

Reverse Total Shoulder Arthroplasty: Impressive Recent Increase in Utilization

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Introduction

Reverse total shoulder arthroplasty (rTSA) is a surgical procedure performed to manage certain pathologies that affect the glenohumeral joint. Unlike an anatomical shoulder replacement, the “cup” is placed into the proximal head of the humerus and the metal ball is fixed to the glenohumeral socket. Reverse total shoulder arthroplasty (rTSA) has become an increasingly utilized procedure for patients with a wide variety of shoulder pathology. In spite of a considerable complication rate, reverse total shoulder arthroplasty has experienced a large increase in utilization between 2011 and 2014.¹ Largely due to the relative success of the reverse shoulder implant in treating rotator cuff arthropathy—since FDA approval in 2004—indications for this procedure have been expanded to include many other diagnoses: including proximal humeral fractures and glenohumeral arthritis. Given the increasing focus on health care utilization and value-based care, it is essential to understand the volume and value of rTSA procedures performed in the United States. The purpose of this manuscript is to describe the utilization, current patient demographics, and economic data associated with reverse total shoulder

arthroplasty (rTSA) procedures performed in outpatient centers across the United States.

Methods

The National Inpatient Sample comprises a 20% weighted sample of discharges from US hospitals (excluding rehabilitation and long-term acute care hospitals) and represents 96% of the US population. The NIS database was queried for Reverse Total Shoulder Arthroplasty in the United States for incidence, mean length of stay (LOS), mean age, mean hospital charge, mean hospital costs, national bill, national costs, sex, payer type, hospital teaching status, and hospital owner type. These data were queried between 2011 to 2014.

Results

Between 2011 and 2014, 114,650 reverse total shoulder arthroplasty surgeries were performed. In 2011, 21,155 surgeries were performed. This increased by 180% to 38,180 in 2014. The incidence (per 100,000 individuals) over this same timeframe increased by 176% from 6.8 to 12. Over this period, there was a mean of 28,663 surgeries performed per year.

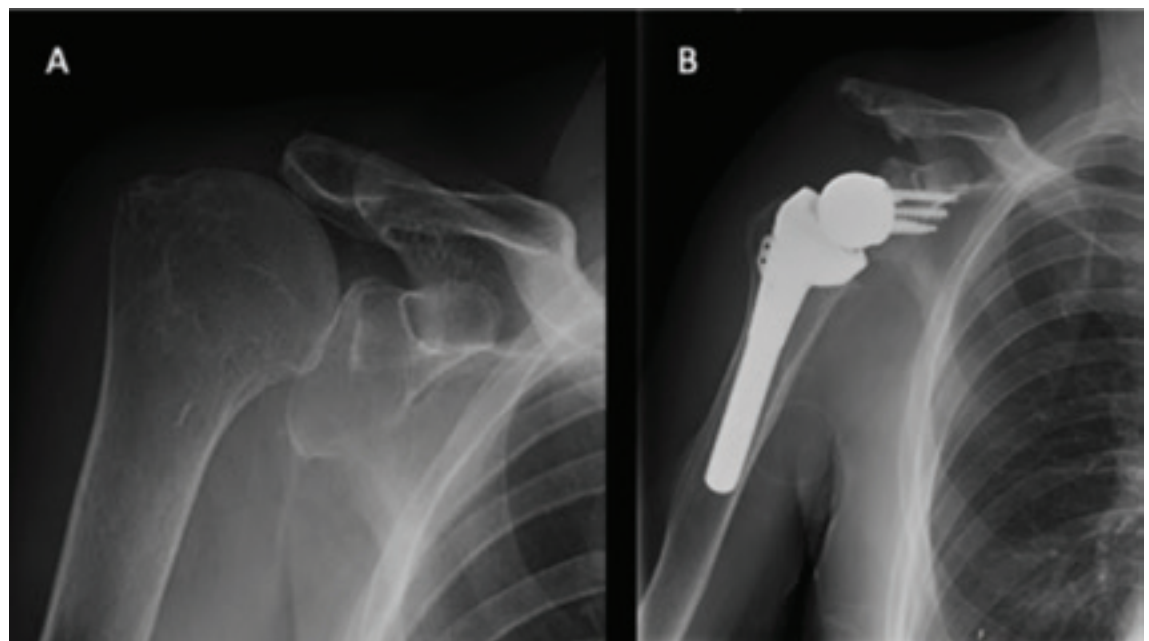


Figure 1: Reverse Total Shoulder Arthroplasty. (A) A radiograph of rotator cuff tear arthropathy; (B) A radiograph of reverse shoulder arthroplasty. (Surgeon: John Kelly)

Table 1. Demographic and Economic Data of patients who receive rTSR

	2011	2012	2013	2014
Total Number	21,155	24,465	30,850	38,180
Incidence Per 100,000	6.8	7.8	9.8	12
Hospital Charge	\$64,813	\$66,086	\$68,480	\$70,820
Hospital Cost	\$19,196	\$20,124	\$20,091	\$19,724
National Bill	\$1,356,197,540	\$1,551,620,170	\$2,002,124,985	\$2,580,087,647
Mean Age	71.9	72.6	72.5	72.7
Mean LOS	2.6	2.5	2.4	2.4
Payer Type				
% Medicare	79%	78%	80%	76.5%
% Medicaid	1%	2%	2%	2%
% Private	15%	16%	14%	16%
Hospital Ownership				
% Gov. Owned	13%	9%	9%	10%
% Non Profit	15%	15%	16%	15%
% For Profit	14%	15%	16%	15%
Teaching Status				
Urban Teaching		49%	48%	63%
Urban Non-Teaching		39%	42%	23%
Rural		9%	11%	11%

The mean hospital charge for rTSA, defined by the mean amount that the hospital charged for a specific procedure, was \$64,813 in 2011, and increased by 9.3% to \$70,820 in 2014. The mean hospital cost, which represents the mean cost of production of a specific procedure, was \$19,196 in 2011 and increased by only 2.8% to 19,724 in 2014. The cost-charge difference—as defined by the difference between mean hospital charge and cost—increased significantly from \$45,617 to \$51,096 in 2014; this reflects a 12.0% increase. The aggregate charge, also called the national bill, is the sum of all charges for all hospitals for all rTSA performed in the US. This increased from nearly \$1,356,197,540 in 2011 to \$2,580,087,647 in 2014—a 90% increase.

The mean age of patient was 72.4 years and the mean length of stay was 2.5 days post-surgery. Over this period, 36% of patients were male and 64% of patients were female. 78.3%, 1.7% and 15% of patients were insured with Medicare, Medicaid or private insurance, respectively. 10% of these procedures were performed at government owned hospitals. 75% of these procedures were performed at private, not for profit hospitals, and 15% occurred at private, for profit hospitals.

Discussion

There been an explosive, 180%, increase in the utilization of rTSR surgery in the United States between 2011 and 2014. This

has been accompanied with a 10% increase in the amount that hospitals charge, an only 2.8% increase in the cost of the for this surgery over this time period. This increase in the amount that hospitals charge could be partially driven by the inherent large cost of the implant itself, which Coe et al report to cost approximately \$12,000—which is 61% of the hospital cost of the procedure in 2014.¹

This increase in both cost and utilization is particularly concerning because of a notable complication rate for the surgery which is naturally associated with increased costs as well.^{2,3} In 2011, Walch et al found the complication rate to be 19%.⁴ In 2007, Wall et al found the complication rate to be unacceptably high, at 68%.⁵ In 2016, Barco, et al reported that the complication rate for primary rTSA was 15%, a lower, however still substantial rate. Typical complications of rTSA include: instability, infection, notching, loosening, nerve injury, acromial and scapular spine fracture, and component disengagement.⁶

Since FDA approval of rTSR in 2004, it has been used for an increasing number of “off label” indications for which it has not been officially improved.⁷ The sizable increase in utilization of this procedure demands close inspection of how much value rTSA affords patients, especially in comparison to lesser invasive alternatives, such as partial arthroscopic rotator cuff repair or superior capsular reconstruction.⁸

The limitations of this study are primarily due to the intrinsic nature of utilizing a large patient database. The NIS database does not include physician based-fees, however the hospital-specific cost-to charge ratios have been validated by the Agency for Healthcare Research and Quality. Since the NIS is based on ICD-9 billing codes, any inaccuracies in a hospital's billing record will be reflected in the data in the NIS.

In summary, rTSR has an increasing utilization rate, hospital charge and a both high and increasing complication rate. In addition to this, demographic information about the rTSR patient population was identified. The goal of this study was not to determine the cause of these observed trends, but to identify these trends and relate them to one another.

Conclusions

These data show an increase in utilization and hospital charge for this procedure-which is particularly concerning when considering the high and increasing complication rate. Understanding this economic data in addition to the demographic data of the patient population is the first step to

allowing the medical community to make better decisions to provide improved value-based-care with respect to rTSR.

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