JSES Reviews, Reports, and Techniques 1 (2021) 357–360

Contents lists available at ScienceDirect

JSES Reviews, Reports, and Techniques

journal homepage: www.jsesreviewsreportstech.org

Psychological disorders confer poor functional outcomes after reverse total shoulder arthroplasty

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ARTICLE INFO

Keywords:
Reverse total shoulder arthroplasty
Outcomes
Psychological disorders
Surgery
Revision

Level of evidence: Level IV; Retrospective Review

Background: Reverse total shoulder arthroplasty (RTSA) is being used to treat a number of shoulder disorders. The purpose of the present study was to investigate the correlation between psychological disorders, drug and alcohol abuse, and postoperative complications and outcomes after RTSA.
Methods: A total of 128 patients who underwent an RTSA between January 2010 and February 2017 were identified. American Shoulder and Elbow Surgeons, SST, ROM, complications, radiographic outcomes and patient satisfaction were collected. Follow-up occurred at a minimum of 2 years postoperatively (average of 3.68 years). Statistical analysis evaluated the effects of multiple risk factors: psychological disorders, substance abuse, and preoperative diagnoses.
Results: Psychological disorder diagnosis correlated with statistically significant lower American Shoulder and Elbow Surgeons function ($P = .027$) and Simple Shoulder Test ($P = .029$) scores compared with those without a psychological disorder. It also conferred poor functional outcomes based on external rotation ($P = .012$). Complications, especially major complications, were more prevalent in patients with psychological diagnoses than without. A history of substance abuse correlated with a lower external rotation ($P = .025$).
Conclusion: Both a preoperative psychological diagnosis and a history of substance abuse conferred worse objective and functional outcomes scores after RTSA.

Reverse total shoulder arthroplasty (RTSA) is being used with more frequency each year, nationally representing one-third of arthroplasty cases.[10] Expanding indications has resulted in the procedure being used to treat severe osteoarthritis, massive rotator cuff tears, failed shoulder arthroplasty, and fracture sequelae.[1] RTSA has been shown to provide significant pain relief and clinical outcomes in patients with such maladies.[4]

Psychological disorders such as anxiety, depression, schizophrenia, bipolar disorder, and obsessive compulsive disorder (OCD) have been linked to poor outcomes and higher complications after orthopedic surgery.[9,11] Similar to other psychological disorders, reports of substance abuse coupled with other health risks have been shown to lead to complications and poorer outcomes.[5] Thorpe et al[9] reported that patients who scored poorly on a range of psychological measures before shoulder surgery displayed worse American Shoulder and Elbow Surgeons (ASES) scores at 3 and 12 months after surgery.

Psychosocial factors contributing to patient-reported outcomes after orthopedic surgeries are neither well understood nor widely available in the literature. The purpose of this study is to identify potential risk factors contributing to poorer outcomes and complications and analyze the role that psychological disorders play in the postoperative outcomes of patients after RTSA.

Materials and methods

Study design

Patients older than 18 years of age who underwent RTSA by a single surgeon (RMG) between 2010 and 2017 were included. Institutional review board approval was obtained for a retrospective chart analysis from the local institutional review board. Patients in the psychological disorder category presented with one of the following in their medical history: anxiety, depression, OCD,

St. Elizabeth Healthcare Institutional Review Board approved this study (study no. 11/2017-032).

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https://doi.org/10.1016/j.xrrt.2021.06.008

bipolar disorder, and schizophrenia. Substance abuse, also considered a psychological disorder, was separated out of this list to be evaluated independently.[2] Major complications included scapular spine fracture, periprosthetic fracture, infection, and dislocation; patients with any major complications were categorized as major despite any minor complications also being present. Minor complications included patients with one or more than one of the following: acromial stress fracture, scapular notching, and coracoid impingement. Study procedures were carried out in accordance with ethical standards of the responsible committee on human experimentation. This study is a single-center, multilocation data analysis study.

Data sources/measurements

Recorded outcomes included range of motion, ASES scores, Simple Shoulder Test (SST) scores, patient satisfaction, and complications.

Patient follow-up occurred at a minimum of 2 years. Radiographs, complications, and range of motion were evaluated by the *(treating)* surgeon (RMG) at their most recent clinic visit. SST and ASES scores were collected through a retrospective chart review. Patients who did not have in-clinic follow-up at 2 years were contacted via a telephone for collection of patient reported outcomes such as the ASES, SST, and patient satisfaction.

Statistical analyses

A statistical analysis of the data was conducted using an independent samples t-test, one-way analysis of variance, multiple comparison procedures, and polynomial contrasts using Statistical Package for Social Sciences (SPSS; IBM, Armonk, NY, USA) through Northern Kentucky University.

Results

Participants

A total of 154 patients, older than 18 years of age who received RTSA for treatment of rotator cuff arthropathy, osteoarthritis, fracture, chronic dislocations, or instability, were retrospectively identified.

During the course of the study, 26 patients were excluded owing to death and were therefore not able to be contacted for midterm follow-up; of the remaining 128 patients, 98 (76%) were contacted and surveyed at an average of 3.68 years (44.20 months; range 2-8). However, all 154 patients were included in the calculations for complications (Table I).

Clinical outcomes

An independent samples t-test found that patients with a diagnosis of a psychological disorder resulted in statistically significant lower postoperative ASES function (ASESf) ($P = .027$) and postoperative SST ($P = .029$) scores than those without a psychological disorder (Table II).

ASES pain score improved from a preoperative average of 15.83 (standard deviation [SD] ± 13.08) to a postoperative average of 41.45 (SD ±12.38) with an increase of 25.62 (range: 0-50). Patients with a psychological disorder illustrated a lower preoperative ASES pain score of 15.41 than the cohort without a psychological disorder who exhibited an average score of 16.23. The psychological disorder cohort also illustrated a lower average improvement from preoperative to postoperative time points than their counterpart, 23.98 and 27.08, respectively.

The average ASESf score improved from 13.97 (SD ± 11.55) to 37.36 (SD ± 11.19) with an increase of 23.39 (range: 0-50). Patients with a psychological disorder exhibited a higher ASESf than patients without a psychological disorder with preoperative averages of 14.89 and 13.00, respectively; however, patients without a disorder improved more from preoperative to postoperative time points with an average of 26.76 compared with those with a psychological disorder who improved an average of 19.85.

The overall preoperative average ASES score was 22.97 (SD ± 19.64) and postoperative average ASES score was 60.02 (SD ±38.4; range 0-100). This illustrates a net score improvement of 37.05 on average; patients without a psychological disorder improved more with an average of 42.15 compared with those with a disorder who improved an average of 31.62. The preoperative baseline of patients with a psychological disorder was higher in patients with a psychological disorder than those without, averages of 23.95 and 22.05, respectively.

The SST score improved from preoperative average of 1.71(SD ± 2.17) to a postoperative average of 8.2 (SD ± 2.71) with an increase of 6.49 (range: 0-12). Patients with a psychological disorder exhibited a lower average preoperative score of 1.59 compared with their counterpart without a psychological disorder with an average preoperative score of 1.83. The average improvement from preoperative to postoperative time points was higher in patients without a psychological disorder with an improvement of 6.93 points. Patients with a psychological disorder improved an average of 5.96 points.

A paired *t*-test illustrated a significant difference between all the preoperative to postoperative scores for both cohorts regardless of psychological diagnosis. The only aspect that did not illustrate this same trend was the internal rotation which was not significantly different between preoperative and postoperative time points ($P = .229$).

Range of motion

Postoperatively, patients demonstrated overall improvement of extension, flexion, and total arc of motion. Forward flexion increased by an average of 62 degrees (95% confidence interval: 52.01-72.36; range: 0-160). External rotation (ER) improved by an average of 45 degrees (95% confidence interval: 37.17-52.83). Patients with a psychological disorder exhibited a significantly lower ER ($P = .012$) and those in the subcategory of substance abuse also correlated with a lower ER ($P = .025$).

Table I
Population demographics.

RTSA (N = 128)	
Age*	71.59 ± 8.63
Gender	
Male	31 (24.22%)
Female	97 (75.78%)
Psychological disorder	62 (48.44%)
Men	14 (22.58%)
Women	48 (77.42%)
Substance abuse	10 (7.81%)
Men	3 (30%)
Women	7 (70%)
Alcohol abuse	7 (5.47%)
Men	3 (42.86%)
Women	4 (57.14%)

RTSA, reverse total shoulder arthroplasty.
Population demographics excluding deceased: list of clinical characteristics with number of patients (percentage proportion of total n) or mean ± standard deviation.
*Data presents as mean and standard deviation.

Table II
Clinical characteristics and postoperative data results.

	Psychological disorders			Substance abuse		
	Yes	No	*P* value	Yes	No	*P* value
ASESp	39.39 ± 12.74	43.31 ± 11.73	.122	39.29 ± 9.79	41.62 ± 12.54	.635
ASESf	34.75 ± 11.57	39.76 ± 10.26	.027*	39.07 ± 8.49	37.23 ± 11.36	.678
ASES	55.57 ± 37.15	64.20 ± 39.08	.207	78.36 ± 17.49	78.39 ± 22.35	.997
SST	7.56 ± 2.77	8.76 ± 2.53	.029*	7.86 ± 1.96	8.22 ± 2.76	.733
ER	43.53 ± 20.55	53.55 ± 22.20	.012*	31.88 ± 18.86	49.91 ± 21.71	.025*
IR	6.77 ± 4.27	7.78 ± 3.48	.162	7.78 ± 4.16	7.26 ± 3.88	.707
FF	139.91 ± 26.89	146.75 ± 26.41	.165	138.89 ± 27.16	143.84 ± 26.80	.598

ASES, American Shoulder and Elbow Surgeons score (combined function + pain); *ASESf*, American Shoulder and Elbow Surgeons score (function portion); *ASESp*, American Shoulder and Elbow Surgeons score (pain portion); *ER*, external rotation; *FF*, forward flexion; *IR*, internal rotation; *SST*, Simple Shoulder Test.
Postoperative data and their statistical significance following an independent sample t-test (ie, psychological disorders and substance abuse).
The data include mean ± standard deviation for each category or grouping factor.
*Represents a significant difference.

Satisfaction

Patients' satisfaction was assessed by telephone interviews in which they were asked to affirm or deny the following statement: "I am satisfied with the outcome of my surgery". Of 92 patients, 86 (93.48%) reported that they were satisfied with the outcome of the surgery.

Complications

A total of thirteen patients (8.4% of total patients) experienced a complication after their procedure. Two patients experienced more than one postoperative complication. Six of those thirteen patients (46.2%) had comorbid psychological diagnoses. Of those patients who experienced a complication, 9 (69.2%) had minor complications (acromial stress fracture, scapular notching, and coracoid impingement) and 4 (30.8%) had major complications (scapular spine fracture, periprosthetic fracture, infection, and dislocation). Three of 4 of the major complications occurred in patients with a psychological diagnosis. There was no difference in overall complications between the two groups ($P = .8096$). None of the patients with complications presented with a comorbid substance or alcohol abuse history (Tables III and IV)

Table III
Complications.

Total	13
Minor	9 (69.23%)
Major	4 (30.77%
Psychological disorder	6 (46.15%)
Minor	3
Major	3
No psychological disorder	7 (53.85%)
Minor	6
Major	1

Complications both major and minor categorized by comorbidities with deceased patients included. Percentages are listed as prevalence per row.

Table IV
Caption: List of complications and their prevalence.

Complications documented in postoperative patients	Number of occurrences*
Stress fracture	7
Infection	3
Malunion	1
Coracoid impingement	1
Scapular notching	1
Periprosthetic fracture	1
Spine fracture	1
Dislocation	1

*Some patients had multiple complications.

Discussion

A medical history of a psychological diagnosis has shown to be an influential variable associated with negative outcomes after surgery.[2,9,11] In our study, patients with a psychological diagnosis of anxiety, depression, OCD, bipolar disorder, and schizophrenia reported worse functional scores than those without a psychological diagnosis. There was a significant difference between cohorts of patients with and without a psychological diagnosis for both ASESf ($P = .027$) and SST ($P = .029$) scores. ASESf scores differed by an average of 5.73 points in favor of those without a diagnosis; similarly, SST scores differed by an average of 1.33 points, and ER differed by an average of 9.57 degrees. This result is in conjunction with Wu et al[11] supporting the link between psychological disorders and poor postoperative outcomes.

Explanations for this result may stem from psychological symptoms commonly associated with depression, such as fatigue and decreased concentration, which interfere with the rehabilitation process after a major procedure, such as RTSA, where the recovery is longer.[11] Further supporting articles such as Thorpe et al reported that poor psychological function (eg, anxiety and depression) correlated to worse ASES scores 3 and 12 months postoperatively.[9] Psychiatric diagnoses such as OCD, bipolar disorder, and schizophrenia are linked to comorbid anxiety, depression, and subsequent substance abuse disorders.[2]

Psychological disorders, particularly mood and anxiety disorders, are frequently comorbid with substance abuse.[8] The influential factors that lead to the development of a psychological disorder can also lead to substance abuse behaviors. In a research report series, the prevalence of drug abuse roughly doubled in patients who suffered from a mood or anxiety disorder when compared to respondents without a mood or anxiety disorder.[8] In addition, substance abuse amplifies the symptoms of psychological disorders due to the pharmacological effects of the substance (ie, drug).[8] These results are in conjunction with what is known of psychological disorders and their comorbidity to substance abuse. In our study, there was a correlation between substance abuse and psychological disorders ($P = .025$) and the patients with a history of substance abuse reported a poorer outcome of lower ER scores with an average difference of 17.81 degrees between patient groups.

This study indicated a significant difference in functional outcomes and risk of complication based on psychological diagnosis and history of substance abuse. Pain scores, however, did not differ

between cohorts based on past medical history. Both cohorts, however, saw an improvement from preoperative to postoperative time points; a finding that was also seen in Frankle et al.[3] The finding of decreased postoperative functionality is supported by Lai et al[6] after hallux valgus surgery and no difference in pain scores.

Furthermore, the importance of mental health and its preoperative assessment as a risk factor is considered vital based on these results and the results of similar studies like that of the randomized control trial from Nilsson et al.[7] This study reveals a strong and serious need for the attempt to be made by nurses, surgeons, and anesthetists to especially consider postoperative recovery of patients with low preoperative mental health scores (ie, psychological diagnosis). To that fact, a future study that uses a larger sample size would be beneficial to ascertain greater validity in these results. It would also be interesting to separate out the specific psychological diagnoses to establish the risks conferred by each diagnosis separately. Findings from this review could be used to guide treatment options and manage patient postsurgical expectations. However, further research on the topic is needed to verify the correlations found in this study.

Limitations

Some limitations to this retrospective study include the small sample size of specific diagnoses and low percentages of matched preoperative to postoperative data points. This limited the ability to perform a post hoc analysis based on procedural diagnosis. In addition, 75% of the patients in this study were women which may impact the generalizability of the study.

Conclusion

Previous findings established that patients with psychological diagnoses experience poorer outcomes and higher risks of complications. This review found similar associations for postoperative outcomes after RTSA. Patients with a comorbid psychiatric diagnosis of anxiety, depression, OCD, bipolar disorder, and schizophrenia exhibited lower postoperative outcomes (ie, ASESf, SST, and ER).

These findings highlight the need for caution when operating on a patient with a psychological disorder and comorbid history of substance abuse as there is a more limited postoperative functionality indicated by their ASESf, SST, and ER scores. Although, patients with psychological diagnoses do not perform as well, they still exhibit improvement from preoperative to postoperative time points. Based on these findings, surgeons and patients with these comorbidities can be more realistically prepared for postoperative outcomes after RTSA and patients encouraged to follow a stricter adherence to rehabilitation and physical therapy.

Disclaimers

Funding: No funding was disclosed by the author(s).

Conflicts of interest: The authors, their immediate families, and any research foundations 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.

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