

Return to Sport at 6 Months After Shoulder Surgery

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Background: Many surgical procedures are intended to return patients to sport early, but it is unknown how realistic these expectations are after shoulder surgery.

Purpose: To determine which of the commonly performed surgical interventions in the shoulder best facilitated return to sport, and which did not, by 6 months postoperatively.

Study Design: Cohort study; Level of evidence, 3.

Methods: The study was a retrospective analysis of prospectively collected data from patients who underwent shoulder surgery from a single surgeon over 12 years. To be included, at least 20 patients needed to have undergone that procedure and complete a questionnaire evaluating their shoulder's function preoperatively and 6 months postoperatively. The primary outcome was a change in the response to the question, "What is your current level of sport?"

Results: A total of 2261 surgical procedures in 13 categories met the inclusion criteria. Capsular release was the only procedure associated with improved patient-reported sporting level at 6 months ($d = 0.18$ [95% CI, 0.05–0.30]; $P = .009$). This represented a mean improvement of 41% from the preoperative sporting level. Bankart repair was associated with the greatest decrease in patient-reported sporting level at 6 months (mean decline of 21%) ($d = -0.17$ [95% CI, -0.34 to -0.01]; $P = .034$), followed by rotator cuff repair (mean decline of 13%) ($d = -0.06$ [95% CI, -0.03 to -0.10]; $P = .0004$). There were no significant changes in sporting level at 6 months postoperatively for rotator cuff repair with acromioplasty, polytetrafluoroethylene (PTFE) patch repair, acromioplasty, superior labral anterior to posterior (SLAP) repair, total shoulder arthroplasty, reverse total shoulder arthroplasty, rotator cuff repair with capsular release, rotator cuff repair with stabilization, calcific debridement, or hemiarthroplasty.

Conclusion: Capsular release was the only surgical procedure that provided a significant improvement in patient-reported sporting level in a relatively short period of time (6 months). Patients who underwent rotator cuff repair and Bankart repair were the only surgical groups that reported a significant decline in sporting level 6 months postoperatively.

Keywords: shoulder; surgery; return to sport; capsular release; Bankart repair; rotator cuff repair

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Ethical approval for this study was obtained from the Prince of Wales Hospital Human Research Ethics Committee (No. 11/STG/37).

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The key goals of shoulder surgery are to reduce pain, restore function, and improve quality of life. A major component of quality of life for many involves return to sport. Advances in surgical techniques and technology have improved clinical outcomes regarding an improvement in function and pain alleviation, and accordingly, these advances have increased patient expectations to return to premorbid levels of activity. However, there is little information concerning which surgical procedures for the shoulder provide the greatest patient-reported improvement in sporting level from the preoperative state. Surgeons readily promote rapid recovery and return to sport after surgery, but how realistic are these expectations?

Sport participation benefits not only physical health but also mental health, community well-being, and social capital.^{33,34} Playing sport and belonging to a sport team have been shown to instill a sense of personal empowerment and achievement,^{6,9,24} reduce stress,³⁰ develop self-esteem,

teach self-discipline, improve coping mechanisms, and increase respect for peers and team cooperation.^{10,35,36} Sport provides opportunities for socialization, reducing isolation and enhancing community well-being.¹⁰ Sport plays an integral cultural role worldwide, and 52% of Australians participate in sport or physical activity at least 3 times per week.²

Many surgeons, surgical implant companies, and surgical facilities promote early return to sport. When discussing return to sport, an orthopaedic center noted that “recuperation can take up to 6 months.”²⁵ A Melbourne clinic reported return to sport from 8 weeks after rotator cuff repair.²¹ Similarly, a Boston hospital included return to sport at 4 to 6 months in its superior labral anterior to posterior (SLAP) repair rehabilitation protocol.³² A New York orthopaedic hospital explained that “participation in vigorous sports may be restricted for 4 to 6 months” after rotator cuff repair.¹⁹ In our facility, 6 months after surgery is the usual time when patients are cleared for return to full activities. It is undetermined, however, whether this is a realistic goal.

An understanding of which shoulder surgical procedures best facilitate return to sport may assist both patients and surgeons in more accurately managing expectations and holistically benefit health. Hence, the aim of this study was to determine which of the commonly performed surgical interventions in the shoulder best facilitated return to sport, and which did not, for the patient at 6 months postoperatively.

METHODS

Study Design

The study was a retrospective analysis of prospectively collected data from patients who underwent shoulder surgery from a single surgeon (the senior author: G.A.C.M.) on a single campus between 2004 and 2016 to determine the effect size of different surgical interventions in the shoulder on patient-reported sporting level. The primary outcome was a change in the patient’s response to the following question preoperatively and 6 months postoperatively: “What is your highest level of sport now?” To be included in this study, patients needed to have undergone primary shoulder surgery by the senior author. For a procedure to be included in the analysis, a minimum of 20 patients was required to have undergone that procedure. Patients undergoing 2 surgical procedures at the same time were also included, provided that at least 20 patients had undergone that combination of procedures. Patients were excluded from the study if they had a concomitant shoulder fracture, underwent revision surgery, did not attend 6-month follow-up, or did not respond to the above question preoperatively or at 6-month follow-up.

Outcome Measures

Patients received a modified L’Insalata questionnaire¹⁸ before surgery and 6 months after surgery. Patients were asked within the 14-question L’Insalata questionnaire to

rank their current highest level of sport, overall shoulder status, frequency of pain, level of pain, and functional level using a Likert scale. Responses were converted to ordinal numerical values for statistical analysis. For example, for our primary outcome question (“What is your highest level of sport now?”), there were 4 possible responses on a Likert scale (*none*, *hobby*, *club*, and *national*), which were assigned the numbers 0, 1, 2, and 3, respectively. Secondary outcomes for this study were patient-reported overall shoulder status (graded from *very bad* to *good*), frequency of pain (graded from *daily* to *none*), level of pain (graded from *very severe* to *none*), and difficulty with activities (graded from *very severe* to *none*). A full version of the L’Insalata questionnaire is shown in Appendix Figure A1.

Surgical Technique

All surgical procedures analyzed within this study were performed under interscalene block by the senior author with the patient placed in the beach-chair position. A surgical intervention in the shoulder was undertaken either arthroscopically or open. Acromioplasty for rotator cuff tears,¹ Bankart repair and SLAP repair for labral tears,^{13,15} calcific debridement for calcific tendinitis,²⁹ capsular release for idiopathic adhesive capsulitis,^{4,23} and polytetrafluoroethylene (PTFE) patch rotator cuff repair and rotator cuff repair for rotator cuff tears were performed using an arthroscopic technique.³ Open shoulder surgery was undertaken for shoulder replacements, specifically total shoulder arthroplasty, reverse total shoulder arthroplasty, and hemiarthroplasty. The indication for total shoulder arthroplasty was severe glenohumeral arthritis, the indication for reverse total shoulder arthroplasty was rotator cuff arthropathy, and hemiarthroplasty was indicated for both glenohumeral arthritis and rotator cuff arthropathy.³⁷ A further description of each intervention is provided in Appendix Table A1.

Rehabilitation Protocol

A total of 13 surgical procedures met the criteria for analysis. The rehabilitation protocol for each of the 13 interventions is summarized in Table 1.

Statistical Analysis

Wilcoxon signed-rank tests were used to evaluate the significance of 6-month postoperative outcomes within each surgical intervention group. The Kruskal-Wallis test with the Dunn correction was utilized to determine whether significant differences in sporting level at 6 months postoperatively existed between surgical groups. Effect size was calculated by taking the mean difference in preoperative and postoperative responses on the Likert scale and dividing this by the pooled preoperative and postoperative standard deviations to give a standardized mean difference (Cohen *d*) for each outcome. Pearson and Spearman correlation coefficients were used to measure the strength and direction of association between subjective and objective measures of shoulder function and level of sport

TABLE 1
Rehabilitation Protocols^a

Type of Surgery	6 Weeks Postoperatively	3 Months Postoperatively	6 Months Postoperatively
<ul style="list-style-type: none"> • Rotator cuff repair • Rotator cuff repair + acromioplasty • Total shoulder arthroplasty • Reverse total shoulder arthroplasty • Calcific debridement • Rotator cuff repair + stabilization • PTFE patch rotator cuff repair 	Lifting up to 0.5 kg below chest level, no overhead activities except when performing prescribed exercises	Commencing light lifting close to body of 2 kg depending on progress, occasional light overhead work (<15-minute duration), light breaststroke swimming permitted at 4 to 6 months depending on progress	Ultrasound with our sonographer to check repair, returning to full work duties and sports if final clearance obtained from surgeon
<ul style="list-style-type: none"> • Bankart repair • SLAP repair 	Lifting up to 5 kg below chest level, no overhead activities except when performing prescribed exercises	Commencing lifting between 10 and 20 kg depending on progress and repair, occasional overhead work (<15-minute duration)	Returning to full work duties and sports if final clearance obtained from surgeon
<ul style="list-style-type: none"> • Capsular release • Acromioplasty 	Returning to work and driving as soon as desired, no restrictions	Progression of exercise program	Returning to full work duties and sports if final clearance obtained from surgeon
<ul style="list-style-type: none"> • Total shoulder arthroplasty • Reverse total shoulder arthroplasty • Hemiarthroplasty 	Lifting up to 0.5 kg below chest level, no overhead activities except when performing prescribed exercises	Lifting close to body of 2 kg depending on progress, occasional light overhead work (<15-minute duration), light breaststroke swimming permitted at 3 to 6 months depending on progress	Returning to full work duties and sports if final clearance obtained from surgeon
<ul style="list-style-type: none"> • Rotator cuff repair + capsular release 	Removal of sling at 6 weeks, lifting up to 1 kg below chest level, no overhead activities except when performing prescribed exercises	Commencing light lifting close to body between 2 and 5 kg depending on progress and repair, occasional light overhead work (<15-minute duration), light breaststroke swimming permitted at 4 to 6 months depending on progress	Ultrasound with our sonographer to check repair, returning to full work duties and sports if final clearance obtained from surgeon

^aPTFE, polytetrafluoroethylene; SLAP, superior labral anterior to posterior.

preoperatively and at 6 months postoperatively as well as the change in sporting level.

RESULTS

Study Cohort

Between 2004 and 2016, a total of 3729 surgical procedures were performed by the senior author. Of the 3729 patients, 622 were excluded, as they underwent a surgical procedure that was performed with less than the minimum requirement of 20 procedures. Also, 321 patients who underwent revision surgery, 46 patients who were treated for shoulder fractures, 159 patients who did not return for follow-up at 6 months, and 320 who failed to complete a response to the outcome question preoperatively and/or at 6 months were excluded, leaving 2261 patients for the study (Figure 1).

Of these 2261 patients, 1305 underwent rotator cuff repair, 235 underwent rotator cuff repair with

acromioplasty, 109 underwent Bankart repair, 96 underwent capsular release, and 95 underwent PTFE patch repair. The number of patients who underwent the remaining 8 procedures, as well as the patient demographics for each surgery type, are shown in Table 2.

Preoperatively, 55% of the total cohort reported their sporting level as “none,” while 32% reported playing at the “hobby” level, 11% at the “club” level, and 2% at the “national” level. At 6 months postoperatively, 57% of the total cohort reported their sporting level as “none,” while 33% reported playing at the “hobby” level, 8% at the “club” level, and 1% at the “national” level (Table 3).

Change in Sporting Level

The primary outcome for this study was a change in patient-reported sporting level. For the entire cohort, there was a statistically significant decrease in sporting level from preoperatively to 6 months postoperatively (95% CI, -0.08 to -0.02; $P = .0005$). On average, the

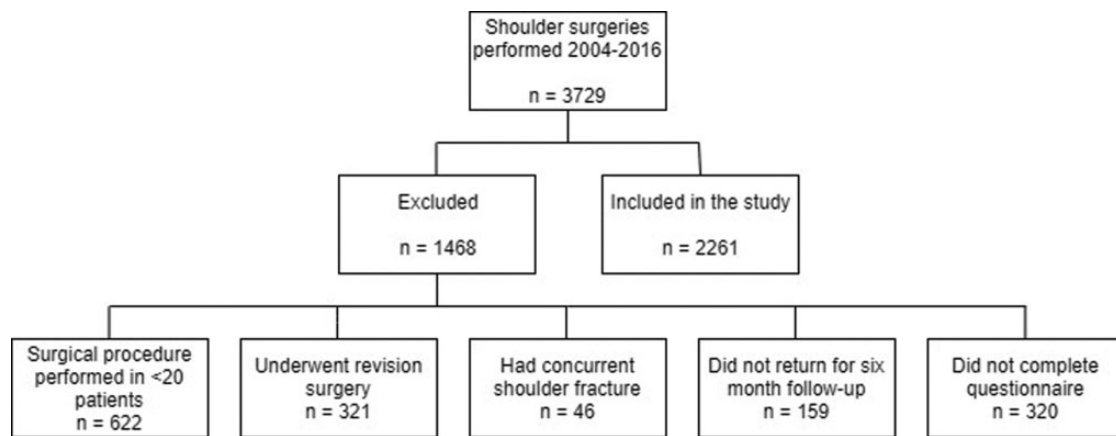


Figure 1. Flowchart of included and excluded patients in this study.

TABLE 2
Patient Demographics^a

Type of Surgery	Patients, n	Sex, M:F, n	Age, Mean ± SD (Range), y	Duration of Symptoms, Mean ± SD (Range), mo	Shoulders, R:L, n	Insurance, PUB:PRI, n	Workers' Compensation, n (%)
Rotator cuff repair	1305	742:563	59 ± 0.3 (18-91)	22.0 ± 1.5 (0-387)	773:532	135:1170	411 (31)
Rotator cuff repair + acromioplasty	235	121:114	58 ± 0.7 (28-84)	24.7 ± 4.1 (1-518)	158:77	13:222	70 (30)
Bankart repair	109	84:25	28 ± 1.1 (12-82)	26.0 ± 14.3 (0-360)	58:51	7:102	17 (16)
Capsular release	96	37:59	54 ± 0.8 (24-69)	13.6 ± 2.1 (2-31)	41:55	3:93	33 (34)
PTFE patch rotator cuff repair	95	65:30	65 ± 1.1 (45-91)	28.6 ± 1.6 (6-70)	35:60	5:90	27 (28)
Acromioplasty	88	44:44	46 ± 1.2 (19-75)	22.5 ± 1.5 (21-24)	45:43	5:83	45 (51)
SLAP repair	77	65:12	36 ± 1.1 (19-56)	26.1 ± 9.2 (2-125)	42:35	4:73	40 (52)
Total shoulder arthroplasty	64	37:27	69 ± 1.5 (48-90)	95.7 ± 130.5 (1-672)	35:29	6:58	2 (3)
Reverse total shoulder arthroplasty	53	18:35	74 ± 1.3 (54-91)	49.9 ± 12.1 (4-372)	33:20	9:44	6 (11)
Rotator cuff repair + capsular release	50	19:31	57 ± 1.2 (40-72)	15.0 ± 4.2 (2-123)	24:26	3:47	16 (32)
Rotator cuff repair + stabilization	44	36:8	43 ± 1.7 (21-78)	15.8 ± 6.5 (1-120)	24:20	0:44	19 (43)
Calcific debridement	25	9:16	51 ± 2.3 (31-76)	14.0 ± 5.4 (1-31)	9:16	0:25	3 (12)
Hemiarthroplasty	20	6:14	69 ± 4.3 (51-85)	55.9 ± 24.9 (1-420)	13:7	1:19	0 (0)

^aF, female; L, left; M, male; PRI, private; PTFE, polytetrafluoroethylene; PUB, public; R, right; SLAP, superior labral anterior to posterior.

TABLE 3
Sporting Levels^a

Sporting Level	Preoperative, %	6 Months Postoperative, %
None	55	57
Hobby	32	33
Club	11	8
National	2	1

^aN = 2261 patients.

sporting level for the entire cohort declined from a mean of 0.59 to 0.53. This was a decline of 10% from their mean preoperative level.

Capsular release was the only surgical group that had a significant improvement in sporting level from preoperatively to 6 months postoperatively ($P = .009$) (Figure 2). On average, this group improved from a mean sporting level of 0.42 to 0.59 (with 0 being “none,” 1 being “hobby”) in the 6-month period. Rotator cuff repair and Bankart repair were the only surgical groups that had a significant decline in sporting level at 6 months postoperatively ($P = .0004$ and $.034$, respectively). The rotator cuff repair group declined from a mean sporting level of 0.52 to 0.46 and the Bankart repair group from 0.99 to 0.82. For the remaining 10 surgery types, there were no significant changes in patient-reported sporting level at 6 months postoperatively.

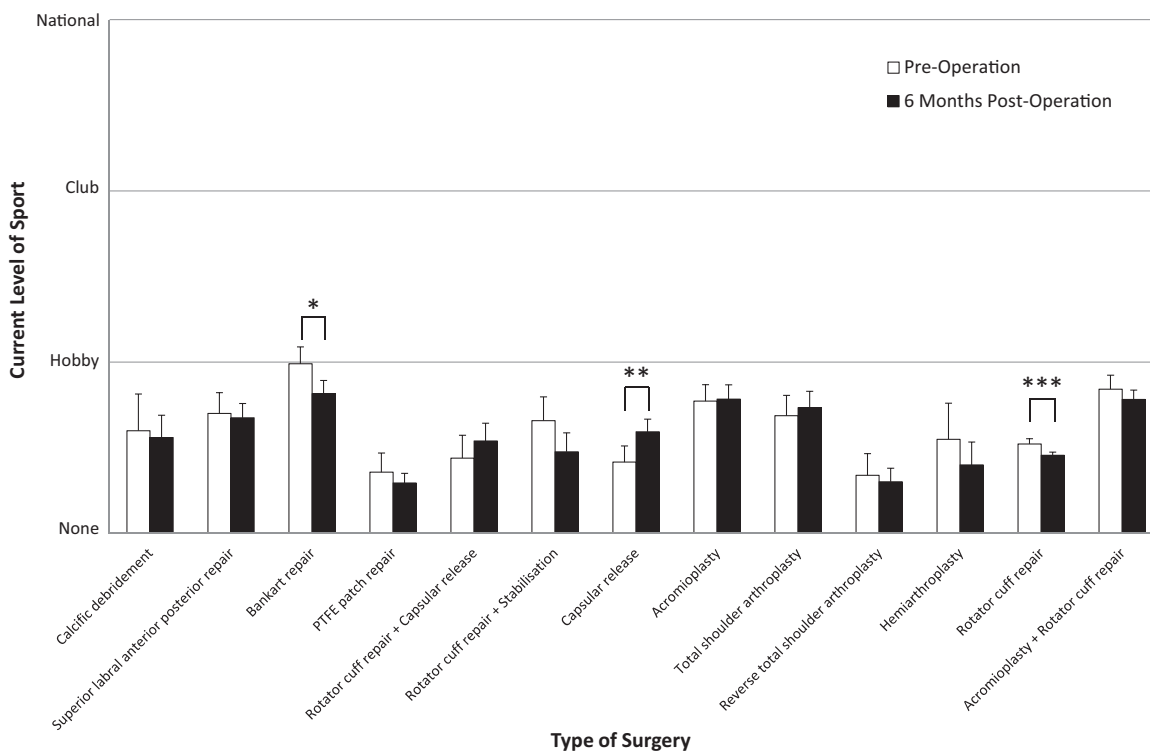


Figure 2. Effect of preoperative and 6-month postoperative patient-reported sporting level in patients who underwent each surgical procedure (N = 2261). Error bars indicate the standard error of the mean. *** $P < .001$, ** $P < .01$, * $P < .05$ (Wilcoxon signed-rank test). PTFE, polytetrafluoroethylene.

Capsular release and Bankart repair had the greatest effect size on patient-reported sporting level at 6 months (Figure 3). Capsular release had an effect size of 0.18 in patient-reported sporting level at 6 months (95% CI, 0.05-0.30; $P = .009$), representing a 41% improvement from the preoperative level. Bankart repair was the poorest performing shoulder surgery in its effect on patient-reported sporting level at 6 months, with an effect size of -0.17 (95% CI, -0.34 to -0.01 ; $P = .034$), indicating that patients declined 21% from their mean preoperative level, followed by rotator cuff repair, with an effect size of -0.06 (95% CI, -0.03 to -0.10 ; $P = .0004$) representing a 13% decline from the preoperative level. No other surgical procedures had a significant effect size on patient-reported sporting level.

Change in Sporting Level of Capsular Release Group. Compared with preoperatively, there was no significant change in the sporting level of the capsular release group at 6 weeks postoperatively or at 3 months postoperatively (Figure 4). However, there was a significant improvement in sporting level at 6 months postoperatively ($P = .009$).

Subgroup Analysis. Preoperatively, Bankart repair had the highest sporting level of the 13 surgical groups compared, with 25% reporting a “club” level and 6% reporting a “national” level. Reverse total shoulder arthroplasty had the lowest preoperative sporting level, with 77% reporting “none” and 13% reporting a “hobby” level, followed by PTFE patch repair and rotator cuff repair with capsular release (Figure 5A). At 6 months after surgery, Bankart repair

had the highest sporting level, with 18% reporting a “club” level and 2% reporting a “national” level. PTFE patch repair had the lowest 6-month sporting level, with 75% reporting “none” and 25% reporting a “hobby” level, followed by reverse total shoulder arthroplasty and hemiarthroplasty (Figure 5B).

Preoperative Versus 6-Month Sporting Levels for Capsular Release, Bankart Repair, and Rotator Cuff Repair. Preoperatively, 66% of the capsular release group reported a sporting level of “none.” This decreased to 53% at 6 months after surgery; 27% reported a “hobby” level preoperatively, and this increased to 35% at 6 months after surgery. The percentage of patients reporting a “club” level increased from 7% preoperatively to 10% postoperatively; 0% reported a “national” level preoperatively, which increased to 2% at 6 months after surgery (Figure 6).

Preoperatively, 37% of the Bankart repair group reported a sporting level of “none.” This increased to 40% at 6 months postoperatively; 33% reported a “hobby” level preoperatively, and this decreased to 39% at 6 months postoperatively. The percentage of patients reporting a “club” level decreased from 25% preoperatively to 18% postoperatively; 6% reported a “national” level preoperatively, which decreased to 2% at 6 months postoperatively (Figure 7).

Preoperatively, 37% of the rotator cuff repair group reported a sporting level of “none.” This increased to 44% at 6 months postoperatively; 46% reported a “hobby”

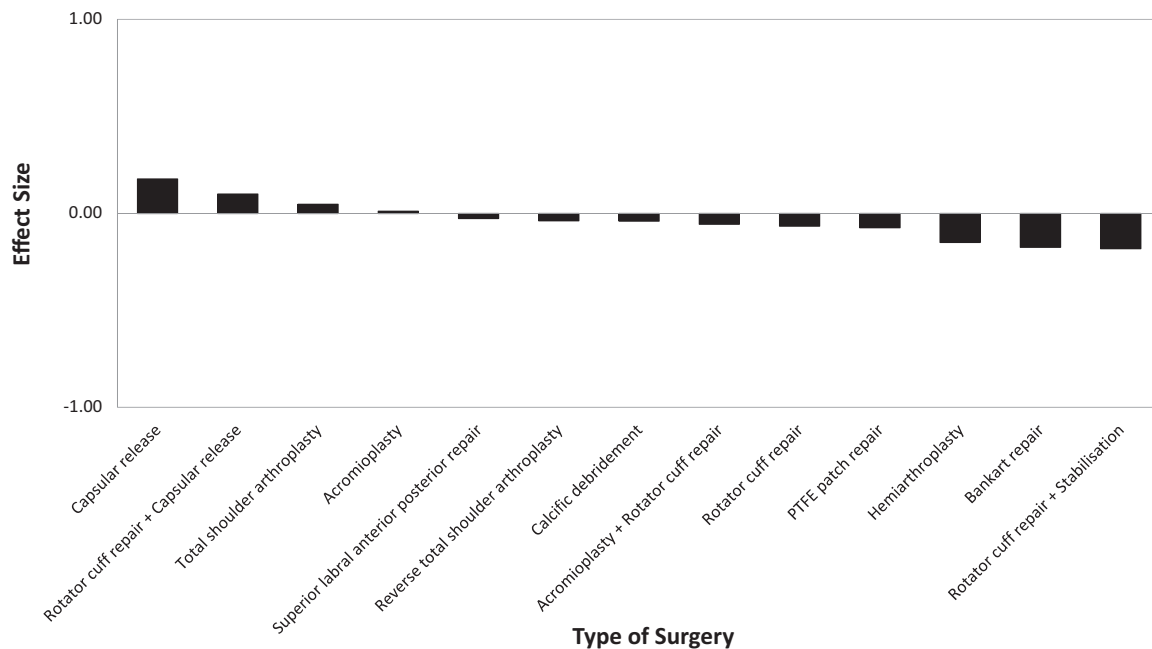


Figure 3. Effect size of the surgical intervention on patient-reported sporting level at 6 months postoperatively. PTFE, polytetrafluoroethylene.

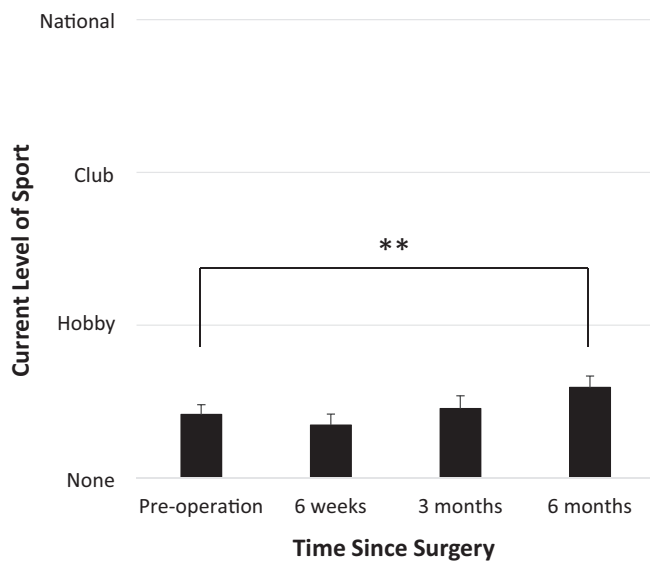


Figure 4. Mean preoperative and 6-week, 3-month, and 6-month postoperative patient-reported sporting level in patients who underwent capsular release. Error bars indicate the standard error of the mean. ** $P < .01$ (Wilcoxon signed-rank test).

level preoperatively, and this decreased to 37% at 6 months postoperatively. The percentage of patients reporting a “club” level increased from 14% preoperatively to 15% postoperatively; 3% reported a “national” level preoperatively, which remained at 3% at 6 months postoperatively (Figure 8).

Relationship Between Objective Measures and Change in Sporting Level. For the capsular release group, a greater change in sporting level (improvement) from preoperatively to 6 months postoperatively was associated with younger age ($\rho = -0.46, P = .013$) and greater range of motion in abduction at 6-month postoperative follow-up ($\rho = 0.56, P = .001$). For patients who underwent Bankart repair, a greater change in sporting level (decline) from preoperatively to 6 months postoperatively was associated with less preoperative range of motion in external rotation ($\rho = -0.314, P = .042$). For the rotator cuff repair group, a greater change in sporting level (decline) from preoperatively to 6 months postoperatively was associated with older age ($\rho = 0.114, P = .017$), less preoperative range of motion in external rotation ($\rho = -0.118, P = .013$), and lower preoperative strength in external rotation ($\rho = -0.096, P = .045$).

For patients who underwent SLAP repair, a greater change in sporting level (decline) from preoperatively to 6 months postoperatively was associated with less preoperative range of motion in external rotation ($\rho = -0.301, P = .047$). For the PTFE patch repair group, a greater change in sporting level (decline) from preoperatively to 6 months postoperatively was associated with older age ($\rho = -0.507, P = .019$). For the rotator cuff repair with capsular release group, a greater change in sporting level (decline) from preoperatively to 6 months postoperatively was associated with less preoperative strength in external rotation ($\rho = -0.534, P = .033$). For the rotator cuff repair with stabilization group, a greater change in sporting level (decline) from preoperatively to 6 months postoperatively was associated with younger age ($\rho = 0.478, P = .028$).

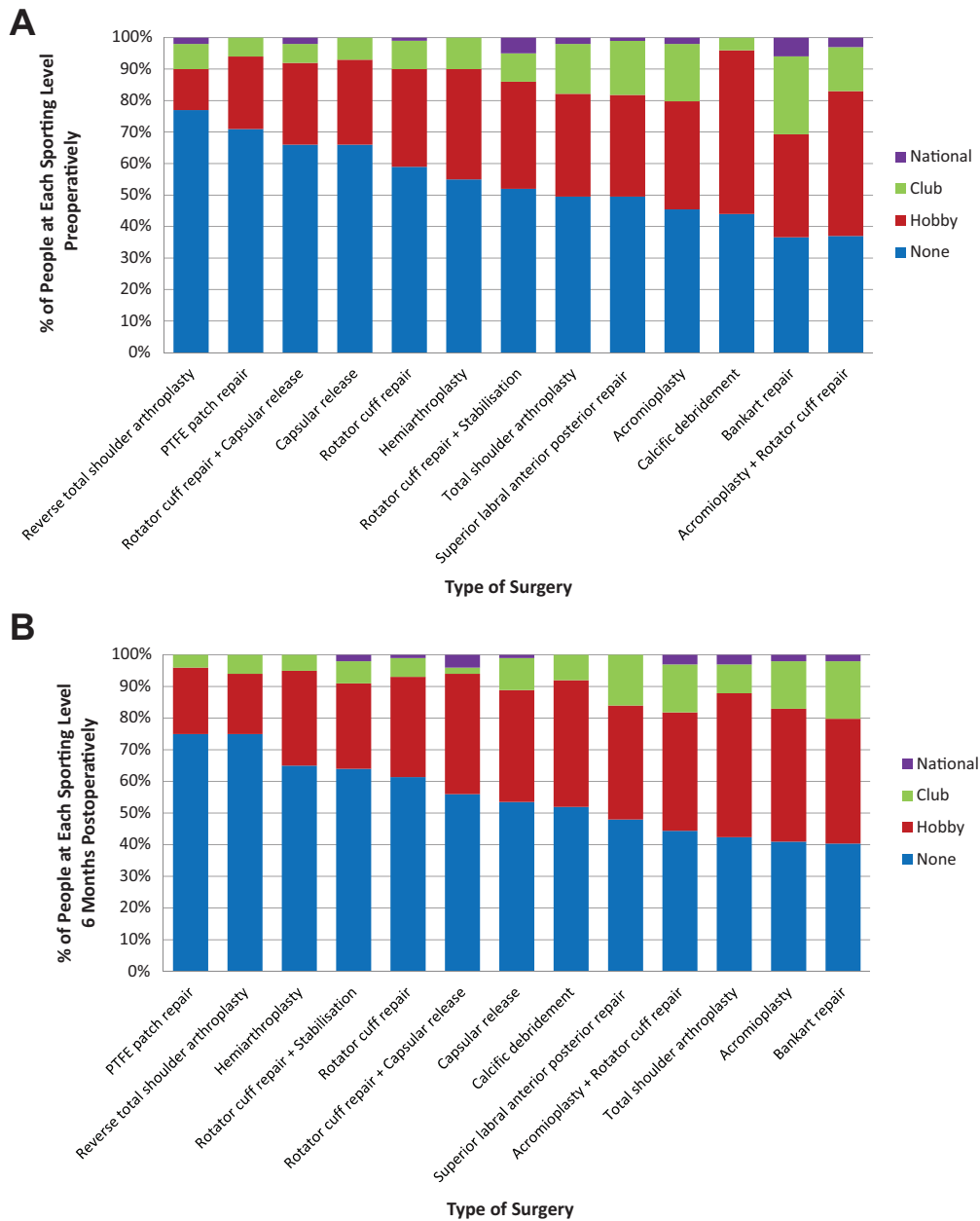


Figure 5. (A) Percentage of each surgical group that reported being at a “none,” “hobby,” “club,” or “national” sporting level preoperatively. (B) Percentage of each surgical group that reported being at a “none,” “hobby,” “club,” or “national” sporting level at 6 months postoperatively. PTFE, polytetrafluoroethylene.

DISCUSSION

Capsular release was the only surgical procedure in this study that facilitated return to sport at 6 months after surgery, generating a 41% improvement in the mean sporting level. Bankart repair and rotator cuff repair were the only surgical procedures associated with a decrease in patient-reported sporting level at 6 months postoperatively, declining 21% and 13%, respectively, from their mean preoperative sporting levels. No significant

change in sporting level was seen in patients who underwent the other 10 surgical procedures.

When examining the study cohort as a whole, shoulder surgery did not appear to facilitate return to sport at 6 months postoperatively, as the entire cohort saw a decline of 10% from their mean preoperative sporting level. However, it must be remembered that the rotator cuff repair group constituted 58% of the total study cohort, and this procedure was associated with a decline in sporting level at 6 months postoperatively.

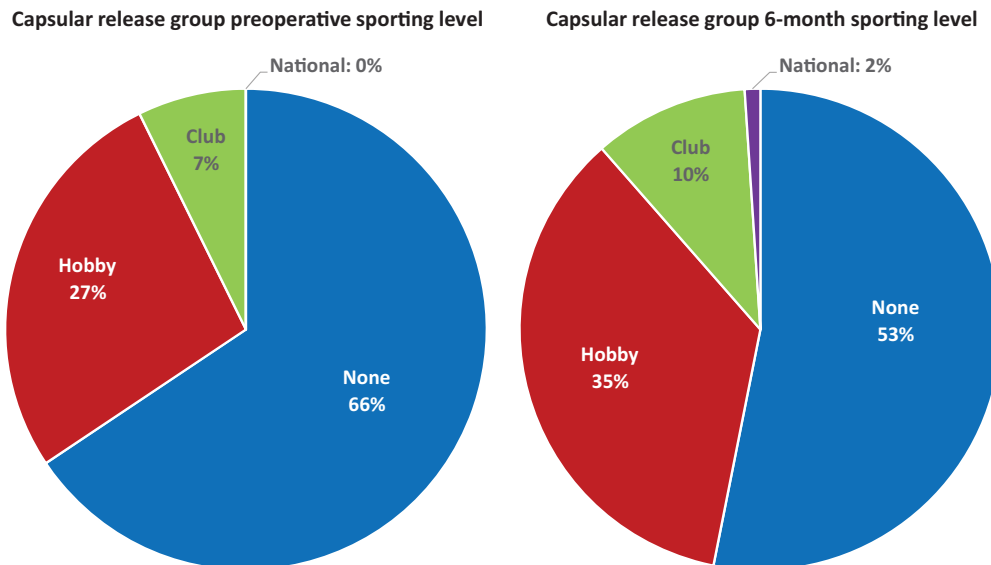


Figure 6. Proportions of the capsular release group that reported being at a “none,” “hobby,” “club,” or “national” sporting level preoperatively and 6 months postoperatively.

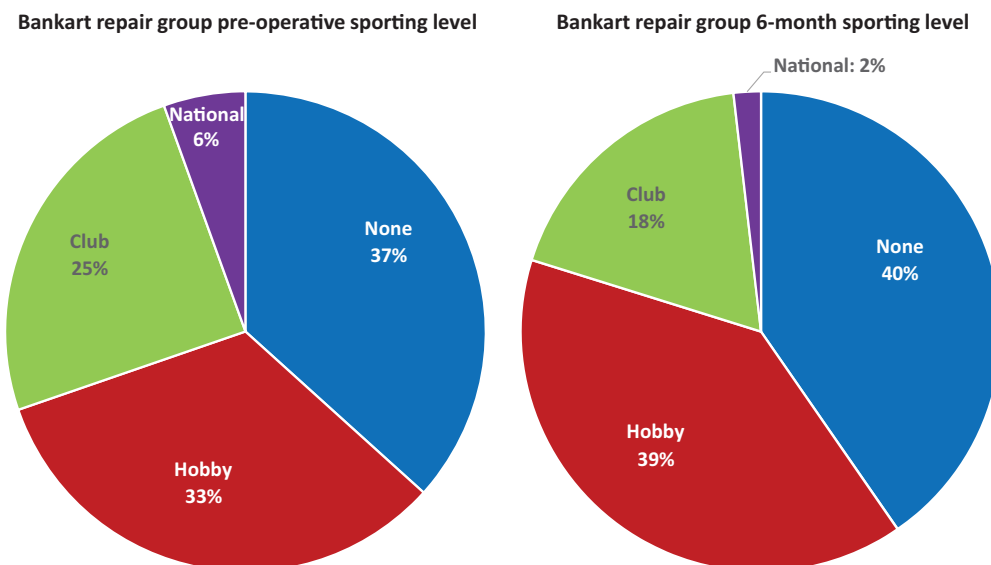


Figure 7. Proportions of the Bankart repair group that reported being at a “none,” “hobby,” “club,” or “national” sporting level preoperatively and 6 months postoperatively.

Capsular release was the only procedure that generated improvement in patient-reported sporting level at 6 months postoperatively. Several factors can be hypothesized to determine why capsular release was the most effective surgical intervention. The patients undergoing capsular release in this study reported lower sporting levels preoperatively; that is, 66% of the patients undergoing capsular release in this study reported a preoperative sporting level of “none” and a further 27% as “hobby.” However, the reverse total shoulder arthroplasty and PTFE patch repair groups had even lower preoperative sporting levels, with

77% reporting “none” and 13% “hobby” and with 71% reporting “none” and 23% “hobby,” respectively.

To our knowledge, no previous studies have evaluated return to sport after capsular release for adhesive capsulitis. However, Paraparan et al²⁶ found that capsular release provided the greatest effect size in patient-reported overhead function. Perhaps this facilitated return to overhead sport in our patient cohort. Furthermore, capsular release involves the precise release of thickened capsular tissue, allowing for rapid short-term improvements in range of motion and pain reduction.^{7,8} Bhargav and

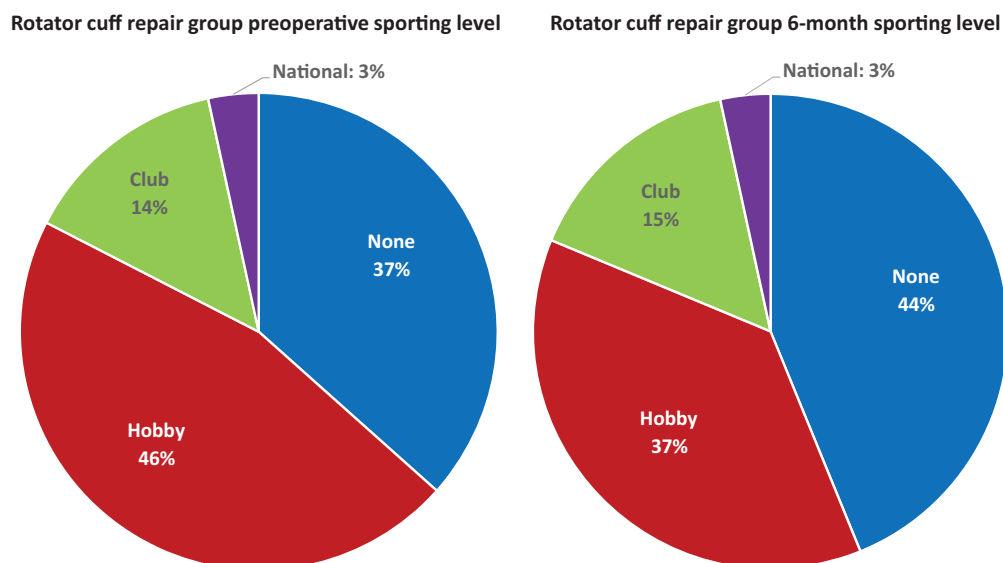


Figure 8. Proportions of the rotator cuff repair group that reported being at a “none,” “hobby,” “club,” or “national” sporting level preoperatively and 6 months postoperatively.

Murrell⁴ reported that after capsular release, the severity of pain at rest decreases from moderate to mild and that range of motion in forward flexion increases from 70° to 100° by 1 week after surgery. Moreover, patients undergoing capsular release are encouraged to start using their shoulder as soon as possible after surgery,²² perhaps aiding in return to sport and the confidence to do so to a higher level within the 6-month follow-up period. There was, however, no significant change in sporting level of the capsular release group at 6 weeks postoperatively or at 3 months postoperatively. Factors associated with an improvement in sporting level for the capsular release group were younger age and greater range of motion in abduction at 6-month postoperative follow-up.

Procedures that did not facilitate return to sport by 6 months were Bankart repair and rotator cuff repair. The Bankart repair group was composed of the youngest patients, with a mean age of 28 ± 1.1 years, thus likely to have had high functional demands. This group also had the greatest number of both “club” and “national” levels preoperatively, with high activity levels and high expectations to meet postoperatively. Plath et al²⁸ have previously demonstrated that an improvement in sporting proficiency is highly dependent on the age of the patient and the demands on the shoulder in sport. They found that older patients had greater improvements in sporting proficiency compared with younger patients, as did those with lower preoperative risk levels and lower preoperative performance levels.

Our study found that a greater change in sporting level (decline) for the Bankart repair group was associated with less preoperative range of motion in external rotation. Our results support previous studies that show greater improvements for Bankart repair over a longer follow-up period of 2 to 10 years^{11,14} rather than 6 months.

Gerometta et al¹² found that 9.8 ± 5.4 months was the mean time required for young (mean age, 29 ± 9.1 years) recreational and competitive athletes to return to their previous level.

Patients who underwent rotator cuff repair constituted the largest surgical group in this study ($n = 1305$). On average, this group declined in sporting level by 13%. While this was statistically significant, a 13% decrease may not represent a clinically significant decline. The main change for this group was seen in patients reporting a change from “hobby” level preoperatively to “none” at 6 months postoperatively. Preoperatively, 37% of the rotator cuff repair group reported a sporting level of “none,” which increased to 44% at 6 months after surgery; 46% reported a “hobby” level preoperatively, and this decreased to 37% at 6 months after surgery. However, even a change between these levels was not statistically significant.

Overall, 58% of patients who underwent this procedure had full-thickness rotator cuff tears, and 42% had partial tears. The mean duration of symptoms for our rotator cuff repair group was 22.0 ± 1.5 months (range, 0-387 months), with 37% reporting that there was no specific injury that initiated their shoulder pain, suggesting an atraumatic cause. The mean age of this surgical group was 59 ± 0.3 years (range, 18-91 years). Payne et al²⁷ have previously reported superior outcomes for younger athletes with traumatic causes rather than those with insidious shoulder pain. Other studies have reported improved return to sport levels following rotator cuff repair after longer follow-up periods of 26 to 67 months but with significantly smaller cohorts (<50 patients).^{5,8,16,17} This study represents the largest cohort of arthroscopic rotator cuff repairs analyzed in the literature for an effect on sporting level. Sonnery-Cottet et al³¹ found that 9 months was the mean time required for middle-aged tennis players to return to sport, supporting our results that 6 months is an insufficient time

for patients undergoing rotator cuff repair (mean age, 59 years) to return to their preoperative sporting level. In the rotator cuff repair group in our study, older patients had a greater decline in sporting level at 6 months, as did those with less preoperative range of motion in external rotation and lower preoperative strength in external rotation.

There are several strengths to this study. All shoulder surgical procedures under analysis were performed by the same surgeon at a single center, and all patients completed an identical questionnaire at uniform time intervals: preoperatively and 6 months postoperatively. This allowed a valid comparison of all common surgical interventions in the shoulder based on results from the L'Insalata questionnaire, which is a validated instrument capable of distinguishing pain and functional outcomes. Unlike many existing studies, recall bias was not an issue because the data were collected prospectively. Moreover, all shoulder surgical procedures being compared in this study had equivalent or larger patient numbers than existing comparable studies.

There are a number of limitations to this study's findings. It was a retrospective cohort study. The study's high internal validity means that its findings may not apply to other surgical centers. This study is based solely on subjective data obtained through a questionnaire. The outcome measures used in our study were limited to a change in the level of sport compared with the preoperative level, but this does not necessarily equate to performance. Specific sports and their effect on return to play after different procedures were not analyzed. Additionally, the follow-up period of 6 months was short. The full effects of surgery may not be realized until a longer period after the surgical intervention. Finally, it must be remembered that the various surgical interventions under comparison were for disparate indications and followed varied rehabilitation protocols.

CONCLUSION

Capsular release for adhesive capsulitis was the only surgical procedure in this study that provided a therapeutic effect in improving patient-reported sporting level in a relatively short period of time (6 months). Bankart repair and rotator cuff repair were associated with a decrease in patient-reported sporting level at 6 months postoperatively. No significant change in sporting level was seen for patients who underwent rotator cuff repair with acromioplasty, PTFE patch repair, acromioplasty, SLAP repair, total shoulder arthroplasty, reverse total shoulder arthroplasty, rotator cuff repair with capsular release, rotator cuff repair with stabilization, calcific debridement, or hemiarthroplasty in the 6-month follow-up period. These findings can shape the expectations of patients and surgeons alike regarding return to sport at 6 months after shoulder surgery.

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APPENDIX

FIRST VISIT ONLY

ADDITIONAL INFORMATION

Date Stamp

Medical Record Number

1. Gender: Female Male
2. Age
3. Birth Date

 -

 -
4. What is your occupation?
5. Which shoulder is affected? Right Left Both
6. Are you right handed, left handed or ambidextrous? Right Left Both
7. Date your shoulder problem began

 -

 -
8. Was this related to a specific injury? Yes No
9. If yes, how did you injure your shoulder?
10. Does this injury involve an insurance claim? Yes No
11. What was your level of activity at work before your shoulder problem? None Light activity Moderate activity Strenuous labour
12. What was your highest exercise level before your shoulder problem? None Hobby sport Club sport National sport
13. How many times has your shoulder been out of joint (dislocated)? >10x 5-9x 2-4x 1x Never

14. Have you any allergies? Yes No If so, to what? _____

15. Do you take medications regularly? Yes No If so, list their names? _____

16. Please indicate if you have ever suffered from any of the following:

Rheumatoid arthritis <input type="checkbox"/>	
Indigestion, heart burn or ulcers <input type="checkbox"/>	
High blood pressure <input type="checkbox"/>	Heart trouble <input type="checkbox"/>
Hepatitis or jaundice <input type="checkbox"/>	Shortness of breath <input type="checkbox"/>
Kidney trouble <input type="checkbox"/>	Sleep apnoea <input type="checkbox"/>
Bleeding disorder <input type="checkbox"/>	Stroke <input type="checkbox"/>
Asthma <input type="checkbox"/>	Any other serious illness <input type="checkbox"/>
Thrombosis or clots <input type="checkbox"/>	
Fits or funny turns <input type="checkbox"/>	

17. Have you had any of these treatments for your shoulder? How many? Mark if treatment helped


Chiropractic therapy <input type="checkbox"/>		<table border="1" style="display: inline-table; border-collapse: collapse; width: 20px; height: 20px;"></table>	
Physiotherapy <input type="checkbox"/>		<table border="1" style="display: inline-table; border-collapse: collapse; width: 20px; height: 20px;"></table>	<input type="checkbox"/>
Acupuncture <input type="checkbox"/>		<table border="1" style="display: inline-table; border-collapse: collapse; width: 20px; height: 20px;"></table>	<input type="checkbox"/>
Injections <input type="checkbox"/>		<table border="1" style="display: inline-table; border-collapse: collapse; width: 20px; height: 20px;"></table>	<input type="checkbox"/>
Surgery <input type="checkbox"/>		<table border="1" style="display: inline-table; border-collapse: collapse; width: 20px; height: 20px;"></table>	<input type="checkbox"/>

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(continued)

Figure A1. L'Insalata questionnaire used in this study.

SHOULDER FORM

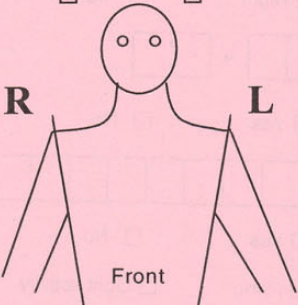


Today's Date Medical Record Number

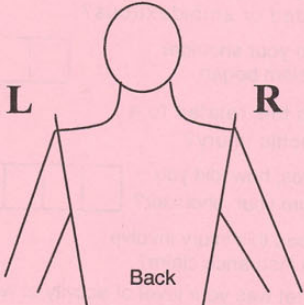
Please answer all questions on this side of the form.

1. Which of your shoulders is affected?

Right
Left



Front



Back
2. Mark X where the pain is and an arrow where it goes
3. How often is your shoulder

	Always	Daily	Weekly	Monthly	Never
a. painful during activity?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. painful when you sleep?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. extremely painful?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. What is the level of your shoulder pain

	Very Severe	Severe	Moderate	Mild	None
a. when you are resting?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. with activities above your head?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. when you sleep?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. How "stiff" is your shoulder?

	Very	Quite	Moderately	A Little	Not at all
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. How much difficulty do you have

	Very Severe	Severe	Moderate	Mild	None
a. with reaching behind your back?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. with activities above your head?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. How is your shoulder over-all?

	Very Bad	Bad	Poor	Fair	Good
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. What is your current level of activity at work?

	None	Light Activity	Moderate Activity	Strenuous Labour
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. What is your highest level of sport now?

	None	Hobby Sport	Club Sport	National Sport
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Appendix Figure A1. (Continued).

TABLE A1
Surgical Interventions Examined in This Study^a

Surgical Intervention	Description	Indication(s)
Rotator cuff repair	Reattachment of the torn rotator cuff tendon using sutures, bone anchors, and/or a PTFE patch to their respective insertions on the humeral head	Rotator cuff tear
Acromioplasty	Removal and smoothing of the lateral aspect and undersurface of the acromion to primarily relieve impingement of underlying rotator cuff tendons and associated tears of the rotator cuff	Tendinitis, bursitis, and impingement as well as inflammatory AC arthritis
Capsular release	Division of the thickened capsule circumferentially around the glenoid, with the aim to provide immediate relief from pain and stiffness	Idiopathic, posttraumatic stiffness; diabetes and postoperative stiffness/frozen shoulder; possibly osteoarthritis in younger patients
Distal clavicle excision	Removal of distal 5 to 7 mm of the clavicle	AC joint impingement and osteoarthritis with no underlying instability
Bankart repair	Use of sutures and bone anchors to reattach and tighten the labrum and associated ligaments around the glenoid	Shoulder instability
SLAP repair	Use of sutures and bone anchors to reattach the superior aspect of the glenoid labrum at the point of insertion of the long head of the biceps tendon	SLAP tear (specifically types II-IV), which is a tear along the superior portion of the glenoid labrum at the point of insertion of the long head of the biceps tendon and depending on the severity of the tear may extend into the tendon of the biceps muscle (type IV)
Calcific debridement	Debridement of calcific phosphate residue primarily within the rotator cuff	Calcific tendinitis
Total shoulder arthroplasty	Humeral prosthesis with glenoid resurfacing and prosthesis	Osteoarthritis, inflammatory arthritis, avascular necrosis of the humeral head, glenohumeral chondrolysis
Reverse total shoulder arthroplasty	Glenoid sphere and humeral cup prostheses	Osteoarthritis, rotator cuff arthropathy, tumors of the humeral head
Hemiarthroplasty	Humeral prosthesis only	Osteoarthritis, inflammatory arthritis, avascular necrosis of the humeral head, Neer fractures, glenohumeral chondrolysis

^aFrom Paraparan et al,²⁶ Altchek et al,¹ Martin et al,²⁰ Kim et al,¹⁵ Nicholson,²³ Barr,³ Bhargav and Murrell,⁴ Porcellini et al,²⁹ Wiater and Fabing,³⁷ and Gorantla et al.¹³ AC, acromioclavicular; PTFE, polytetrafluoroethylene; SLAP, superior labral anterior to posterior.