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BASIC SCIENCE

Preoperative patient expectations of elective reverse shoulder arthroplasty

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Background: The purpose of this study was to determine patients' preoperative expectations before primary elective reverse shoulder arthroplasty (RSA). We hypothesized that younger patients, patients with better preoperative function, patients with shoulder osteoarthritis (OA), and patients with no prior joint replacements would have higher expectations of RSA.

Methods: We prospectively studied 333 primary RSAs performed for cuff tear arthropathy (n = 242), OA (n = 68), or post-traumatic arthritis (n = 23). Expectations were assessed preoperatively using the Hospital for Special Surgery's shoulder surgery expectations survey. Preoperative patient-reported measures were assessed with the American Shoulder and Elbow Surgeons shoulder score; Shoulder Activity Scale score; Short Form 12 mental component and physical component scores; and visual analog scale scores for pain, fatigue, and general health. A Poisson regression model was performed to control for potential confounding variables.

Results: Relief of night-time pain, relief of daytime pain, improvement in self-care, improvement in the ability to drive or put on a seat belt, and improvement in the ability to perform daily activities were reported as ''very important'' by approximately half of patients. No association was found between age and overall expectations. Multivariate analysis showed that better preoperative Shoulder Activity Scale and Short Form 12 physical component scores were associated with greater expectations ($P < .001$). OA was associated with greater expectations compared with cuff tear arthropathy ($P < .001$). A history of either contralateral RSA or any joint replacement was associated with lower expectations ($P < .001$).

Conclusion: Patients have the highest expectations for pain relief and the performance of simple tasks after RSA. Patients with higher preoperative function, OA, and no previous joint replacements have greater expectations of RSA.

Level of evidence: Basic Science Study; Validation of Outcome Instrument

Keywords: Reverse shoulder replacement; preoperative patient expectations; cuff tear arthropathy; glenohumeral arthritis; patient-reported outcomes; return to sport

This study was approved by the Institutional Review Board of the Hospital for Special Surgery (No. 26117).

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The incidence as well as utilization of reverse shoulder arthroplasty (RSA) is increasing in the United States and worldwide.[14,18] Patients choose to pursue RSA because of desires for pain relief and improved function and quality of life. Patient expectations across a multitude of orthopedic procedures have been analyzed and play a role in patient outcomes. Previous studies examining expectations of elective orthopedic procedures have shown that expectations can vary based on age, sex, diagnosis, prior joint arthroplasty, activity levels, and health status.[2,4,5,11] Within shoulder surgery, preoperative expectations have been assessed for arthroscopic surgery,[17] rotator cuff repair,[5] instability,[12] and anatomic total shoulder arthroplasty (TSA).[4] It is important for surgeons to know what patients' expectations of RSA are to ensure that the patients' and surgeons' expectations and goals align.

The Hospital for Special Surgery's shoulder surgery expectations survey (HSS-ES) is a measure of patient expectations before shoulder surgery, and questions can be categorized into pain relief, improvement in psychosocial factors, and functional improvements.[8] The survey was developed and validated in a group of patients with a variety of shoulder pathologies, including rotator cuff tears and glenohumeral arthritis.[8] Previous studies have shown that higher preoperative expectations correlated with better outcomes after rotator cuff repair and anatomic shoulder arthroplasty.[5,16] Furthermore, higher expectations for specific questions were shown to be associated with better outcomes in a specific domain (ie, higher preoperative expectations for pain relief were associated with better visual analog scale [VAS] pain scores postoperatively) in anatomic shoulder arthroplasty and RSA.[13,16]

Previous studies have focused on patient expectations in the setting of anatomic TSA performed for glenohumeral osteoarthritis (OA), in which younger age was independently associated with greater expectations.[4] However, no studies, to our knowledge, have examined preoperative patient expectations of RSA. RSA is typically performed for a variety of indications and in an older patient population than anatomic TSA. The objectives of this study were to measure patients' preoperative expectations of primary elective RSA for a diagnosis of rotator cuff tear arthropathy (CTA), glenohumeral OA, or post-traumatic arthritis and to determine how expectations vary based on diagnosis, patient demographic characteristics, prior joint replacements, health status, and functional status. We hypothesized that younger patients, patients with better preoperative function, patients with glenohumeral OA, and patients with no prior joint replacements would have higher expectations of RSA.

Materials and methods

This study was a retrospective review of prospectively collected data using the shoulder registry at a tertiary-care teaching institution. Patients presenting to our institution with shoulder pathology were asked to participate in our shoulder registry. Informed consent was obtained, and patients answered questionnaires related to their expectations as well as outcomes. Patients were included if they underwent primary RSA for a diagnosis of CTA, glenohumeral OA, or post-traumatic arthritis from July 1, 2008, to January 8, 2016. Patients were excluded if they underwent primary RSA for a diagnosis of acute trauma or inflammatory arthritis (Fig. 1).

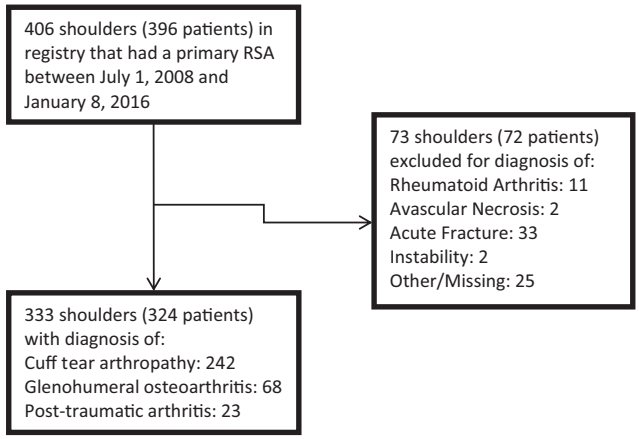

Figure 1 Inclusion and exclusion flowchart. *RSA*, reverse shoulder arthroplasty.

Patients' preoperative expectations were recorded via the HSS-ES.[8] The original survey was 17 questions and was validated. The rendition given to our patient population included 2 additional questions regarding improvement in the ability to participate in overhead sports and improvement in the ability to participate in non-overhead sports.[8] Each question had 5 possible responses: "very important," "somewhat important," "a little important," "I do not expect this," and "this does not apply to me." Patients were given the survey at the beginning of the visit, before seeing the surgeon, and ratings of their expectations on the 19-question survey were recorded (Table I). A greater level of expectations was defined as an answer of "very important," in keeping with previous studies analyzing the HSS-ES.[13,16] Answers to each question, as well as the total number of "very important" responses, were recorded for each patient. Apart from the preoperative discussion of the risks and benefits of surgery as part of routine informed consent, no deliberate attempts were made to influence patient expectations.

Patient age, sex, body mass index (BMI), education level, history of any joint replacement, history of contralateral shoulder replacement, laterality, and dominant arm were recorded. Preoperative patient-reported outcome measures were assessed using the American Shoulder and Elbow Surgeons (ASES) shoulder score; Shoulder Activity Scale (SAS) score; Short Form 12 (SF-12) mental component and physical component scores; and VAS scores for pain, fatigue, and general health.

Statistical analysis

Each item from the expectations survey and the cumulative score were analyzed. For each question, the responses were grouped into 2 categories to assist with analysis: Responses of "very important" represented higher expectations, and all other responses

Table I Responses to Hospital for Special Surgery's shoulder surgery expectations survey

	Response to question "How important are these expectations in the treatment of your shoulder?," No. of patients					Greater expectations, %
	Very important	Somewhat important	A little important	I do not expect this	This does not apply to me	
Relieve daytime pain	160	139	19	4	10	48
Relieve night-time pain	162	132	18	4	16	49
Improve shoulder range of motion	115	172	36	7	3	35
Stop shoulder from dislocating	91	53	10	3	171	28
Stop shoulder from clicking	129	88	14	1	99	39
Improve ability to carry objects > 10 lb (4.5 kg)	122	125	50	10	25	37
Improve ability to reach above shoulder level	123	148	40	10	11	37
Improve ability to reach sideways	141	136	39	9	8	42
Improve self-care	161	133	15	1	21	49
Be employed for monetary reimbursement	56	25	0	2	240	17
Improve psychological well-being	129	90	20	4	81	40
Improve ability to interact with others	123	80	31	4	92	37
Improve ability to perform daily activities	153	125	30	5	18	46
Improve ability to drive or put on a seat belt	157	97	17	4	57	47
Improve ability to exercise or participate in professional sports	82	73	31	4	139	25
Improve ability to participate in overhead sports	49	60	18	14	186	15
Improve ability to participate in non-overhead sports	63	62	23	11	167	19
Improve ability to participate in recreational activities	129	112	31	9	51	39
For the shoulder to be back to the way it was before this problem started	116	156	33	6	19	35

Expectations marked "very important" represented greater expectations. Expectations marked "somewhat important," "a little important," "I do not expect this," or "this does not apply to me" represented lower expectations.

corresponded to lower expectations. Relationships between the responses to the 2 categories of expectations and categorical variables were assessed using Wilcoxon (Mann-Whitney) tests. Associations involving continuous variables were assessed with Spearman correlations.

To analyze cumulative expectations, the total number of questions with a response of ''very important'' was calculated for each patient. Correlations with the total number of high expectations were analyzed with Wilcoxon (Mann-Whitney) tests for bimodal categorical characteristics (sex, laterality, history of joint replacement, history of contralateral shoulder replacement, dominant arm). The Kruskal-Wallis test was used when comparing diagnosis and categories of education, and Pearson correlations were used for continuous variables (age, BMI, ASES score, SAS score, VAS pain score, VAS fatigue score, VAS general health score, SF-12 physical component subscale score, and SF-12 mental component subscale score).

A Poisson regression model was fitted in a stepwise method to control for confounding variables and examine independent baseline patient-specific factors that are associated with high expectations (defined as the total number of expectations marked ''very important''). The model was fitted while considering age, sex, diagnosis (CTA, OA, and post-traumatic arthritis), previous contralateral RSA, any previous joint replacement, SAS score, and SF-12 physical component score. The final Poisson model included variables that were significant at the .05 level while adjusting for age and sex. All analyses were performed using SAS software (version 9.4; SAS Institute, Cary, NC, USA).

Results

A total of 396 patients underwent primary RSA and consented to be included in our institution's shoulder registry during the study period. Among these patients, 333 RSAs (324 patients) were performed for the treatment of CTA (242 RSAs), OA (68 RSAs), or post-traumatic arthritis (23 RSAs) and were included in our study (Fig. 1). Twenty-four fellowship-trained sports medicine surgeons performed the surgical procedures.

The mean age ± standard deviation was 72.1 ± 8.7 years (range, 45-97 years). There were 208 women (64.2%) and 116 men (35.8%). Of the patients, 165 (51%) had at least a college degree. A history of at least 1 joint replacement (knee, hip, or shoulder) was found in 143 patients (44%). A history of a contralateral RSA was noted in 27 patients (8.3%). The preoperative ASES, SAS, VAS pain, VAS fatigue, VAS general health, and SF-12 mental component and physical component scores are shown in Table II.

Responses to each expectation question are shown in Table I. Relief of daytime pain, relief of night-time pain, improvement in self-care, improvement in the ability to drive or put on a seat belt, and improvement in the ability to perform daily activities were scored as ''very

Table II Preoperative patient-reported outcome measures

	n	%	Preoperative score				
			Mean	SD	Median	Minimum	Maximum
ASES	317	95	36	20	33	0	88
SAS	323	97	5.4	4.9	4.0	0	20
VAS pain	326	98	35	28	72	0	100
VAS fatigue	328	98	41	33	38	0	100
VAS general health	330	99	41	27	44	0	100
SF-12 MCS	282	85	50	12	53	13	69
SF-12 PCS	282	85	33	8.1	33	13	57

SD, standard deviation; *ASES*, American Shoulder and Elbow Surgeons; *SAS*, Shoulder Activity Scale; *VAS*, visual analog scale; *SF-12*, Short Form 12; *MCS*, mental component subscale; *PCS*, physical component subscale.

important'' by approximately half of the patients (range, 46%-49%). In the question-specific analysis, women had greater expectations for improvement in the ability to participate in overhead sports ($P = .001$) and non-overhead sports ($P = .002$) whereas men had higher expectations for improvement in their psychological well-being ($P = .026$). Having a history of a joint replacement (hip, knee, or shoulder) was associated with greater expectations for preventing the shoulder from dislocating ($P = .026$), carrying objects over 10 lb (4.5 kg) ($P = .015$), improving psychological well-being ($P = .036$), performing activities of daily living ($P = .008$), exercising ($P = .029$), and participating in recreational activities ($P = .018$), as well as for the shoulder to be back to the way it was before the current problem started ($P = .06$). Having a history of contralateral shoulder arthroplasty was associated with higher expectations for carrying objects over 10 lb (4.5 kg) ($P = .037$), improving self-care ($P = .015$), and performing activities of daily living ($P = .003$), as well as for the shoulder to be back to the way it was before the current problem started ($P = .032$). A diagnosis of CTA was associated with greater expectations for relief of nighttime pain ($P = .037$). Post-traumatic arthritis and CTA were associated with greater expectations for participating in overhead sports ($P = .047$) and non-overhead sports ($P = .010$) relative to OA.

The mean number ± standard deviation of ''very important'' expectations was 6.8 ± 6.1 of 19 questions (36%), with a median of 5 and a range of 0 to 19. We found no association between sex, age, BMI, education, or preoperative ASES, VAS, or SF-12 mental component scores and a greater number of expectations. When we controlled for other variables, better SAS and SF-12 physical component scores were associated with greater expectations ($P < .001$). A diagnosis of CTA was associated with lower expectations compared with a diagnosis of OA ($P < .001$), and post-traumatic arthritis was associated with the lowest expectations ($P = .044$). A history of contralateral RSA was associated with lower overall expectations ($P = .003$), as was a history of any joint replacement ($P < .001$). Age and sex were not correlated with overall expectations ($P > .05$) (Table III).

Discussion

The results supported most of our hypotheses about preoperative expectations of RSA. Although patients with better preoperative function, glenohumeral OA, and no prior joint replacements had higher expectations of RSA, there was no association between age and expectations. The results also showed that patients undergoing RSA had high expectations for pain relief and the performance of simple tasks. Notably, we also found a significant portion of patients who had high expectations for returning to recreational activities and sports. Patients undergoing RSA had lower expectations on average compared with a study of anatomic TSA.[16]

Preoperative function, as measured by a shoulder-specific scale (SAS) and by overall function and physical health (SF-12 physical component score), directly correlated with expectations of RSA. Patients with low preoperative physical function had lower expectations of RSA, whereas those with higher preoperative function had higher expectations. This contrasts with the findings of worse functional status being associated with higher expectations of total hip arthroplasty,[11] as well as cervical[10] and lumbar spine surgery.[9] Henn et al[4] examined preoperative function and its effect on expectations before anatomic TSA and found no association on multivariate analysis.

For patients with high expectations in the functional-improvement domain, it is important to identify and counsel them about the likelihood of returning to particular sports or activities after RSA. Greater expectations for recreational activities, exercise, non-overhead sports, and overhead sports were cited by 39%, 25%, 19%, and 15% of patients, respectively (Table I). Recent systematic reviews have shown that approximately 75% of patients are able to return to at least 1 sport after RSA.[1,7] Returning to overhead sports is more challenging after shoulder arthroplasty.

Table III Poisson regression model examining baseline patient-specific factors that are predictive of high expectations

Outcome: No. of "very important" expectations	Estimate	SE	IRR	*P* value
Age	−0.00003	0.003	1.0	.99
Female vs. male	0.024	0.049	1.0	.63
Diagnosis (reference: cuff tear arthropathy)				
Osteoarthritis	0.37	0.054	1.4	<.0001
Post-traumatic arthritis	−0.21	0.10	0.081	.044
History of contralateral RSA vs. none	−0.43	0.12	0.65	.0003
History of joint replacement vs. none	−0.22	0.052	0.80	<.0001
Preoperative PROMs				
SAS score	0.028	0.005	1.0	<.0001
SF-12 PCS score	0.011	0.003	1.0	.0001

SE, standard error; *IRR*, incidence rate ratio; *RSA*, reverse shoulder arthroplasty; *PROMs*, patient-reported outcome measures; *SAS*, Shoulder Activity Scale; *SF-12 PCS*, Short Form 12 physical component subscale.

Rates of return to tennis were 63% across all shoulder arthroplasties and 25% after RSA.[1,3] In this study, we found that high expectations for performing overhead and non-overhead sports were associated with worse preoperative function, female sex, and older age. Another issue with expectations of returning to sports is the unknown long-term implications of implant survival in patients who return to sports, particularly overhead or high-demand upper-extremity sports such as swimming and weight lifting.

Patients with OA have higher expectations before RSA relative to patients with CTA, and patients with post-traumatic arthritis have the lowest expectations before surgery. Patients with CTA experience pain and dysfunction related to their rotator cuff tear in the first stage, followed by the additional pain that ensues later as glenohumeral arthritis develops. The longevity and severity of their symptoms may contribute to patients with CTA having fewer expectations than patients with OA. Despite lower overall expectations, patients with CTA did have higher expectations for relief of night-time pain, which can likely be attributed to their rotator cuff pathology.

Patients who have undergone previous arthroplasty are an interesting subset as, having already been through the process, they have the best insight into expectations. They also carry a selection bias because they liked the result enough to subject themselves to the procedure again. Previous studies have shown that expectations can change between bilateral arthroplasties. Scott et al[15] found that 17% of patients had higher expectations whereas 20% had lower expectations when assessed between staged knee arthroplasties. We report that prior contralateral RSA was associated with lower overall expectations of subsequent RSA. It is interesting to note that, when looking at the role of prior contralateral RSA regarding individual expectations, we found it was associated with greater expectations for 4 specific questions. Patients with prior contralateral RSA had increased expectations for carrying objects over 10 lb (4.5 kg), improving self-care, and performing activities of daily living, which may reflect the importance of being able to perform less demanding activities after RSA. A surprising finding was that patients with prior contralateral RSA also had higher expectations for the shoulder to be back to the way it was before their shoulder problem started. Across all patients in our cohort, this expectation was marked as ''very important'' in 35% of patients; however, as a complete return to normal is likely an unattainable expectation after RSA, it is important to address this point during preoperative counseling to set appropriate expectations before surgery.

Similarly to patients who previously underwent a contralateral RSA, those with a history of any joint replacement had lower overall expectations. This finding is consistent with other reports on arthroplasty expectations. Hepinstall et al[6] found that a history of any joint arthroplasty was associated with diminished expectations before knee arthroplasty. Despite fewer expectations overall, patients seemingly condensed their expectations to factors they deemed realistic after having undergone and recovered from a prior arthroplasty.

This study has several strengths. It comprised a prospectively collected, comprehensive cohort of 333 primary elective RSAs performed by 24 surgeons at our institution. To our knowledge, this is the first study to have looked, on a large scale, at preoperative patient expectations before undergoing elective RSA, and given that many of the aforementioned findings contradict the findings of expectation analyses in the arthroplasty and shoulder literature, these results can help clinicians to better understand this unique patient population and set expectations.

Despite these strengths, this study has several limitations. First, the study was undertaken in an urban, tertiary-care center and excluded patients with acute trauma, inflammatory arthritis, or revision RSA; thus, the generalizability to all RSA patients is limited. Second, the intrinsic design of the survey did not allow for weighting or ranking of expectations, which may have allowed further

determinations of the most important expectations before RSA. In addition, there could be a potential selection bias of those patients agreeing to participate in our institution's shoulder registry. Finally, the HSS-ES has been validated across multiple shoulder diagnoses, but several of the questions may not apply to a cohort of patients undergoing RSA (ie, ''stopping the shoulder from dislocating'' or ''being employed for monetary reimbursement''). The survey question pertaining to ''improving ability to exercise or participate in professional sports'' is also difficult to interpret. Some patients could answer the question based on routine exercise whereas others could answer based on professional sports, which can decrease the reliability of the question.

Conclusion

Patients undergoing RSA have higher expectations for pain relief and the performance of simple tasks. Furthermore, patients with better preoperative functional status, glenohumeral OA, no history of contralateral RSA, or any joint replacements have higher expectations of RSA. It is important to identify which patients tend to have loftier expectations, such as returning to sports, as they may benefit most from counseling on realistic improvements that they are likely to obtain from surgery. Understanding what patients expect of RSA allows for the patients and surgeons to align their goals and for overall patient satisfaction to improve.

Disclaimer

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