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How do massive immobile rotator cuff tears behave after arthroscopic interval slides? Comparison with mobile tears

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Abstract

Purpose: the aim of this study was to compare clinical outcomes of contracted immobile massive rotator cuff tears mobilised through an arthroscopic interval slide technique *versus* massive mobile cuff tears directly repaired without any mobilisation.
Methods: twenty-five patients who underwent arthroscopic repair for massive rotator cuff tears with a minimum of 18 months follow-up were included. The patients were retrospectively divided into two groups. In group 1, a single or double interval slide was performed to achieve adequate tendon mobilisation. In group 2 (control group), massive rotator cuff tears were arthroscopically repaired without any additional release. Patients were evaluated with validated outcomes scores: subjective and objective Constant score, a Visual Analogue Scale (VAS) for pain, and single Assessment Numeric Evaluation (SANE).
Results: the two groups were comparable in terms of age, gender and involvement of the dominant arm. The mean follow-up duration was 31 months in group 1 and 28 months in group 2 (p = 0.4). The two groups showed no significant differences in SANE and VAS results (group 1: SANE 77%, VAS 1.3; group 2: SANE 88%, VAS 1.6), or in total Constant score (group1: 66.5 ± 11; group 2: 75 ± 14; p = 0.1) and subjective Constant score (Group 1: 31 ± 5; group 2: 30.8 ± 7; p = 0.9). A significant difference was found for the objective Constant score, which was higher in the control group (group 1: 35.5 ± 7; group 2: 44 ± 8; p = 0.009).
Conclusions: Subjective clinical outcomes of arthroscopic repair with or without interval slides did not differ and were satisfactory. Objectively, immobile cuff tears showed inferior results.The use of interval slides might be considered a first step or an alternative to more invasive procedures for low demanding patients.
Level of evidence: Level III, retrospective comparative study.

Key Words: arthroscopic repair, immobile tears, interval slide, massive tears, rotator cuff.

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Introduction

Rotator cuff tears are a common source of pain, weakness and disability of the shoulder, especially in people aged 60 years and older (1,2). Current management includes a wide range of conservative and surgical modalities. The size of the rotator cuff tear has a significant effect on the clinical result after a surgical repair. The treatment of massive (two or more tendons) rotator cuff tears is still a challenge, particularly when the lesions present poor mobility with severely contracted tissue, which precludes a direct repair to the bone. In these cases, a salvage procedure such as an interval slide technique can be used (3). In these situations is still unclear whether the cuff, after the release, behaves as in a mobile situation in terms of final outcome. The aim, in patients with massive rotator cuff tears, whether mobile or immobile, is to restore a pain-free and functional shoulder that will allow them to regain their previous quality of life.

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The purpose of this study was to compare the final outcomes of arthroscopic repair of massive rotator cuff tears performed using selective arthroscopic interval slide releases *versus* standard repair.

Methods

Study design

The study was designed as a retrospective comparative cohort study. Twenty-five patients, representing the study population, underwent arthroscopic repair of massive rotator cuff tears at our institution between 2005 and 2009. Patients were selected for inclusion in the study on the basis of pre-defined inclusion and exclusion criteria. The inclusion criteria were: previous arthroscopic repair of massive rotator cuff tears with a minimum 18 months of follow-up; preoperative severe or moderate pain at rest and loss of shoulder function not responsive to conservative treatment; grade-3 tendon retraction according to Patte's classification (4) (retraction at the level of the glenoid); and fatty infiltration (any grade for the supraspinatus and less than grade 4 for the infraspinatus, according to Goutallier's classification) (5,6) on preoperative MRI. Exclusion criteria were: osteoarthritis, frozen shoulder, radiculopathy, neuromuscular or other systemic or local skeletal pathologies. A history of trauma and previous surgery to the same shoulder were also considered exclusion criteria.

The patients were divided into two groups according to the surgical technique used: in group 1 (treatment group), arthroscopic rotator cuff repair was performed through a single or double interval slide; in group 2 (control group), rotator cuff tears were directly repaired to the bone. The decision on whether to perform an interval slide was based on intra-operative tendon mobility.

Surgical technique

Following induction of general anesthesia, the patients were placed in the lateral decubitus position. Four kilograms of balanced suspension were used with the arm in 20° to 30° of abduction as well as 20° of forward flexion.

Following appropriate treatment of any intra-articular pathology, the arthroscope was placed into the subacromial space through the posterior portal. A lateral portal was created in line with the posterior aspect of the clavicle, or slightly anterior or posterior, depending on the position of the rotator cuff tear.

To allow complete visualization and classification of the rotator cuff tear, all fibrotic bursal tissue was removed from the margins of the tear. Following complete removal of the overlying bursa, the tear was identified and assessed for mobility. Apart from anterior or posterior interval slide releases, a standardized single-row suture anchor repair together with a biceps tenotomy was performed in all the patients.

If the lesion involved more than two tendons and was not mobile from medial to lateral, then the tear was classified as massive and contracted.

Anterior interval slide

The supraspinatus tendon was initially identified and a traction stitch was placed along the lateral edge of the tendon and pulled out through the lateral portal. The anterior margin of the supraspinatus tendon was delineated by the leading edge of the biceps tendon and the rotator interval. The scapular spine delineated the posterior margin of the supraspinatus tendon.

When performing an anterior interval slide, the scope was placed into the posterior portal. A basket punch was introduced through the lateral portal and the supraspinatus tendon was then released from lateral to medial, starting at the free margin of the tendon tear and progressing to the base of the coracoid. This release also incised the coracohumeral ligament.

Posterior interval slide

In performing posterior interval slides, it was critical to expose the lateral border of the scapular spine, which indicates the interval between the supraspinatus and infraspinatus, by resecting the medial fibro-fatty tissue with a shaver introduced from posterior and the arthroscope from lateral until the arching column of the scapular spine was visible. The slide was performed while viewing through the lateral portal. The posterior edge of the supraspinatus was then released by incising the interval between the supraspinatus and infraspinatus tendons and progressing towards the scapular spine. Care was taken in each release to avoid injury to the suprascapular nerve.

Postoperative management
Postoperative rehabilitation was standardized on an outpatient basis. In both groups a sling with abduction pillow was worn continuously for four weeks after surgery except during bathing and exercises. Active elbow flexion and extension was encouraged. Patients performed scapular exercises immediately.
Passive mobilisation and assisted active exercises within the pain-free range of motion were also performed up to eight weeks after surgery. Afterwards, active exercises with and without resistance were initiated.

Clinical assessment
Patients were clinically evaluated with specific functional rating scales. A limb-specific and two quality of living scores were used: the Constant score (CS), a Visual Analogue Scale (VAS) for pain and a Single Assessment Numeric Evaluation (SANE).
The Constant score was considered the primary outcome of the study. It is calculated using a system that combines a shoulder function test (range of motion and strength for a total of 65 points) with a subjective evaluation of shoulder complaints (pain and limitations of daily living activities for a total of 35 points) (7).
The VAS, a 10-cm horizontal continuous scale from 0 to 10 (no pain to excruciating pain), was used to subjectively quantify patient's pain (8).
The SANE rating was determined by the subject's response to the following question: "How would you rate your shoulder today as a percentage of normal (0 to 100% scale with 100% being normal)?" (9).

Statistical analysis
Continuous variables were expressed as mean values (± standard deviation). Categorical variables were presented as percentages of cases.
We tested differences between the two groups for continuous variables with an unpaired Student's t or Mann-Whitney test, according to the characteristics of the data distribution. The chi-square test was used to assess the differences in categorical variables. Statistical analyses were carried out using SPSS Version 17 (SPSS Inc., Chicago, IL, USA). For all analyses, a p-value < 0.05 was considered statistically significant.

Results

Twenty-five patients were included in the present study; 13 patients were included in group 1 and 12 in group 2. In group 1, eight patients underwent a single posterior interval slide and five patients a double interval slide (anterior and posterior).
There were no significant differences between the two groups with regard to age, gender and involvement of the dominant side (**Tab. 1**). The two groups were also comparable for length of follow-up (the median follow-up was 31 months in group 1 and 28 months in group 2; p = 0.4).
No significant differences were found in the SANE and VAS results (group 1: SANE 77%, VAS 1.3; group 2: SANE 88%, VAS 1.6), (SANE: p=0.5; VAS: p=0.7).
The mean post-operative Constant score was 66.5 ± 11 in group 1 and 75 ± 14 in group 2 (p= 0.1). The two groups showed no significant difference in the subjective Constant score (group 1: 31±5; group 2:30.8±7; p=0.9). Instead, a statistically significant difference was found in the objective Constant score (group 1: 35.5±7; group 2: 44 ± 8; p = 0.009) (**Tab. 2**).

Discussion

Massive immobile rotator cuff tears account for less than 10% of massive rotator cuff lesions (3,10). These

Table 1. Comparison of baseline characteristics between the two groups.

Variables	Group 1	Group 2	Overall	p
N° patients	13	12	25	ns*
Gender (% males)	61	50	56	ns*
Age (years)	63±6	69±7	64.9	ns*
Involvement of the dominant side (%)	61.5	75	68	ns*

*ns: non-significant

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Table 2. Summary of results.

Outcomes	Group 1	Group 2	p
SANE (%)	77	88	0.5
VAS	1.3	1.6	0.7
Constant score (total)	66.5±11	75±14	0.1
Constant score (subjective)	31±5	30.8±7	0.9
Constant score (objective)	35.5±7	44±8	0.009

tears are commonly considered irreparable and major reconstructive options exist (e.g. latissimusdorsi transfer, reverse shoulder arthroplasty). However, arthroscopic repair in rotator cuff tears continues to evolve, allowing the treatment of more complex cases. Arthroscopic mobilization techniques were recently suggested as a viable option in massive contracted rotator cuff lesions (10-13).

We compared the results of 25 patients who underwent either arthroscopic repair of immobile massive rotator cuff tears mobilized with an interval slide release technique or standard arthroscopic repair of mobile massive lesions. The results revealed a low level of residual pain in both groups (1.3 *vs* 1.8). The mean SANE value was good in both groups (77% in group 1 and 88% in group 2). Only one patient in both group considered the treatment inadequate (SANE < 60%). Satisfactory subjective Constant scores were recorded following arthroscopic repair both of immobile massive rotator cuff tears and of mobile cuff lesions. Previous studies evaluating the outcome of arthroscopic rotator cuff repair using interval slides have given clinical results comparable to our treatment group data (10-13). The satisfaction rate in our immobile rotator cuff tear patients (92.3%) was similar to the satisfaction rates reported by Tauro (11) and Burkhart (12), respectively 93 and 88.8%. A previous study (13) showed a satisfactory quality of living in 21 patients (81%) who underwent arthroscopic functional repair of immobile rotator cuff lesions. Berdusco et al. (10) reported clinical improvements in pain, function and strength in 11 patients with massive irreparable rotator cuff tears, treated with arthroscopic interval slides (although 55% of the cases showed a massive retearing of the rotator cuff to the original size of the tear).

Burkhart et al. (12, 14) also demonstrated strength improvement at final follow-up after mobilisation with an interval slide technique. However, our series showed that the use of interval slides is not sufficient to obtain a recovery of shoulder strength comparable to that obtained in standard cases. The objective Constant score remained significantly lower in group 1 respect to group 2. These data suggest that the strategy for treating a massive contracted tear might differ depending on the patient's requests. If the patient's aim is to obtain a pain-free shoulder, an arthroscopic cuff repair with mobilisation techniques may be sufficient. Instead, in patients specifically wanting to obtain an improvement in strength, other options have to be discussed. A systematic review demonstrated improvements in shoulder function, motion, strength and pain after latissimus dorsi tendon transfers for irreparable rotator cuff tears (15).The authors showed a good post-operative Constant score (73.2), comparable to our results, with strength improved by a mean of 1.3 kg. In this review, the patients undergoing latissimus dorsi transfer were young (mean age, 58.7), prevalently males (70%), with involvement of the dominant side in 77% of cases. A large proportion of patients (41%) had a previously failed rotator cuff surgery, meaning that surgeons seem to consider tendon transfers a "second step" procedure. Moreover, the authors reported a 9.5% rate of complications with a reoperation rate of 6.9%. Currently, there are no studies comparing latissimusdorsi tendon transfer with any other treatment, therefore it is not possible to determine whether latissimusdorsi transfer is a preferable technique in young, active patients with irreparable rotator cuff tears.

Another important goal of arthroscopic repair in massive rotator cuff tears is the possibility of reducing progression of glenohumeral osteoarthritis. In a long-term follow-up study, Paxton et al. (16) showed radiographic progression of cuff tear arthropathy after a failed arthroscopic repair of large or massive rotator cuff tears, although improvements in clinical outcome, pain relief and range of motion appeared to last more than at least ten years. Zingg et al. (17) studied 19 patients with non-operatively managed, moderately symptomatic massive rotator cuff tears. Over an average of four years, they demonstrated that glenohumeral osteoarthritis progressed substantially and the acromiohumeral distance significantly decreased from a mean of 8.2 mm at the time of diagnosis to a mean

of 5.6 mm. At present, given the lack of studies with a long-term follow-up, it is not possible to conclude that these arthroscopic procedures prevent proximal humeral migration or cuff tear arthropathy, allowing postponement of reverse shoulder arthroplasty.

The main limitation of the present study is the relatively limited number of patients included.This type of study provides a low level of evidence, whereas other designs could have given more incisive results and conclusions. The lack of postoperative imaging is another major limitation, although this is less relevant given that the main outcome was purely clinical. Another bias is the internal variability of the treatment group, as some of the patients received a single interval slide and some a double interval slide.

Unfortunately, the treatment group was too small to allow further subgroup analysis.

In conclusion, we found that subjective outcomes of arthroscopic repair with or without interval slides did not differ and were satisfactory. Objectively, immobile cuff tears showed inferior results. The use of interval slides might be considered a first step or an alternative to more invasive procedures for low demanding patients.

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