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Revision for a failed reverse: a 12-year review of a lateralized implant

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Background: The purpose of this study was (1) to evaluate the rates of reverse shoulder arthroplasty (RSA) revisions during a 12-year period, (2) to assess the influence of primary diagnosis and the impact of implant modifications on revisions, (3) to describe surgical management of failed RSA, and (4) to analyze outcomes of patients with minimum 24-month follow-up.

Methods: A retrospective database review identified primary diagnosis for 1418 patients who underwent RSA from 2000 to 2012. A subgroup of 85 patients required return to the operating room for removal or exchange of components. Indication to reoperate, intraoperative management, and outcomes were reviewed. Indications were grouped into 7 categories: baseplate failure, humeral component dissociation, glenosphere dissociation, glenohumeral dislocation, aseptic humeral loosening, periprosthetic fracture, and infection. During the study, design modifications were made to the baseplate, humeral socket, and glenosphere. Surgical strategies were analyzed through operative reports. Range of motion, American Shoulder and Elbow Surgeons scores, and Simple Shoulder Test scores were collected before and after surgery and compared for 58 patients with 2-year follow-up.

Results: Overall revision rate was 6%. Patients undergoing RSA for failed hemiarthroplasty had the highest revision rate (10%). Indications for revision included baseplate failure (2.5%), infection (1.3%), humeral dissociation (0.7%), glenosphere dissociation (0.6%), periprosthetic fracture (0.4%), glenohumeral dislocation (0.4%), and aseptic humeral loosening (0.3%). Baseplate modifications reduced the incidence of baseplate failure to 0.3%. Range of motion and the Simple Shoulder Test and American Shoulder and Elbow Surgeons scores improved.

Conclusion: Although revision RSA is challenging, with higher risk for complications compared with primary RSA, patients still exhibit significant clinical improvements.

Level of Evidence: Level IV, Case Series, Treatment Study.

Keywords: Reverse shoulder arthroplasty; revision shoulder arthroplasty; baseplate failure; humeral loosening; glenosphere dissociation; failed reverse shoulder arthroplasty

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Reverse shoulder arthroplasty (RSA) has become the standard of treatment for cuff tear arthropathy in elderly patients.[5,8,13,14] However, expanding indications coupled with positive results have led to a rapid increase in the use of RSA.[11,17] An estimated 22,000 RSAs were performed in the United States in 2011; more than 80,000 are projected in 2020.[11,19] Consequently, as the population continues to age and patients' desire to remain active increases, more revisions will be required.

Unfortunately, little is known about indications to reoperate or outcomes after revision for failed RSA. Boileau et al looked at 37 patients requiring a return to the operating room for revision RSA during a 12-year period.[4] Frankle et al discussed outcomes after revision for a failed baseplate[16] and described outcomes after revision for periprosthetic fractures.[2] Cusick et al performed a biomechanical analysis of dissociated glenospheres and offered treatment options for this complication.[10] This study's purpose was (1) to evaluate the rates of RSA revisions during a 12-year period, (2) to assess the influence of primary diagnosis and the impact of implant design modifications on revisions, (3) to describe surgical management of failed RSA, and (4) to analyze outcomes of patients with minimum 24-month follow-up. We hypothesized that design modifications made throughout the course of this study will result in a decline in the RSA revision rate.

Table I Description of study population and indications for RSA revision performed by the senior author

	Total (2000-2012)	Failed (2000-2012)
Count	1418	85
Gender		
Female	854 (60.2%)	48 (56.5%)
Male	564 (39.7%)	37 (43.5%)
Age	69.8 ± 10.3	66.7 ± 10.7
Primary diagnosis		
Primary CTA*	649 (45.8%)	26 (4%)
Failed rotator cuff surgery	294 (20.7%)	18 (6.1%)
Failed HA†	251 (17.7%)	26 (10.4%)
Failed TSA	105 (7.4%)	8 (7.6%)
Proximal humerus fracture	79 (3.8%)	3 (3.8%)
Failed ORIF	14 (1%)	0 (0%)
Other‡	26 (1.8%)	4 (15.4%)

CTA, cuff tear arthropathy; *HA*, hemiarthroplasty; *TSA*, total shoulder arthroplasty; *ORIF*, open reduction and internal fixation.

* Includes patients with massive rotator cuff tears with or without arthritis and irreparable tears with preserved range of motion.

† Hemiarthroplasty performed for proximal humerus fractures and cuff tear arthropathy.

‡ Includes resection arthroplasty, chronic dislocation, neuropathic shoulder, and avascular necrosis.

Materials and methods

Indications

We retrospectively reviewed our database and identified the primary diagnosis for all 1418 patients who underwent RSA by the senior author (M.A.F.) between January 1, 2000, and December 31, 2012 (Table I). We identified 111 patients who required a return to the operating room for either a removal or exchange of components. Of the 111 revisions, there were 26 for which the primary RSA was performed at an outside institution. These were excluded from the study. The medical records and radiographs of each of the 85 remaining patients were reviewed to determine the initial primary diagnosis for RSA, chief complaint after surgery, indication to reoperate, timing of the complication, intraoperative management, and outcome after revision surgery.

The primary presentation for patients was an acute increase in pain. In addition, those with baseplate failure, humeral dissociation, glenosphere dissociation, and dislocation had a feeling of instability. The specific cause for reoperation was categorized as follows: (1) glenoid baseplate failure, (2) mechanical dissociation of the humeral component, (3) glenosphere dissociation, (4) glenohumeral dislocation, (5) aseptic humeral loosening, (6) periprosthetic fracture, and (7) infection. Each indication was defined by the following criteria.

Baseplate failure was identified by radiographic changes in the baseplate position over time combined with either the presence of broken screws or increasing lucency surrounding screws (Fig. 1).

Mechanical dissociation of the humeral component was identified by either radiographic separation of the metaphyseal shell from a well-fixed humeral stem or polyethylene socket disengagement from the humeral stem (Fig. 2). Radiographic suspicion of polyethylene disengagement was confirmed with reported intraoperative findings.

Glenosphere dissociation was radiographically identified by isolated failure of the Morse taper engagement to the baseplate (Fig. 3). Serial radiographs were used to confirm changes in glenosphere position, without movement of the baseplate. Intraoperative records also confirmed a well-fixed baseplate.

Glenohumeral dislocation was represented by a radiographic loss of articulation between the glenosphere and humeral socket. Patients with another identifiable source of dislocation, ie, glenosphere or humeral dissociation, were not placed into this category (Fig. 4).

Aseptic humeral loosening comprised a radiographic grossly loose stem without positive pathology, cultures, or elevated inflammatory markers (erythrocyte sedimentation rate, C-reactive protein). In addition, preoperative revision radiographs and operative records were used to assess the grade of proximal humeral bone loss (Fig. 5).

Periprosthetic fractures included only those that required removal or exchange of the humeral component. Stable implants requiring an open reduction and internal fixation and those treated nonoperatively were excluded from this study. Intraoperative records were also reviewed to confirm a loose humeral component.

Infection was diagnosed on the basis of several factors: elevated preoperative inflammatory markers, physical examination findings of erythema or drainage, intraoperative puss, and pathology. During surgery, 4 tissue or bone specimens along with 3