion in one case (1.5%) (Table 2).

The differences in the clinical characteristics (profession and sports activity) and the functional results (Constant and UCLA) between the groups of patients, according to the type and grade of the lesion, were analyzed either using the Mann-Whitney test or using the chi-square test (according to whether the variable was quantitative or qualitative). The nonparametric Kruskal-Wallis and Pearson tests were also used. The research data were processed through the Statistical Package for the Social Sciences (SPSS), version 17.0. For all

the statistical measurements made, the statistical significance level was set at 5%.

### Surgical technique

All the patients were operated by four surgeons (GGG, FOF, JMF and FMLS) belonging to the Shoulder Group of the BH Lifecenter Orthopedic Hospital. The patient was positioned in lateral decubitus after administration of general anesthesia in association with brachial plexus block. Arthroscopic viewing was obtained through a standard posterior portal and, if there was a need to repair any intra-articular lesion, this was addressed with the aid of an anterior portal located in the rotator cuff interval. The lesion was debrided and the depth was evaluated using the tip of the shaver (4.5 mm in diameter). When this became fully immersed in the lesion, the lesion was considered to be of high grade. The articular lesions were marked using a monofilament thread that was inserted in a needle and passed percutaneously through the lesion.

Low-grade partial lesions were treated by means of debridement, while high-grade lesions were completed and then repaired using anchors. Acromioplasty was performed when there were intraoperative signs suggestive of subacromial impact, i.e. lesions due to subacromial friction, viewed before using the shaver blade. During the postoperative period, the patients continually used a padded abduction sling for 3 weeks and all underwent the same rehabilitation protocol, which consisted of analgesia, rehabilitation of the range of motion (ROM) and, finally, strengthening. The strengthening exercises were implemented after reaching the 60th postoperative day, provided that the passive ROM had become normal.

### Results

The mean Constant score among the patients with bursal lesions was  $82.64 \pm 6.98$  (range: 59.3–99) and with articular lesions,  $83.57 \pm 7.58$  (range: 66–95), while the mean UCLA score for the bursal lesions was  $33.37 \pm 2.85$  (range: 21–35) and for the articular lesions,  $32.83 \pm 2.95$  (range: 22–35). There was no statistically significant difference in the results according to the type of lesion (Table 3). Using the validation of Boehm,<sup>28</sup> we found that the results were excellent and good in 47 patients (73.5%), satisfactory and fair in 16 (25%) and poor in one (1.5%). Using the UCLA categories, we found that the results were excellent and good in 62 patients (97%) and fair and poor in two (3%).

No significant differences in the types and grades of lesions were observed in relation to the variables of profession and sport. There were also no significant differences in age at the time of the surgery, in relation to the functional results. The statistical analysis showed that it was more common for the patients with low-grade lesions to undergo a debridement procedure ( $p < 0.05$ ), while it was more common for the patients with high-grade lesions to undergo repair after completion of the lesion independent of the location at which the tendon was affected (Table 4).

Sixty-one patients (95.3%) were satisfied with the procedure, while three (4.7%) said that they would not undergo it

**Table 2 – Associated procedures.**

Acromioplasty	61 (95%)
Total Munford (resection of the distal clavicle)	1 (1.5%)
Partial Munford	2 (3%)
Repair of SLAP lesion	6 (9.3%)
Bankart surgery	1 (1.5%)

**Table 3 – Results from the functional scores compared with the type of lesion.**

Parameter	n	Bursal		n	Articular		p-Value
		Mean	SD		Mean	SD	
Constant	35	82.64	6.98	29	83.57	7.58	0.318
UCLA	35	33.37	2.85	29	32.83	2.95	0.355

The probabilities of significance (*p* values) refer to the Mann–Whitney test.

**Table 4 – Distribution of lesions and treatments.**

Variable	Type of lesion and grade				p-Value
	Low-grade bursal		High-grade bursal		
	n	%	n	%	
Surgery					0.000
Debridement	10	83.4%	1	4.5%	
Debridement + repair	1	8.3%	3	13.6%	
Repair after completion of lesion	1	8.3%	18	81.9%	
Total	12	100%	22	100%	
Variable	Low-grade articular		High-grade articular		p-Value
	n	%	n	%	
Surgery					
Debridement	4	31%	0	0%	
Debridement + repair	2	15.3%	4	23.5%	
Repair after completion of lesion	7	53.7%	13	76.5%	
Total	13	100%	17	100%	

The probabilities of significance (*p* values) refer to the chi-square test.

again. Among these unsatisfied patients, the mean Constant score was  $68.1 \pm 9.39$  (range: 59.3–78) and the UCLA score was  $24 \pm 4.35$  (21–29). No significant differences in the functional results were observed in relation to the presence of associated lesions that were treated concomitantly with the tendon repair (Table 5).

Among the postoperative complications, two patients (3%) with articular lesions presented renewed tearing (one of them was due to trauma) and underwent arthroscopic repair again, with satisfactory evolution. Another two patients (3%) developed adhesive capsulitis, also with favorable evolution.

## Discussion

Partial lesions of the rotator cuff may cause pain and functional limitation of the shoulder. Most of the symptoms occur at night and during activities involving effort with an upper limb elevated.<sup>29</sup> They are potentially more painful than

complete lesions, possibly because of the non-physiological tension that is created in the fibers of the remnant tendon.<sup>30</sup> Biomedical studies have demonstrated that after a partial lesion of the rotator cuff occurs, the tension patterns in the fibers surrounding the lesion become altered such that lesion propagation is favored, even to the point of reaching a complete lesion.<sup>4,31–33</sup> Yamanaka et al.<sup>34</sup> demonstrated the progression of partial articular lesions over time. Forty patients with lesions of this type were evaluated by means of arthrography over a mean follow-up period of 412 days after the initial diagnosis had been made. The lesion increased in size in 53% and it progressed to a complete lesion in 28% of the cases. This progression probably occurred through changes to the tension patterns of the fibers in the remnant tendon, as observed in biomechanical studies.<sup>31–33,35</sup>

The initial conservative treatment consists of rest, changes to activities, use of anti-inflammatory drugs, intra-articular infiltration of corticoids and physiotherapy. When this treatment method fails, surgical intervention is indicated.<sup>29</sup> In the

**Table 5 – Profile of the patients evaluated and categorized according to the presence of associated lesions.**

Parameters	n	Without associated lesion		n	With associated lesion		p-Value
		Mean	SD		Mean	SD	
Constant	46	83.42	7.29	18	82.13	7.15	0.289
UCLA	46	32.08	3.12	18	33.22	2.24	0.982

The probabilities of significance (*p* values) refer to the Mann–Whitney test.

literature, many surgical approaches for this type of lesion have been described, with varying functional results.<sup>12-24,29</sup> The tendency has been to debride the low-grade lesions and repair the high-grade lesions. However, the data reported so far have been limited to making indications for a specific type of treatment for each type and grade of lesion.<sup>25</sup>

Our study was based on 64 patients who presented partial lesions (bursal or articular) of the supraspinatus tendon alone and who had been operated by means of videoarthroscopy. In our series, unlike what we found in the literature, we had more patients with partial bursal lesions (54.7%) than with partial articular lesions (45.3%).<sup>2,29</sup>

In the literature, we found four prospective studies that compared the functional results between treatments of partial articular and partial bursal lesions.<sup>12,15,23,36</sup> In two of these studies,<sup>12,15</sup> there was no statistically significant difference between the groups. Another study<sup>36</sup> demonstrated better results from bursal lesions, while the last of these studies<sup>23</sup> found a high failure rate among the bursal lesions. Kartus et al.<sup>15</sup> found a mean postoperative Constant score of 61.5 in the group with bursal lesions after debridement and acromioplasty, while the score was 72 in the group with articular lesions that underwent the same treatment, but without any statistical difference. Park et al.<sup>36</sup> observed that after debridement and acromioplasty, there was a notable reduction in pain 6 months after the operation, in patients with bursal lesions in comparison with the group with articular lesions. However, this difference between the types of lesion was not found in new evaluations that were made after one and 2 years of follow-up. It was observed in our study that there was no difference in the functional results between the patients with regard to the location of the lesion (articular or bursal).

Cordasco et al.<sup>12</sup> observed a higher failure rate in the group with bursal lesions treated with debridement and acromioplasty. Failure occurred in 29% of the patients with bursal lesions (4 out of 14 shoulders) and in 3% of the patients with articular lesions (2 out of 63 shoulders). In another study, Kamath et al.<sup>23</sup> compared the results from 42 shoulders that underwent repair after completion of the lesion (33 with articular lesions and nine with bursal lesions). Renewed tearing occurred in 22.2% of the patients with bursal lesions, compared with 9.1% of the patients with articular lesions.

In our study, we observed renewed tearing in two patients with articular lesions (3%) but not in any of the patients with bursal lesions.

In 1991, Snyder et al.<sup>7</sup> evaluated 31 patients with partial articular lesions who underwent arthroscopic debridement, with or without associated acromioplasty. They found satisfactory results (mean UCLA score of 32 points), without any differences in the results between performing subacromial decompression and not doing this. Budoff et al.<sup>14</sup> found that 86% of the results were good or excellent, according to the UCLA score, among 62 shoulders that were treated with debridement of partial lesions of the rotator cuff, with or without acromioplasty. Kartus et al.<sup>15</sup> obtained a mean Constant score of 65 points from evaluating 26 patients who were treated by means of debridement in association with acromioplasty. These authors attributed the unsatisfactory results to degeneration of the rotator cuff over the years and concluded that acromioplasty had not protected the tendon from the

degenerative process. In our study, 10 out of the 11 patients who presented bursal lesions and underwent debridement in association with acromioplasty presented a mean Constant score of 84.06 (range: 78-89.4) and a mean UCLA score of 34.7 (range: 33-35), which were considered to be good results. The effect on the results from performing or not performing acromioplasty could not be compared statistically, given that this procedure was performed in the cases of 95% of all of the patients evaluated.

We performed repairs after completion of the lesions in 19 patients with partial bursal lesions (29.6%) and in 20 patients with partial articular lesions (31.2%). The mean scores resulting from these treatments were 81.78 (range: 59.3-99) and 32.97 (range: 21-35), respectively. In 2007, Deutsch<sup>11</sup> evaluated 41 patients with high-grade partial lesions who underwent repair after the lesions had been completed. After a mean follow-up of 38 months, significant improvements in pain and functional results were observed, as assessed using the score of the American Shoulder and Elbow Surgeons (ASES). In 2008, Porat et al.<sup>22</sup> used this technique to treat 36 patients with high-grade articular lesions and obtained good and excellent results in 83.3% of the cases, as assessed using the UCLA score. In 2009, Kamath et al.<sup>23</sup> demonstrated a satisfaction rate of 93% among 41 patients with high-grade articular lesions who underwent repair after completion of the lesions. These data are similar to the results found by our group, with 100% satisfaction and good/excellent results when the repair was performed after completion of the lesions in the high-grade cases.

The main limitation of the present study was the small sample size followed up (64 patients), in comparison with the total population of patients operated (704 patients). This situation occurred because our service receives patients from many regions of the country and, thus, many of these patients were unable to come in person for the evaluation. Furthermore, because this was a retrospective study, we were unable to objectively observe the evolution of the functional results. We consider that the positive points of our study were the long follow-up (mean of 76 months) in a population that was homogenous in terms of age and demand, with specific surgical treatment for each type of lesion and a single rehabilitation protocol.

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## Conclusion

The videoarthroscopic treatment of these partial lesions of the rotator cuff presented good or excellent results when the low-grade lesions were debrided and the high-grade lesions were repaired after completion. These results were maintained over the long term, with a high satisfaction rate and few complications. No statistically significant differences were observed between the results from the articular and bursal lesions, or between the grades of lesion. Long-term randomized prospective studies comparing the techniques of transtendon repair and repair after completion of the lesion become necessary.

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## Conflicts of interest

The authors declare no conflicts of interest.

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