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Complication rates comparing primary with revision reverse total shoulder arthroplasty

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Background: Complication rates after reverse total shoulder arthroplasty (RTSA) have, in previous series, been reported to be high. The purpose of this study was to describe the complication rates, types, timing, and risk factors after revision RTSA, as compared with primary RTSA.

Methods: We performed a retrospective review of patients who underwent primary or revision RTSA to determine early (within 90 days) complication rates. Complications were subdivided into medical versus surgical and minor versus major.

Results: One hundred thirty-seven patients met the inclusion criteria. Of these, 111 underwent primary RTSA and 26 underwent RTSA as a revision from a previous arthroplasty. The overall complication rates were 25% after primary RTSA and 69% after revision RTSA. Minor complications accounted for 80% of the complications after primary RTSA and 94% after revision RTSA. Surgical complications were more frequent than medical complications in revision patients, occurring in 18% of primary cases and 62% of revisions. Revision patients more frequently required transfusions, with rates of 5% and 31% for primary cases and revisions, respectively. Overall, minor, surgical, intraoperative, perioperative, and postoperative complications were all significantly more frequent after revision RTSA. Multivariate logistic regression showed that revision status was the most significant predictor of overall ($P < .001$), minor ($P < .001$), surgical ($P < .001$), intraoperative ($P = .002$), and postoperative ($P < .001$) complication rates. Medical complications were predicted by body mass index ($P < .001$).

Conclusion: Revision RTSA has a significantly higher rate of complications than primary RTSA. These patients are significantly more likely to require transfusions. Patients should be aware that minor complications are frequent after revision RTSA and should be counseled accordingly.

Level of evidence: Level III, Retrospective Cohort Study, Treatment Study.

Keywords: Complications; revision; reverse total shoulder arthroplasty; medical; surgical; transfusion

This study was approved for exemption from institutional review board (IRB) review by the Rush University Medical Center Research and Clinical Trials Administration Office because it was deemed that "this research involves the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens, if these sources are either publicly available or if the information is recorded by the investigator in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects." The IRB exemption was approved and obtained for this study under protocol 11102407-IRB01.

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Although reverse total shoulder arthroplasty (RTSA) was initially designed for rotator cuff tear arthropathy, indications have expanded to include massive rotator cuff tears without glenohumeral arthritis, proximal humeral fractures, glenohumeral osteoarthritis in the setting of irreparable rotator cuff tears, and revision arthroplasty.[8,14] Although RTSA has been associated with significant improvements in patient satisfaction, symptoms, and function,[1,12,20,23,28] complication rates have ranged from 19% to 68%.[27,35] Surgical complications include but are not limited to periprosthetic fracture, hematoma, periprosthetic sepsis, instability, acromial fracture, glenoid baseplate failure, scapular notching, damage to the axillary nerve, heterotopic ossification, glenoid component dissociation, scapular fracture, and blood-loss anemia requiring transfusion.[5,8,9,13,33,36] Previously identified risks factors for complications after RTSA include a body mass index (BMI) greater than 35 kg/m^2 or less than 25 kg/m^2.[2,17,19]

RTSA used to revise a previous failed primary arthroplasty provides significant improvements in patient pain and range of motion,[18,21,24,25,31,34] with rates of patient satisfaction as high as 89%.[3] Isolated outcome studies of revision RTSA have shown high surgical complication rates comparable with or higher than primary RTSA.[3,14,15,21,24,26,31,34] However, there is a paucity of studies directly comparing complication rates in primary and revision RTSA, as well as determining whether these rates are because of the revision nature of the surgical procedure or underlying patient characteristics.

The primary specific aim of this study was to compare the complication rates in patients who underwent either primary or revision RTSA by a single surgeon in a consecutive series of patients. The secondary aim was to determine whether revision versus primary status was a more or less important driver of complication rates than patient characteristics. We hypothesized that revision RTSAs would have significantly higher complication rates and that revision status would be the most important predictor of complication rates.

Materials and methods

This is a comparative retrospective cohort study. Patients who underwent either primary or revision RTSA by the senior author (G.P.N.) between October 2007 and April 2011 with a minimum of 90 days' postoperative follow-up were included for analysis. The preoperative indications for primary RTSA included a massive irreparable rotator cuff tear with pseudoparalysis, rotator cuff tear arthropathy, inflammatory arthropathy in the setting of a rotator cuff tear, glenohumeral osteoarthritis in the setting of an irreparable rotator cuff tear, and proximal humeral fracture sequelae. The preoperative indications for revision RTSA included failed hemiarthroplasty due to glenoid arthritis and/or rotator cuff deficiency and failed total shoulder arthroplasty due to glenoid loosening and/or rotator cuff deficiency. Patients were excluded if the RTSA had been performed as a revision of a failed open reduction–internal fixation procedure or as a revision of an antibiotic-laden polymethyl methacrylate spacer placement because these were not revisions from arthroplasty components. Patients with incomplete records were also excluded.

Preoperative consultation notes, operative reports, perioperative inpatient records, and postoperative clinic notes were reviewed, and the following data were recorded: age, sex, BMI, laterality of the dominant extremity, laterality of the RTSA, whether the procedure was a revision or primary arthroplasty, indication for the RTSA, medical comorbidities, length of surgery in minutes, estimated intraoperative blood loss in milliliters, implants, concurrent procedures, whether intraoperative or postoperative transfusion was necessary, postoperative length of inpatient hospital stay in days, need for admission to the intensive care unit (ICU), and any complications. The decision to perform transfusion with packed red blood cells was made by the attending orthopaedic surgeon on a case-by-case basis. Our institution does not have binding policies regarding when a postoperative transfusion can or must be given.

The Charlson Comorbidity Index (CCI) was calculated for all patients included in this study. This is a validated tool used in surgical patients to predict their long-term mortality risk based on their medical comorbidities. The CCI assigns medical conditions such as diabetes mellitus, heart disease, renal dysfunction, and cancer history scores ranging from 1 to 6 based on a rising quantitative contribution to mortality risk.[6,7,10]

Complication classification

Complications were categorized using a previously validated classification system.[4,11,17] Any malevolent event deviating from the normal intraoperative, perioperative, or postoperative course was deemed a complication. These events were then subdivided into minor versus major and medical versus surgical. In general, minor complications are non–life threatening and require only pharmacotherapy, whereas major complications are life or limb threatening and require prolonged pharmacologic treatment, surgical intervention, or repeat hospitalization. Medical complications are systemic, whereas surgical complications occur locally at the surgical site. Examples of each subdivided classification are as follows: minor medical complications include ileus and clinical/radiographic atelectasis; minor surgical complications include local cellulitis, wound drainage, and acute blood-loss anemia requiring transfusion; major medical complications include myocardial infection, deep vein thrombosis, and pulmonary embolus; major surgical complications include periprosthetic fracture requiring additional fixation, deep infection requiring debridement, and instability requiring reduction or revision.

Statistical analysis

All analyses were performed using Excel X software (Microsoft, Redmond, WA, USA) and SPSS software, version 18 (IBM, Armonk, NY, USA). Descriptive statistics were calculated first. Kolmogorov-Smirnov analysis was performed on continuous variables, and Mann-Whitney U tests or Student t tests were performed as appropriate based on data normality. Statistical comparison of categorical variables was performed with the Pearson χ^2 test. Multivariate binary logistic regression was