Original article

Return to recreational sport and clinical outcomes with at least 2 years follow-up after arthroscopic repair of rotator cuff tears

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ARTICLE INFO

Article history:
Received 9 October 2015
Accepted 16 February 2016

Keywords:
Rotator cuff tear
Arthroscopic repair
Return to sports
Recreational athletes

ABSTRACT

Introduction: The main objective of the study was to assess return to sports in recreational athletes after arthroscopic repair of rotator cuff tear (RCT).

Material and methods: A retrospective single-center study included all recreational athletes operated between 2008 and 2012 for arthroscopic repair of RCT, with regular sports activity, and aged less than 70 years. All were recontacted at a minimum follow-up of 2 years. The main outcome was return to sports (yes/no). The secondary criteria were return to sports, time to return to sports, number of hours per week of sports activity, and at the last follow-up the subjective assessment of sports level, patient satisfaction, and the Western Ontario Rotator Cuff (WORC) Index.

Results: Seventy-six patients (37 females, 39 males) with a mean age of 57.0 ± 7.3 years were included. Of these 76 patients, 53 (69.7%) patients participated in a sport that specifically involved the upper limb. The mean follow-up was 45 ± 14 months. Postoperatively, 67 of 76 (88.2%) patients returned to a sports activity, the same sport for 52 out of 76 (68.4%). The mean time to return to sports was 6 ± 4.9 months. For patients who had taken up their sport again, the mean number of hours a week was not significantly modified (P=0.58). At the last follow-up, the subjective sports level was judged better or identical to the preoperative level by 52 of 67 (77.6%) patients. The factors significantly associated with absence of return to the previous sport were pain symptoms evolving for more than 9 months before surgery (OR = 3.6 [1.01–12.5], P=0.04) and preoperative sports intensity less than 2 h/week (OR = 4.1 [1.4–12.3], P=0.01). At the last follow-up, the functional improvement evaluated by the WORC Index was strongly significant (P<0.00001) and 73 of 76 (96%) patients were satisfied.

Conclusion: The majority of the recreational athletes returned to sports after arthroscopic rotator cuff repair, most often at the same level and with equivalent intensity compared to before surgery.

Level of evidence: IV, retrospective study.

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1. Introduction

Arthroscopic repair is currently considered as the reference surgical treatment for rotator cuff tear (RCT). Compared to classic open techniques, recovery after arthroscopic repair is faster and the long-term functional results are identical [1].

Regular recreational sports practice, encouraged by public health policies designed for the general public, is widespread in all age groups up to 70 years of age and even beyond. The onset of an RCT is frequent in these age groups and will encumber the pursuit of regular sports in these patients, most of whom do not wish to stop.

The possibilities for returning to sports after arthroscopic repair of rotator cuff tears have not been frequently documented in the literature. The publications on the subject are relatively old [2,3], including classic open techniques [2–6], isolated debridements without cuff repair [6,7], or only with professional athlete subjects [2,4,5,8,9]. Very few data are available on arthroscopic rotator cuff repair in recreational sports athletes, even though this population accounts for the majority of the patients operated compared to professional athletes. In a recent study, Bhatia et al. [10] assessed a series of 31 recreational sports patients over 70 years of age operated for RCT with an arthroscopic technique and they noted that 24 (77%) of these patients returned to their sport at the same intensity.

The main objective of this study was to evaluate the return to sports of these under 70-year-old patients undergoing arthroscopic repair.
rotator cuff repair. The secondary objectives were to search for the factors favoring return to sports and to assess the functional results in this population. The main hypothesis was that arthroscopic repair of the rotator cuff allowed the majority of patients under 70 years of age to return to recreational sports at the same level.

2. Methods

This single-center, retrospective study was approved by the institution’s ethics committee (CPP IDF VI, hôpital Pitié-Salpêtrière, 47, boulevard de l’Hôpital, 75651 Paris, France).

2.1. Inclusion/exclusion criteria

The patients included participated in recreational sports at a minimum once a week, were aged 70 years or older at the time of the intervention, underwent arthroscopic surgery for unilateral full-thickness rotator cuff tear on preoperative imaging (supraspinatus [SSP] and/or infraspinatus [ISP], and/or subscapularis [SSC]). Repair had to be complete with a watertight cuff at the end of surgery. The minimum follow-up was 2 years and the patients were operated on between 2008 and 2012.

The exclusion criteria were patients operated on for repeat tear, those presenting a preoperative neurological lesion in the upper limb, posterosuperior glenoid impingement, and those who refused to participate in the study.

2.2. Surgical and postoperative protocols

All patients underwent surgery with general anesthetic and interscalene block. The entire procedure was performed arthroscopically. The patient was positioned in lateral decubitus, with upper limb traction. Double-row repair was performed in 69 (90.8%) cases and single-row repair in seven (9.2%) cases. Tenotomy of the long head of the biceps without tenodesis was performed in 68 (89.5%) cases and tenodesis in eight (9.5%). An acromioplasty using a motorized reamer was performed in all cases. The lateral centimeter of the clavicle was resected in seven (9.2%) cases, to treat symptomatic acromioclavicular arthropathy. Postoperatively, the upper limb was immobilized in a Mayo Clinic-type brace for 1 month, with no mobilization authorized. Rehabilitation was started after the 1-month follow-up consultation with recovery of passive and active range of motion. Muscle strengthening and resistance work were deferred until the 3rd month.

2.3. Patient follow-up and evaluation protocol

The patients were systematically seen and clinically reexamined at 1 month, 3 months, 6 months, and 1 year after surgery. Return to sports was authorized by the surgeon after the 3rd-month visit if the patient so desired. All patients were contacted at the minimum 2-year follow-up by an independent evaluator.

A questionnaire on the patients’ preoperative sports activities, the return to sports after the surgery, and their sports practice at the last follow-up was completed by telephone by an independent evaluator (Appendix A). Later, the WORC (Western Ontario Rotator Cuff index) score [11] was sent to them by mail to be completed at the last follow-up and retrospectively for the preoperative items. This self-administered questionnaire is a tool to evaluate the quality of life of patients suffering from rotator cuff pathology and comprises 21 questions. On a visual analog scale from 0 (none) and 10 (extreme) the patient was asked to indicate the extent to which he or she had felt symptoms caused by the shoulder over the last 7 days. The five items were: physical symptoms, recreational sports, work and daily activities, lifestyle, and emotions.

2.4. Endpoints

The main endpoint was return to sports activity (yes/no). The secondary criteria were return to sports, the time to return to sports and stabilization of the sports level after the surgery, the number of hours of sports practice, subjective evaluation of the sports level at the last follow-up, patient satisfaction, and the Western Ontario Rotator Cuff (WORC) index at the last follow-up.

2.5. Statistical analysis

The normality of the distributions was tested using the Shapiro–Wilk test. If the distributions were normal, parametric tests were used: the Student t-test for independent groups or paired tests for the quantitative variables and the Chi² test for the qualitative variables. If the distributions were not normal, nonparametric tests were used: the Mann–Whitney test or the Wilcoxon test was used for continuous variables and the Fisher exact test for binary variables. The risk factors for non-return to sports activity were sought in univariate analyses and then in multivariate analyses according to logistic regression comparing the group of patients who had returned to their sports at the last follow-up and those who had not returned to any sports activity. All variables with P<0.25 in the univariate tests were included in the multivariate model. A P-value less than 0.05 was considered statistically significant.

3. Results

3.1. Population

During the 2008–2012 inclusion period, 196 patients underwent surgery in the department for rotator cuff repair. Eighty-six of these patients fulfilled the study’s inclusion criteria. Ten out of 86 (11.6%) patients refused to participate in the study or were lost to follow-up; 76 out of 86 (88.4%) were analyzed. This group included 37 females and 39 males with a mean age of 57 ± 7.3 years at the time of surgery. Of these 76 patients, 14 (18.4%) had a manual job, 40 (52.6%) had a non-manual job, and 22 (28.9%) were retired. The most frequent sports practiced before surgery were tennis, swimming, physical exercises, and golf (Fig. 1). Fifty-three out of 76 (69.7%) patients did a sport that involved the upper limb (tennis, swimming, golf) and 23 out of 76 (30.3%) solicited the upper limb less (physical exercises, running). The patients had been active in their sport(s) a mean 16.7 ± 12.2 years before the intervention. The intensity of the sports activity before surgery was 4.3 ± 4 h/week on average for the entire series. The mean follow-up was 45 ± 14 months.

3.2. Description of lesions

The shoulder pain symptoms had evolved for 19.4 ± 23.6 months at the time of surgery. The dominant side was involved in 57 (75%) cases. Two (2.6%) cases involved an occupational accident or occupational disease. The tear involved one (43.4% of the patients), two (43.4%), or three tendons (16.2%). The characteristics of the tendon tears are described in Table 1.

3.3. Return to sports

Fig. 2 summarizes the conditions of the patients’ return to sports. Of the 53 patients participating in a sport that solicited the
shoulder, 46 (86.8%) returned to the same sport: 16 out of 18 (88.9%) tennis players, ten out of 13 (76.9%) swimmers, and 11 out of 12 (91.7%) golfers. The mean time to return to sports activity was 6 ± 4.9 months. Three patients returned to their sport at 1 month, without the surgeon’s authorization (physical exercises, horseback riding, and cycling). The mean time to stabilization of the sports level was 11.3 ± 7.3 months. For the patients who returned to sports, the mean number of hours per week of sports activity was not significantly modified compared to preoperative habits (4.3 ± 4 vs. 4.5 ± 4.4, \( P = 0.58 \)).

For the patients who returned to their sport, the subjective sports level at the last follow-up was deemed superior (19/67; 28.4%), identical (33/67; 49.2%), or inferior (12/67; 17.9%) compared to the preoperative level. Three of 67 (4.5%) patients who had changed sports could not answer this question.

Forty of 67 (59.7%) of the patients who returned to sports were completely asymptomatic in their shoulder during sports activity at the last follow-up. The patients considered the results of the surgery excellent (63.2%), good (32.9%), fair (2.6%), or poor (1.3%). The three unsatisfied patients had returned to a sports activity but only one had returned to his previous sport, at a lower level.

### 3.4. Clinical results according to the WORC index

Thirty-six out of 76 (47.4%) patients completed the WORC questionnaire. In these patients, the WORC score improved significantly

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**Fig. 1.** Sports activities before surgery (several sports possible per patient).

**Fig. 2.** Return to sports.
Table 1  
Description of tendon lesions.

<table>
<thead>
<tr>
<th>Torn tendon(s)</th>
<th>SSP</th>
<th>ISP</th>
<th>ISP + SSP</th>
<th>ISP + SSP + SSC</th>
<th>SSC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>40.8% (31/76)</td>
<td>35.5% (27/76)</td>
<td>13.2% (10/76)</td>
<td>7.9% (6/76)</td>
<td>2.6% (2/76)</td>
</tr>
</tbody>
</table>

Fat infiltration of torn tendons (Goutallier classification)  

<table>
<thead>
<tr>
<th>Grade</th>
<th>Rate</th>
<th>Grade</th>
<th>Rate</th>
<th>Grade</th>
<th>Rate</th>
<th>Grade</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>45%</td>
<td>2</td>
<td>54.3%</td>
<td>3</td>
<td>0.8%</td>
<td>4</td>
<td>0%</td>
</tr>
</tbody>
</table>

SSP and ISP tendons: tendon retraction in frontal plane (Patte classification)  

<table>
<thead>
<tr>
<th>Zone</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>47.7%</td>
</tr>
<tr>
<td>2</td>
<td>38.7%</td>
</tr>
<tr>
<td>3</td>
<td>13.5%</td>
</tr>
</tbody>
</table>

SSC tendons: tear characteristics  

<table>
<thead>
<tr>
<th></th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper part</td>
<td>16/18 (88.9%)</td>
</tr>
<tr>
<td>Complete tear with no retraction</td>
<td>2/18 (11.1%)</td>
</tr>
<tr>
<td>Complete retracted tear</td>
<td>0/18 (0%)</td>
</tr>
</tbody>
</table>

SSP: supraspinatus tendon; ISP: infraspinatus tendon; SSC: subscapularis tendon.

(preoperative score, 30.2 ± 15 vs. 82.7 ± 15.1 at the last follow-up, P = 10⁻⁵). There was no significant difference on the preoperative WORC score (P = 0.94) or at the last follow-up (P = 0.34) between the patients who had returned to their previous sports and those who had not.

3.5. Factors favoring return to sports

The group of 52 patients who had returned to their sport were compared to the 24 patients who had returned to another sport or who had no sports activity at the last follow-up.

In univariate analyses, the number of hours of sports per week before surgery was significantly greater in the group of patients who had returned to their sport compared to those who had not returned to their sport (4.9 ± 4.5 h/week and 3.2 ± 2.6 h/week, respectively; P = 0.01). Of the variables that did not influence the return to sports activity, we found sports that solicited most particularly the shoulder (P = 0.59) and the existence of tendon retraction in the frontal plane according to the Patte classification (P > 0.05).

The final multivariate model showed that the only factors significantly associated with return to sports were weekly sports activity greater than 2 h/week before surgery (adjusted odds ratio (aOR): 4.11 (1.4–12.3), P = 0.01) and duration of symptoms less than 9 months before surgery (aOR: 3.6 (1.01–12.5), P = 0.04).

4. Discussion

To our knowledge, this is the largest series published to date assessing return to sports activity exclusively in recreational sports participants under 70 years of age, operated on arthroscopically for rotator cuff repair. In this series, nearly 90% of the patients partaking in recreational sports after arthroscopic repair of the rotator cuff were able to return to their sport a mean 6 months after the intervention and found an equivalent or higher level at the last follow-up in nearly 80% of the cases and identical frequency compared to their preoperative situation.

In professional athletes, despite the good clinical results after cuff repair, the rate of return to competitive sports is lower compared to recreational sports participants [2,12]: 7.7% (1/13) in a systematic review of the literature reported by Plate et al. [13] in 13 athletes using the upper limb above the head, 25% in a series of 16 professional baseball players reported by Mazzoué and Andrews [5], and 73% in a series of 33 professional baseball players studied by Namdari et al. [9]. The level at the last follow-up is often lower than the pre-lesion level [5,9] and the return to competition is difficult after cuff repair, which often marks the end of a professional career [8,13].

In this series, preoperative pain evolving for more than 9 months and sports activity intensity less than 2 h/week were significantly associated with absence of return to sports. In the series reported by Sonnery-Cottet et al. [6], the duration of preoperative symptoms (greater than or less than 24 months) did not influence the possibilities of returning to tennis or the time to returning to tennis after surgery. Extension of rotator cuff tear in the sagittal plane had no incidence on the time to return to tennis or the level at the last follow-up.

In 29 amateur golfers who underwent open rotator cuff repair, Vives et al. [14] found 89.7% of patients returning to golf at the same level as their pre-lesion level, but with a weekly intensity significantly reduced at the last follow-up. Out of 51 nonprofessional tennis players operated on for rotary cuff repair with a minimally invasive open procedure or arthroscopic debridement, Sonnery-Cottet et al. [6] found 78.4% of the patients returning to tennis at a mean 9.8 months after surgery at an identical or better level at the last follow-up in 77.5% of the cases. In 21 recreational athletes using the upper limb and having undergone arthroscopic repair of an isolated supraspinatus tear, Liem et al. [12] found 100% of the patients returning to sports at a weekly frequency and duration identical to their preoperative activity. In the present series, 88.6% of the patients participating in a recreational sport soliciting the shoulder returned to the same sport: 91.7% of the golfers, 88.9% of the tennis players, and 76.9% of the swimmers.

In their systematic literature review, Plate et al. [13] found 83.3% of the patients returning to competitive sports a mean 8.6 months after the intervention out of 124 recreational athletes (sports using the upper limb above the head) who underwent arthroscopic debridement or either arthroscopic or open cuff repair. The meta-analysis of Klouche et al. [15] showed that the majority of recreational athletes returned to sports at the same level, but only half of the professional athletes and competitors returned to an equivalent pre-injury level.

The first limitation of this study is its retrospective design. Data collected prospectively would probably have been more precise. Second, the patients’ responses to the questions, notably for the preoperative WORC index, were based on memory and necessarily influenced by the time since the intervention. Third, systematic imaging studies were not carried out in all the patients to check for cuff healing. However, several publications have demonstrated an absence of anatomic and clinical correlation between tendon repair healing on imaging and the clinical result after cuff repair [16,17]. Similarly, Liem et al. [12] found no significant difference in terms of return to sports between patients presenting re-rupture and those who had healed according to MRI. The last limitation concerns the high number of different sports included and the influence of the type of sport (as related to intensity and shoulder solicitation) on the possibilities of returning to the sport, which was not assessed for some patients. However, the inclusion of patients participating in several different sports provides an overall perspective on the possibilities of returning to sports in this population of recreational athletes.

5. Conclusion

Most of the recreational sports patients were able to resume sports after arthroscopic repair of the rotator cuff, most often at the same level and with the same frequency as before surgery. The factors significantly associated with not returning to sports were pain symptoms evolving for longer than 9 months and an intensity of preoperative sports less than 2 h/week.
Disclosure of interest

T. Bauer is a consultant for Arthrex. P. Hardy is a consultant for Arthrex and Zimmer.

The other authors declare that they have no competing interest.

Appendix A. Telephone questionnaire

Last name ..........................................................
First name .........................................................
Date of birth .......................... Date of surgery ........
1) Before surgery

• Sports activities
  ◦ Main sport
  ◦ Other sports

• How many years have you participated in these sports? ...............
• How many hours a week do you do sports? .................

2) After surgery

• Have you returned to sports activity? yes/no
• If yes, date of return to sports activity ........
• Have you returned to the same sport(s)? yes/no
• If you stopped your main sport, what were the reasons?
• If you stopped all sports, what were the reasons?

• How long did it take your current sports level to stabilize? ...............

3) Currently

• How many hours of sports do you do every week? ...............
• How would you evaluate your current level in your sport compared to your level before symptom onset?
  Better Identical Inferior
• How would you evaluate your shoulder’s function and the results obtained?
  Excellent Good Fair Poor

When you are doing your sport, do you feel the following in your shoulder:

Pain Swelling Weakness Other
• Have you undergone surgery again for your shoulder? If yes, date and reasons:

Thank you for your participation.

References