JSES Reviews, Reports, and Techniques 4 (2024) 371–378

Contents lists available at ScienceDirect

JSES Reviews, Reports, and Techniques

journal homepage: www.jsesreviewsreportstech.org

The impact of mental health conditions on clinical and functional outcomes after shoulder arthroplasty: a systematic review

Olivia M. Jochl, AB[a], Eddie K. Afetse, BS, BA[a], Sahil Garg, BS[a], Ajay C. Kanakamedala, MD[a,b], Dane R.G. Lind, BA[a], Maximilian Hinz, MD[a,c], Michael Rizzo, MD[a,b], Peter J. Millett, MD, MSc[a,b], Joseph Ruzbarsky, MD[a,b], Matthew T. Provencher, MD, MBA, MC USNR (Ret.)[a,b,*]

[a]*Steadman Philippon Research Institute, Vail, CO, USA*
[b]*The Steadman Clinic, Vail, CO, USA*
[c]*Department of Sports Orthopaedics, Technical University of Munich, Munich, Germany*

ARTICLE INFO

Keywords:
Total shoulder arthroplasty
Reverse total shoulder arthroplasty
Outcomes
Mental health conditions
Anxiety
Depression

Level of evidence: Level IV; Systematic Review

Background: Shoulder arthroplasty (SA) has been shown to improve quality of life, though outcomes may vary between individuals. Multiple factors may affect outcomes, including preoperative mental health conditions (MHCs). The goal of this systematic review was to evaluate the clinical and functional outcomes after SA in patients with MHC compared to patients without MHC.

Methods: This systematic review was performed in adherence to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines outlined by Cochrane Collaboration. A search of PubMed, the Medline Library, and EMBASE was conducted from inception until September 2023 to obtain studies reporting outcomes after total shoulder arthroplasty and reverse total shoulder arthroplasty in patients with and without MHC. Study characteristics and information on clinical and functional outcomes were collected. All included studies were case-control studies. The methodological quality of the included primary studies was appraised using the methodological index for nonrandomized studies scoring.

Results: Eleven articles published between 2016 and 2023 met inclusion criteria. In total, 49,187 patients, 49,289 shoulders, and five different MHC were included. 8134 patients in the cohort had a diagnosed MHC. The mean patient age was 67.8 years (range, 63.5-71.6 years), and 52.6% of the patients were female. The mean follow-up time was 35.5 months (range, 16.2-58.3 months). Reverse total shoulder arthroplasty was the most common type of procedure (25,543 shoulders, 51.8%). Depression and anxiety were the most reported psychiatric diagnoses (7990 patients, 98.2%). Patients with versus without MHC reported mean improvements of 38 and 42 in American Shoulder and Elbow Surgeons shoulder score and mean Visual Analog Scale pain improvements of 4.7 and 4.9, respectively. Mean complication rates of 31.4% and 14.2% were observed in patients with versus without MHC, respectively. The most prevalent surgical complication in patients with MHC was infection (1.8%), followed by prosthetic complication (1.7%), and adhesive capsulitis (1.6%).

Conclusions: Patients with MHC may have lower preoperative range of motion, worse postoperative shoulder function, and higher postoperative pain levels than patients without MHC. Patients with MHC demonstrated improvements in range of motion and functional outcomes after SA but had higher reported complication and revision rates when compared to patients without MHC. Depression and anxiety were the leading conditions correlated with lower outcomes in patients with MHC after SA. Preoperative physical therapy, mental health counseling, and expectation setting may help these patients reach the maximal achievable benefit from SA.

Shoulder arthroplasty (SA) may be utilized for the treatment of various conditions, including glenohumeral osteoarthritis, inflammatory arthritis, avascular necrosis, fractures, and rotator cuff arthropathy.[2,7,21] This procedure can provide patients with

Institutional review board approval was not required for this systematic review.

*Corresponding author: Matthew T. Provencher, MD, MBA, MC, USNR (Ret.), Steadman Philippon Research Institute, The Steadman Clinic, 181 West Meadow Drive, Suite 4000, Vail, CO 81657, USA.

E-mail address: mprovencher@thesteadmanclinic.com (M.T. Provencher).

https://doi.org/10.1016/j.xrrt.2024.04.014

significant improvements in shoulder pain, function, and quality of life.[33] There is a notable subset of patients undergoing SA who are affected by mental health conditions (MHCs), specifically anxiety and depression.[5] Acknowledging the influences of mental health has become an integral aspect of providing holistic patient care and should be considered in the context of orthopedic treatment.[22,30]

MHCs are common in the United States; the National Institutes of Health reported that 22.8% of adults were living with a MHC in 2021, and 5.7% reported suffering a major depressive episode in the last year.[19] Furthermore, MHC have demonstrated significant associations with other factors that influence an individual's quality of life. Depression, specifically, can suppress the immune system and lead to increased rates of postoperative infections and chronic postsurgical pain.[18] Other studies report that preoperative depression and anxiety can contribute to decreased function and higher complication rates following total hip replacement.[30] In the context of operative orthopedic treatment, mental health is a vital consideration, as a patient's ability and willingness to recover from surgery is related to their mental and emotional well-being.[18,25] As mental health proves a key component of patient recovery, a comprehensive understanding of the relationship between preoperative MHC and outcomes following SA is critical.

The goal of this systematic review was to comprehensively assess the existing literature regarding clinical and functional outcomes in patients with MHC undergoing SA. It was hypothesized that, although patients with MHC would benefit from SA, they would have worse functional outcomes and a higher rate of complications when compared to patients without MHC.

Methods

Literature search

This systematic review was performed in adherence to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses 2020, alongside guidelines outlined by the Cochrane Collaboration.[31] The search strategy involved a systematic search of PubMed, Embase, and Medline from inception until September 17, 2023, to identify studies that reported on clinical or functional outcomes following SA in patients with MHC. The search strategy used consisted of the following terms combined with Boolean operators: ("Shoulder arthroplasty" OR "shoulder replacement") AND ("psychosocial" OR "depression" OR "mental health" OR "anxiety" OR "predictors" OR "schizophrenia" OR "bipolar" OR "psychiatric" OR "psychological"). No limitations were placed on the initial search strategy to obtain a comprehensive list of potential articles. Additionally, reference lists of retrieved articles were assessed to identify additional relevant articles.

Study eligibility (inclusion and exclusion criteria)

The studies included were English language primary studies (retrospective cohort studies, cross-sectional, case series, and case-control studies) that investigated the effects of MHC on surgical outcomes and patient-reported outcomes (PROs) following SA. Systematic reviews, conference abstracts, book chapters, case reports, and technical reports were excluded.

Study selection, data extraction, and quality appraisal

Two independent authors (O.M.J., E.K.A.) screened titles and abstracts of identified studies to determine their inclusion. Irrelevant and duplicate studies were excluded. If study eligibility could not be decided based on the title or abstract, the full text was retrieved and assessed. Any disagreements between the two authors regarding study inclusion were resolved by a third author (A.C.K.). Study demographics, range of motion (ROM), PROs, and complication and revision rates were collected. If studies stratified total shoulder arthroplasty (TSA) and reverse total shoulder arthroplasty (rTSA) cohorts separately, the collected patient-specific characteristics were stratified accordingly. However, if studies included both cohorts and did not stratify their findings, this review included their results in the noncomparative section of the results only. All studies included in this review were case-control studies.

The quality of the included primary studies was appraised using the methodological index for nonrandomized studies scoring (MINORS, Supplementary Appendix S1). The authors created a custom data extraction template used to collect pertinent information for each article.

Statistical analysis

Statistical analysis was performed with Microsoft Excel (Version 16.0.1; Microsoft Corp., Redmond, WA, USA). Descriptive statistics were presented as means, percentages, ranges, and standard deviations when appropriate. When available, raw data were extracted and reported as pooled means. Investigations with individual raw patient data without means, range, and standard deviations were manually included in Microsoft Excel for inclusion in the final calculations.

Results

Study characteristics and patient demographics

The initial systematic search yielded 970 records, from which 502 duplicates were removed, leaving 468 records for screening. Four hundred fifty-three records were excluded as irrelevant or lacking necessary outcome measures. Fifteen full-text articles were screened for inclusion. Four articles were excluded due to their study design. Ultimately, 11 articles published from three journals across three countries were included in the final analysis (Fig. 1). This systematic review included 49,187 patients, 49,289 shoulders, and five MHC, including depression, anxiety, mood disorders, bipolar disorder, and schizophrenia. 8134 patients in the cohort had a diagnosed MHC. The mean patient age in reporting studies was 67.8 years (range, 63.5-71.6 years), and 52.6% of the patients were female. The average follow-up time was 35.5 months (range, 16.2-58.3 months).

rTSA was the most common type of procedure (25,543 shoulders, 51.8%). Depression and anxiety were the most reported MHC (7990 patients, 16.2% of study population). The characteristics of the studies included are detailed in Table I. A summary of the reported ROM and PROs is shown in Tables II and III.

Range of motion after shoulder arthroplasty

Eleven studies[8,11,12,23,24,27,29,32,43-45] evaluated outcomes of TSA and rTSA in 49,289 shoulders. Preoperative ROM alone was assessed by two studies[12,45] (367 shoulders). Postoperative ROM alone was assessed by two studies[24,32] (723 shoulders). Both preoperative and postoperative ROM were assessed by two studies[8,29] (693 shoulders). Two studies (693 shoulders) reported preoperative and postoperative forward elevation (FE), with mean increases of 53° and 60° in patients with vs. without MHC, respectively. Two studies[8,45] (859 shoulders) reported preoperative abduction (AB), and two studies[8,24] (1174 shoulders) reported postoperative AB. Preoperative AB for patients with vs. without MHC was found to be 68° and 78°,

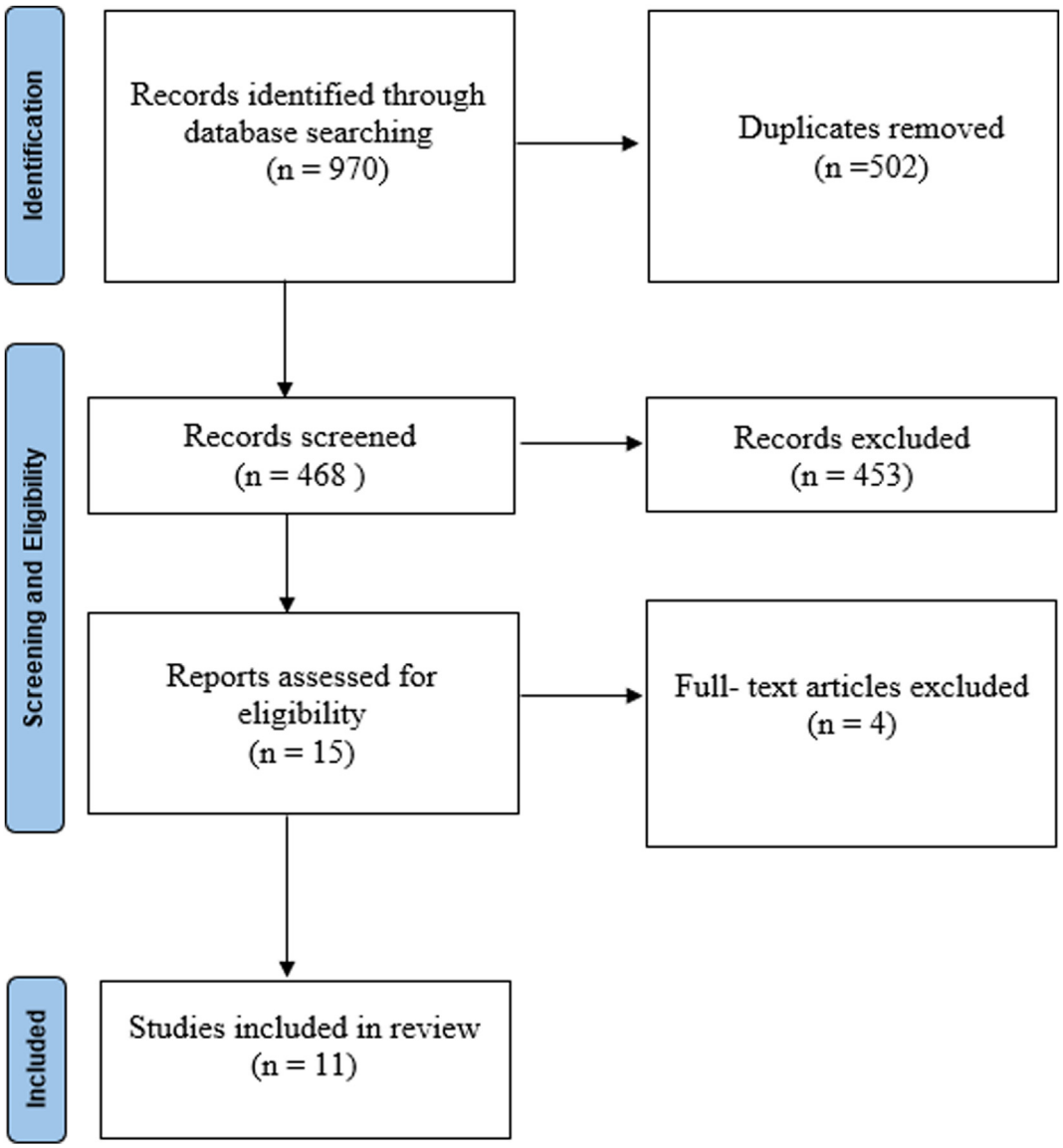

Figure 1 PRISMA flow diagram.

respectively, while postoperative AB was reported to be 100° and 99°.

Two studies (691 shoulders) reported preoperative and postoperative external rotation (ER). Patients with vs. without MHC experienced mean improvements in ER of 19.7° and 20.4°, respectively. Three studies[8,29,45] (859 shoulders) reported preoperative internal rotation (IR) measurements. Due to differences in measurement techniques, pooled means could not be calculated. One study[8] (579 shoulders) reported scored values, defining IR on a scale of 0 to 7 as follows: 0, IR to anterior superior iliac spine; 1, ipsilateral hip; 2, buttocks; 3, sacrum; 4, L5-L4; 5, L3-L1; 6, T12-T8; and 7, T7 or higher. These authors reported scores of 3.06 and 3.10 for patients with vs. without MHC, respectively. One study[29] (114 shoulders) reported degrees of rotation and measured 37.4° for patients with MHC and a range of 47-16° for those without MHC. Finally, one study[45] (280 shoulders) reported IR in terms of position, finding a mean of L4 for those with MHC and L5 for patients without MHC. Three studies[8,29,32] (821 shoulders) reported postoperative IR. Colasanti et al utilized the same scoring system as described above, finding postoperative IR of 3.84 and 4.30 for patients with vs. without MHC, respectively. Porter et at. reported a postoperative IR score of 6.77 for patients with MHC and a score of 7.78 for patients without MHC. Moore et al reported postoperative IR as 50.67° for patients with MHC and 51.52° for patients without MHC.

Range of motion after TSA

Two studies[8,12] reported data on ROM after TSA for 798 shoulders, but only one study reported preoperative and postoperative data. One study[8] (312 shoulders) reported preoperative and postoperative FE. The authors found an improvement of 52° in patients with MHC and an improvement of 56° in patients without MHC. AB was reported by one study[8] (312 shoulders). Patients with vs. without MHC who underwent TSA reported a mean improvement in AB of 21°. One study[8] (312 shoulders) reported preoperative and postoperative ER in patients who underwent TSA, reporting improvements of 34° and 32° for patients with MHC and patients without, respectively. One study[8] (312 shoulders) reported IR for patients undergoing TSA with a preoperative IR score of 3.02 for

Table I
Study characteristics.

Author	Year	LOE	Population	Sample size	Number of cases	Mean age (years)	% female	Mean follow-up	Disorder	Implant type (number)
Werner[43]	2017	3	Patients undergoing SA for OA with preoperative diagnosis of DD	264	264	67.0 (7.4)	64.8	NR	DD	TSA
Diamond[11]	2023	3	Patients undergoing SA for glenohumeral OA with a diagnosis of DD	24,326	24,326	NR	53.6	NR	DD	rTSA
Colasanti[8]	2023	3	Patients undergoing SA with anxiety or DD	487	579	66.9	70.5	58.4 mo	Anxiety, DD	TSA (312), rTSA (267)
Wong[45]	2018	2	Patients undergoing SA with a mental health diagnosis	280	280	66.7	49.2	NR	DD, MD, Anxiety, Schitzophrenia, BPD	TSA (92), rTSA (188)
Eads[12]	2019	3	Patients undergoing SA with a diagnosis of anxiety, DD, or MD	87	87	NR	75.0	36.5 mo	Anxiety, DD, MD	TSA
Moore[29]	2021	3	Patients undergoing SA with anxiety or DD	112	114	69.2	60.5	28.4 mo (24-36 mo)	Anxiety, DD	rTSA
Lunati[27]	2021	3	Patients undergoing SA with preoperative diagnosis of DD	22,623	22,623	NR	50.7	NR	DD	TSA
Kuhlmann[24]	2023	3	Patients undergoing SA with diagnosis of anxiety or DD	595	595	NR	55.6	1.3 y	Anxiety, DD	TSA (225), rTSA (370)
Kohan[23]	2020	3	Patients undergoing SA with diagnosis of anxiety or DD	135	143	64.7 ± 8.7	37.1	20.5 mo (12-39 mo)	Anxiety, DD	TSA
Porter[32]	2021	3	Patients undergoing SA with diagnosis of psychological disorders or substance abuse	128	128	71.59 ± 8.63	75.8	3.68 y	Psychological disorder, substance abuse	rTSA
Werner[44]	2016	4	Patients undergoing SA with risk factors for poor outcomes	150	150	71.6 ± 8.8	68.0	NR	DD	rTSA

LOE, Level of Evidence; *Y*, years; *MO*, months; *SA*, Shoulder Arthroplasty; *TSA*, Total Shoulder Arthroplasty; *rTSA*, Reverse Shoulder Arthroplasty; *DD*, Depressive Disorder; *MD*, Mood Disorder; *BPD*, Bipolar Disorder; *NR*, not reported; *OA*, osteoarthritis.

Table II
Range of motion.

Author	Disorder	Procedure type	Preoperative ROM (MHD)	Postoperative ROM (MHD)	Preoperative ROM (control)	Postoperative ROM (control)
Colasanti[8]	Anxiety, DD	TSA	FE: 95 ± 32, AB: 78 ± 29, ER: 16 ± 17, IR: 3.0 ± 1.5	FE: 147 ± 35, AB: 99 ± 25, ER: 50 ± 19, IR: 4.5 ± 1.5	FE: 93 ± 30, AB: 93 ± 30, ER: 13 ± 14, IR: 3.0 ± 1.4	FE: 149 ± 28, AB: 101 ± 22, ER: 45 ± 17, IR: 4.8 ± 1.2
Colasanti[8]	Anxiety, DD	rTSA	FE: 70 ± 36, AB: 57 ± 31, ER: 16 ± 19, IR: 3.1 ± 1.6	FE: 120 ± 34, AB: 89 ± 21, ER: 29 ± 15, IR: 3.3 ± 1.4	FE: 71 ± 40, AB: 58 ± 33, ER: 17 ± 20, IR: 3.2 ± 1.6	FE: 136 ± 29, AB: 95 ± 18, ER: 32 ± 14, IR: 3.6 ± 1.4
Wong[45]	Anxiety, DD, MD, SPH	TSA, rTSA	FE: 88.0, AB: 71.5, ER: 31.4, IR: L4	NR	FE: 88.5, AB: 77.2, ER: 28.0, IR: L5	NR
Eads[12]	MD	TSA	FE: 94	NR	FE: 112	NR
Moore[29]	Anxiety, DD	rTSA	FE: 66.6 (20 − 170), ER: 35.0,	FE: 135.0 (60 − 180), ER: 35.7, IR: 35.7	FE: 73.1 (0 −180), ER: 33.4	FE: 135.7 (30 − 180), ER: 132.7, IR 52.5
Kuhlmann[24]	Anxiety, DD	TSA, rTSA	NR	AB: 113 ± 33, ER: 33 ± 18, IR: 35 ± 21	NR	NR
Porter[32]	Psychologic disorder	rTSA	NR	ER: 43.5 ± 20.6, IR: 6.8 ± 4.3	NR	ER: 53.6 ± 22.2, IR: 7.8 ± 3.5

MHD, Mental Health Disorder Group; *TSA*, Total Shoulder Arthroplasty; *rTSA*, Reverse Shoulder Arthroplasty; *DD*, Depressive Disorder; *MD*, Mood Disorder; *SPH*, Schizophrenia; *ROM*, Range of Motion; *FE*, Forward Elevation (degrees); *AB*, Abduction (degrees); *ER*, External Rotation (degrees); *IR*, Internal Rotation.

patients with MHC and 3.03 for patients without MHC. Patients with MHC reported a mean postoperative IR of 4.54 and patients without MHC reported a score of 4.8.

Range of motion after rTSA

Three studies[8,29,32] reported outcomes after rTSA for 1215 shoulders. Two studies[8,29] (379 shoulders) reported preoperative and postoperative FE. Patients with vs. without MHC who underwent rTSA reported a mean improvement in FE of 54° and 64°, respectively. AB was reported by one study[8] (267 shoulders). Patients with vs. without MHC who underwent rTSA reported mean improvements in AB of 32° and 37°, respectively. Two studies[8,29] (379 shoulders) reported preoperative ER, finding a mean of 20° in patients with MHC and 23° in patients without MHC. Three studies[8,29,32] (527 shoulders) reported postoperative ER, finding a mean of 34° in patients with MHC and 36° in patients without MHC. Three studies[8,29,32] (517 shoulders) reported preoperative IR. Colasanti et al reported an IR score of 3.09 for patients with MHC and 3.20 for patients without MHC. Porter et al reported an IR score of 1.83 for patients with MHC and 6.77 for patients without MHC. Moore et al reported an IR of 37.42° for patients with

Table III
Clinical outcomes.

Author	Disorder	Implant type	Preoperative scores	ASES (control)	VAS (MHD)	VAS (control)	Postoperative scores	ASES (control)	VAS (MHD)	VAS (control)
			ASES (MHD)				ASES (MHD)			
Werner[43]	DD	TSA	34.4 ± 18.4	31.1 ± 15.0	NR	NR	84.9 ± 17.3	90.8 ± 11.3	NR	NR
Colasanti[8]	Anxiety, DD	TSA	28.0 ± 14.0	34.0 ± 17.0	NR	NR	75.0 ± 27.0	85 ± 18.0	NR	NR
Colasanti[8]	Anxiety, DD	rTSA	29.0 ± 18.0	29.0 ± 17.0	NR	NR	64.0 ± 26.0	78.0 ± 21.0	NR	NR
Wong[45]	Anxiety, DD, MD, SPH	TSA, rTSA	34.8	36.4	5.7	5.6	46.2	42.5	1.7	1.6
Eads[12]	MD	TSA	31.2	43.2	6.8	6.1	70.6	85.9	2.5	0.7
Moore[29]	Anxiety, DD	rTSA	30.7	38.7	6.1	5.28	71.16	73.25	2.29	1.83
Kohan[23]	Mild DD	TSA	32.0 ± 2.5	33.5 ± 1.3	7.6 ± 0.3	7.1 ± 0.2	89.8 ± 2.0	89.7 ± 1.5	0.9 ± 0.3	0.7 ± 0.2
Kohan[23]	Severe DD	TSA	17.0 ± 3.1	33.5 ± 1.3	8.9 ± 0.3	7.1 ± 0.3	77.3 ± 5.5	89.7 ± 1.5	2.3 ± 0.7	0.7 ± 0.3
Kohan[23]	Mild anxiety	TSA	32.2 ± 3	34.2 ± 1.4	7.1 ± 0.4	7.1 ± 0.2	87.4 ± 2.5	89.3 ± 1.9	1.1 ± 0.3	0.8 ± 0.1
Kohan[23]	Severe anxiety	TSA	18.3 ± 3.8	34.2 ± 1.4	8.8 ± 0.3	7.1 ± 0.2	79 ± 56	89.3 ± 1.9	2.1 ± 0.8	0.8 ± 0.2
Porter[32]	Psychological disorder	rTSA	24.0	22.1	NR	NR	55.6 ± 37.2	64.2 ± 39.1	NR	NR

MHD, Mental Health Disorder Group; *TSA*, Total Shoulder Arthroplasty; *rTSA*, Reverse Shoulder Arthroplasty; *DD*, Depressive Disorder; *MD*, Mood Disorder; *SPH*, Schizophrenia; *ASES*, American Shoulder and Elbow Surgeons; *VAS*, Visual Analog Scale; *NR*, not reported.

MHC and a range of 16-47° for patients without MHC. The same studies reported postoperative IR. Colasanti et al reported a score of 3.26 for patients with MHC and 3.59 for patients without MHC. Porter et al reported a score of 7.78 for patients with MHC and 7.26 for patients without MHC. Moore et al reported IR of 50.67° for patients with MHC and 51.52° for patients without MHC.

Patient-reported outcomes after shoulder arthroplasty

The American Shoulder and Elbow Surgeons shoulder (ASES) score and the Visual Analog Scale (VAS) for pain were the most common PROs in the studies included in this review. Seven studies[8,12,23,29,32,43,45] (1871 shoulders) reported preoperative and postoperative ASES score. Patients with vs. without MHC reported mean improvements of 38 and 42 in ASES score, respectively. Four studies[12,23,29,45] (610 shoulders) reported preoperative and postoperative VAS for pain. Patients with vs. without MHC reported mean pain improvements of 4.7 and 4.9 via VAS, respectively.

Patient reported outcomes after TSA

Four studies[8,12,23,43] (917 shoulders) reported preoperative and postoperative ASES score for patients undergoing TSA. Patients with vs. without MHC who underwent TSA reported mean improvements of 50 and 54 in ASES scores. Postoperatively, patients with MHC reported a mean ASES score of 80 points, and patients without MHC reported a mean ASES Score of 88 points. Two studies[12,24] (341 shoulders) reported mean VAS improvements of 5.8 and 6.1 in patients with vs. without MHC, respectively.

Patient reported outcomes after rTSA

Three studies[8,29,32] (516 shoulders) reported preoperative and postoperative ASES score for patients undergoing rTSA. Patients with vs. without MHC who underwent rTSA reported mean improvements of 35 and 44 in ASES score, respectively. One study (112 shoulders) found mean VAS for pain improvements of 3.8 and 3.5 for patients with vs. without MHC, respectively. However, patients without MHC achieved a lower overall pain score (1.8 versus 2.3).

Complications and reoperations after shoulder arthroplasty

Eight studies[8,11,12,24,27,29,32,43,44] (48,745 shoulders) reported complication rates for patients with vs. without MHC undergoing SA. In patients with vs. without MHC who underwent SA, mean complication rates of 31.4% (2473/7871) and 14.2% (5786/40,778), respectively, were observed. The most prevalent surgical complication in patients with MHC was infection (n = 146, 1.8%), followed by prosthetic complication (n = 138, 1.7%), and adhesive capsulitis (n = 130, 1.6%). In patients without MHC, the most prevalent complication was prosthetic complication, which was not further defined, (n = 581, 1.4%), followed by infection (n = 352, 0.85%), and adhesive capsulitis (n = 166, 0.4%).

Four studies[8,12,24,27] (23,884 shoulders) reported reoperation rates for patients with vs. without MHC undergoing SA. In patients undergoing SA with vs. without MHC, pooled reoperation rates of 2.8% (102/3647) and 1.3% (261/20,237), respectively, were observed.

Complications and reoperations after TSA

Four studies[8,12,24,27] (23,884 shoulders) reported complication rates for patients with vs. without MHC undergoing TSA. Pooled complication rates of 14.8% (494/3328) and 18.2% (3593/19,694) were reported in patients with vs. without MHC.

Four studies[8,12,24,27] (23,884 shoulders) reported reoperation rates for patients undergoing TSA with vs. without MHC. Pooled reoperation rates of 2.6% (85/3328) and 1.2% (244/19,694) were observed in patients with MHC who underwent TSA.

Complications and reoperations after rTSA

Six studies[8,11,24,29,32,44] (25,892 shoulders) reported complication rates for patients with vs. without MHC undergoing rTSA. Pooled complication rates of 45.3% (1963/4338) and 17.5% (3625/20,694) were observed in patients with vs. without MHC who underwent rTSA.

Two studies[8,24] (1174 shoulders) reported reoperation rates for patients with vs. without MHC undergoing rTSA. In patients with vs. without MHC who underwent rTSA, one study[8] reported reoperation rates of 6.1% and 3.3%, respectively.

Discussion

The most important finding from this systematic review was that patients with MHC were at an increased risk of experiencing complications after SA. Patients with MHC appear to have similar improvement in ROM and less improvement in PROs after SA compared to patients without MHC. These findings will help to guide improvements in patient selection, patient optimization strategies, and operative expectation setting for patients with MHC indicated for SA.

Patients with MHC were likely to see improvements in functional status and ROM after SA. SA may lead to improvements in overall ROM for patients with MHC, with the largest absolute change observed in AB and FE. While similar improvements in ROM were observed between cohorts and across studies, the heterogeneity in reporting precluded direct statistical comparison. Through an observation of pooled means, subjects with MHC had improvements in shoulder ROM which may be quantified as greater than minimum clinically important difference (MCID), rather, as substantial clinical benefit with mean improvements greater than the established values of 28.5 ± 3.5° in AB, 35.4° ± 3.5° in FE, and 11.7° ± 1.9° in ER.[34]

Combining shoulders of TSA and rTSA, subjects with a MHC experienced a greater improvement in AB of 32°, compared to 21°, and both cohorts experienced similar postoperative AB of 100° and 99° respectively. There was a greater average improvement in patients with a MHC in AB of 11° which exceeds the MCID threshold of 7° ± 4°.[34] This suggests that there was a potentially clinically significant difference between cohorts. Patients with MHC experienced lower improvements in FE compared to those without MHC, with differences of 53° and 60°, respectively. The greater relative improvement of 7° in those without MHC lies below the accepted MCID threshold of 12° ± 4° which suggests that the difference between cohorts does not have clinical significance.[34] Patients with MHC experienced similar outcomes in ER compared to those without MHC, with observed improvements of 19.7° and 20.4°, respectively.

In prior studies, patients with anxiety and depression have demonstrated decreased baseline shoulder ROM. This is likely due to the association between MHC and overall joint stiffness.[13] Several studies have described a predictive relationship between low preoperative ROM and low postoperative ROM.[16,26,35] While individual outcomes are difficult to assess, this review suggests that a lower relative baseline ROM in those with MHC did not affect the ability for meaningful clinical improvement in ROM. Patients with MHC were able to experience similar amounts of improvement to patients without MHC.

Patients with MHC experienced smaller improvements in ASES scores after SA compared to patients without MHC. Subjects with versus without MHC reported a mean change of 50 and 54 after TSA and 35 and 45 after rTSA. MCID values for ASES after TSA and rTSA are 10.3 and 17.0, respectively.[39] This indicates that, regardless of MHC status, patients surpassed previously reported MCID values after TSA and rTSA. While there was a greater difference in ASES score change in subjects without MHC, a MCID between cohorts was not reached. This suggests that there is no clinical difference between those with vs. without MHC. Cole et al[9] specifically identified preoperative pain as a predictor of MCID in ASES score and patient-perceived success from surgery after SA. The ASES scores include a pain component which, in recent study, has become a target of novel adjunct psychosocial interventions and may allow clinicians facilitate improved outcomes in this patient population.[1] These interventions utilize cognitive behavioral therapy and patient education to remodel psychosomatic modulators of pain associated with underlying depression and anxiety.[38] Psychosocial interventions have been directly shown to improve recovery and decrease pain and anxiety which may translate into an added benefit for this subset of patients visualizable through ASES scores.

Patients with MHC had higher postoperative VAS pain scores. The observed changes in VAS scores of 3.8 and 5.8 in patients with MHC after TSA and rTSA, respectively, exceed the reported MCID of 1.4.[39] The observed differences VAS scores between patients with vs. without MHC likely exist due to a combination of factors. Vajapay et al[41] described that psychosocial status alone may have a larger predictive value on outcomes after SA compared to anatomic factors. Patients with MHC are more likely to have lower thresholds for pain, preoperative surgical expectations, and resilience, all of which have been associated with inferior outcomes and can be altered by psychological status.[9,24,40,42] Styron et al[36] identified confidence as a positive predictor of functional and pain-related outcomes after SA. Swarup et al[37] further described specific etiologies by identifying performance of self-care, psychological well-being, and ability to interact with others as predictors of outcomes in SA. Nevertheless, patients with MHC can appreciate the clinically significant improvement in VAS after SA, indicating that this procedure can meaningfully impact quality of life.

Overall, the complication and revision rates for SA patients with MHC were approximately double compared to those without MHC. The complication rate for patients with MHC after rTSA was 45.3% compared to 17.5% in those without MHC. While these rates were within the range of cited values, the rTSA rate of 45.3% was at the extreme end.[17] The most frequently reported complication in patients with MHC undergoing rTSA was infection followed by prosthetic complication. In patients without MHC, the most frequently reported complication was prosthetic complication followed by infection. The frequency of complications was lower regardless of type in those without MHC. Meanwhile, Lunati et al[27] identified a preoperative diagnosis of depression as an independent risk factor for complications after TSA. The notable increase in infection rates may be attributable to the immunosuppressive effects of depressive disorders.[20] Patients with MHC likely presented with increased pain sensitivity which may have been associated with increased opioid consumption.[14] The increased utilization of opioids in this population may also be associated with increased complications such as prolonged length of stay, gastrointestinal dysmotility, and revision rates.[6]

Patients with MHC undergoing rTSA had the highest overall reported revision rate among all cohorts. The two leading causes of revision after rTSA were infection and instability, both of which may be more likely to present in patients with MHC.[4] Colasanti et al[8] attributed the observed increase in revision rates to a lack of overall patient motivation and generalized fatigue. Patients with MHC suffer from increased basal levels of psychological stress which may be attributed to the manifestation of lower motivation and higher fatigue.[15,20] In surgical settings, patients with MHC have been identified as having poorer health literacy and difficulties communicating health concerns.[28] Patients with MHC are also less likely to seek help which may cause communication breakdowns between patients and healthcare providers.[10] Prevention of communication breakdowns is known to reduce complication rates and may help improve outcomes after SA for patients with MHC.[3]

Limitations

This study has several limitations. First, heterogeneity in reporting precluded quantitative meta-analysis. Moreover, there was heterogeneity in implant use, surgical techniques, and indications, which may limit the generalizability of these findings. Many of the studies included contained small sample sizes. The

present investigation performed a qualitative systematic review with quantitative calculations when feasible.

Conclusion

Patients with MHC may have lower preoperative ROM, worse postoperative shoulder function, and higher postoperative pain levels than patients without MHC. Patients with MHC demonstrated improvements in ROM and functional outcomes after SA but had higher reported complication and revision rates when compared with patients without MHC. Depression and anxiety were the leading conditions that lead to lower outcomes in patients with MHC after SA. Preoperative physical therapy, mental health counseling, and expectation setting for patients with MHC may help these patients reach the maximal achievable benefit from SA.

Disclaimers:

Funding: No funding was disclosed by the authors.
Conflicts of interest: Ajay Kanakamedala declares being on the Editorial Board of Arthroscopy. Joseph Ruzbarsky declares payments from Smith and Nephew. Peter Millett declares IP royalties, consulting fees, and research support from Arthrex; research support from Ossur, Siemens, and Smith & Nephew; and publishing royalties and financial or material support from Springer; and holds stock or stock options in VuMedi. Matthew Provencher declares royalties from Arthrex, Inc. Arthrosurface, Responsive Arthroscopy (2020), and Anika Therapeutics, Inc.; Consulting fees from Arthrex, Inc., Joint Restoration Foundation (JRF), Zimmer Biomet Holdings, and Arthrosurface; received grants from the Department of Defense (DoD), the National Institute of Health (NIH), and the DJO (2020); Honoria from Flexion Therapeutics; is an editorial board or governing board member for SLACK, Inc.; Board or committee member for AANA, AAOS, AOSSM, ASES, SDSI, and SOMOs; serves on the medical board of trustees for the Musculoskeletal Transplant Foundation (through 2018). The other authors, their immediate families, 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 Data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.xrrt.2024.04.014.

References

1. Ahmed R, Lanham NS, Peterson JR, Jobin CM, Levine WN. Characterization of ASES score pain and functional improvement after anatomic total shoulder arthroplasty: a patient-centered perspective. J Shoulder Elbow Surg 2022;31:1042-6. https://doi.org/10.1016/j.jse.2021.10.031.
2. Angst F, Pap G, Mannion AF, Herren DB, Aeschlimann A, Schwyzer HK, et al. Comprehensive assessment of clinical outcome and quality of life after total shoulder arthroplasty: usefulness and validity of subjective outcome measures. Arthritis Rheum 2004;51:819-28. https://doi.org/10.1002/art.20688.
3. Arriaga AF, Elbardissi AW, Regenbogen SE, Greenberg CC, Berry WR, Lipsitz S, et al. A policy-based intervention for the reduction of communication breakdowns in inpatient surgical care: results from a Harvard surgical safety collaborative. Ann Surg 2011;253:849-54. https://doi.org/10.1097/SLA.0b013e3181f4dfc8.
4. Boileau P. Complications and revision of reverse total shoulder arthroplasty. Orthop Traumatol Surg Res 2016;102(1 Suppl):S33-43. https://doi.org/10.1016/j.otsr.2015.06.031.
5. Bot AG, Menendez ME, Neuhaus V, Ring D. The influence of psychiatric comorbidity on perioperative outcomes after shoulder arthroplasty. J Shoulder Elbow Surg 2014;23:519-27. https://doi.org/10.1016/j.jse.2013.12.006.
6. Brandner GT, Guareschi AS, Eichinger JK, Friedman RJ. Impact of opioid dependence on outcomes following total shoulder arthroplasty. J Shoulder Elbow Surg 2024;33:82-9. https://doi.org/10.1016/j.jse.2023.05.040.
7. Charles MD, Cvetanovich G, Sumner-Parilla S, Nicholson GP, Verma N, Romeo AA. Outpatient shoulder arthroplasty: outcomes, complications, and readmissions in 2 outpatient settings. J Shoulder Elbow Surg 2019;28:S118-23. https://doi.org/10.1016/j.jse.2019.04.006.
8. Colasanti CA, Lin CC, Anil U, Simovitch RW, Virk MS, Zuckerman JD. Impact of mental health on outcomes after total shoulder arthroplasty. J Shoulder Elbow Surg 2023;32:980-90. https://doi.org/10.1016/j.jse.2022.10.028.
9. Cole EW, Moulton SG, Werner BC, Denard PJ. Why patients fail to achieve a Patient Acceptable Symptom State (PASS) after total shoulder arthroplasty? JSES Int 2022;6:49-55. https://doi.org/10.1016/j.jseint.2021.09.017.
10. Demyttenaere K, Bonnewyn A, Bruffaerts R, Brugha T, De Graaf R, Alonso J. Comorbid painful physical symptoms and depression: prevalence, work loss, and help seeking. J Affect Disord 2006;92:185-93. https://doi.org/10.1016/j.jad.2006.01.007.
11. Diamond KB, Gordon AM, Sheth BK, Romeo AA, Choueka J. How does depressive disorder impact outcomes in patients with glenohumeral osteoarthritis undergoing primary reverse shoulder arthroplasty? J Shoulder Elbow Surg 2023;32:1886-92. https://doi.org/10.1016/j.jse.2023.03.013.
12. Eads RB, Brolin TJ, Smith RA, Azar FM, Throckmorton TW. Mood disorders are associated with inferior outcomes of anatomic total shoulder arthroplasty. Curr Orthop Pract 2019;30:142-6. https://doi.org/10.1097/bco.0000000000000727.
13. Ebrahimzadeh MH, Moradi A, Bidgoli HF, Zarei B. The relationship between depression or anxiety symptoms and objective and subjective symptoms of patients with frozen shoulder. Int J Prev Med 2019;10:38. https://doi.org/10.4103/ijpvm.IJPVM_212_17.
14. Etcheson JI, Gwam CU, George NE, Virani S, Mont MA, Delanois RE. Patients With Major Depressive Disorder Experience Increased Perception of Pain and Opioid Consumption Following Total Joint Arthroplasty. J Arthroplasty 2018;33:997-1002. https://doi.org/10.1016/j.arth.2017.10.020.
15. Farholm A, Sorensen M. Motivation for physical activity and exercise in severe mental illness: A systematic review of cross-sectional studies. Int J Ment Health Nurs 2016;25:116-26. https://doi.org/10.1111/inm.12217.
16. Friedman RJ, Eichinger J, Schoch B, Wright T, Zuckerman J, Flurin PH, et al. Preoperative parameters that predict postoperative patient-reported outcome measures and range of motion with anatomic and reverse total shoulder arthroplasty. JSES Open Access 2019;3:266-72. https://doi.org/10.1016/j.jses.2019.09.010.
17. Galvin JW, Kim R, Ment A, Durso J, Joslin PMN, Lemos JL, et al. Outcomes and complications of primary reverse shoulder arthroplasty with minimum of 2 years' follow-up: a systematic review and meta-analysis. J Shoulder Elbow Surg 2022;31:e534-44. https://doi.org/10.1016/j.jse.2022.06.005.
18. Ghoneim MM, O'Hara MW. Depression and postoperative complications: an overview. BMC Surg 2016;16:5. https://doi.org/10.1186/s12893-016-0120-y.
19. Health NIoM. Major depression. 2023. Available at: https://www.nimh.nih.gov/health/statistics/major-depression. Accessed July 2024.
20. Henckens MJ, Klumpers F, Everaerd D, Kooijman SC, van Wingen GA, Fernandez G. Interindividual differences in stress sensitivity: basal and stress-induced cortisol levels differentially predict neural vigilance processing under stress. Soc Cogn Affect Neurosci 2016;11:663-73. https://doi.org/10.1093/scan/nsv149.
21. Iannotti JP, Norris TR. Influence of preoperative factors on outcome of shoulder arthroplasty for glenohumeral osteoarthritis. J Bone Joint Surg Am 2003;85:251-8. https://doi.org/10.2106/00004623-200302000-00011.
22. Kennedy P, Joshi R, Dhawan A. The effect of psychosocial factors on outcomes in patients with rotator cuff tears: a systematic review. Arthroscopy 2019;35:2698-706. https://doi.org/10.1016/j.arthro.2019.03.043.
23. Kohan EM, Aleem A, Chamberlain AM, Keener JD. The influence of mental health on outcomes following total shoulder arthroplasty. Semin Arthroplasty: JSES 2020;30:18-27. https://doi.org/10.1053/j.sart.2020.04.001.
24. Kuhlmann NA, Franovic S, Burdick GB, Hanson DS, Dash ME, Ayoola AS, et al. Shoulder arthroplasty outcomes in patients with major depressive disorder or generalized anxiety disorder. Semin Arthroplasty: JSES 2023;33:722-6. https://doi.org/10.1053/j.sart.2023.07.005.
25. Lamers SM, Bolier L, Westerhof GJ, Smit F, Bohlmeijer ET. The impact of emotional well-being on long-term recovery and survival in physical illness: a meta-analysis. J Behav Med 2012;35:538-47. https://doi.org/10.1007/s10865-011-9379-8.
26. Levy JC, Ashukem MT, Formaini NT. Factors predicting postoperative range of motion for anatomic total shoulder arthroplasty. J Shoulder Elbow Surg 2016;25:55-60. https://doi.org/10.1016/j.jse.2015.06.026.
27. Lunati MP, Wilson JM, Farley KX, Gottschalk MB, Wagner ER. Preoperative depression is a risk factor for complication and increased health care utilization following total shoulder arthroplasty. J Shoulder Elbow Surg 2021;30:89-96. https://doi.org/10.1016/j.jse.2020.04.015.
28. McBride KE, Solomon MJ, Lambert T, O'Shannassy S, Yates C, Isbester J, et al. Surgical experience for patients with serious mental illness: a qualitative study. BMC Psychiatry 2021;21:47. https://doi.org/10.1186/s12888-021-03056-x.
29. Moore AR, Brolin TJ, Smith RA, Azar FM, Throckmorton TW. Outcomes after primary reverse total shoulder arthroplasty in patients with comorbid anxiety and depressive disorders: a retrospective cohort study. Curr Orthop Pract 2021;32:37-42. https://doi.org/10.1097/bco.0000000000000940.

30. O'Connor JP, Holden P, Gagnier JJ. Systematic review: preoperative psychological factors and total hip arthroplasty outcomes. J Orthop Surg Res 2022;17:457. https://doi.org/10.1186/s13018-022-03355-3.
31. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. Syst Rev 2021;10:89. https://doi.org/10.1186/s13643-021-01626-4.
32. Porter A, Greiwe RM. Psychological disorders confer poor functional outcomes after reverse total shoulder arthroplasty. JSES Rev Rep Tech 2021;1:357-60. https://doi.org/10.1016/j.xrrt.2021.06.008.
33. Sanchez-Sotelo J. Total shoulder arthroplasty. Open Orthop J 2011;5:106-14. https://doi.org/10.2174/1874325001105010106.
34. Simovitch R, Flurin PH, Wright T, Zuckerman JD, Roche CP. Quantifying success after total shoulder arthroplasty: the minimal clinically important difference. J Shoulder Elbow Surg 2018;27:298-305. https://doi.org/10.1016/j.jse.2017.09.013.
35. Sollaccio DR, King JJ, Struk A, Farmer KW, Wright TW. Clinical predictors for optimal forward elevation in primary reverse total shoulder arthroplasty. J Shoulder Elb Arthroplast 2019;3:2471549219831527. https://doi.org/10.1177/2471549219831527.
36. Styron JF, Higuera CA, Strnad G, Iannotti JP. Greater patient confidence yields greater functional outcomes after primary total shoulder arthroplasty. J Shoulder Elbow Surg 2015;24:1263-7. https://doi.org/10.1016/j.jse.2015.04.018.
37. Swarup I, Henn CM, Nguyen JT, Dines DM, Craig EV, Warren RF, et al. Effect of pre-operative expectations on the outcomes following total shoulder arthroplasty. Bone Joint J 2017;99-B:1190-6. https://doi.org/10.1302/0301-620X.99B9.BJJ-2016-1263.R1.
38. Szeverenyi C, Kekecs Z, Johnson A, Elkins G, Csernatony Z, Varga K. The use of adjunct psychosocial interventions can decrease postoperative pain and improve the quality of clinical care in orthopedic surgery: a systematic review and meta-analysis of randomized controlled trials. J Pain 2018;19:1231-52. https://doi.org/10.1016/j.jpain.2018.05.006.
39. Tashjian RZ, Hung M, Keener JD, Bowen RC, McAllister J, Chen W, et al. Determining the minimal clinically important difference for the American Shoulder and Elbow Surgeons score, Simple Shoulder Test, and visual analog scale (VAS) measuring pain after shoulder arthroplasty. J Shoulder Elbow Surg 2017;26:144-8. https://doi.org/10.1016/j.jse.2016.06.007.
40. Tokish JM, Kissenberth MJ, Tolan SJ, Salim TI, Tadlock J, Kellam T, et al. Resilience correlates with outcomes after total shoulder arthroplasty. J Shoulder Elbow Surg 2017;26:752-6. https://doi.org/10.1016/j.jse.2016.12.070.
41. Vajapey SP, Cvetanovich GL, Bishop JY, Neviaser AS. Psychosocial factors affecting outcomes after shoulder arthroplasty: a systematic review. J Shoulder Elbow Surg 2020;29:e175-84. https://doi.org/10.1016/j.jse.2019.09.043.
42. Vogel M, Binnebose M, Wallis H, Lohmann CH, Junne F, Berth A, et al. The unhappy shoulder: a conceptual review of the psychosomatics of shoulder pain. J Clin Med 2022;11:5490. https://doi.org/10.3390/jcm11185490.
43. Werner BC, Wong AC, Chang B, Craig EV, Dines DM, Warren RF, et al. Depression and patient-reported outcomes following total shoulder arthroplasty. J Bone Joint Surg Am 2017;99:688-95. https://doi.org/10.2106/JBJS.16.00541.
44. Werner BC, Wong AC, Mahony GT, Craig EV, Dines DM, Warren RF, et al. Causes of poor postoperative improvement after reverse total shoulder arthroplasty. J Shoulder Elbow Surg 2016;25:e217-22. https://doi.org/10.1016/j.jse.2016.01.002.
45. Wong SE, Colley AK, Pitcher AA, Zhang AL, Ma CB, Feeley BT. Mental health, preoperative disability, and postoperative outcomes in patients undergoing shoulder arthroplasty. J Shoulder Elbow Surg 2018;27:1580-7. https://doi.org/10.1016/j.jse.2018.02.066.