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Workers' compensation claims and outcomes after reverse shoulder arthroplasty

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Background: The effect of workers' compensation claims on outcomes after reverse shoulder arthroplasty (RSA) has not been investigated. The purpose of this study was to evaluate outcomes after RSA in patients with a workers' compensation claim and to compare them with a control group without a workers' compensation claim.

Methods: We identified 14 primary RSAs completed in patients with a workers' compensation claim and a minimum of 2 years of follow-up in a prospective shoulder arthroplasty registry. Fourteen patients without a workers' compensation claim served as the age-, gender-, and diagnosis-matched control group. The Constant score, the American Shoulder and Elbow Surgeons score, the Western Ontario Osteoarthritis of the Shoulder Index, the Single Assessment Numeric Evaluation score, mobility, and the patient's satisfaction were assessed for both groups preoperatively and at final follow-up.

Results: There were no differences between the groups regarding patient demographics, duration of follow-up, complications, preoperative shoulder function scores, or preoperative mobility ($P > .05$). Both groups significantly improved on all shoulder function scores and for mobility from preoperative to final follow-up (all $P < .001$); however, the workers' compensation group had significantly worse Constant ($P = .002$), American Shoulder and Elbow Surgeons ($P = .003$), and Western Ontario Osteoarthritis of the Shoulder Index ($P = .001$) scores. Only 57% of the workers' compensation group reported that they were satisfied or very satisfied at final follow-up compared with 93% in the control group. The workers' compensation group had a lower return to work rate (14.2% vs 41.7%), but this did not reach statistical significance ($P = .117$).

Conclusion: Patients with a workers' compensation claim had significant improvements after RSA, but they achieved significantly worse outcomes compared with the control group.

Level of evidence: Level III, Case-Control Design, Treatment Study.

Keywords: Reverse shoulder arthroplasty; Workers' compensation

Workplace injuries are commonplace throughout the world. According to the U.S. Bureau of Labor Statistics, more than 300,000 cases of musculoskeletal injuries in the United States are paid for by workers' compensation insurance,[37] and upper extremity injuries make up the

The Institutional Review Board at the Texas Orthopedic Hospital approved this study: TOH144.

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majority of workers' compensation claims.[37] Furthermore, workers' compensation status has been shown to have a detrimental effect on outcomes after operative treatment, particularly in orthopedic surgery.[16,19]

Promising results have been reported after reverse shoulder arthroplasty (RSA) for various pathologic processes[3,11,15,27,33,41,45]; however, little is known about patient demographic and clinical factors that may adversely affect outcomes. Recent work suggests that younger age,[33] increased body mass index,[18] and failed prior arthroplasty may adversely affect outcomes after RSA.[4] However, there have been no studies investigating outcomes for RSA in patients with a workers' compensation claim.

The purpose of this study was to evaluate preoperative and final follow-up shoulder function scores, mobility, satisfaction, and return to work in patients after RSA with a workers' compensation claim and to compare them with an age-, gender-, and diagnosis-matched control group without a workers' compensation claim. We hypothesized that the patients with a workers' compensation claim would improve clinically after surgery but would not do as well as the control group. We also hypothesized that the patients with a workers' compensation claim would be less likely to return to work or to be satisfied after surgery despite improvements in clinical parameters.

Materials and methods

Patient inclusion criteria and demographics

We identified 14 primary RSAs completed in patients with a workers' compensation claim with a minimum of 2 years of follow-up in a prospective shoulder arthroplasty registry from 2004 to 2011. Fourteen patients without a history of a workers' compensation claim served as an age-, gender-, and diagnosis-matched control group. All cases were performed at a single, high-volume shoulder arthroplasty center by a single surgeon (T.B.E.).

Specific patient demographic and clinical characteristics reviewed included age, gender, duration of follow-up, hand dominance, smoking status, body mass index, history of depression, history of diabetes, and work status. Work status was separated into employed, unemployed, disabled, and retired. Work demands were separated into sedentary/light demands and heavy/strenuous labor. Shoulder function scores evaluated preoperatively and at final follow-up included the Constant score,[8] the age- and gender-adjusted Constant score,[7] the American Shoulder and Elbow Surgeons (ASES) score,[31] the Western Ontario Osteoarthritis of the Shoulder (WOOS) Index,[29] the Single Assessment Numeric Evaluation,[44] and mobility. Satisfaction was assessed by having the patients describe themselves as very dissatisfied, dissatisfied, satisfied, or very satisfied.

The determination of a workers' compensation claim was decided by certified workers' compensation physicians in our state before the patient's seeking consultation with the treating surgeon. The workers' compensation status was not determined by the treating surgeon. The diagnoses requiring RSA in the workers' compensation group included rotator cuff tear arthropathy (7 patients), massive rotator cuff tear with no osteoarthritis (4 patients), post-traumatic malunion (2 patients), and failed prior arthroplasty (1 patient). The diagnoses requiring RSA in the control group (non–workers' compensation) were the same as the workers' compensation group and included rotator cuff tear arthropathy (7 patients), massive rotator cuff tear with no osteoarthritis (4 patients), post-traumatic malunion (2 patients), and failed prior arthroplasty (1 patient).

Twelve of the 14 patients in the workers' compensation group had prior operations at outside hospitals before presenting to our institution for RSA, including 10 patients with multiple prior failed rotator cuff repair surgeries, 1 patient with a prior failed total shoulder arthroplasty, and 1 patient with a prior failed open reduction and internal fixation for a proximal humerus fracture. Ten of the 14 patients in the control group had prior operations at outside hospitals before presenting to our institution for RSA, including 8 patients with multiple prior failed rotator cuff repair surgeries, 1 patient with a prior failed total shoulder arthroplasty, and 1 patient with a prior failed open reduction and internal fixation for a proximal humerus fracture.

Four complications were noted in the workers' compensation group: intraoperative humeral shaft fracture treated with cerclage wires (1 patient), postoperative anterior dislocation treated with closed reduction (2 patients), and 1 postoperative periprosthetic infection requiring irrigation and débridement with retention of the components. The patient who developed an infection had a history of multiple failed rotator cuff repair surgeries. The control group had 2 complications: postoperative anterior dislocation treated with closed reduction (2 patients).

Surgical technique and postoperative rehabilitation

The Aequalis (Tornier, Edina, MN, USA) RSA system was used for all patients during the study period. The RSA technique used during the study period is well described,[14,38] and a standardized postoperative rehabilitation protocol was followed.[28,38] There were no differences in postoperative management between patients in the workers' compensation group and patients in the non–workers' compensation group.

Clinical assessment

Patients were prospectively enrolled in a shoulder arthroplasty outcomes registry and observed clinically. Patients were examined preoperatively by the senior surgeon (T.B.E.) with subsequent examinations postoperatively at 1 week, 6 weeks, 3 months, 6 months, 12 months, and then annually after that. Mobility was determined by a hand-held goniometer to assess active range of motion measurements. Strength of abduction was measured with a hand-held digital dynamometer (Chatillon Digital Force Gauge 200 lbf; AMETEK, Inc, Largo, FL, USA). Radiographs were obtained at each clinic appointment and included anteroposterior in the plane of the scapula, scapular Y, and axillary views. All intraoperative and postoperative complications were recorded.

Statistical analysis

Independent sample t tests assuming unequal variances were used to compare age, duration of follow-up, body mass index,

Table I Patient demographics

	Workers' compensation	Control group (non–workers' compensation)	*P*
Number	14 (10 M/4F)	14 (10 M/4F)	
Age at surgery (yr), mean ± standard deviation [range]	58.8 ± 5.7 [49-69]	63.4 ± 6.5 [50-72]	.054
Follow-up (yr), mean ± standard deviation [range]	3.4 ± 1.7 [2.0-7.7]	3.6 ± 1.8 [2.0-8.0]	.697
Complications	4 (28.6%)	2 (14.3%)	.357
Dominant arm	10 (71.4%)	9 (64.3%)	.686
Smoker	2 (14.3%)	0 (0%)	.142
Depression	2 (14.3%)	4 (28.6%)	.357
Diabetes	2 (14.3%)	4 (28.6%)	.357
Body mass index (kg/m^2)	32.0 ± 8.4	27.1 ± 5.3	.077

Table II Shoulder function scores and mobility (mean ± standard deviation)

	Workers' compensation group		Control group (non–workers' compensation)	
	Preoperative	Final follow-up	Preoperative	Final follow-up
Constant, pain	2.4 ± 2.7	6.6 ± 4.6	3.9 ± 2.8	11.6 ± 4.9
Constant, activity	3.5 ± 2.5	8.1 ± 4.4	4.7 ± 2.2	14.1 ± 5.3
Constant, mobility	7.0 ± 10.9	20.3 ± 11.4	10.4 ± 12.6	29.4 ± 10.6
Constant, strength	0.4 ± 1.3	8.6 ± 8.2	1.8 ± 4.1	10.5 ± 6.2
Constant, total	13.3 ± 12.9	43.5 ± 24.0	20.8 ± 16.7	65.6 ± 24.2
Constant, adjusted	15.7 ± 14.8	53.8 ± 29.0	25.7 ± 19.9	85.0 ± 30.8
ASES	24.6 ± 20.9	48.0 ± 25.4	33.4 ± 19.2	70.7 ± 23.0
ASES, pain	6.9 ± 3.2	3.7 ± 3.6	5.9 ± 3.1	1.7 ± 2.3
WOOS	80.6 ± 14.4	56.4 ± 27.4	71.4 ± 17.7	28.4 ± 25.9
SANE	20.9 ± 27.6	51.0 ± 30.8	19.2 ± 17.4	56.9 ± 28.7
Flexion	29 ± 49	124 ± 44	45 ± 65	145 ± 48
Abduction	29 ± 49	122 ± 44	44. ± 64	145 ± 48
External rotation	6 ± 13	15 ± 13	11 ± 12	36 ± 15

ASES, American Shoulder and Elbow Surgeons score; *WOOS*, Western Ontario Osteoarthritis of the Shoulder Index; *SANE*, Single Assessment Numeric Evaluation.
No group differences existed preoperatively (all $P > .05$).

Table III *P* values for select comparisons

	Preoperative vs final follow-up	Workers' compensation group vs control group	Group changes from preoperative to final follow-up
Constant, pain	<.001	.002	.078
Constant, activity	<.001	.001	.021
Constant, mobility	<.001	.021	.282
Constant, strength	<.001	.258	.865
Constant, total	<.001	.004	.140
Constant, adjusted	<.001	.001	.083
ASES	<.001	.002	.148
ASES, pain	<.001	.035	.513
WOOS	<.001	.001	.069
SANE	<.001	.768	.600
Flexion	<.001	.144	.820
Abduction	<.001	.128	.740
External rotation	<.001	<.001	.012

ASES, American Shoulder and Elbow Surgeons score; *WOOS*, Western Ontario Osteoarthritis of the Shoulder Index; *SANE*, Single Assessment Numeric Evaluation.

preoperative shoulder function scores, and mobility between the 2 groups. The χ^2 tests were performed to determine if significant differences existed between the groups for comorbidities including complications, arm dominance, smoking status, history of depression, and history of diabetes. A mixed linear model was used to test for differences in preoperative, final follow-up, and preoperative to final follow-up change (i.e., improvement) in the shoulder function scores and mobility between workers' compensation and control groups. The analysis accounted for the matching of workers' compensation and control cases and allowed for heterogeneity of variances in the measurements at each time point.

Institutional Review Board approval was obtained (TOH144).

Results

There were no statistical differences between the workers' compensation group and the control group regarding age, gender, duration of follow-up, complications, arm dominance, smoking status, history of depression, history of diabetes, or body mass index (Table I). The average clinical follow-up for the entire cohort was 3.5 years (standard deviation, 1.7 years; range, 2-8 years). No group differences were noted for preoperative outcome scores or preoperative mobility (Table II).

Both groups significantly improved on all shoulder function scores and for mobility from preoperative to final follow-up (all $P < .001$); however, the workers' compensation group had significantly worse adjusted Constant ($P = .001$), ASES ($P = .002$), and WOOS ($P = .001$) scores and less external rotation ($P < .001$) compared with the control group (Table III). The workers' compensation group performed worse on nearly all outcome scores at final follow-up compared with the control group, but the workers' compensation group did have significant improvement from preoperative to final follow-up on most outcome measures. The absolute improvement from preoperative to final follow-up was nearly identical in the 2 groups. No significant differences were detected for shoulder function scores and mobility by preoperative to final follow-up group changes with the exception of Constant activity and external rotation (Table III).

Figure 1 shows that both groups improved significantly for the adjusted Constant score, from preoperative assessment to final follow-up ($P < .001$), but patients in the control group scored significantly better than patients in the workers' compensation group at final follow-up ($P = .001$). The absolute improvement from preoperative to final follow-up between the groups was almost identical for the adjusted Constant score as demonstrated by the similar slope of the lines and the nonsignificant interaction ($P = .083$). Similar findings were noted for ASES scores (Fig. 2) and WOOS Index (Fig. 3).

All patients thought that they were either dissatisfied or very dissatisfied with their shoulder preoperatively (Table IV). Satisfaction ratings improved postoperatively,

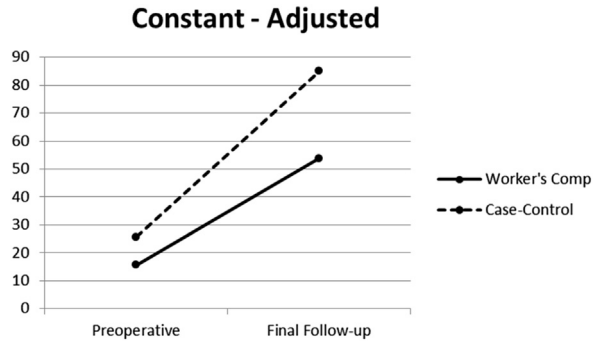

Figure 1 The adjusted Constant score changes from preoperative assessment to final follow-up.

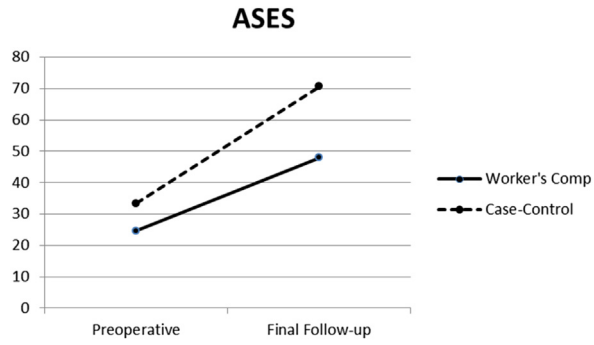

Figure 2 American Shoulder and Elbow Surgeons (ASES) score changes from preoperative assessment to final follow-up.

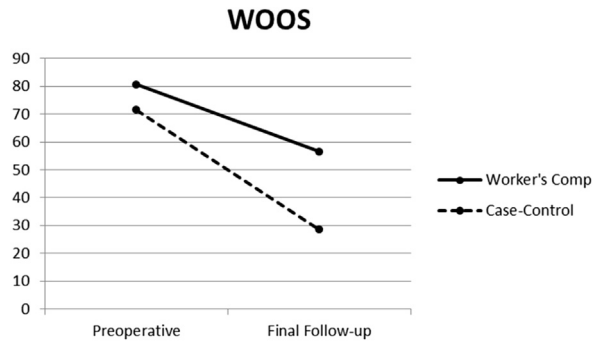

Figure 3 Western Ontario Osteoarthritis of the Shoulder (WOOS) Index changes from preoperative assessment to final follow-up.

but only 57% of the workers' compensation group reported that they were satisfied or very satisfied with their shoulder compared with 93% of the control group ($P = .029$).

Work demands before surgery

Preoperatively in the workers' compensation group, there were 8 patients with sedentary/light work demands and 6 patients with heavy/strenuous work demands. Comparatively, in the control group, preoperatively 3 patients were

Table IV Patient satisfaction data

	Workers' compensation group		Control group (non–workers' compensation)	
	Preoperative	Final follow-up	Preoperative	Final follow-up
Very dissatisfied	12 (86%)	2 (14%)	11 (79%)	1 (7%)
Dissatisfied	2 (14%)	4 (29%)	3 (21%)	0 (0%)
Satisfied	0 (0%)	5 (36%)	0 (0%)	6 (43%)
Very satisfied	0 (0%)	3 (21%)	0 (0%)	7 (50%)

retired, 7 patients had sedentary/light work demands, and 4 patients had heavy/strenuous work demands. The workers' compensation group had a higher employment rate and slightly more strenuous work before surgery, but these differences were nonsignificant ($P = .176$).

Work status and return to work after surgery

All of the patients in the workers' compensation group were employed before surgery, and 11 of the 14 patients in the control group were employed before surgery (3 were already retired). After surgery, only 2 patients (14.2%) in the workers' compensation group returned to work (sedentary/light work), and 1 patient is currently seeking employment but was unemployed at final follow-up. Five patients in the workers' compensation group are disabled and 6 have retired since surgery. Of the 11 patients in the control group who were working before surgery, 5 (45.5%) were employed at final follow-up (sedentary/light work), 1 was disabled, and 5 retired after surgery. No patients in either group returned to heavy/strenuous work demands after surgery. The ability to return to heavy/strenuous labor after RSA depends on the specific demands of the job and is considered on a case-by-case basis. The control group had a higher return to work rate than the workers' compensation group (45.5% vs 14.2%), but this did not reach statistical significance ($P = .099$).

Discussion

Patients who undergo RSA with a workers' compensation claim make significant improvements compared with their preoperative condition. However, they do not do as well as patients without a workers' compensation claim in a case-controlled fashion. Despite significant improvements in clinical parameters, there is a trend toward these patients being less likely to return to work, and they are less likely to be satisfied with their results in the workers' compensation group. To our knowledge, this is the first study to examine this relationship after RSA.

Particular attention in the literature has been paid to patients with work-related injuries to the spine and upper extremity, with worse outcomes noted for treatments of rotator cuff tears, superior labrum anterior-posterior tears, ulnar impaction syndrome, carpal tunnel syndrome, flexor tendon injuries, autologous chondrocyte implantation, and hip labral tears, as well as to procedures such as total knee arthroplasty and spinal fusion.[1,10,12,13,17,20,21,23-26,30,32,35,36,39,42,43] Patients may show improvement from preoperative or injury state but tend not to do as well as non–workers' compensation patients.

Results from this study mirror those of prior studies in regard to outcomes specifically for shoulder surgery. Cuff and Pupello noted an increased rate of noncompliance and worse outcomes in patients after rotator cuff repair in a prospective cohort study.[9] Holtby and Razmjou also found similar results after rotator cuff repair in a case-control study.[22] In addition, Nicholson found an increased mean time to return to full duty work for patients with a workers' compensation claim after arthroscopic acromioplasty in a prospective case-control study.[34]

There is a paucity of evidence examining outcomes in patients with workers' compensation claims undergoing arthroplasty procedures. There is only one other study of which we are aware that addresses the influence of workers' compensation claims on outcomes after shoulder arthroplasty. Chen et al noted a significant correlation between decreased satisfaction and workers' compensation status in patients undergoing hemiarthroplasty or total shoulder arthroplasty, but only 5 of the 70 patients in the study had a workers' compensation claim.[6] In addition, nonprosthetic treatment of grade IV osteochondral lesions of the glenohumeral joint with débridement has shown similar results.[5] The patients generally improved after surgery, but workers' compensation patients showed less improvement compared with non–workers' compensation patients.

The specific reason that workers' compensation status is associated with worse postoperative outcomes is not clear, although studies have speculated that workers' compensation patients tend to be less educated, to work in more strenuous environments, and to have less social support.[2,21] In addition, patients with workers' compensation claims have been shown to express lower self-rated function and health status compared with non–workers' compensation patients.[40] Balyk et al[2] performed a prospective study in which preoperative characteristics of workers' compensation and non–workers' compensation patients were well defined; they found significant differences in type of injury, age, biceps disorders, preoperative clinical scores, and a trend toward decreased range of motion between the two groups. Our investigation controlled for these preoperative

variables, allowing us to isolate the effects of workers' compensation status on patient outcomes.

There were several limitations noted in this investigation. Although this is the largest series of patients with RSA in the setting of a workers' compensation claim, it is still a small number of patients and a heterogeneous population. Injuries requiring treatment were from various diagnoses. Although case-control patients were matched for diagnosis, we cannot draw conclusions for any specific diagnosis. Also, these patients were treated under workers' compensation claims based on the determination of certified workers' compensation physicians in our state before the patient's seeking consultation with the treating surgeon. The treating surgeon did not determine the workers' compensation status. The determination of a workers' compensation claim was specific to rules and regulations in our state, and these criteria may not apply to other states or other countries. Furthermore, although a minimum of 2-year follow-up was required, this is still relatively short-term follow-up for the longevity of the reverse shoulder prosthesis.

Conclusions

Significant improvements can be expected after RSA in patients with a workers' compensation claim. However, patients with a workers' compensation claim do not reach the same peak outcome scores after RSA as patients without a history of a workers' compensation claim do.

Disclaimer

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