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Anatomic shoulder arthroplasty in workers' compensation patients: predictors of success and return to work

*John C. Wu, MD, Anastasia J. Whitson, BSPH, Jie J. Yao, MD, Frederick A. Matsen III, MD, and Jason E. Hsu, MD**

Department of Orthopaedics and Sports Medicine, University of Washington, Seattle, WA, USA

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ABSTRACT

Background: In patients with shoulder arthritis, workers' compensation (WC) status presents unique challenges to the clinician because of the socioeconomic and psychosocial aspects attendant to patients covered on this type of insurance. Patients, surgeons, and these insurance programs would be informed by a better understanding of the factors that may impact the results of a shoulder arthroplasty as treatment for glenohumeral arthritis in this population. The objectives of this study were to determine: (1) the extent to which patient-reported outcomes are impacted by WC status in comparison to patients covered by other types of insurance, (2) which factors are predictive of a successful outcome of shoulder arthroplasty as defined by improvement exceeding the minimal clinically important difference (MCID), (3) the ability of WC patients to return to their presurgical occupation after arthroplasty.

Methods: This was a retrospective study of a longitudinally maintained institutional database of 677 patients who underwent primary anatomic shoulder arthroplasty with a minimum 2-year follow-up, 39 of whom had WC insurance. These patients were compared to a matched cohort of 78 patients without WC insurance. Primary outcome measures included SST scores, SANE scores, and need for revision surgery. Univariate and multivariate analyses were performed to determine preoperative characteristics associated with success as defined by improvement greater than the MCID of the SST.

Results: Success, defined as improvement beyond MCID, occurred in a significantly lower proportion of WC patients compared to non-WC patients (64% vs. 94%, $P < .001$). Older age ($P = .010$) and a higher preoperative SF-36 role physical domain score (a measure of the patient's perceived limitations in routine activities;$P = .007$) were associated with improvement beyond the MCID on univariate analysis. Higher preoperative SF-36 role physical domain scores had the greatest correlation with a successful outcome (OR 1.19, 95% 0.99-1.43, $P = .07$). A significantly lower percentage of patients with physically-demanding jobs returned to previous occupation compared to patients with non-physically-demanding jobs (13% vs. 73%, $P = .001$).

Conclusions: The challenges in treating patients covered by WC are underscored by the high percentage of these patients that do not improve beyond the MCID and the high percentage of patients with physically-demanding jobs that are unable to return to their presurgical

This study was approved by the University of Washington Institution Review Board (IRB #STUDY00007300).

*Corresponding author: Jason E. Hsu, MD, Shoulder and Elbow Surgery, University of Washington Medical Center, 1959 NE Pacific Street, Box 356500, Seattle, WA 98195-6500, USA.

E-mail address: jehsu@uw.edu (J.E. Hsu).

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occupation. Those patients who report less disability with routine daily activities (ie, higher SF-36 role physical domain scores) may fare better with anatomic shoulder arthroplasty. Patients with physically-demanding jobs should be counseled that return to their previous occupation is unlikely.

Level of Evidence: Level III; Retrospective Cohort Comparative Study

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Treating glenohumeral arthritis in patients under workers' compensation (WC) status has unique challenges for the shoulder surgeon due to the socioeconomic and psychosocial aspects attendant to patients covered on this type of insurance.[3] The surgeon is often called upon to opine whether the arthritis was caused or aggravated by the patient's work, to determine when the patient can return to work, to define restrictions for work and to report the degree of permanent partial impairment related to the arthritis. While the WC system is designed to protect and provide benefits to injured workers, these associated socioeconomic components can create an environment that shifts the focus away from optimizing the treatment of the patient's arthritis.[3] WC status is known to be associated with poor outcomes after surgery.[4]

The literature pertaining to the effect of WC status on shoulder arthroplasty outcomes is limited to only a few studies.[2,5,6] Despite significant improvements in pain and function, patients with WC undergoing shoulder arthroplasty appear to have lower improvement in patient reported outcomes, higher reoperation rates, and higher rates of persistent pain than non-WC patients. Because of the unique challenges associated with WC insurance, it would be helpful to identify the factors that may affect the results of a shoulder arthroplasty in this patient population. We sought to determine: (1) the extent to which patient-reported outcomes are impacted by WC status in comparison to patients covered by other types of insurance, (2) which factors are predictive of a successful outcome of shoulder arthroplasty as defined by improvement exceeding the minimal clinically important difference (MCID), (3) the ability of WC patients to return to their presurgical occupation after arthroplasty. We hypothesized that (1) patient reported outcomes would be significantly worse in patients with WC status than those without, (2) psychosocial factors, such as current work status and involvement of a lawyer, would have a strong correlation with a successful outcome, (3) WC patients with physically-demanding jobs would be unlikely to return to their presurgical occupation.

Materials and Methods

Patient selection

This study was approved by the University of Washington Institution Review Board (IRB #STUDY00007300). This was a retrospective cohort study of a longitudinally-maintained institutional database of patients having primary shoulder arthroplasty between the dates of August 2010 and August 2017. A total of 1,112 patients were enrolled into the database during this time period. Patients were included if (1) they had a primary anatomic shoulder arthroplasty (total shoulder arthroplasty or ream and run arthroplasty) and (2) they had a clinical follow-up of at least 2 years.

Patient evaluation and outcomes

Demographic information was recorded including age, sex, body mass index (BMI), history of prior surgery, history of depression or anxiety, diabetes status, tobacco use, alcohol use, marital status, current working status, and involvement of a lawyer. Patient optimism prior to surgery was assessed using the following question: "On a 0-10 scale, where 0 is not at all helpful and 10 is extremely helpful, how helpful do you believe surgery will be for your current shoulder pain and functioning?" Visual Analog Scale pain, Short Form 36 (SF-36), Simple Shoulder Test (SST), and Single Assessment Numeric Evaluation (SANE) scores were collected preoperatively and 2-years postoperatively.

Retrospective matched cohort

Patients were divided into two groups based on insurance type: WC and non-WC. Using these criteria, 39 patients with workers compensation were identified. Due to statistically significant differences in patient characteristics (age, sex, ASA class, BMI, history of prior shoulder surgery, active smoking status) between the 39 WC patients and the 638 non-WC patients (Appendix 1), a matched non-WC cohort was created. Two non-WC patients were matched to every WC patient based on similar age, sex, ASA class, history of prior surgery, smoking status, type of procedure, preoperative SST, and preoperative SANE scores.

Return to previous occupation

In the WC cohort, the WC claims were reviewed to determine the physical demands of the presurgical occupation as classified by the United States Department of Labor Office of Worker's Compensation Programs. Jobs that required medium (9.1-22.7 kg or 20-50 pounds of force occasionally), heavy (22.7-45.4 kg or 50-100 pounds of force occasionally), or very heavy (>45.4 kg or >100 pounds of force occasionally) physical demands were classified as physically-demanding, while jobs that required sedentary (less than 4.5 kg or 10 pounds of force occasionally) or light (4.5-9.1 kg or 10-20 pounds of force occasionally) physical demands were classified as non-physically-demanding. We classified return to work as either return to previous occupation to some capacity or did not return to previous occupation.

Table 1 – Patient demographics and preoperative characteristics of workers' compensation cohort versus matched non-worker's compensation patients (1WC:2 non-WC patient ratio).

	All N (%) or Mean ± SD	WC patients N (%) or Mean ± SD	Non-WC patients N (%) or Mean ± SD	*P* value
Number of patients	117	39	78	-
Age	55.5 ± 10.2	53.9 ± 9.7	56.4 ± 10.4	.215
Sex				1.000
Male	108 (92%)	36 (92%)	72 (92%)	
Female	9 (8%)	3 (8%)	6 (8%)	
BMI	30.2 ± 5.2	32.2 ± 5.4	29.2 ± 4.8	.003*
ASA				1.000*
1	13 (11%)	5 (13%)	8 (10%)	
2	86 (74%)	28 (72%)	58 (74%)	
3	18 (15%)	6 (15%)	12 (15%)	
4	0 (0%)	0 (0%)	0 (0%)	
Smoker	10 (9%)	5 (13%)	5 (6%)	.242
Diabetic	7 (6%)	4 (10%)	3 (4%)	.220
Depression	21 (18%)	8 (21%)	13 (17%)	.609
Anxiety	23 (20%)	9 (23%)	14 (18%)	.511
Marital status				.882
Married	86 (74%)	29 (74%)	57 (73%)	
Single	19 (16%)	4 (10%)	15 (19%)	
Divorced / widowed / other	12 (10%)	6 (15%)	6 (8%)	
Currently working	65 (56%)	20 (51%)	45 (58%)	.511
Lawyer involved	9 (8%)	8 (21%)	1 (1%)	<.001*
Diagnosis				.584
Osteoarthritis	76 (65%)	24 (62%)	52 (67%)	
Capsulorrhaphy arthropathy	14 (12%)	5 (13%)	9 (12%)	
Other	27 (23%)	10 (25%)	17 (21%)	
Arthroplasty type				1.000
Total shoulder arthroplasty	60 (51%)	20 (51%)	40 (51%)	
Ream and run arthroplasty	45 (39%)	15 (39%)	30 (39%)	
Hemiarthroplasty	12 (10%)	4 (10%)	8 (10%)	
Surgery on dominant extremity	72 (62%)	23 (64%)	49 (63%)	.687
Prior shoulder surgery	58 (49%)	19 (49%)	39 (49%)	.896
Pre-op optimism (0 to 10)	9.3 ± 1.1	9.4 ± 1.1	9.2 ± 1.1	.561
Pre-op pain VAS score	7.1 ± 1.9	7.4 ± 1.3	6.9 ± 2.1	.149
Pre-op SST	3.3 ± 2.3	2.9 ± 2.5	3.4 ± 2.2	.289
Pre-op SANE	34 ± 18	32 ± 16	35 ± 18	.381
Preoperative SF-36 domains				
Physical component summary	40 ± 20	34 ± 18	42 ± 20	.077
Mental component summary	80 ± 21	74 ± 25	83 ± 17	.098
Physical function	62 ± 20	59 ± 23	64 ± 18	.297
Role physical	43 ± 27	36 ± 28	46 ± 26	.084
Role emotional	82 ± 27	72 ± 36	86 ± 21	.039*
Mental health	75 ± 16	71 ± 18	77 ± 14	.105
Bodily pain	34 ± 19	30 ± 18	36 ± 19	.136
Vitality	57 ± 21	55 ± 19	57 ± 22	.675
General health	72 ± 19	70 ± 20	73 ± 19	.455
Social function	68 ± 26	62 ± 29	72 ± 24	.090

BMI, Body Mass Index; *ASA*, American Society of Anesthesiologists class; *VAS*, Visual Analogue Scale; *SST*, Simple Shoulder Test; *SANE*, Single Assessment Numeric Evaluation; *SF-36*, Short Form 36; *WC*, Workers' Compensation.

P value: 2-sample *t* test for parametric continuous variables, Chi-squared or Fisher exact test for categorical variables.

†ASA 1 and 2 compared to ASA 3 and 4 in analysis. Values are presented as frequencies (percentages) and means ± standard deviations.

* $p < 0.05$

Statistical analysis

Descriptive characteristics are presented as means, standard deviations, and ranges for continuous variables and as counts and percentages for categorical variables. Statistical significance of differences in the characteristics between WC and non-WC patients was calculated using the 2-sample *t* test with unequal variances and either the chi-squared test or Fisher exact test (as appropriate). Similarly, characteristics of WC patients with and without a successful outcome as defined by improvement beyond the defined MCID for each respective cohort, were compared. A successful outcome was defined as one in which the SST improved ≥3 points based on a MCID threshold of

2.4 as previously defined by Tashjian et al.[8] A multivariate logistic regression analysis was used to determine independent predictors of a successful outcome. For the multivariate analysis, we included age, sex, work status, preoperative diagnosis, preoperative SST, preoperative SF-36 mental and physical component summaries, and variables found to be significant on univariate analysis. Statistical analyses were performed with the use of SPSS (Version 25.0; IBM Corp., Armonk, NY, USA).

Results

Comparison of workers' compensation and matched nonworkers' compensation cohorts

The WC cohort was statistically similar to the matched non-WC cohort for all characteristics with the exception of a heavier BMI (32.2 ± 5.4 vs. 29.2 ± 4.8, P= .003) and more frequent lawyer involvement (21% vs. 1%, P< .001). Preoperative SST score (2.9 ± 2.5 vs. 3.4 ± 2.2, P= .289), preoperative SANE score (32 ± 16 vs. 35 ± 18, P= .381), age (53.9 ± 9.7 vs. 56.4 ± 10.4, P= .215), ASA class (P= 1.000), history of prior surgery (P= .896), and smoking status (P= .242) were similar (Table 1).

Preoperatively, WC patients reported a similar Visual Analog Scale pain scores (7.4 ± 1.3 vs. 6.9 ± 2.1, P=.149), SST scores (2.9 ± 2.5 vs. 3.4 ± 2.2, P= .289), and SANE score (32 ± 16 vs. 35 ± 18, P= .381) to the matched non-WC patients. For the preoperative SF-36 domains, only role emotional (72 ± 36 vs. 86 ± 21, P= .039) maintained statistical significance between the 2 cohorts.

Postoperatively, WC patients reported significantly lower SST scores (6.9 ± 3.9 vs. 10.0 ± 2.5, P< .001) and lower improvement in SST (3.9 ± 3.8 vs. 6.6 ± 2.8, P< .001) compared to the matched non-WC cohort (Table 2). Similarly, the percentage of maximum possible improvement (43% ± 45% vs. 78% ± 28%, P< .001) and SANE scores (65 ± 21 vs. 80 ± 18, P< .001) were lower.

Six WC patients (15%) required open revision procedures while only 3 non-WC patients (4%) required revision (P= .058). Revision in the WC cohort was performed for subscapularis failure for 2 patients and persistent pain and stiffness in 4 patients. Revision in the non-WC cohort was performed for subscapularis failure in 1 patient and persistent pain and stiffness in 2 patients.

Factors predictive of success in workers' compensation patients

Using improvement greater than the MCID for the SST (≥3) as a metric of success, 25 WC patients (64%) were defined as achieving a successful outcome. This was a significantly smaller percentage compared to the matched non-WC cohort in which 73 patients (94%) were defined as having a successful outcome (P< .001).

When comparing WC patients that improved more than the MCID of the SST to WC patients that did not, patients that had improvement greater than the MCID were older (56.8 ± 9.5 vs. 48.8 ± 8.2, P= .010) and had higher scores in the SF-36 role physical domain (45 ± 30 vs. 21 ± 19, P= .007; Table 3). Depression (P= .686), anxiety (P= 1.000), marital status (P= .238), current working status (P= .146), involvement of a lawyer (P= .686), and optimism scores (P= .312) were not significantly associated with a successful outcome. On multivariate analysis, a higher SF-36 role physical domain had the strongest correlation with a successful outcome (OR 1.19, 95% 0.99-1.43, P= .07; Table 4), while male sex (OR 10.13, 95% 0.21-482.76, P= .24) and status of currently working (OR 3.06, 95% 0.25-36.71, P= .38) had the highest odds ratios.

Return to previous occupation

Of the 34 patients with WC claim data available, 11 worked in a job that was classified as sedentary or light physical demands, while 23 worked in a job that was classified as medium, heavy, or very heavy physical demands. In total, 11 of 34 WC patients (32%) were able to return to previous occupation. 8 of 11 patients (73%) working in non-physically-demanding jobs returned to previous occupation while only 3 of 23 patients (13%) working in physically-demanding jobs returned to previous occupation (P= .001).

Table 2 – Patient-reported outcomes in workers' compensation cohort versus matched nonworker's compensation patients (1WC:2 non-WC patient ratio).

	All N (%) or Mean ± SD	WC patients N (%) or Mean ± SD	Non-WC patient N (%) or Mean ± SD	P value
Number of patients	117	39	78	-
Post-op SST	9.0 ± 3.4	6.9 ± 3.9	10.0 ± 2.5	**<.001***
SST change	5.7 ± 3.4	3.9 ± 3.8	6.6 ± 2.8	**<.001***
% MPI	66 ± 38	43 ± 45	78 ± 28	**<.001***
Post-op SANE	75 ± 21	65 ± 21	80 ± 18	**<.001***
Open revision procedure	9 (8%)	6 (15%)	3 (4%)	.058

SST, Simple Shoulder Test; *SANE*, Single Assessment Numeric Evaluation; *WC*, Workers' Compensation; *% MPI*, percentage of maximum possible improvement.

P value 2-sample t test for parametric continuous variables, Chi-squared for categorical variables. Values are presented as frequencies (percentages) and means ± standard deviations.

* $p < 0.05$

Table 3 – Patient demographics and preoperative characteristics of all WC patients; WC patients with SST change above MCID; WC patients with SST change below MCID.

	All WC patients N (%) or Mean ± SD	SST change >MCID N (%) or Mean ± SD	SST change <MCID N (%) or Mean ± SD	*P* value
Number of patients	39	25	14	-
Age	53.9 ± 9.7	56.8 ± 9.5	48.8 ± 8.2	**.010***
Sex				.289
Male	36 (92%)	24 (96%)	12 (86%)	
Female	3 (8%)	1 (4%)	2 (14%)	
BMI	32.2 ± 5.4	31.4 ± 5.2	33.7 ± 5.5	.217
ASA†				1.000
1	5 (13%)	5 (20%)	0 (0%)	
2	28 (72%)	16 (64%)	12 (86%)	
3	6 (15%)	4 (16%)	2 (14%)	
4	0 (0%)	0 (0%)	0 (0%)	
Smoker	5 (13%)	4 (16%)	1 (7%)	.637
Diabetic	4 (10%)	3 (12%)	1 (7%)	1.000
Depression	8 (21%)	6 (24%)	2 (14%)	.686
Anxiety	9 (23%)	6 (24%)	3 (21%)	1.000
Marital status				.238
Married	30 (77%)	21 (84%)	9 (64%)	
Single	4 (10%)	2 (8%)	2 (14%)	
Divorced/other	5 (13%)	2 (8%)	3 (21%)	
Currently working	20 (51%)	15 (60%)	5 (36%)	.146
Lawyer involved	8 (21%)	6 (24%)	2 (14%)	.686
Diagnosis‡				.268
Osteoarthritis	24 (61%)	17 (68%)	7 (50%)	
Capsulorrhaphy arthropathy	5 (13%)	5 (20%)	0 (0%)	
Other	10 (26%)	3 (12%)	7 (50%)	
Arthroplasty type				.431
Total shoulder arthroplasty	20 (51%)	14 (56%)	6 (43%)	
Ream and run arthroplasty	15 (39%)	10 (40%)	5 (36%)	
Hemiarthroplasty	4 (10%)	1 (4%)	3 (21%)	
Surgery on dominant extremity	23 (59%)	15 (60%)	8 (57%)	.862
Prior shoulder surgery	19 (49%)	12 (48%)	7 (50%)	1.000
Pre-op optimism (0-10)	9.4 ± 1.1	9.5 ± 0.8	9.1 ± 1.5	.312
Pre-op pain VAS score	7.4 ± 1.3	7.5 ± 1.4	7.1 ± 1.2	.421
Pre-op SST	2.9 ± 2.5	2.8 ± 2.1	3.3 ± 3.1	.581
Pre-op SANE	32 ± 16	33 ± 16	29 ± 18	.506
Preoperative SF-36 domains				
Physical component summary	34 ± 18	40 ± 17	27 ± 19	.070
Mental component summary	74 ± 25	78 ± 23	68 ± 27	.296
Physical function	59 ± 23	64 ± 16	50 ± 30	.141
Role physical	36 ± 28	45 ± 30	21 ± 19	**.007***
Role emotional	72 ± 36	77 ± 31	65 ± 43	.407
Mental health	71 ± 18	77 ± 16	63 ± 20	.056
Bodily pain	30 ± 18	34 ± 17	24 ± 20	.137
Vitality	55 ± 19	55 ± 18	56 ± 22	.927
General health	70 ± 20	73 ± 15	64 ± 26	.274
Social function	62 ± 29	66 ± 27	54 ± 33	.298

BMI, Body Mass Index; *ASA*, American Society of Anesthesiologists class; *VAS*, Visual Analogue Scale; *SST*, Simple Shoulder Test; *SANE*, Single Assessment Numeric Evaluation; *SF-36*, Short Form 36; *MCID*, minimal clinically important difference; *WC*, Workers' Compensation.
P value: 2-sample t test for parametric continuous variables, Chi-squared or Fisher exact test for categorical variables.

* $p < 0.05$
† ASA 1 and 2 compared to ASA 3 and 4 in analysis.
‡ "Capsulorrhaphy arthropathy" and "Other" groups combined in analysis. Values are presented as frequencies (percentages) and means ± standard deviations.

Table 4 – Multivariate analysis to determine independent predictors of improvement greater than the SST MCID in WC patients.

	Odds Ratio (95% CI)	*P* value
Age	1.09 (0.94-1.26)	.23
Male sex	10.13 (0.21-482.76)	.24
Currently working	3.06 (0.25-36.71)	.38
Diagnosis - capsulorrhaphy arthropathy or other	0.33 (0.01-9.18)	.52
Preoperative SST	0.69 (0.39-1.23)	.21
Preop SF-36 role physical	1.19 (0.99-1.43)	.07
Preop SF-36 mental component summary	1.01 (0.95-1.08)	.69
Preop SF-36 physical component summary	1.03 (0.96-1.11)	.43

MCID, minimal clinically important difference; *SST*, Simple Shoulder Test; *SF-36*, Short Form 36; *WC*, Workers' Compensation.
SST-related variables were removed due to collinearity.
Odds ratios are presented with 95% confidence intervals (CI).

Discussion

The treatment of patients with shoulder arthritis covered by WC carries with it some unique challenges. The data from this study support our hypotheses that patient reported outcomes are significantly worse in patients with WC status than those without and that WC patients with physically demanding jobs are unlikely to return to their presurgical occupation. However, our study did not clearly identify psychosocial factors that were associated with a successful outcome.

WC status has previously been reported to negatively affect outcomes after shoulder surgery. Cvetanovich et al found that worker compensation patients experience clinical improvements after shoulder arthroplasty but had inferior ASES and SST scores, higher rate of persistent pain at 2-year follow-up, and less forward elevation when matched with a nonworker's compensation population.[2] The WC patient group also had a higher re-operation rate. Steinhaus et al performed a systematic review and meta-analysis and reported a return to work rate of 63.6% at a mean of 2.3 months postoperatively after shoulder arthroplasty.[7] Heavy-intensity occupations, as defined by the United States Department of Labor, resulted in a significantly lower return to work rate. Jawa et al found that worker's compensation patients receiving an anatomic total shoulder appeared to have worse ASES scores when compared to a non-worker's compensation population.[5] They also reported that less than a third of the patients were able to return to work of any kind, and none were able to return to full duty at their current job. Our results add to this information by defining the characteristics of patients covered by WC in contrast to those covered by other insurance programs, including younger age, a higher percentage of males, a higher percentage of patients who were smoking, had a diagnosis of anxiety, had prior surgery, and had lawyer involvement. In addition, we assessed the factors associated with patients on WC who were able to return to their presurgical occupation after arthroplasty, including a higher levels of presurgical physical activity and a job requiring fewer physical demands.

Psychosocial factors are often considered to have a profound impact on recovery and outcomes after shoulder arthroplasty. A recent systematic review provided evidence that supports the idea that psychosocial factors may play an important role in patient outcomes after shoulder arthroplasty.[9] Chen et al also evaluated three patient-reported outcomes measurement information system (PROMIS) domains, physical function, depression, and pain interference scores, and found that preoperative scores were predictive of postoperative achievement of the MCID within each domain.[1] Our study did find lower preoperative SF-36 scores in many domains (including social function, mental health, role emotional) for our WC patients compared to non-WC patients, demonstrating baseline differences between the 2 cohorts. This may explain why there was a smaller proportion of patients who exceeded the MCID for the SST within the WC cohort compared to non-WC. However, in our univariate analysis within the WC cohort, we did not find psychosocial factors such as depression, anxiety, status other than married, status of currently working, or lack of lawyer involvement to be associated with a successful outcome, although definitive conclusions cannot be made given our limited sample size. We did find, however, that patients' preoperative perceived limitations in routine activities (role physical) was associated with failure of improvement past the MCID.

This study does have limitations. First, we only included those undergoing anatomic shoulder arthroplasty to limit the heterogeneity of the patient population. Therefore, our results may not be generalizable to work-related injuries that involve reverse arthroplasty for cuff-related problems. Second, our sample size may not have been large enough to adequately detect differences in patients with "success" and "failure." A larger sample size potentially could demonstrate a significant correlation of psychosocial factors to a successful outcome. Third, while we were able to document whether patients returned to previous occupation or not, we were not able to determine the degree to which return to previous occupation was driven by the physical limitations of the patient's shoulder, by other patient psychosocial factors, or by limitations set forth by the surgeon. Fourth, our focus was on patient-reported outcomes and revision rates. We did not collect radiographic or range of motion data.

Conclusion

The challenges in treating patients covered by WC are underscored by the high percentage of these patients that did not improve beyond the MCID and the high percentage of patients with physically-demanding jobs that were unable to return to their presurgical occupation. This study helps inform the management of patients with glenohumeral arthritis who are covered by Workmen's Compensation by assessing the factors associated with patients on WC who (1) had improvement greater than the MCID of the SST (older age

and less disability with routine activities), and (2) were able to return to their presurgical occupation after arthroplasty (job requiring fewer physical demands).

Disclaimer

The author, their immediate family, and any research foundation with which they are affiliated have not received any financial payments or other benefits from any commercial entity related to the subject of this article.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1053/j.sart.2020.11.017.

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