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Complication rate and implant survival for reverse shoulder arthroplasty versus total shoulder arthroplasty: results during the initial 2 years

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Background: The use of reverse total shoulder arthroplasty (RTSA) has significantly increased in recent years. However, there is large variance in reported complication rates and sparse data on implant survival. This study used a statewide patient database to investigate complication rates and implant survival for RTSA.

Methods: All patients undergoing RTSA or total shoulder arthroplasty (TSA) from 2011 to 2013 were identified within a statewide database. The complication and revision rates at 30 days, 90 days, 1 year, and 2 years postoperatively were determined. Potential risk factors for complications were analyzed with logistic regression, and Kaplan-Meier survival curves were used to compare implant failure.

Results: During the 3-year period, 10,844 procedures (6,658 TSA; 4,186 RTSA) were found within the database. The all-cause complication rate at 90 days and 2 years postoperatively was significantly higher for RTSA ($P < .001$). RTSA patients had a significantly increased risk of infection ($P < .05$) and dislocation ($P < .001$) in the early and midterm postoperative course. Workers' compensation, male sex, preoperative anemia, and those aged younger than 65 years had a significantly higher risk for complications ($P < .001$). Although RTSA initially had a higher rate of implant failure than TSA during the early postoperative period, this rate equalized at approximately the 1-year mark.

Conclusion: RTSA patients had significantly higher complication rates compared with TSA patients, with identifiable risk factors for all-cause complications postoperatively and equivalent accepted implant failure at 2 years.

Level of evidence: Level III; Cross Sectional Design; Large Database Analysis

Keywords: arthroplasty; complications; statewide; database; shoulder

The use of shoulder arthroplasty has grown tremendously during the past decade. In recent prevalence data from 2004 to 2008, the number of shoulder arthroplasty procedures performed increased by approximately 3000 cases each successive year compared with fewer than 400 cases each year prior.[16] This trend is likely to continue. Multiple factors, including increased number of shoulder specialists, increased elderly population, improved implant selection and techniques, and expanding indications secondary to the introduction of the reverse total shoulder arthroplasty (RTSA) to the United

This study was exempt from Institutional Review Board review at our institution because it used a publicly disseminated database.

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States orthopedic community in 2003, likely contribute to this rise.

Modern RTSA was developed in France by Grammont et al[8] to treat rotator cuff arthropathy. This design, using a medialized center of rotation, later gained U.S. Food and Drug Administration (FDA) approval for use in the United States in November 2003. Although designed for rotator cuff arthropathy, indications for use have also more recently been expanded to include proximal humeral fractures and subsequent sequelae as well as arthroplasty in which there is insufficient glenoid bone stock for the polyethylene glenoid component of an anatomic total shoulder arthroplasty (TSA).[3-5,9,24]

The increased use of RTSA with its expanding indications has resulted in higher complication rates and unknown implant survival. Complication rates for RTSA have been reported ranging from 4.8% to 68%, which is in stark comparison with the more established TSA, with reported complication rates of approximately 10%.[1,6,9,25] However, these results are from relatively small cohort studies with a single surgeon or institution. This limits the ability of these studies to provide accurate complication rates that may be generalized nationwide.

By contrast, using a large database may provide more accurate estimates due to the large sample size from multiple institutions. Although prior database studies have investigated postoperative complications during the initial admission, to our knowledge, no prior study has investigated postoperative complications beyond this time period.[14,22,23] Given the increasing scope of RTSA use, determining the early and midterm complication rate and implant survival is critical.

The goal of this study was to use a mandatory statewide database to identify complication rates and implant survival, as defined by implant revision, during the initial 2-year postoperative period. We hypothesized that RTSA would be associated with higher complication rates and lower implant survival than TSA.

Materials and methods

Data from the California Office of Statewide Health Planning and Development (OSHPD) state discharge database was used for this study. This mandatory database collects data from all public and private inpatient hospitals, ambulatory surgery (AS) centers, and emergency departments (EDs) in the state of California, excluding the Shriner's hospital system. Data collected include patient demographic information, such as age, sex, and race/ethnicity, as well as pertinent medical history such as diagnosis and total hospital charges.

Diagnosis and procedure codes can be searched using the International Classification of Diseases, Ninth Revision (ICD-9) or Current Procedural Terminology (CPT; American Medical Association, Chicago, IL, USA) billing codes. The primary advantage of using the OSHPD database is that individuals are identified through a record linkage number that is constant for all admissions. Thus, any later ICD-9 code or CPT code assigned to a patient during any future admission, ED visit, or surgery can be identified using the record linkage number.

Inclusion and exclusion criteria

ICD-9 codes 81.80 and 81.88 were used to screen inpatient data from 2011 to 2013 for patients with a primary procedure of a TSA or RTSA, respectively. Before 2011, there was no unique ICD-9 code for RTSA. Patients with a history of humeral fracture (midshaft or below), chronic dislocation, malignancy, active or chronic shoulder infection, or hardware removal were excluded from the cohort. A full list of inclusion and exclusion diagnosis codes are listed in Appendix S1.

Outcomes investigated

Our identified cohort was stratified by procedure type and history of fracture. Age, gender, ethnicity, primary health insurance, hospital case volume, hospital teaching status, hospital bed size, hospital TSA and RTSA case volume, and comorbidities (congestive heart failure, hypertension, diabetes, peripheral vascular disease, obesity, chronic kidney disease, depression, anemia, rheumatoid arthritis) were documented and assessed for each readmission. The record linkage number was used to identify any subsequent readmission to an inpatient hospital, AS center, or ED setting in the state of California after the index procedure from 2011 to 2013.

Annual trends were determined by tabulating the total number of cases by year for RTSA and TSA and dividing by the total number of patients in the inpatient database by year (provided by the OSHPD). Because there was no specific ICD-9 procedure code or CPT code that identifies revision shoulder arthroplasties before 2013, revision cases were identified when an ICD-9 code for RTSA or TSA was listed in a subsequent readmission. We recognize that this may indicate a shoulder arthroplasty on the contralateral extremity; however, similar to other database studies, the coding used does not differentiate for laterality.[7]

The primary complications investigated were shoulder pain, stiffness, infection, dislocation, mechanical, hemorrhage, thromboembolic, and neurovascular. These complications were identified if the corresponding ICD-9 diagnosis code was flagged in a subsequent readmission. For a full list of the ICD-9 codes used for each complication investigated, refer to Appendix S1. All-cause complication rates at 1 year postoperatively were used to identify risk factors for readmission. The all-cause complication rate was defined as the total complication rate for the primary complications identified in this study. Two-year outcomes data were reported for individuals who received a shoulder arthroplasty in 2011. Similarly, 1-year outcomes data were provided for those who received a shoulder arthroplasty in 2011 or 2012.