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Complications rates, reoperation rates, and the learning curve in reverse shoulder arthroplasty

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Background: Reverse shoulder arthroplasty (RSA) has ushered a new era in shoulder surgery. However, the results of RSA also described the complication rates associated with the procedure as inordinate and a learning curve associated with the incidence of complications.

Methods: The records of 112 patients who underwent 114 RSA procedures by the senior author (G.I.G.) were reviewed for complications related to a RSA. Of these, 93 RSA procedures were the primary treatment for the shoulder, and 21 were revisions.

Results: The total complication rate for the entire group was 7%. Complications included 3 periprosthetic fractures, 3 hematomas, 1 acromion fracture, and 1 deep infection. The complication rate was 19% in the revision RSA group and 4.3% in the primary RSA group ($P \leq .02$). Complication rates in the initial RSA patients in this series did not differ from the final procedures in this series ($P = .96$). The total reoperation rate was 5.3%, and was 19% in the revision RSA group vs 2.2% in the primary RSA group ($P \leq .02$).

Conclusion: Complications and reoperations associated with a RSA, although significant, occurred at much lower rate than in previous reports. This series demonstrates a significant difference in complication rates and reoperation rates between primary and revision RSA. Revision RSA complications and reoperations were far more common than in primary RSA procedures. No evidence of a learning curve related to surgical experience was demonstrated in this series.

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

Keywords: Complication; reverse shoulder arthroplasty; learning curve; periprosthetic fracture; infection; seroma; scapular fracture

Reverse shoulder arthroplasty (RSA) opened a new chapter in the treatment of rotator cuff arthroplasty when promoted by Professor Grammont beginning in the mid-1980s.[17] The indications for use of the procedure have continued to expand to include failed hemi and total shoulder arthroplasty, fractures and fracture sequela, and insufficiency of the rotator cuff in inflammatory arthritis or rotator cuff tears.[1-3,5,11,14-16,18,20,22,25-29,34-36] Numerous reports have documented significant improvements in pain, motion, and function in patients treated with RSA.[1-3,10,14,22,25,26,36,37,39]

These reports also detail a worrisome aspect of RSA: a vast array of complications and reported high rates of complications associated with the procedure. Complication rates as high as 75% have been reported in series of RSA.[38] There has been disagreement regarding the role of revision surgery and its relation to complication rates in RSA.[16,26,35,37] The concept that these complications are

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part of a surgical learning experience has been detailed in other reports.[21,33,38] The purpose of the current study was to report the incidence of initial complications in a consecutive series of patients treated with a RSA.

Materials and methods

The senior author (G.I.G.) treated 114 shoulders in 112 patients (36 men and 76 women) with RSA between 2006 and 2011. The records of these patients were analyzed for complications and reoperations associated with a RSA. The average age at the time of operation was 64 years (range, 53-86 years). Seventy-three RSAs were performed for patients with painful pseudoparesis caused by a massive irreparable rotator cuff tear. Twenty RSAs were performed for patients with 3- or 4-part proximal humeral fractures and associated greater tuberosity osteopenia. Twenty-one RSAs were performed for revision of a failed procedure, including 3 failed open reduction and internal fixations, 4 failed total shoulder arthroplasties, and 14 failed shoulder hemiarthroplasties. The average length of follow-up was 26 months (range, 12-48 months).

The prostheses used in this series included 7 Delta III (DePuy, Warsaw, IN, USA), 9 Delta Extend (DePuy), and 98 Reverse Shoulder Prostheses (DJ Orthopedics, Austin, TX, USA). Glenosphere prosthesis size included 4 that were 36 mm, 9 that were 38 mm, and 3 that were 42 mm in the Delta 3/Extend system. Glenosphere size in the Reverse Shoulder Prosthesis series included 22 that were 32 mm neutral, 64 that were 32-4, 10 that were 36 mm neutral, and 2 that were 36-4.

All prostheses were implanted through a deltopectoral approach, with the patient in the beach chair position, and with the use of regional anesthesia, general anesthesia, or a combination of both. In all patients with a preserved subscapularis tendon, this was repaired at the end of the procedure. All humeral components in this series were implanted with use of bone cement. A suction drain was used and left in place for 48 hours postoperatively.

The patient was placed into an abduction sling for the first 2 weeks after surgery. This was replaced at 2 weeks with a standard sling to be worn in public and at night. A physician-directed therapy program was initiated, which included passive range of motion. The patient was also instructed to use the extremity for light activities of daily living. The sling was discontinued at 6 weeks postoperatively, and a strengthening program was initiated at 10 weeks.

Statistical analysis of the results was performed using the Pearson χ^2 test, with the Yates correction for continuity used in conjunction. The significance level was set at $P = .05$.

Results

The complication rate and reoperation rate for all patients are reported in Table I and Table II, respectively. A complication occurred in 8 RSA procedures, for a complication rate of 7% for the entire group. Complications for the entire group included 3 periprosthetic fractures (2 type B and 1 type C).[19] There were also 3 postoperative hematomas, 1 scapular fracture (Fig. 1), and 1 deep infection.

Table I Complications of primary and revision reverse shoulder arthroplasty

Type of surgery	Complication	Patients (No.)
Primary	Deep infection	1
Primary	Scapular fracture	1
Primary	Seroma/hematoma	1
Primary	Periprosthetic fracture	1
Revision	Periprosthetic fracture	2
Revision	Seroma/hematoma	2

Table II Reoperations of primary and revision reverse shoulder arthroplasty

Type of surgery	Complication	Procedure	Patients (No.)
Primary	Deep infection	Irrigation and debridement; component exchange	1
Primary	Seroma/hematoma	Irrigation and debridement	1
Revision	Periprosthetic fracture	Open reduction and internal fixation	2
Revision	Seroma/hematoma	Irrigation and debridement	2

A repeat operation was performed in 6 shoulders, giving a reoperation rate of 5.3% for the entire group. Reoperations for the entire group after a RSA included 2 open reduction and internal fixation procedures for type B periprosthetic humeral fractures (Fig. 2). Two irrigation and debridements were performed for postoperative hematomas. One irrigation and debridement was coupled with associated polyethylene and glenosphere exchange for deep infection. The infection occurred within 3 weeks of the primary procedure and resolved with surgical debridement and antibiotics, without further intervention.

Complication and reoperative rates differed significantly when comparing primary reverse shoulder arthroplasty and revision RSA (Table II). The complication rate was 19% in the revision RSA group and 4.3% in the primary RSA group ($P = .02$). The reoperation rate was 19% in the revision RSA group vs 2.2% in the primary RSA group ($P = .02$).

The complication rate for the initial 20 RSA procedures was the 0%. The complication rate in the final 20 procedures in this series was 5% (1 postoperative periprosthetic fracture that was treated nonoperatively; Fig. 3). Complication rates in the initial RSA procedures did not differ significantly vs the final RSAs performed ($P = .96$).

At latest follow-up, scapular notching was observed in 9 of the Delta III and Delta Extend prosthesis. We recorded 5 cases of type I and 4 cases of type II notching.[3] We observed scapular notching on the anteroposterior view of 4 Reverse Shoulder Prosthesis. The notching was classified as type I in all cases.