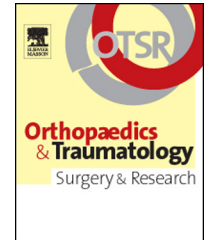




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ORIGINAL ARTICLE

# Arthroscopic repair of the rotator cuff: Prospective study of tendon healing after 70 years of age in 145 patients



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## KEYWORDS

Shoulder;  
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## Summary

**Introduction:** The level of activity of patients older than 70 years is tending to increase, as are their expectations in terms of joint function recuperation. It has not been proven that rotator cuff repair healing is satisfactory in the elderly. The main hypothesis of this study was: repair of supraspinous lesions in patients older than 70 years is reliable in terms of both clinical results and healing. The secondary hypothesis was: tendon healing is significantly correlated with the Constant, ASES, and SST scores as well as with age, tendon retraction, and fatty infiltration.

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E-mail address: [phflurin@gmail.com](mailto:phflurin@gmail.com) (P.-H. Flurin).

**Material and methods:** Multicenter prospective study on 145 patients older than 70 years, with 135 patients reviewed at 1 year (93%). The mean age was 73.9 years. Full-thickness tears of the supraspinatus extended at most to the upper third of the infraspinatus and retraction limited to Patte stages 1 and 2 were included. Clinical assessment was carried out in accordance with the Constant, ASES, and SST scores. Healing was evaluated with ultrasound.

**Results:** A significant improvement was noted in the Constant (44/76) +31.5 ( $P < 0.0001$ ), ASES (35/90) +54.4 ( $P < 0.0001$ ), and SST (3.5/10) +6.6 ( $P > 0.0001$ ) scores at 1 year of follow-up. The healing rate was 89% with 15 re-tears, nine of which were stage 1 and six stage 2. The clinical result was not correlated with patient age (Constant,  $P = 0.24$ ; ASES,  $P = 0.38$ ; SST,  $P = 0.83$ ) nor with the retraction stage (Constant,  $P = 0.71$ ; ASES,  $P = 0.35$ ; SST,  $P = 0.69$ ) or the stage of fatty infiltration ( $P > 0.7$ ). Healing was correlated with the quality of the clinical result (Constant,  $P = 0.02$ ; ASES,  $P = 0.03$ ) and age ( $P = 0.01$ ) but was not correlated with retraction or the fatty infiltration stage ( $P > 0.3$ ).

**Discussion/conclusion:** Arthroscopic repair significantly improves the clinical results, even in patients older than 70 years. The clinical results are not correlated with age (but deterioration of the result was not noted after 75 years) or frontal retraction (but the study only included retractions limited to stages 1 and 2). The healing rate is satisfactory, but this study is limited to small ruptures of the supraspinatus, and the postoperative ultrasound analysis probably inferior to CT imaging with contrast agent injection, often used as the reference. Healing proves to be correlated with the quality of the clinical result and patient age.

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## Introduction

The aging of the population and lifestyle changes in senior citizens have modified their demand in terms of treatment for rotator cuff tears. The level of activity of patients older than 70 years is tending to increase as are their expectations in terms of joint function recuperation. The studies conducted to date have clearly demonstrated a correlation between the healing rate and the quality of functional recuperation, in particular in strength, as well as a decrease in the healing rate related to age and a greater degeneration of the rotator cuff. It has therefore not been clearly proven that healing of rotator cuff repair is satisfactory in the most elderly patients [1–24].

The aim of this study was to analyze the healing of the rotator cuff in a population of patients over 70 years of age with the main hypothesis that repair of supraspinatus lesions in these patients was reliable in terms of clinical and anatomic results. The secondary hypothesis postulated that tendon healing could be significantly correlated with the Constant, ASES, and SST clinical scores as well as age, tendon retraction, and fatty infiltration [25–28].

## Material and methods

### Methods

This was a multicenter prospective study conducted from July 2010 to August 2011 in 11 surgical centers in preparation for the Société française d'arthroscopie (French Arthroscopy Society, SFA) symposium on rotator cuff tears in patients older than 70 years, held in Lille in December 2012. This series completed a comparative study on decompression and cuff repair at the same symposium. The inclusion and exclusion criteria were the same in the two studies, as were

the participating research centers. Certain centers were not able to randomize their patients, and these cases were added to the repair population of the randomized study to establish a sufficiently large population for statistical analysis of the results on healing and corresponding correlations [29].

The inclusion criteria were age equal to or greater than 70 years, a distal or medium-sized tear that could be reduced without freeing the supraspinatus and with extension limited to the upper third of the infraspinatus, with fatty infiltration less than or equal to grade 3.

The exclusion criteria were joint stiffening, subacromial or glenohumeral joint space narrowing, associated instability, extended rupture deemed unreducible without excessive tension, as well as partial repair of the cuff.

The repairs were all performed arthroscopically with single- or double-row reinsertion according to each center's usual practices. An acromioplasty was performed in all cases [30], associated with a tenotomy or tenodesis of the long portion of the biceps in 95% of the cases [31].

Rehabilitation was standardized with elbow brace immobilization for 6 weeks and early self-rehabilitation.

The results were analyzed with a minimum follow-up of 1 year. The Constant, American Shoulder and Elbow Surgeons Score (ASES), and Simple Shoulder Test (SST) scores were used to quantify the objective and subjective functional recuperation levels [25,26,32–34]. Healing of the rotator cuff was assessed with ultrasound.

Multicenter collection and computerization of the data were outsourced to Calimed (N. Richardet). The statistical analysis was performed by the Aix-en-Provence CNRS laboratory (Parole et Langage; Speech and Language; M. Pitermann). From the beginning, the statistical analysis excluded patients who were lost to follow-up. The Mann-Whitney test was used for numerical variables and the Fisher exact test for categorical variables. The minimal

**Table 1** Initial paraclinical assessment.

	Suturing
<i>Subacromial height</i>	9.79 mm ( $\pm 2$ )
<i>Samilson classification</i>	
Stages 0 + 1	95%
Stage 2	5%
<i>Frontal retraction</i>	
Stage 1	39%
Stage 2	61%
<i>Fatty infiltration</i>	
Stage 0	10%
Stages 1 + 2	86%
Stage 3	4%
<i>Tendon thickness</i>	
Normal	51%
Thinned	49%
<i>Reducibility</i>	
Easy	78%
Difficult	22%

significance rate retained was 5%. Differences were considered significant at  $P < 0.05$ .

## Population

The study investigated 145 patients over 70 years of age, respecting the inclusion criteria, undergoing surgery for repair of the rotator cuff in 11 specialized surgical centers in France (Bordeaux-Mérignac, l'Union, Paris, Toulouse, Rennes, Versailles, Libourne, Nice, Boulogne, Lyon, Strasbourg); 135 (93%) patients were reviewed with a minimum follow-up of 1 year. The distribution by center ranged from 2 patients (Strasbourg) to 33 patients (Bordeaux-Mérignac).

The 10 patients lost to follow-up had undergone insufficient clinical follow-up at 6 months for seven cases, absence of clinical and ultrasound follow-up in two cases, and death independent of the surgery in one case.

The mean age of the population was 73.9 years ( $\pm 3.4$ ), the lesioned side was the right side in 73% of the cases. Seventy-nine patients were female (58.5%).

## Initial clinical assessment

The mean preoperative Constant score was 44.4 ( $\pm 12$ ) with a pain subscore at 5.32 ( $\pm 2.8$ ), activity at 8.08 ( $\pm 3$ ), active mobility at 26.1 ( $\pm 8$ ), and strength at 4.86 ( $\pm 3.6$ ). The mean initial ASES score was 35.44 ( $\pm 14.6$ ) and the SST score was 3.52 ( $\pm 2.4$ ).

## Initial paraclinical assessment

The type of lesion is summarized in [Table 1](#), noting a majority of intermediary lesions and stage 1 and 2 fatty infiltration in 86% of the cases; stage 3 only accounted for a small proportion (4%) of the cases ([Table 1](#)).

**Table 2** Outcomes analysis.

	Tendon continuity	Full-thickness re-ruptures	P-value
<i>Age</i>	74	76	0.01
<i>Constant score</i>	77	70	0.015
Pain	12	10	0.04
Activity	18	17	NS
Mobility	36	34	0.01
Strength	10	8	NS
<i>ASES</i>	91	82	0.02
<i>SST</i>	10	9	NS

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

## Surgical technique

The surgical repairs were undertaken with one to five tendon anchors (two to three anchors in 59% of the cases and four to five anchors in 31% of the cases). A tenotomy of the long portion of the biceps was performed in 76% of the cases and tenodesis in 19%.

## Results

### Clinical results

At 1 year of follow-up, the mean Constant score was 76/100 (+31.5), the ASES score 90/100, and the SST score 10/12, with significant improvement compared to the preoperative assessment for all of the clinical scores and all of the Constant score parameters ( $P < 0.05$ ) ([Figs. 1 and 2](#)).

The statistical analysis did not find that patient age influenced the clinical result (Constant ( $P = 0.24$ ), ASES ( $P = 0.38$ ), SST ( $P = 0.83$ )), nor did gender ( $P = 0.76$ ), retraction ( $P = 0.71$ ), or fatty infiltration ( $P = 0.73$ ).

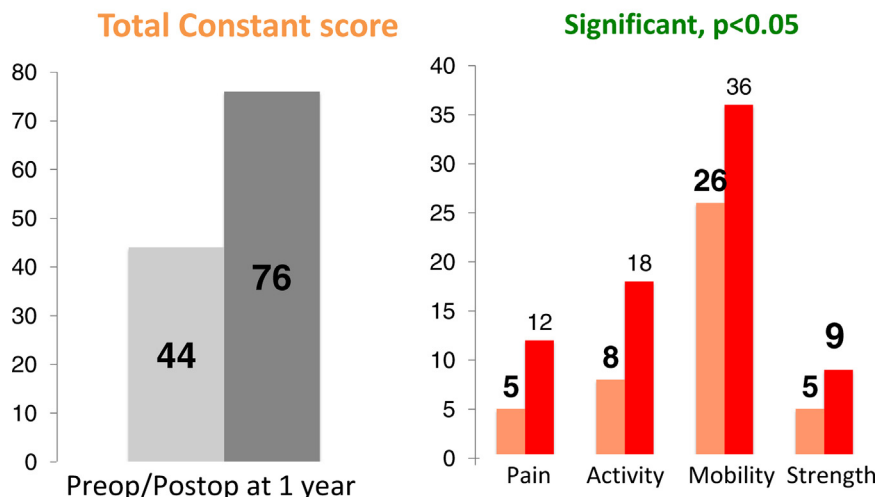
### Anatomical results

Ultrasound follow-up found 110 non-ruptured cuffs, giving a rate of 81.5% healing that was deemed complete at follow-up. A partial tear, i.e., not full-thickness, was demonstrated in 9 cases (6.5%), and in 16 cases, healing failure with full-thickness re-tear was demonstrated, i.e., 12% of the series.

To study the correlations, we separated these results into two populations corresponding to biomechanical criteria: tendon continuity separating full-thickness tears from continuous cuffs, including both non-ruptured cuffs and partial tears. Given the small number of re-ruptures, the correlations are difficult to demonstrate rigorously with either the Fisher exact test or the Spearman non-parametric test. One-factor analysis of variance (healed versus unhealed) demonstrated trends that it may be possible to clarify in a larger study.

The results were expected, with re-ruptured cuffs in older patients and with worse overall clinical Constant and ASES scores ([Table 2](#)).

# Constant Score



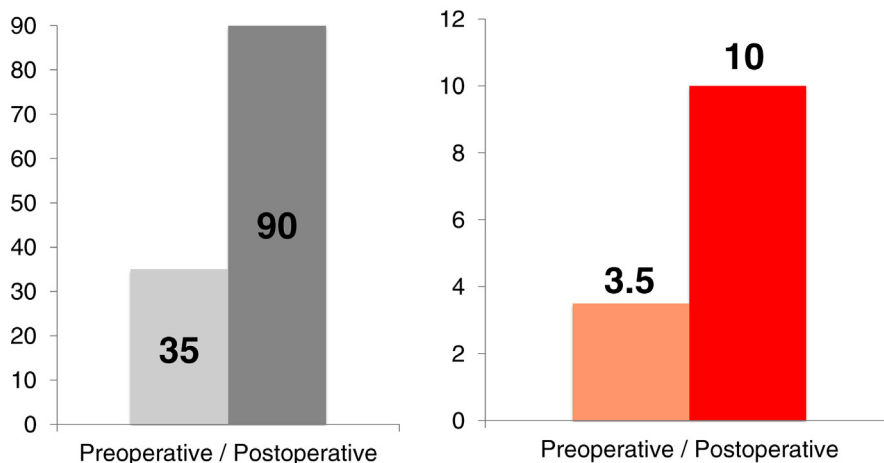
*SYMPOSIUM – Rotator cuff tears in subjects older than 70 years*

**Figure 1** Pre- and postoperative comparison of global Constant and items.

## ASES score

## SST score

**Significant**



*SYMPOSIUM – Rotator cuff tears in subjects older than 70 years*

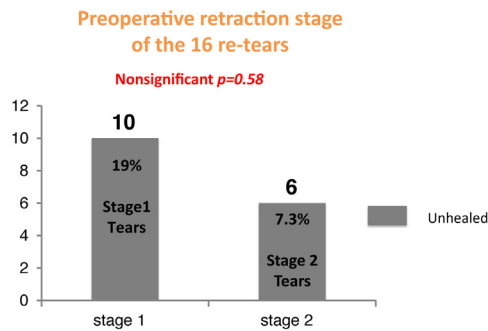
**Figure 2** Pre- and postoperative comparison of ASES and SST scores.

Depending on the level of retraction of the tear, for distal tears, we found 19% unhealed cuffs after surgery and for intermediate tears 7.3% healing failure. This result is not statistically significant given the low number of re-ruptures and did not match the expectation of better healing for distal tears.

As for fatty infiltration, the patients with stage 0 and 1 fatty infiltration presented a 5.8% re-rupture rate, and those with stage 2 or 3 presented a 16.2% healing failure rate. Given the small number of patients whose tears did not heal, these differences cannot be judged statistically significant but represent a relatively clear trend that should be confirmed in a larger study (Fig. 3).

## Discussion

Many studies, in particular the 2004 SFA study, established a correlation between age and healing rate [1–22,35]. In addition, several publications have demonstrated the efficacy of simple decompression with tenotomy for patients whose functional demand is limited or whose cuff has a massive tear with a high risk of non-healing [10,30,31,36]. The first part of this 2012 SFA study and the comparative study reported by Dezalyin 2011 have clearly demonstrated the superiority of the clinical results of suturing compared to simple decompression with, in particular, better functional scores for patients with a greater demand in



**Figure 3** Correlation between retraction and tendon healing failure.

terms of activities [3–5,7,9,11,15,16,19,20,30,36,37]. The present study investigating rotator cuff healing in patients older than 70 years completes the comparative study. The different studies reported in the literature demonstrate quite substantial variability in the healing rates depending on the population selected and how healing is analyzed. Charouset al. demonstrated a 42% re-tear rate in patients older than 65 years with arthro-CT follow-up and Fehring reported a 21% healing failure rate based on ultrasound [3]. In a comparative study, Dezaly et al. found a 32.4% failure rate for a population of patients older than 60 years, including 26% retracted tears [4]. The present study found a much lower failure rate, ranging from 12% to 18.5% depending on whether or not partial tears are included as healing failures. This particularly low rate can be explained by the selection of distal or intermediate tears, reducible without tension, as well as healing assessment using ultrasound, which is certainly less demanding than arthro-CT with contrast agent injection, which can detect fissurations that are not visible on ultrasound. This study being a multicenter study with operator-dependent ultrasound results, which are more difficult to interpret postoperatively than preoperatively given the presence of suture material, can also explain slightly greater tolerance in the interpretation of tendon healing. In this population of elderly subjects with a degenerating cuff, the 1-year follow-up can exclude re-ruptures that may progressively appear at a later date.

It would have been useful to have been able to compare all the characteristics of the subpopulations of healed and re-ruptured cuffs so as to specify the repair indications related to the risk factors of failure. Although the low number of patients with re-rupture in this series does not have sufficient statistical power to obtain significant correlations, the trends nonetheless point in the same direction, as expected, and correspond to the data reported in the literature, except for a higher re-rupture rate for the smallest tears in the series (19% for stage 1 and 7.3% for stage 2). The Dezaly et al. study found 21% re-rupture for stage 1 tears and 35% for stage 2 tears [4]. As for fatty infiltration, a quite pronounced inverse trend can be observed with 5.8% failure for low stages and 16.2% for stage 2 and higher fatty infiltrations. These data are encouraging but undoubtedly require a healing study on a larger population of patients with a greater variety of tears.

## Conclusion

Arthroscopic repair of distal and intermediate rotator cuff tears can obtain very good results even in patients older than 70 years with a mean Constant score above 75 and mean strength greater than 4 kg. These clinical results do not deteriorate in a subpopulation over 75 years of age. The clinical scores (Constant, ASES, and SST) seem correlated with the healing rate, which itself seems to depend on patient age and fatty infiltration. The highly satisfactory healing rate obtained in this study based on ultrasound follow-up seems to validate the option of repairing the cuff after 70 years of age, particularly since, in the first part of this evaluation, cuff repair appeared to be superior to simple decompression. Evaluation of longer-term results will make it possible to reinforce this indication by clarifying the clinical and anatomic progression of these repaired degenerative cuffs compared to a control group of cuffs repaired with simple decompression, the results of which risk to deteriorate with time.

## Disclosure of interest

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

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