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Use of reverse total shoulder arthroplasty in the Medicare population

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Background: Reverse shoulder arthroplasty (RSA) has been Food and Drug Administration approved in the United States since 2004 but did not obtain a unique code until 2010. Therefore, the use of this popular procedure has yet to be reported. The purpose of this study was to examine the use and reimbursement of RSA compared with total shoulder arthroplasty (TSA) and shoulder hemiarthroplasty (SHA).
Methods: We analyzed the 100% sample of the 2011 Medicare Part A claims data for patients aged 65 years or older. Patient demographic characteristics, diagnoses, provider information, reimbursements, and lengths of stay were extracted from the claims data.
Results: In 2011, a total of 31,002 shoulder arthroplasty procedures were performed; 37% were RSAs, 42% were TSAs, and 21% were SHAs. Osteoarthritis was the primary diagnosis code in 91% of TSAs, 37% of SHAs, and 45% of RSAs. A primary diagnosis of osteoarthritis with no secondary code for rotator cuff tear was found in 22% of patients undergoing RSA. The mean length of stay for RSA (2.6 days; SD, 2.1 days) was longer than that for TSA (2.1 days; SD, 1.5 days) and shorter than that for SHA (3.5 days; SD, 3.6 days) ($P < .001$). Lower-volume surgeons (<10 arthroplasties per year) performed most shoulder arthroplasties: 57% of RSAs, 65% of TSAs, and 97% of SHAs. Seventy percent of RSAs were implanted by surgeons who performed more RSAs than TSAs and SHAs combined.
Conclusions: RSA is performed with similar frequency to TSA and almost twice as much as SHA in the Medicare population. Lower-volume surgeons perform most RSAs, and a majority of surgeons perform more RSAs than all anatomic shoulder arthroplasties combined.
Level of evidence: Epidemiology Study, Database Analysis.

Keywords: Shoulder arthroplasty; reverse shoulder arthroplasty; Medicare claims data

Reverse total shoulder arthroplasty has been Food and Drug Administration approved in the United States since 2004. Early reports from European surgeons showed complication rates as high as 50% and recommended that reverse total shoulder arthroplasty be reserved for patients older than 70 years with low functional demands and ''severe shoulder dysfunction caused by an irreparable

The patient data are deidentified and publicly available; therefore, the study was exempt from requiring institutional review board approval.

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rotator cuff tear associated with other glenohumeral lesions."[6,24] More recently, there has been increasing interest in expanded indications including acute proximal humeral fractures, late fracture sequelae, osteoarthritis (OA) with severe glenoid deformity and an intact cuff, post-traumatic arthritis, and revision shoulder arthroplasty.[20,23] Despite these expanded indications and the widespread use of reverse shoulder arthroplasty (RSA), its use has yet to be reported in the United States. Until 2010, the *International Classification of Diseases* code for RSA was the same as that for an anatomic total shoulder arthroplasty (TSA). As a result, little has been known about the overall use and cost of this new technology. With the implementation of a new *International Classification of Diseases* code for RSA, its use can now be examined.

Multiple studies have evaluated trends in the use of all shoulder arthroplasties but none specific to RSA.[3,7,12,14] One of these studies, by Kim et al,[14] reported a sharp increase in the incidence of TSA in 2004 with an increased linear slope in the number of shoulder arthroplasties performed after 2004 compared with before. They postulated that this was related to the Food and Drug Administration approval of RSA in the United States and pointed out that further studies were needed to identify the use of RSA along with its safety and efficacy.

The US Medicare population includes more than 40 million persons aged 65 years or older and is the single largest insurer for the elderly. Medicare claims data have been used previously to examine treatment patterns, outcomes, and trends in hip, knee, and shoulder arthroplasty.[2,3,10-12,15-18,21] The 2011 Medicare Part A claims data allow for the examination of the use of TSA, shoulder hemiarthroplasty (SHA), and RSA in the United States.

The purposes of this study were to examine and compare the current use of RSA with that of TSA and SHA in the Medicare population in the United States and to provide data on the potential impact of cost. Our hypotheses are that RSA accounts for a substantial portion of the volume and costs associated with shoulder arthroplasty in the Medicare population and that RSAs are implanted for a variety of diagnoses, in addition to cuff tear arthropathy.

Methods

In this retrospective study, we analyzed claims submitted by hospitals and hospital outpatient clinics (Medicare Part A) from January 1 through December 31, 2011. Individual claims submitted to Medicare for payment were deidentified and encrypted by the Centers for Medicare and Medicaid Services (CMS) and were then made available for qualified health care researchers. These claims records reflect the medical service for elderly Medicare beneficiaries who receive care through the conventional fee-for-service program, not including beneficiaries enrolled in the Medicare Advantage plans (ie, Medicare Part C) or beneficiaries who were Medicare eligible because of disability or end-stage renal disease. The CMS made both 100% and 5% samples of these claims records available for investigators, and the 100% data from 2011 were used in this study.

Claims associated with TSA, SHA, and RSA were identified and extracted using the appropriate procedure codes in accordance with the *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM). Upper extremity revision procedures, identified by ICD-9-CM code 81.97, were excluded from this analysis. Patient demographic characteristics, diagnoses, provider information, reimbursements, and length-of-stay data were also extracted from the claims data using the ICD-9-CM where appropriate. Diagnoses were categorized into 1 of 9 categories based on a predetermined algorithm (Table I). These diagnoses were evaluated for the primary diagnosis associated with the RSA, as well as a separate evaluation for any secondary diagnoses. Provider data were categorized by procedure volume for the operating surgeon. Providers were categorized by the number of arthroplasties performed per year in Medicare patients as very low volume (1-5), low volume (6-10), moderate volume (11-20), or high volume (>20) using the identifier for the operating surgeon. This was based on clinically meaningful cutoff values based on those used by Jain et al.[10,13] Length-of-stay data and hospital payments were analyzed for each procedure type. Data were stratified for patients with a principal diagnosis of fracture/dislocation with comparison to other diagnoses.

To estimate the proportion of the national procedure volume that was captured by our Medicare Part A analysis, we compared the Medicare Part A procedure counts with those reported by the Healthcare Cost and Utilization Project (HCUP) Nationwide Inpatient Sample (NIS) (http://hcupnet.ahrq.gov/).[8] This provided an estimate of the total nationwide volume for all ages and payers in the United States.

Standard errors for procedure counts from the HCUP NIS data have been presented as reported by the online database. Standard errors were not required for the Medicare procedure counts because the 100% sample was used. Mean values for age, length of stay, and claim payments were compared for the Medicare population between procedure types using a 1-way analysis of variance with post hoc Bonferroni testing (IBM SPSS Statistics, version 20; IBM, Armonk, NY, USA).

Results

There were a total of 31,002 shoulder arthroplasty procedures that met our inclusion criteria in the Medicare Part A population. Of these, 37% were RSAs, 42% were TSAs, and 21% were SHAs (Table II). Two thirds (66%) of all RSA recipients were female patients. This proportion of female recipients was greater than that for TSA but smaller than the proportion of female recipients of SHAs (Table II). Within the studied population, recipients of RSAs were approximately 2 years older than recipients of TSAs ($P < .001$) but approximately the same age as recipients of SHAs ($P = .614$) (Table II). The proportions of admissions that were classified as emergent or urgent were 10%, 5%, and 30% for RSA, TSA, and SHA, respectively (Table II). The mean length of stay for RSA was 2.6 days, varying from 2.3 days for high-volume surgeons to 2.8 days for very low–volume surgeons ($\eta^2 = 0.01$). This was