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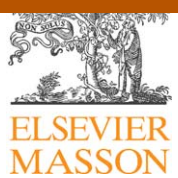

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ORIGINAL ARTICLE

# Occupational outcome after surgery in patients with a rotator cuff tear due to a work-related injury or occupational disease. A series of 262 cases

**L. Nové-Josserand*, J.-P. Liotard, A. Godeneche, L. Neyton, F. Borel, B. Rey, E. Noel, G. Walch**

*Shoulder Unit,Santy Orthopaedic Center, 24, avenue Paul-Santy, 69008 Lyon, France*

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**KEYWORDS**
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**Summary** The goals of this study were to establish the occupational outcome after surgery in patients with a rotator cuff tear from a work-related injury (WRI) or occupational disease (OD) and determine which factors and conditions affected return to work. Hypothesis: return to work was possible for this type of patient. This questionnaire-based study comprised 262 shoulders in 254 patients with a WRI/OD who had surgery performed on their shoulder between 2000 and 2005. The average age was $50.5 \pm 6.4$ years. The following variables were analysed: employment status (private sector, self-employed, government employee), type of work (non-manual, manual, heavy manual labour), nature of tendon injury and surgical technique (open, mini-open and arthroscopy). Return to work occurred in 59.5% of the cases. Factors that prevented return to work (40.4% of the cases) included retirement (14.1%), an unrelated medical condition (10.3%), and the outcome of the operated shoulder (16.0%). Age had an impact on return to work ($P < 5 \times 10^{-4}$). The type of work and nature of tendon injury did not affect return to work, but did affect time away from work. Employment status and surgical technique had an effect on return to work, but not on time away from work. Age was a decisive factor for return to work. Retirement seemed to be the most common choice starting at 55 years of age. Arthroscopy seemed to have reduced the impact of the WRI on the results, particularly on the time away from work. A preoperative evaluation of the patient's probability of returning to work should be done based on occupational and injury features. There may be a longer delay in returning to work for certain profiles of work (manual labour) and tendon injury. Patient management can be improved by knowing the factors and conditions that influence return to work.

*Level of evidence:* Level IV - Retrospective study.



* Corresponding author. Tel.: +33 4 37 53 00 14, fax: +33 4 37 53 00 15.
*E-mail address:* lnovejosserandpro@wanadoo.fr (L. Nové-Josserand).

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## Introduction

Shoulder pathology is a commonly reported work-related injury or occupational disease. Rotator cuff tears, referenced in Table 57-A of the French Health Insurance system, are very common and mostly affect middle-aged males who do manual labour. This problem was identified by Codman in 1934 [1]. The surgical management of rotator cuff tears in the scope of a work-related injury or occupational disease has a poor prognosis relative to results and return to work [2—8]. The differences are mostly based on subjective results [5,7], although this is controversial [9—13]. In some studies, the population in question is thought to be different than the general population [2,7,14], while in others, the independent variable is thought to be work-related injury or occupational disease itself [8].

We wanted to determine the medium-term outcome after surgery in patients with a rotator cuff tear due to a work-related injury or occupational disease, independent of the nature of the tendon injury and surgical technique. We hypothesized that a return to work was possible for this specific population. An additional goal was to determine the factors and conditions that impact the return to work, so that patient case management can be improved.

## Material and methods

From 2000 to 2005 inclusively, 1155 patients had surgical repair performed for a rotator cuff tear by the same surgeon (LNJ), independent of technique. Of these patients, 290 patients (25.1% of the population) had a documented work-related injury or occupational disease (Table 57-A of the French Health Insurance system).

To determine the occupational outcome and subjective results, a questionnaire was sent to these 290 patients. The questionnaire was to be returned by mail. Two patients were deceased (0.7%), 34 patients were lost to follow-up (11.7%) and 254 patients responded to the questionnaire, which corresponded to an 87.6% response rate. Eight patients had bilateral surgery. A total of 262 shoulders were included in this series.

There were 183 men (72%) and 71 women (28%). The right side was involved in 69% of cases. Average age at the time of the procedure was $50.5 \pm 6.4$ years. There was no relationship between age and gender. One female patient was no longer working at the time of the procedure because she was laid off before the surgery (0.4%). Private sector employees made up 75.2% of the population, self-employed persons made up 12.6% and government employees made up 11.8%. Three types of work were represented: non-manual work in 6.1% of cases, manual labour in 25.5% of cases and heavy manual labour in 68.3% of cases. Heavy manual labour was defined as manual labour that required forceful activities with repetitive movements, especially with the arms overhead (plasterer, painter, mason, hairdresser, road haulier, etc.). The different types of tendon injuries are outlined in Table 1. The tears were either complete or partial, and required surgical repair. Isolated supraspinatus tears were most common. Only one rotator cuff tendon was injured in 64.1% of cases. Two tendons were injured in 28.2% of cases. Three tendons were injured in 7.6% of cases. The tear was reported as a work-related injury in 67% of cases and as an occupational disease in 33% of cases. An open surgical tendon repair was performed in 185 cases (70.6%), a mini-open repair in 24 cases (9.2%) and arthroscopic repair in 53 cases (20.2%). The arthroscopic repairs included the surgeon's learning curve for this technique.

Bilateral repair was performed in eight cases: seven men and one woman, having an average age of $50.9 \pm 4.9$ years. All had performed manual labour, and two of them had performed heavy manual labour. There were two self-employed individuals (heavy manual labour) and six private sector employees (manual labour).

The questionnaires were sent out at least 2 years after the surgical procedure. Two to seven years had passed between the procedure and questionnaire response.

Statistical analyses were performed with Statview 5 software (SAS Institute, Cary, North Carolina, USA). A Chi-square test was performed on qualitative data. Multivariate analyses were performed on quantitative data. Non-parametric tests were performed when the sample size was limited. The significance level was set at 0.05 for all tests.

## Results

### Overall results

Return to work occurred in 156 cases (59.5%) but did not occur in 106 cases (40.5%). The return to work data is summarized in Table 2. The primary reason for not returning to work was related to the shoulder injury in 16% of the cases and not related to the injury in 24.4% of the cases.

### Return to work

At the time of return to work, the average age was $48.1 \pm 0.8$ years. Seventy-five percent of this population was male. Gender had no effect on return to work or amount of time away from work. Work-related injuries accounted for 75.6% of cases and occupational diseases for 24.4%. In 120 cases (45.8% of the whole population), the return to work was in the same position. The average time away from full-time work was $9.8 \pm 6.2$ months. After being away from full-time work, a return to part-time work occurred in 37.5% of cases. In 36 cases (13.7% of the whole population), the return to work occurred in a different position. In 25% of the cases, the job was modified within the same professional environment, and in 75% of cases, professional retraining was required. Within this last group, the return to work occurred in the same type of work or a less manually intensive position, resulting in an average time away from full-time work of $12.4 \pm 6.5$ months.

### No return to work

Various factors contributed to some patients not returning to work. Retirement was the most prevalent factor: 37 cases (14.1% of the whole population) with an average age of $57.3 \pm 5.6$ years. In 27 cases (10.3% of the population), another medical condition was responsible for the patient

**Table 1** Nature of tendon injury in the population operated on for a rotator cuff tear as defined in Table 57-A of the French Health Insurance System.

| Supraspinatus only 131 cases (%) | Subscapularis only 37 cases (%) | Supra + infraspinatus 20 cases (%) | Supra + subscapularis 54 cases (%) | Supra + infra + subscapularis 20 cases |
|---|---|---|---|---|
| 50 | 14.1 | 7.6 | 20.6 | 7.6% |
| 64.1 | | 28.2 | | 7.6% |

not returning to work; these patients had an average age of 51.8 ± 5.0 years.

The operated shoulder was the primary reason for not returning to work in 42 cases (16% of the whole population). This was either due to an extended leave (13 cases) or a lay-off without return to work (29 cases); these patients had an average age of 50.2 ± 5.6 years. The average time elapsed before the lay-off was 20 months (1—48).

## Factors affecting the return to work

Age had a significant effect on return to work ($P < 0.0001$) and return to the same position ($P < 0.0001$). However, age was not related to the time away from work ($P = 0.89$). Most of the patients under 50 years of age returned to work, while one of five patients above 55 years of age returned to work and more than 40% of them retired (Table 3).

The diagnosis of a work-related injury/occupational disease had a significant effect on return to work ($P = 0.0005$) and on return to the same position ($P < 0.0001$) (Table 4). The time away from full-time work was longer within the scope of an occupational disease, but this was not significantly different from a work-related injury: 12.0 ± 6.0 months versus 9.8 ± 6.0 months ($P = 0.07$). The ''occupational disease'' group had more females (36.8% vs. 23%), was of a similar age (50 years), had more private sector employees (88% vs. 69%), had more heavy manual labour (74% vs. 65%), but had slightly less severe injuries (injury to one tendon only, 71% vs. 60%) than the work-related injury group.

The type of work did not affect return to work ($P = 0.42$) but did have a significant effect on time away from work, which was directly related to the requirement for manual labour ($P = 0.05$) (Table 5).

Employment status had a significant effect on return to work ($P = 0.0015$), with private sector employees and a return to the same position ($P = 0.0004$) being negatively affected. The self-employed patients and government employees had a similar progression. The average time away from full-time work was longer for those in the private sector but this was not significantly different from the other groups (Table 6).

The nature of the tendon injury did not affect return to work ($P = 0.21$) but did have a significant effect on time away from work ($P = 0.04$) (Table 7). The group with three injured tendons had a higher average age than the group with one injured tendon.

Surgical technique had an impact on return to work, with an open procedure being advantageous ($P = 0.004$). Surgical technique did not have an effect on time away from work, even if it was slightly longer for open procedures (Table 8). There was a difference in the average age of the populations associated with the three surgical techniques.

Return to work occurred in two patients with bilateral injuries who were self-employed (one returned to the same position and one to a modified position). None of the private sector employed patients with a bilateral injury returned to work: one retired, one stopped for another reason and four were laid-off because they were unable to perform the work.

Subjective improvement was significantly related to return to work ($P = 0.0005$) and time away from full-time work ($P = 0.0003$). It was not related to age, nature of tendon injury or surgical technique.

## Discussion

Work-related injuries or occupational diseases are well-known to be negative factors in terms of outcome and return to work after the repair of a rotator cuff tear, since first it was suggested by Codman [1—8].

Hawkins and co-workers [2] documented the outcome of a rotator cuff repair in 100 patients, 30 of whom had a work-related injury. Only two of the 30 patients with a work-related injury returned to work, and the delay was twice as long as the standard population. Overall, the outcomes were worse, except for range of motion, which was identical for the two populations. The authors suggested that motivation was different and included seeking financial compensation as a side benefit. Misamore and co-workers [3] compared the results in terms of function and return to work after rotator cuff repair in a standard population and a work-related injury population. A work-related injury was a significant

**Table 2** Occupational outcome for patients who returned to work and who did not return to work.

| Returned to work 59.5% | | Did not return to work 40.5% | | |
|---|---|---|---|---|
| Returned to same position 45.8% | Returned to different position 13.7% | Retirement 14.2% | Other medical reason 10.3% | Due to shoulder 16% |

**Table 3** Return to work and subjective improvement results as a function of age.

| | ≤ 50 years old 111 cases (%) | 50—55 years old 75 cases (%) | ≥ 55 years old 76 cases | |
|---|---|---|---|---|
| Returned to work | 82.8 | 64 | 21% | $P < 10^{-4}$ |
| Different position | 20.7 | 5.3 | 0 | $P < 10^{-4}$ |
| Retirement | 1.8 | 6.7 | 42% | $P < 10^{-4}$ |
| Subjective improvement | 88.8 | 88.8 | 82.6% | n/s |

**Table 4** Return to work and subjective improvement results as a function of classification as a work-related injury (WRI) or an occupational disease (OD).

| | WRI175 cases | OD87 cases | |
|---|---|---|---|
| Returned to work | 63.7% | 43.6% | $P = 0.0005$ |
| Returned to same position | 52% | 28% | $P < 10^{-4}$ |
| Time away from full-time work (months) | $9.8 \pm 6.3$ | $12 \pm 6.4$ | $P = 0.07$ |
| Subjective improvement | 85.7% | 81.6% | n/s |

**Table 5** Return to work and subjective improvement results as a function of type of work.

| | Non-manual 16 cases | Manual 67 cases | Heavy Manual 179 cases | |
|---|---|---|---|---|
| Returned to work | 75% | 58.2% | 58.6% | $P = 0.42$ |
| Different position | 0 | 8.9% | 11.7% | n/s |
| Time away from work (months) | $7 \pm 2.5$ | $9.2 \pm 6$ | $11.2 \pm 6$ | $P = 0.05$ |
| Subjective improvement | 81.2% | 86.5% | 83.8% | n/s |

**Table 6** Return to work and subjective improvement results as a function of employment status.

| | Private sector employee 198 cases | Self-employed 33 cases | Government employee 31 cases | |
|---|---|---|---|---|
| Returned to work | 53% | 78.8% | 80.6% | $P = 0.0015$ |
| Different position | 39% | 70% | 68% | $P = 0.0004$ |
| Time away from work (months) | $11 \pm 7$ | $8.5 \pm 5$ | $9.9 \pm 5$ | n/s |
| Subjective improvement | 82.8% | 91% | 87% | n/s |

**Table 7** Return to work and subjective improvement results as a function of the number of tendons injured.

| | Injury to 1 tendon 168 cases | Injury to 2 tendons 74 cases | Injury to 3 tendons 20 cases | |
|---|---|---|---|---|
| Returned to work | 62.5% | 54% | 55% | $P = 0.21$ |
| Time away from work (months) | $9.3 \pm 4$ | $12 \pm 7$ | $15.3 \pm 4$ | $P = 0.04$ |
| Subjective improvement | 85.1% | 86.5% | 70% | $P = 0.06$ |
| Average age (years) | $49.4 \pm 7$ | $52.2 \pm 5$ | $54 \pm 4$ | n/s |

**Table 8** Return to work results as a function of surgical technique.

| | Open 185 cases | Mini-open 24 cases | Arthroscopy 53 cases | |
|---|---|---|---|---|
| Returned to work | 66% | 41.6% | 45.3% | $P = 0.004$ |
| Time away from work (months) | $10.9 \pm 7$ | $8.7 \pm 2.5$ | $8.75 \pm 4$ | n/s |
| Average age (years) | $49.8 \pm 6$ | $50.3 \pm 5$ | $53.2 \pm 5$ | n/s |

impediment to the overall result and subjective evaluation outcomes. Return to work occurred in 42% of those having a work-related injury and 94% of those in the standard population, however there were no differences in the time away from work. The difference was even greater when manual labour was involved. Shinners and co-workers reported on a 36-month follow-up of 41 patients who had a mini-open rotator cuff repair procedure done. The group with a work-related injury (11 patients) had a worse outcome overall. Return to work occurred in 82% of the cases, but with restrictions or changes to the work. The time away from work was significantly greater. With a prospective study, McKee and co-workers [4] demonstrated the negative influence that a work-related injury could have on the outcome of rotator cuff repairs. They also showed that a work-related injury was negatively correlated to preoperative status. Watson and Sonnabend [5] evaluated factors affecting the outcome of rotator cuff repairs on a series of 667 shoulders that were operated on between 1983 and 1996. A questionnaire was sent to the patients an average of 3.8 years after the surgery (minimum of 6 months). The group of patients with a work-related injury (14.5% of the population) had a subjective result that was satisfactory, but less than the standard population (71% versus 90%). Balyk and co-workers [7] conducted a 3-month and 6-month prospective evaluation of the outcomes in a standard and work-related injury population. Although the two groups had identical preoperative features, the negative effect of a work-related injury (26% of the population) was less prominent at 6 months and was mostly apparent on subjective factors. Henn and co-workers [8] used a multivariable analysis of the different factors affecting a standard and a work-related injury population to show that a documented work-related injury was an independent, negative factor.

Nevertheless, this negative effect is controversial. Ianotti and co-workers [9] did not find a significant difference in the Constant score or subjective evaluations with work-related accidents, but found that the time away from work was greater (7.8 months versus 2 months). Krishnan and co-workers [12] found that functional recovery was very good after rotator cuff repairs in younger subjects, even in the context of a work-related injury. Ninety percent returned to the same working conditions, despite the tendon injury being more significant on average than typically seen. O'Holleran and co-workers [10] found no influence of age, gender and work-related injury on patient satisfaction after arthroscopic or mini-open rotator cuff repair. A work-related injury does not seem to affect the outcome when an arthroscopic repair is performed [11—13]. The populations studied by Krishnan [12] and Burns [13] were fairly young, under 50 years of age on average.

Since having a work-related injury does not affect tendon healing [15,16], the preoperative characteristics of the population in question have been hypothesized as the reason for the negative effect of a work-related injury. Different studies have shown that because the population is younger, mostly single, mostly consists of smokers, has a lower social status and less university education, their expectations from the surgical procedure are less [7,8,14]. This population also does more manual labour and works more hours, which increases exposure to injury risks [2,8,14]. When operated earlier, the tendon injury can be identical [2,8] or greater than in the standard population [12]. Nevertheless, there are no gender and co-morbidity differences in these populations [8,17]. Thus the effect of a work-related injury on the patient's preoperative state is also controversial [4,18,19].

Henn and co-workers [20] showed that a patient's expectations or motivation related to the outcome of the procedure was a strong positive predictive factor for the result of rotator cuff repairs. This aspect could help explain the negative influence of a work-related injury, where the population has an increased awareness of the shoulder problem and lower expectations from the surgical treatment [8,17]. Recent studies that have included all the criteria outlined above, particularly the preoperative ones, concluded that a work-related injury is an independent negative factor, especially on subjective outcome measures [7,8].

The return to work rate in our series was 60% and most returned to the same position. The return to work rate reported in the literature varies: 7% with twice as much time needed, [2], 42% versus 94% in the standard population [3], 68% in a manual labour population [21], 82% with a change to the work position often needed [6], 90% for a younger population operated by arthroscopy [12,13], or even no difference [9]. A bilateral injury seems to be crippling to private sector employed patients.

Our study was not designed to analyse and compare the preoperative characteristics of this work-related injury population. Based on our study, age seems to be a factor determining return to work, which had been reported by others [12,13]. The type of work and nature of tendon injury did not have an effect on return to work, but rather time away from work, which was greater for manual labour jobs [2,9] and more severe tendon injuries, although this is controversial [3].

The disparity in these results can be partly explained by the work laws in each country. In France, the labour laws are different based on employment status (private sector, self-employed, government). The self-employed workers and government employees had an identical result, in contrast to private-sector employees. Local factors can interfere with a potential return to work: size of the company, lay off scheme, lack of lay-offs in the government, disability. When a patient does not return to work, the outcome is not automatically a treatment failure — in one-quarter of the cases, patients did not return to work because of a factor other than the shoulder. Early retirement is proposed to older patients. The legal retirement age in France is 60 years of age, but in reality, the average retirement age is 58.5 year for men and 59.5 years for women. After the age of 55, retirement or an early retirement is the preferred option. The diagnosis of an occupational disease has a worse impact on return to work than the diagnosis of a work-related injury, which probably points to the chronic nature of the lesion. A confirmed occupational disease would logically reduce the likelihood of returning to the work that caused the pathology.

Our study seems to show that an open procedure is advantageous, but it must be pointed out that the arthroscopic procedures were done early in the surgeon's learning curve for this procedure. Our hypothesis was that arthroscopy would result in a shorter time away from work, and maybe even a greater rate of return to work. Our results showed this trend without being significant; the effect was proba-

bly hidden by the average age being artificially higher in the arthroscopy group (learning curve). In most of the recent studies showing that having a work-related injury has a minor effect, the repairs were performed by arthroscopy. [10—13].

Knowing that the patient's preoperative expectations and motivation is a strong, independent, predictive factor of the result [20], it may be necessary to let the patient know about the postoperative and occupational outcomes before starting the procedure. These results help us grasp the potential for return to work as a function of age, work characteristics and injury features. A patient can return to work or not return to work, depending on the criteria evaluated. Depending on the type of work (heavy manual labour) and nature of the tendon injury, the time away from work may be longer and it may be necessary to change to a new position.

## Conclusion

Rotator cuff repair in the context of a work-related injury or occupational disease allows for return to work in the same or a modified position in almost 60% of cases. In almost one-quarter of the cases, the patient did not return to work because of a factor unrelated to the operated shoulder. Overall, 16% of the population studied did not return to work because of the shoulder injury itself.

Age was the most important factor determining return to work. Employment status, with private sector employees being worse off, the diagnosis of an occupational disease and surgical technique all had an impact on the rate of return to work. The type of work, nature of tendon injury, surgical technique, and to a lesser degree an occupation disease versus a work-related injury, had an impact on the time away from work. By knowing which factors and conditions affect return to work, we will be able to better inform our patients before surgery, which will make their subsequent return to work easier.

## Disclosure of interest

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

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