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ORIGINAL ARTICLE

Rotator cuff tears after 70 years of age: A prospective, randomized, comparative study between decompression and arthroscopic repair in 154 patients



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KEYWORDS

Arthroscopy;
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Summary

Introduction: Arthroscopic repair of rotator cuff tears leads to better clinical outcomes than subacromial decompression alone; however the former is rarely proposed to patients above 70 years of age. Our hypothesis was that arthroscopic repair would be superior to decompression in patient 70 years or older. The primary goal was to compare the clinical results obtained with each technique. The secondary goal was to analyze the effects of age, tendon retraction and fatty infiltration on the outcome.

Methods: This was a prospective, comparative, randomized, multicenter study where 154 patients were included who were at least 70 years of age. Of the included patients, 143 (70 repair and 73 decompression) were seen at one-year follow-up; these patients had an average age of 74.6 years. Shoulders had a complete supraspinatus tear with extension limited to the upper-third of the infraspinatus and Patte stage 1 or 2 retraction. Clinical outcomes were evaluated with the Constant, ASES and SST scores.

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Results: All scores improved significantly with both techniques: Constant +33.81 ($P < 0.001$), ASES +52.1 ($P < 0.001$), SST +5.86 ($P < 0.001$). However, repair led to even better results than decompression: Constant (+35.85 vs. +31.8, $P < 0.05$), ASES (+56.09 vs. +48.17, $P = 0.01$), SST (+6.33 vs. +5.38, $P = 0.02$). The difference between repair and decompression was not correlated with age; arthroscopic repair was also better in patients above 75 years of age (Constant, ASES and SST scores $P < 0.01$). There was no significant correlation between the final outcomes and initial retraction: Constant ($P = 0.14$), ASES ($P = 0.92$), SST ($P = 0.47$). The difference between repair and decompression was greater in patients with stages 0 and 1 fatty infiltration (Constant $P < 0.02$) than in patients with stages 2 and 3 fatty infiltration (Constant $P < 0.05$).

Conclusion: There was a significant improvement in all-clinical scores for both techniques 1 year after surgery. Repair was significantly better than decompression for all clinical outcomes, even in patients above 75 years of age. The difference observed between repair and decompression was greater in patients with more retracted tears and lesser in patients with more severe fatty infiltration.

Level of proof: II (prospective, randomized study with low power).

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Introduction

It is generally accepted that rotator cuff repair leads to better clinical outcomes than subacromial decompression alone, but it is rarely proposed to older patients as a treatment option. In 2004, the French Arthroscopy Society (SFA) performed a study on arthroscopic rotator cuff repair that found a lower healing rate in older patients, but few complications and functional improvement in all cases. Patient age was significantly correlated with clinical outcomes and tendon healing [1].

Since then, many published studies have evaluated clinical outcomes of rotator cuff repair in patients over 60, 65 or 70 years of age and found promising clinical results in this age group, with variable anatomical results [2–15]. The SFA decided to further evaluate this repair indication in older adults by spearheading a multicenter study. Since 60 or 65 years of age was no longer seems to be the threshold for a person to be considered elderly, the minimum age was intentionally set at 70 years for this study. Along with evaluating the outcomes of rotator cuff repair in this population, the SFA also sought to compare the standard treatment method used in this age group, namely palliative decompression, with the treatment typically used in a middle-age population, namely arthroscopic repair of the rotator cuff.

The hypothesis was that arthroscopic repair would be better than decompression in older patients who are likely to be less active and may have more severely degenerated rotator cuff tendons. The primary goal was to compare the results achieved with repair versus decompression. The secondary goal was to analyze the effects of age, activity level, tendon retraction and fatty infiltration on these results.

Material and methods

Methods

A prospective, comparative, randomized, multicenter study was performed between July 2010 and August 2011. Twelve surgical centers agreed to participate in this study, which

was designed to recruit two consecutive 6-month cohorts. In half the centers, every patient of at least 70 years of age seen during the first 6 months was treated with surgical repair, while every patient seen in the next 6 months received palliative decompression. In the other half of the centers, the decompression cohort was recruited in the first 6 months and the repair cohort during the second 6 months, so as to homogenize the two populations relative to the time of the year where the patients were seen and operated.

Fairly early on after the study was initiated, five centers could not respect the randomization criteria. Seven centers continued to participate in the study until its end and abided by the surgical indication criteria for the period assigned to them.

The following inclusion criteria were used in this study:

- patient 70 years of age or older (no upper limit);
- complete supraspinatus tear that can be reduced without tendon release;
- extension limited to the upper-third of the infraspinatus, with no significant subscapularis involvement;
- fatty infiltration ≤ 3 ;
- stage 1 or 2 retraction, according to the Patte classification;
- flexible shoulder, with no subacromial or glenohumeral impingement.

The following exclusion criteria were applied in this study:

- massive tears requiring intra-operative arthrolysis;
- non-reducible tear without excessive tension;
- partial rotator cuff tear;
- instability associated with the cuff tear.

Surgical technique

Arthroscopic surgery was performed in every case: acromioplasty was carried out in every patient and, if applicable, a single-row or double-row repair was performed, according to each center's usual practice [16–24]. Tenotomy or

tenodesis of the long head of the biceps was done in 91.5% of cases [25].

Rehabilitation protocol

For all patients, a standardized postoperative protocol was implemented with early self-rehabilitation and splint immobilization for 8–10 days after pain had disappeared in patients who had received decompression or for 6 weeks in patients who underwent rotator cuff repair.

Data analysis

The results were analyzed with a minimum follow-up of 1 year to optimize the number of patients reviewed in this hard-to-mobilize elderly population. The clinical evaluation was based on the Constant, American Shoulder and Elbow Surgeons Score (ASES) and Simple Shoulder Test (SST) scores [26–29]. A/P X-rays in neutral rotation were used to measure the subacromial space before and after the surgery in both groups. The patient's activity level was evaluated before and after surgery with the Senior Shoulder Activity (SSA) score, a four-level scoring system specifically designed for this study (Table 1).

Statistical analysis

Multicenter data collection and computerized data processing were outsourced to Calimed (N. Richardet). The statistical analysis was performed by M. Pitermann from the Aix-en-Provence CNRS laboratory. The goals of the statistical analysis were to validate the homogeneity of the two recruited sub-populations, compare the clinical results between repair and decompression and analyze the effects of age, activity level, tendon retraction and fatty infiltration on the results. The averages from the two sub-populations were compared using the Mann-Whitney U-test for ordinal data and the Fisher test for categorical variables. To compare the gains resulting from each procedure, the improvement after 1 year was calculated in each patient and then the Mann-Whitney U-test used to compare

the changes in each clinical parameter. Differences were considered significant when $P < 0.05$.

Population

One hundred and fifty-four (154) patients 70 years or older were included and 143 were reviewed with a minimum follow-up of 1 year. These patients were distributed among seven specialized surgery centers in France (Bordeaux, Libourne, Versailles, Nice, Toulouse, Boulogne, and Strasbourg) with 8 to 69 patients having been included at each of these centers. Of the 93% of patient reviewed, 73 had received decompression and 70 had received decompression + repair. The average patient age was 74.6 years (± 3.3) and 59% were women.

The epidemiology data were compared statistically to ensure homogeneity of the two sub-populations (Table 2). The mean age, gender ratio, preoperative functional score and injury severity in the two groups were not statistically different.

Results

Overall clinical outcomes after 1 year

All the clinical outcomes significantly improved after the surgery, for both techniques. The mean Constant score went from 42.95 (± 11.57) out of 100 preoperatively to 76.7 (± 10.3) at last follow-up. Pain went from 4.29 (± 2.86) to 13.33 (± 2.5) on a 15-point scale. The activity score went from 8.06 (± 2.98) to 18.11 (± 2.8) on a 20-point scale. Mobility went from 24.81 (± 7.66) to 36.27 (± 4.8) on a 40-point scale and strength went from 5.79 (± 3.28) to 9.12 (± 4.3). The ASES score went from 35.98 (± 13.21) to 88.23 (± 12.7) and the SST score went from 4.18 (± 2.15) to 10.18 (± 2.21). The progression was marked by three cases of adhesive capsulitis (two in the repair group) and one case of lower limb phlebitis. There were no infections or re-operation in this series.

Comparison of repair versus decompression

Arthroscopic repair led to better results than decompression alone for the three overall clinical scores and for each item in the Constant score, including pain, which had already been greatly improved by decompression. The most striking change was the strength increase in the repair group relative to the decompression group (Fig. 1). But this relative difference was less pronounced when only the preoperative to postoperative improvements were compared (Table 3).

Correlations

Does age affect the clinical outcome?

To determine if the difference between repair and decompression was present in more elderly patients, the two sub-populations were further divided into a 70–74 year group and a 75 or older group. The superiority of repair over decompression was still apparent in these two age groups, meaning that these results also apply to patients beyond

Table 1 Senior Activity Score.

I	Sedentary No household chores No DIY home improvement No gardening No sports involving the shoulder
II	Occasionally active Light household chores Occasional light gardening or DIY activities No sports involving the shoulder
III	Active Daily household chores Regular gardening or DIY activities (2–3×/week) No sports involving the shoulder
IV	Very active Daily gardening or DIY activities Sports involving the shoulder

DIY: do-it-yourself.

Table 2 Comparison of epidemiological parameters of the two populations.

	Repaired	Decompressed	P-value
Average age	74.4	74.9	0.30
Gender	37% men 63% women	45% men 55% women	0.37
Overall Constant Score (/100)	44	42	0.29
Pain (/15)	4	4.6	0.4
Activity (/20)	8.5	7.6	0.04
Active motion (/40)	25.9	23.8	0.07
Strength (/25)	5.5	6.1	0.78
ASES	36.5	35.5	0.78
SST	4.1	4.2	0.95
Subacromial height	9.5 mm	9 mm	0.009
Samilson classification	Stages 0 + 1: 95% Stage 2: 5%	Stages 0 + 1: 92% Stage 2: 8%	0.065
Retraction in frontal plane	Stage 1: 48% Stage 2: 52%	Stage 1: 51% Stage 2: 49%	0.74
Fatty infiltration	Stage 0: 12.5% Stages 1 + 2: 86% Stage 3: 1.5%	Stage 0: 7.5% Stages 1 + 2: 83.5% Stage 3: 9%	0.15
Tendon thickness	Normal: 45% Thinner: 54.5%	Normal: 44% Thinner: 56%	0.86
Reduction	Easy: 82% Hard 18%	Easy: 88% Hard: 12%	0.62

ASES: American Shoulder and Elbow Surgeons Score; SST: Simple Shoulder Test Score.

75 years of age. The difference between repair and decompression actually seemed to increase after 75 years of age, but not significantly, although the efficacy of repair relative to decompression in patients above 75 years of age was still apparent (Table 4).

Does fatty infiltration affect the clinical outcome?

The difference between repair and decompression for the Constant and ASES scores, especially strength levels, was even greater in patients with less fatty infiltration (FI) (Fig. 2).

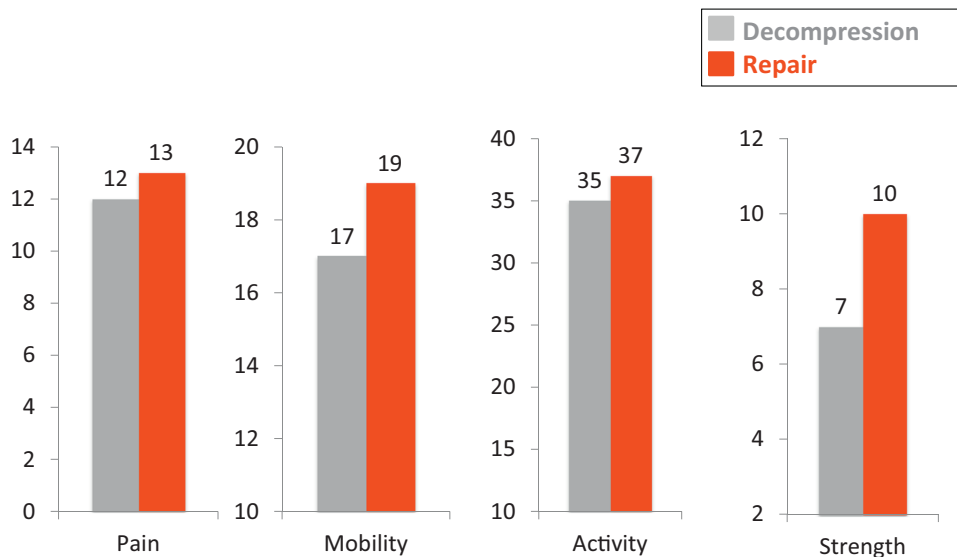


Figure 1 Constant score components at 1 year; all components were significantly different between groups ($P < 0.05$).

Table 3 Comparison of pre- and postoperative winnings.

	Improvement with repair + decompression	Improvement with decompression only	P-value
Constant (/100)	36.39	31.27	0.041
Pain (/15)	9.99	8.15	0.014
Activity (/20)	10.36	9.78	0.73
Active motion (/40)	11.14	11.78	0.51
Strength (/25)	4.90	1.72	<0.0001
ASES	55.93	46.81	0.010
SST	6.17	5	0.020

ASES: American Shoulder and Elbow Surgeons Score; SST: Simple Shoulder Test Score.

Table 4 Analysis of the influence of age on the clinical outcome.

	70–74 group			75+ group		
	Repaired	Decompressed	P-value	Repaired	Decompressed	P-value
Constant	80.34	74.64	0.0037	80.08	72.16	0.0043
ASES	92.79	85.43	0.0016	93.22	81.88	0.0002
SST	10.47	8.89	0.022	10.73	9.52	0.0063

ASES: American Shoulder and Elbow Surgeons Score; SST: Simple Shoulder Test Score.

Correlation with tendon retraction

The difference between repair and decompression was significantly greater for stage 2 retracted tears, especially for the strength and pain outcomes (Fig. 3).

Discussion

The comparative design chosen for this study can be debated but we felt that random allocation by drawing lots was overly restrictive and hard for patients to accept. We instead chose to indirectly randomize consecutive cohorts to simplify the decision-making and explanations during patient care, and also to allow inclusion or every patient 70 years or older

having a surgical indication in every center in the study [30]. This study was consistent with standard of care, given the soundness of the two surgical treatments used [16–24]. In the 2011 Dezaly study, the authors seemed to regret using simple randomization as it resulted in an unequal number of patients in each group. It also induced a selection bias because certain patients or surgeons may have refused to follow the drawing of lots when the patient was informed of the allocated treatment the day before the procedure [3].

The clinical outcome scores used in this study were chosen to allow comparisons with published studies from European (Constant score) and American centers (ASES and SST scores). The scores complement each other since the Constant score is based on more objective data, with little

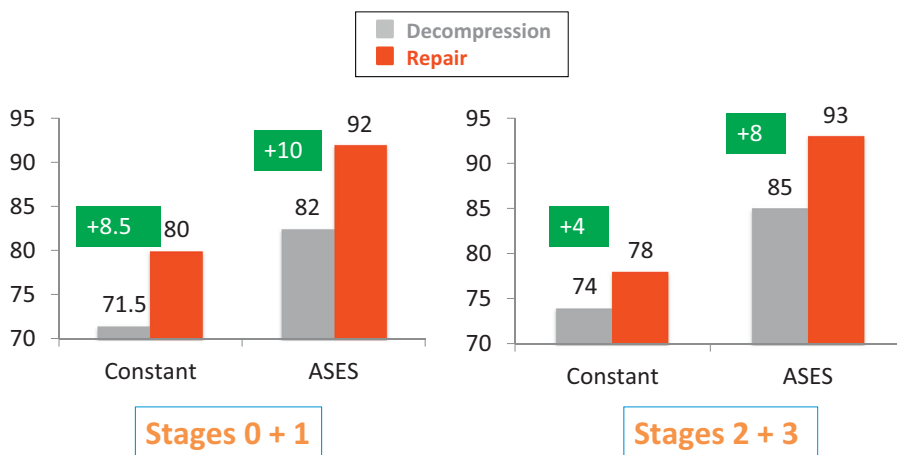


Figure 2 Effect of fatty infiltration on clinical outcomes. The differences in the Constant and American Shoulder and Elbow Surgeons Score scores between the repair and decompression groups were significantly greater for tears with less fatty infiltration.

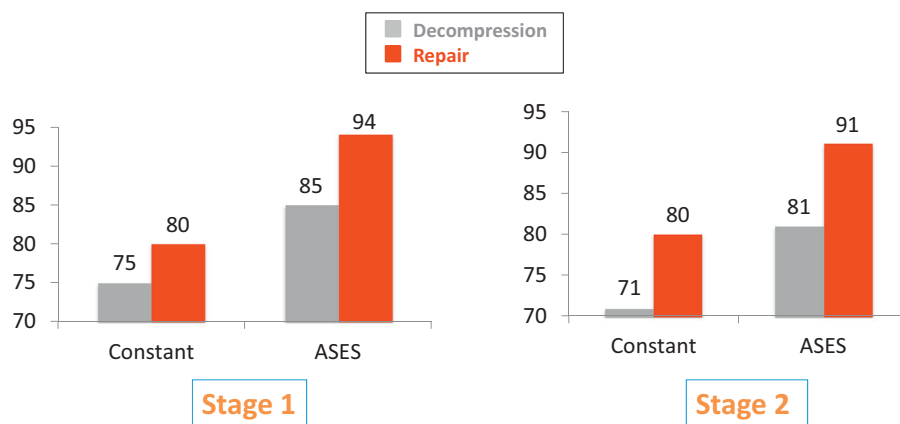


Figure 3 Effect of tendon retraction on clinical outcomes. Differences between the repair and decompression groups were greater for stage 2 retracted tendons.

impact on the patient's assessment of function, while the ASES and SST scores are mainly based on the patient's self-evaluation of shoulder function [26–29].

The minimum age of 70 years in the study is higher than 60 or 65 year minimum used in several published studies [2–15]. Rotator cuff tears are mainly found in people above 50 years of age, with the 576 patients included in the 2004 SFA study being 58 years old on average [1]. To obtain relevant information on rotator cuff repair in older patients, we had to distance ourselves from the typical population by aiming for an average age of 75 years in the included cohorts. The world population is growing older and many people above 70 years of age are involved in physical and sports activities. As a consequence, the question of whether to repair the rotator cuff is relevant because this population wants optimal functional recovery to support their active lifestyle. To measure the effect of age on the results and especially on the difference obtained between repair and decompression, we created two sub-groups (70–74 years and 75+ years) with 75 and 68 patients, respectively.

The effect of fatty infiltration is less in the current study because only small and medium size tears were included. Fifty percent of patients had stage 0 or 1 fatty infiltration, while 40% had stage 2. Only a few patients had stage 3 fatty infiltration, which was not sufficient to draw any statistical conclusions. The superiority of repair versus decompression in terms of clinical and functional outcomes, especially strength levels, was more pronounced when repairing rotator cuff muscles with a low degree of fatty infiltration. When stage 2 retracted tendons were repaired, the differences between repair and decompression were also greater. The optimal profile for repair is a 70+ year-old patient with a mid-size tear with minor fatty infiltration (stage 0 or 1). This is consistent with conclusions from the Dezaly study where repair was found to be better than decompression only for medium size tears [3,31,32].

It has been previously reported that clinical outcomes were good for open repair and that patients were highly satisfied [7,13]. But a study by Lam's group found that 56% of patients had mediocre or poor objective clinical outcomes, despite an 84% satisfaction rate. However, these studies included a relatively high number of massive tears, which would have negatively affected the outcomes. With

arthroscopic surgery, others have reported good functional results in studies with 54 patients above 60 years of age and 39 patients above 70 years of age [10,12]. But neither of these studies had a control group or randomization, and the small number of patients did not allow age and tear size to be correlated. Downie performed a meta-analysis in 2012 to compare surgical treatment with functional (non-surgical) treatment [5]. Out of 448 studies evaluated, only 8 were retained. He put emphasis on the pressing need to clarify the efficacy of various treatment options in older patients, despite generally good results reported in surgical treatment studies. The current study and the Dezaly study have made up for these shortcomings by performing randomized comparative studies in sufficiently a large number of patients to allow for statistical analyses. In comparison to the Dezaly study, the current study excluded massive tears and had more distal and intermediate tears, which lead to greater statistical power. This may explain the observed significant difference between decompression and repair for the whole population, including distal tears. Note that the differences were not significant in the Nancy study [3]. The same trend was found in the current study with a significant difference in all items of the Constant score for stage 2 tears and only in the overall Constant and strength component for stage 1 tears.

Other studies have focused on tendon healing [2,4,6,15]. These non-comparative studies reported good functional results, which is consistent with our study, and also found variable healing rates depending on the type of tear and surgical technique used. The current study was intentionally limited to evaluating functional outcomes by comparing two surgical techniques targeting very different anatomical structures. Another multicenter study using the same inclusion and exclusion criteria as the current study is being performed in parallel within the SFA to focus on tendon healing. The results of 135 patients seen at one-year post-operative will be published separately.

In terms of the surgical technique used, we only included patients operated arthroscopically. Because of the multicenter and multi-surgeon nature of the study, both single-row and double-row repairs were used. This could be considered a limitation of this study, but both types of repair are used in current practice. Thus similar results can be expected with

arthroscopic repair by any surgeon who may be asked to treat this condition in patients of this age. The goal of the study was not to compare two surgical repair techniques, but to compare surgical repair with decompression alone.

Another limitation of this study was the relatively short follow-up (1 year), which seems sufficient to compare two techniques beyond their postoperative course. But it is probably insufficient to validate the long-term prognosis of the non-repaired cuff tendons, which may progress towards tear extension and humeral head migration, versus repaired cuff tendons, which may re-tear because of the tendon degeneration present in patients of this age. A second SFA study will review these same two patient populations over a longer period of time with the aim of providing additional information to determine appropriate indications and surgical techniques.

Conclusion

Both rotator cuff repair and decompression alone significantly improved the clinical outcomes after 1 year, thus both can be proposed to patients having a rotator cuff tear to improve their condition after conservative treatment and rehabilitation have failed, even if above 70 years of age.

The clinical scores used in this study (Constant, ASS, SST) revealed that repair was better than decompression, which improved strength as expected, but surprisingly also provided more pain relief. The superiority of repair was also apparent in patients greater than 75 years of age. We recommend that highly active patients be treated with surgical repair since they would derive the greatest benefit from the procedure. The differences observed between repair and decompression were greatest for intermediate-stage retractions, but was still significant with distal tears. This difference was most apparent in tendons with minor fatty infiltration. Surgeons must remain cautious when determining the surgical indication by basing it on preoperative evaluations and precise analysis of tear size and degree of fatty infiltration, especially in older patients where the cuff tendons will be more degenerated in general.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

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