What is a Successful Outcome Following Reverse Total Shoulder Arthroplasty?

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Abstract: *Background*: With variations in joint destruction, patient expectations and health status, it can be difficult to interpret outcomes following arthroplasty. The purpose of this study was to determine the relationships between different outcome indicators in 44 patients followed for two years after a reverse shoulder arthroplasty.

Methods: Prospectively collected outcomes included the Constant-Murley score, Simple Shoulder Test (SST), range of motion (ROM), strength, patient satisfaction with their care and independent clinician case-review to determine global clinical outcome. Continuous outcomes were divided in two subgroups according to definitions of functional outcomes. Cohen's kappa was used to evaluate agreement between outcomes. Pearson correlations were used to quantify inter-relationships.

Results: Although 93% of patients were substantially satisfied, fewer had good results on the other outcomes: 68% on global clinical outcome, 46% on SST and 73% on Constant-Murley score. The SST demonstrated better than chance agreement with Constant-Murley score, ROM in flexion, abduction and external rotation, and strength in external rotation. No agreement between satisfaction and other outcomes were observed. Significant correlations were observed between Constant-Murley score and SST ($r = 0.78$). The Constant-Murley score and SST demonstrated variable correlation with ROM and strength in flexion, abduction, internal and external rotation ($0.38 < r < 0.73$); the highest correlations being observed with shoulder elevation ROM ($r > 0.50$).

Conclusions: Results show that outcome varies according to patient perspective and assessment methods. Patient satisfaction with their care was related to neither self-reported nor physical impairment outcomes. Positive patient ratings of satisfaction may not necessarily be evidence of positive outcomes.

Keywords: Shoulder arthroplasty, simple shoulder test (SST), multifactorial.

INTRODUCTION

Total shoulder arthroplasty is the reconstructive option to deal with severe shoulder joint damage. Reverse total shoulder arthroplasty (RSA) is often used in more complex shoulder derangement with coexistent rotator cuff deficiencies. RSA has been used successfully in patients with rotator cuff arthropathy, complex proximal humerus fractures and non-unions, and for revisions of failed conventional shoulder arthroplasties [1]. The main advantage of RSA over conventional arthroplasty for patient with rotator cuff deficiencies is that it uses a semiconstrained design that provides a mechanical advantage to the deltoid muscle allowing it to participate in forward elevation [1-3]. RSA provides functional improvements to a subgroup of patients for whom no other good solution previously existed [1, 2, 4]. However, given these indications, it can be problematic to decide when outcomes are optimized.

RSA is performed in patients with substantial impairment and disability prior to surgery; therefore, full function recovery is unlikely. Furthermore, since function is multifactorial, it can be difficult to ascertain functional outcome based on the evaluation of isolated impairments like range of motion and strength. For this reason, some consider patient satisfaction an essential criterion since it forms a global rating. Satisfaction, however, can be related to process as well as outcomes achieved, and does not reflect change over time [5].

Clinicians and researchers share a common goal of determining whether interventions provide sufficient benefit to warrant their implementation. These thresholds can be problematic to define in all reconstructive surgeries, but are especially difficult in RSA where the pathology is complex and leads to extensive impairment and disability. Thus, RSA provides a good model for variations in outcome definition. The purpose of this study was to examine concordance between different methods of determining outcomes following RSA.

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Table 1. Baseline Patients' Characteristics

Patients' Characteristics		Reverse Total Shoulder Arthroplasty Group (n = 44)	
		Mean or n	SD or %
Age (years)		72.6	9.3
Gender	**Men**	14	22%
	Women	30	68%
Dominant side	**Right**	41	93%
	Left	3	7%
Dominant side operated	**Yes**	27	61%
	No	17	39%
Previous shoulder surgery	**Yes**	19	43%
	No	25	57%
Short Form 12 (SF-12)	**Mental**	50.8	12.1
	Physical	29.5	7.3
Simple Shoulder Test score (SST, 0-12)		1.6	1.4
Indications	**Rotator cuff arthropathy**	21	48%
	Proximal humeral non-union/fracture	8	18%
	Shoulder instability	6	14%
	Failed shoulder arthroplasty	8	18%
	Rheumatoid arthritis	1	2%

MATERIALS AND METHODOLOGY

Subjects

Fifty-one patients treated with RSA were enrolled in this prospective cohort study. Indications for surgery included: rotator cuff tear arthropathy, massive rotator cuff tear with pseudoparalysis/anterosuperior instability**,** severe inflammatory arthritis with a large rotator cuff tear, proximal humeral non-union or fracture, and revision from failed conventional arthroplasty. Inclusion criteria were: 1) primary RSA with a Delta III prosthesis[1]; and 2) ability to complete self reported questionnaires in English. Written informed consent was obtained from all the participants. This study was approved by the Institutional Review Board.

Seven of 51 patients were unavailable for follow-up due to death (n=3), relocation (n=1) or lost to follow up (n = 3); leaving 44 patients for data analyses (87% of the original sample). The demographics of these patients are presented in Table **1**. All patients underwent RSA utilizing a standard deltopectoral approach. Post-operatively, a routine sling was employed for 4-6 weeks followed by standard rehabilitation.

Follow-Up

Patients were evaluated before surgery and thereafter at their annual follow-up visits (up to five years). The outcome was defined as outcomes status at 2-years post-surgery, except in cases where this visit was not attended. Since outcomes were stable after two year, when a variable was missing from the two year data set, data from the subsequent follow-up were substituted. The mean follow-up time was 2.2 years.

Evaluations

Outcome measures assessed at each evaluation included: 1) SF-12; 2) Constant-Murley score (CMS); 3) Simple Shoulder Test (SST); 4) range of motion; and, 5) strength. The pain subscale of the CMS was also used to evaluate shoulder pain. At each follow-up visit, patients answered a question pertaining to their overall satisfaction with their shoulder care. The patients were assessed by experienced research assistants following standardized testing protocols. At the end of the study, two independent clinicians adjudicated a global clinical rating of post surgical status based on criteria established through a consensus of postsurgical improvement. This was defined as the Global Clinical Outcome and is similar in concept to a global rating of change sometimes completed by patients, but has the advantage of being based on expert opinion.

Test Procedures

Strength: Maximal isometric strength of shoulder abductors, flexors and internal and external rotators was measured in kilograms using the JTech™ hand held dynamometer[2]. With the patient seated, the arm tested was positioned at 0˚ of elevation and axial rotation, with the elbow at 90° of flexion. Patients performed three trials for each of the muscle group and the average maximal strength was used for data analysis. A strength deficit of 40% or less compared to age-matched normative data was considered as

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functional strength since 60% of normal strength was considered sufficient for function in low demand patients [6].

Range of Motion: Active flexion, abduction, internal rotation and external rotation range of motion were measured in degrees using a goniometer. Flexion and abduction were measured seated with the arm straight, while internal rotation was measured supine with the humerus abducted in the frontal plane to 90° and the elbow flexed to 90°. External rotation was measured in both the sitting (at 0° of abduction) and supine (at 90° of abduction) positions with the elbow flexed to 90°. A range of motion of 100° of flexion and abduction and of 40° of internal and external rotations was considered as a functional outcome. These cut-offs were chosen since most of daily life activities can be performed within these amplitudes [7].

Self-Reported Shoulder Function: The SST was use to assess patient reported shoulder function [8]. The SST consists of 12 questions with dichotomous response options. For each question, patients indicate whether they are able or unable to do the questioned activity. The scores range from 0 (worst) to 12 (best). The SST has been shown to be valid, reliable and responsive [9].

Constant-Murley Score: The CMS is a 100-point scoring system that is divided into four subscales: pain (15 points), activities of daily living (20 points), range of motion (40 points) and strength (25 points) [10]. Pain and activities of daily living are self-reported by the patient using visual analog scales and ordinal categories. Range of motion is obtained during active painfree elevation in flexion and abduction (using a goniometer), and functional internal and external rotation of the shoulder (using ordinal scale). Strength testing was performed at 90° of abduction in the scapular plane with the JTech (maximum of 3 repetitions). Normative scores for the SST and CMS are available for different age groups [6, 11]. For the SST and CMS, a deficiency of 40% or less compared to age-matched normative data was considered as a good functional outcome.

Satisfaction Rating: Satisfaction was rated by the patients by answering the following question: How satisfied were you with your care? The response options were: 0 = not at all, 1 = slightly, 2 = moderately, 3 = quite a bit and 4= extremely. Patients were considered satisfied if they were quite a bit or extremely satisfied (0-2 = unsatisfied, 3-4 = satisfied).

Global Clinical Outcome: A Global Clinical Outcome was determined to incorporate a composite rating of surgical outcomes. The intent was not to suggest this as a means for determining outcomes, but to have some independent comparison standard. An orthopaedic surgeon with experience in performing RSA, a physical therapist who specialized in shoulder rehabilitation, a shoulder surgery fellow and an epidemiologist met at the outset of the study to define guidelines for classification of surgical outcome. The approach was designed to incorporate both indications/ inherent limitations performing a RSA, consideration to preoperative status and improvements required to make the patient more functional. Explicit criteria were defined, which included evaluating changes from preoperative status in terms of pain, physical capability and functional limitations to those achieved two years after surgery. The criteria for a good outcome were: 1) an improvement of active flexion of greater than 50° or a range of motion in flexion of at least 100° without any deterioration compared to baseline; 2) stable or improved active external rotation compared to baseline; 3) no pain at rest and no/minimal pain during activities of daily living; and 4) no postoperative complications that still affected function. Two independent raters (a shoulder physical therapist and a shoulder surgery fellow), not involved in the care of the patients, independently reviewed each patient's clinical file and physical assessment data to determine Global Clinical Outcome. Following independent assessment, raters met to adjudicate any disagreements on Global Clinical Outcome.

Statistical Methods

Five outcomes were used to determine the relative success of the surgery: Global Clinical Outcome, SST, CMS, pain, and satisfaction. For each outcome, patients were dichotomized into categories defined as (1) a successful or good outcome or (2) an unsuccessful or poor outcome. For the SST and CMS, dichotomous station was performed on the basis of percentage deficit: (1) deficit of 40% or less or (2) deficit of greater than 40% compared to age-matched normative data. Pain scores were dichotomized as: (1) above 10/15 or (2) 10 or below. Patient satisfaction rating was dichotomized as those who were: (1) extremely or quite a bit satisfied, versus those (2) moderately, slightly or not at all satisfied.

Agreements between outcome categorizations were evaluated using Cohen's kappa coefficient [12]. Pearson correlations were used to establish relationships of raw scores. Independent *t*-tests were used to compare subgroups having successful *vs* unsuccessful outcomes across different measurement approaches. An alpha level of 0.05 was used for all tests. All analyses were conducted with SPSS[3]. Correlations were not performed when one score was a component of the other (e.g. pain and CMS) since the correlation for these co-dependent measures would be artificially inflated.

RESULTS

Agreement

There was significantly better than chance expected agreement between the Global Clinical Outcome and (a) the CMS total score or its pain subscale, and (b) range of motion in abduction, internal rotation and external rotation (Table **2**). There was also significantly better than chance expected agreement between the SST and (a) the CMS total score or its pain subscale, (b) range of motion in flexion, abduction and external rotation, and (c) isometric strength in external rotation. The agreement between satisfaction and other outcome ratings never exceeded chance expected amounts.

COMPARISON ACROSS SUBGROUPS

Satisfaction

Satisfaction Rating: At the 2 year follow-up visit, 93% (n = 37) of the patients were satisfied with their care, while 7% (n = 3) were not satisfied. There were no significant

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Table 2. Agreement (Cohen's Kappa) Between Clinical Outcomes

Variables		Satisfaction	GCO	SST	CMS-total	CMS-Pain
GGO		0.02	-	-	-	-
SST		0.03	0.25	-	-	-
CMS	**Total**	0.24	**0.53***	0.36*	-	-
	Pain	0.12	0.32*	0.37*	**0.51***	-
ROM	**Flexion**	0.03	**0.63***	0.40*	**0.58***	0.26
	Abduction	-0.04	0.49*	0.47*	**0.50***	0.13
	IR	-0.01	0.22*	0.28	0.07	0.10
	ER (supine)	-0.01	0.33*	0.39*	0.21	0.14
	ER (sitting)	-0.03	0.09	0.20	0.07	0.06
Strength	**Flexion**	0.06	-0.06	0.08	0.08	-0.04
	Abduction	0.08	-0.09	0.19	0.15	-0.06
	ER	-0.03	0.12	0.47*	0.16	0.09
	IR	0.00	0.02	0.06	0.02	-0.05

*Significant agreement ($P < 0.05$); Bold: Agreements above 0.50.
Abbreviations: GCO, Global clinical outcome; SST, Simple Shoulder Test; CMS, Constant-Murley score; ROM, Range of motion; IR, Internal rotation; ER, External rotation.

differences between the satisfied and unsatisfied patients in terms of age, SST, CMS, pain, range of motion and strength (Table **3**). One of the unsatisfied patients had postoperative complications (dislocation), while another had a very low SST score (2/12) and no active external rotation at follow-up visit. The remaining patient did not have any apparent reason for dissatisfaction with the surgery, as the patient had no complications and achieved a maximum score of 12 on the SST.

Global Clinical Outcome

Sixty-eight percent (n = 30) of the patients were characterized has having a good clinical outcome using the clinician based consensus Global Clinical Outcome; whereas 32% (n = 14) were regarded as having a poor outcome. Six of the patients with a poor outcome had substantial postoperative complications. The patients who had good outcome according to the Global Clinical Outcome reported significantly better function on the SST and CMS and less pain (Table **3**). They also had significantly more shoulder flexion, abduction, internal rotation and external rotation at 90° of abduction (Table **3**). Furthermore, they were stronger in isometric internal rotation.

Function

Simple Shoulder Test: At follow-up, 46% (n = 19) of the patients had a 40% or less deficit on the SST compared to age-matched normative data, while 54% (n = 22) had greater than a 40% deficit. Patients with better self-reported shoulder function on the SST had significantly better shoulder function scores on the CMS, but also had better outcome scores in terms of overall health status on both the physical and mental components of the SF-12 (Table **3**). They also had significantly better range of motion in flexion, abduction and external rotation and were stronger in isometric flexion, abduction and internal and external rotation.

Constant-Murley Score: Following surgery, 73% (n = 30) of the patients had a 40% or less deficit with the CMS, as compared to age-matched normative data; while 27% (n = 11) had a greater than 40% deficit. The patients that had a better CMS also scored significantly better on the SST and the physical components of the SF-12 (Table **3**). They also had significantly more shoulder flexion, abduction, and internal and external rotation, and were stronger in shoulder isometric abduction and external rotation (Table **3**).

Pain

CMS pain subscale (*0 = severe pain; 15 = no pain*): Two years after surgery, 62% of patients scored greater than 10 on the pain subscale of the CMS, while 38% scored 10 or less. Patients that had less pain were significantly older (Table **3**). They also scored significantly better on the SST, CMS and the physical components of the SF-12, and had significantly more shoulder internal rotation range of motion and isometric strength.

CORRELATIONS

Significant positive correlations were observed between the two shoulder function scales (Table **4**). Furthermore, the CMS and SST were correlated with: 1) pain level; 2) range of motion; and, 3) isometric strength. Significant positive correlations were also observed between the CMS pain subscale and 1) age, and, 2) range of motion in internal and external rotation at 90° of abduction.

DISCUSSION

This study illustrates that outcomes of RSA varied according to patient's perspective and the assessment method used, with varying rates of concordance between different outcome measures. Patient satisfaction with their care was the outlier in that it was not correlated with other outcomes and exceeded 90% despite substantial residual pain, range of motion and strength deficits and functional

Table 3. Mean (Standard Deviation) for Each Subgroup

Variables		Satisfaction		Global Clinical Outcome		SST Deficit (as % of Normal)		CSM Total Deficit (as % of Normal)		CMS Pain Subscale	
		S	NS	Good	Poor	≤ 40%	> 40%	≤ 40%	> 40%	> 10	≤ 10
Age (years)		73 (10)	78 (4)	73 (9)	71 (9)	70 (8)	75 (10)	72 (9)	72 (9)	75 (8)*	67 (8)*
SST (0-12)		6 (3)	5 (6)	6 (3)*	3 (4)*	8 (2)*	3 (2)*	7 (3)*	2 (2)*	7 (3)*	3 (3)*
CSM (0-100)	**Total**	55 (17	43 (17)	60 (14)*	37 (21)*	65 (13)*	43 (18)*	62 (13)*	28 (14)*	61 (14)*	39 (21)*
	Pain	12 (4.2	10 (5)	12 (4)*	9 (5)*	13 (4)	11 (4)	13 (4)*	8 (5)*	15 (1)*	6 (3)*
SF-12 (0-100)	**Mental**	51 (14	49 (15)	52 (14)	48 (15)	55 (8)*	46 (17)*	52 (14)	45 (16)	53 (13)	45 (15
	Physical	38 (11)	30 (10)	36 (11)	36 (13)	43 (9)*	32 (10*	40 (11)*	29 (6)*	40 (11)*	32 (9)*
ROM (in °)	**Flexion**	117 (33)	87 (77)	128 (27)*	79 (36)*	139 (23)*	94 (38)*	130 (28)*	72 (35)*	122 (28)	101 (50)
	Abduction	107 (37)	77 (67)	122 (33)*	67 (26)*	129 (32)*	84 (37)*	121 (35)*	65 (28)*	111 (34)	97 (50)
	IR	24 (22)	23 (21)	28 (19)*	10 (20)*	31 (24)	18 (18)	28 (11)*	21 (18)*	29 (21)*	15 (20)*
	ER (supine)	25 (28)	27 (46)	32 (5)*	5 (11)*	37 (32)*	14 (23)*	32 (29)*	8 (21)*	31 (28)	14 (29)
	ER (sitting)	18 (17)	15 (22)	21 (18)	11 (11)	24 (19)*	12 (15)*	21 (17)*	9 (12)*	20 (17)	14 (17)
Strength (in kg)	**Flexion**	4 (2)	3 (2)	4 (3)	4 (3)	5 (3)*	3 (2)*	5 (3)	3 (2)	4 (2)	4 (3)
	Abduction	5 (3)	4 (2)	5 (3)	4 (2)	6 (3)*	4 (2)*	5 (3)*	3 (2)*	5 (3)	5 (3)
	ER	3 (2)	2 (2)	3 (2)	2 (1)	4 (2)*	2 (1)*	3 (2)*	2 (1)*	3 (2)	2 (2)
	IR	4 (2)	5 (3)	4 (2)*	3 (1)*	5 (2)*	3 (1)*	4 (2)	3 (1)	4 (2)*	3 (2)*

*Significant differences.
Abbreviations: SST, Simple Shoulder Test; CMS, Constant-Murley score; SF-12, Short form 12; S, Satisfied; NS, Non satisfied; ROM, Range of motion; IR, Internal rotation; ER, External rotation.

Table 4. Correlations Between Clinical Outcomes

Variables		Age	SST	CMS		SF-12		ROM (in °)				
				Total	Pain	Mental	Physical	Flexion	Abd	IR	ER (supine)	ER (Sitting)
Age		—	-0.17	0.04	0.49**	0.03	-0.25	-0.24	-0.32*	-0.01	-0.21	-0.28
SST		-0.17	—	**0.78****	**0.52****	0.34*	**0.64****	**0.62****	**0.56****	**0.52****	**0.55****	0.48**
CMS	**Total**	0.04	**0.78****	—	**0.57****	0.30	0.39*	**0.72****	**0.73****	**0.58****	**0.55****	0.43**
	Pain	0.49*	**0.52****	**0.57****	—	0.33*	0.28	0.18	0.12	0.42**	0.33*	0.14
SF-12	**Mental**	0.03	0.34*	0.30	0.33*	—	0.01	0.13	0.13	0.24	0.16	0.21
	Physical	-0.25	**0.64****	0.39*	0.28	0.01	—	0.28	0.12	0.29	0.26	0.18
Strength	**Flexion**	-0.29	0.38*	0.45**	-0.07	0.15	0.25	0.47**	**0.51****	0.15	0.19	0.40**
	Abduction	-0.36*	0.47**	**0.50****	-0.04	0.19	0.27	**0.52****	**0.57****	0.15	0.23	**0.53****
	ER	-0.27	0.47**	**0.50****	0.01	0.13	0.33*	**0.58****	**0.53****	0.20	0.47**	**0.55****
	IR	-0.14	**0.63****	**0.59****	0.27	0.21	0.44**	**0.51****	0.46**	**0.52****	**0.63****	**0.54****

*Significant at $P < 0.05$; ** Significant at $P < 0.01$. Bold: Correlations above 0.50. Abbreviations: SST, Simple Shoulder Test; CMS, Constant-Murley score; SF-12, Short form 12; ROM, Range of motion; IR, Internal rotation; ER, External rotation.

limitations. From this perspective, patient satisfaction with their care was relatively non-informative. The Global Clinical Outcome process is an extension of an adjudication process sometimes used in clinical trials and allows experts to weight multiple factors and complex considerations. The Global Clinical Outcome, while potentially the best reflection of overall outcome, requires extensive chart reviews with independent expert raters and thus is not practical for routine assessment.

From the remaining standardized outcomes, the SST and CMS seemed to be the best indicator of the overall success of a RSA surgery since they were equally related to impairment, motion and strength scores. The CMS agreed to a greater extent with the Global Clinical Outcome, which may reflect that the subscales of the CMS address the criteria

that the clinicians consider when deciding whether the surgery was successful. Conversely, the SST agreed with categorical subgroups of external rotation range of motion and strength, whereas the CMS did not agree with these subgroups. This suggests that the SST is better at differencing functional subgroups, since external rotation range of motion and strength contributes to functional ability following a RSA [1, 3, 13-15].

The agreements between different outcome measures were fairly low, with only 11 of 51 comparisons exceeding chance. This suggests that conclusions on the success of the treatment would depend heavily on the particular outcome modality chosen. This is an agreement with work done on the elbow rating scales that showed similar discordance between different outcome measures [16]. Two potential reasons could explain the poor agreement between different outcome measuring tools. First, it is possible that the different outcome methods reflect different constructs or perspectives on outcome. In this case, individual results for a particular method of assessing outcome might be true for that perspective, but provide little information on other perspectives. Secondly, it is also possible that, by defining categories of success using specific cut-offs, important information was lost. However, correlations between raw scores confirmed that the relationships between different outcomes are moderate at best. The implications of this are that different outcome measures should be used in clinical practice and research in order to provide a comprehensive view of outcome.

Our methodology required setting the cut-offs for successful versus unsuccessful outcomes. We did this because the decision of success versus failure is a common judgment. We used literature on functional requirements and statistical properties of the measures to establish these cut-offs, but recognize they are somewhat arbitrary. The minimal detectable change (MDC) is a statistical measure defining the smallest difference or change that would be statistically significant when comparing samples. The MDC of SST and CMS are unknown. However, the MDC of the visual analog scale, such as the ones used in the CSM, is 20% [17] and the MDC of other self-report shoulder scales is also close to 20% [17]. Since two standard deviations is a common definition when defining normality, the approach we used for defining the threshold for a successful functional outcome was a variation from normal score that exceeded twice the MDC. Since the actual shoulder strength needed to perform different functional activities has not been determined, the same approach was used to compare strength deficits to normative data. Most of the patients undergoing a RSA will have rotator cuff deficiencies, and therefore significant preoperative weakness [18]. Post-surgical restoration of normal strength is not expected. Since we observed relatively little agreement between functional strength and either functional range of motion or self-report outcomes, it appears that even patients with low levels of strength may be functional following RSA.

Agreements beyond chance were observed between the SST and functional external rotation range of motion and strength; confirming that external rotation is an important aspect of shoulder function. Rotator cuff tear arthropathy can be associated with atrophy or fatty infiltration of infraspinatus and teres minor in patient with a combined loss of active elevation and external rotation [3, 19]. Although RSA can restore active elevation in patient with rotator cuff deficiencies, it cannot restore active external rotation when both the infraspinatus and teres minor muscles are absent or atrophied [2, 3, 20]. Simovitch and colleagues have shown that stage-3 or 4 fatty infiltration of the teres minor compromises the outcome of RSA [20]. In these patients, preliminary results suggest that the addition of a latissimus dorsi and teres major transfer to a concomitant RSA could be an option in order to improve active external rotation and, therefore, function [3].

Our data suggests that patient's satisfaction with their care rating is a poor indicator of shoulder function. Ninety-three percent of the subjects were satisfied even though some of the satisfied patients had less than 50° of shoulder elevation, no active external rotation, moderate to severe pain and postoperative complications. Wall and colleagues observed the same percentage (93.0%) of satisfied patients following RSA [4]. Since patients undergoing RSA are typically older and percent with disability, they have substantially modified their activity expectations. Small improvements in pain relief and physical impairment may improve their ability to complete valued low demand activities. Schmitt *et al.* [5] demonstrated that patient satisfaction ratings do not accurately reflect true change over time since they are heavily influenced by current status. Others have indicated that patient satisfaction is highly influenced by process such as wait times or friendliness of staff. It is also possible that patients appreciate the efforts made to deal with their complex shoulder disability, particularly since other health care providers would have been unable to offer any solution. Only qualitative studies would shed light on the actual thinking of patients in determining this level of satisfaction. However, these findings suggest that healthcare providers should avoid assuming that operation was worthwhile performing because the patient is satisfied with its care.

Complication rates following RSA have been shown to be close to 25% [21]. In the present study, there were a total of eleven complications in nine patients (20.5%). At follow-up, only one patient with postoperative complications was not satisfied and there were no significant differences between patients with and without complications for function, pain, range of motion and strength. Six of the nine patients with complications, however, were considered as having a poor Global Clinical Outcome. This suggests that complications affected clinicians' perspective on surgical success to a greater extent than it did for the patients. Some patients experience complications that require additional surgical procedures and additional medical care but ultimately were more functional than they had been prior to surgery. Complications do not necessarily lead to unsatisfied patients or to poor functional outcomes if they can be adequately resolved. This suggests that patients should be informed not only on the absolute rate of surgical risk, but also what might be required in terms of subsequent management to resolve surgical complications.

This study does have limitations. While we used clinical measurement approaches to dichotomized outcomes, these cut points could not be validated as the best inflection points

for function or success. Furthermore, the wording of the satisfaction question may have influenced patients to reflect on process given that it specifically mentioned satisfaction with their care rather than asking to perform a global rating on their shoulder function or improvement of their condition. Therefore, our findings do not generalize to global rating of change scores sometimes used when evaluating patients. Strengths of this study are the use of a single surgical procedure that exemplifies the challenge in defining surgical success, and that independent evaluators were used to adjudicate outcomes.

CONCLUSION

In conclusion, since different outcome measure do not agree with each other in terms of whether a functional outcome has been achieved, it would be important to sample different constructs-i.e. both measured impairments and self-reported disability. Despite concerns about self-report measures, these were equally or more related to independent expert global assessment than were measures of physical impairments.

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ABBREVIATIONS

CMS	=	Constant-Murley Score
RSA	=	Reverse Total Shoulder Arthroplasty
SST	=	Simple Shoulder Test

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