Increasing Rates of Reverse Total Shoulder Arthroplasty in the Treatment of Geriatric Proximal Humerus Fractures in the United States, 2010-2018

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INTRODUCTION:
In the surgical management of geriatric proximal humerus fractures (PHFx), open reduction and internal fixation (ORIF) has historically been the dominant option compared to hemiarthroplasty (HA). However, since its development, reverse total shoulder arthroplasty (RTSA) has been increasingly applied as a primary treatment for challenging fractures and has been associated with improved outcomes and shorter hospitalizations. We aim to analyze the trends, complications, and costs associated with the surgical management of geriatric PHFx using a large national database.

METHODS:
The National Inpatient Sample (NIS) was queried from 2010 to 2018 to identify patients aged 65 or over who sustained PHFx undergoing ORIF, reverse or anatomic shoulder arthroplasty (SA), HA using ICD-9 and ICD-10 diagnostic and procedure codes. ICD-9 procedure codes did not reliably distinguish between reverse and anatomic shoulder arthroplasty, so shoulder arthroplasty generally was reported. Multivariable regression was used to evaluate differences between fixation methods regarding health care utilization metrics, hospital costs, and index hospital complications.

RESULTS:
A total of 94,227 surgically managed PHFx patients were identified between 2010 and 2018, with the total number increasing from 10,464 in 2010 to 12,335 in 2018. The proportion of patients undergoing open reduction internal fixation (ORIF) decreased from 58.6% in 2010 to 28.6% in 2018 (p<0.001), while the proportion undergoing SA increased from 9.5% in 2010 to 64.8% in 2018 (p<0.001, Figure 1). The vast majority of SA operations were RTSA compared to TSA from 2016-2018 (97.1% vs. 2.9%). Hospital costs decreased over time for patients treated with SA ($576 / year, p<0.001, Figure 2), but increased for those treated with ORIF ($279 / year, p<0.001). Length of stay (LOS) decreased significantly for all patients, but decreased most substantially for SA patients (0.24 days / year, p<0.001, Figure 3), followed by HA patients (0.11 day/year, p=0.003) and ORIF patients (0.04 days/year, p=0.03).

On multivariate analysis, ORIF patients were more likely to be younger (p<0.001) and have a higher comorbidity score (p=0.002). The hospital costs of SA and HA were $6,423 and $3,667 more than ORIF after controlling for age, comorbidity, and other factors (p<0.001 for both). The length of stay (LOS) was 0.55 days less for SA compared to ORIF (p<0.001); the difference between HA and ORIF was not significant. SA patients were significantly less likely to undergo non-home discharge compared to ORIF (OR 0.68, p<0.001), while HA patients were more likely (OR 1.1, p=0.02). The overall incidence of any complication was 30.3%, with the most common being postoperative blood transfusion (19.2%). On multivariate analysis, SA patients had significantly lower rates of blood transfusion compared to ORIF (OR 0.72, p<0.001), while HA patients had a higher rate (OR 1.28, p<0.001). SA patients also had significantly lower rates of wound complications (OR 0.48, p=0.01), pneumonia (OR 0.66, p<0.001), and other pulmonary complications (OR 0.70, p<0.001) compared to ORIF patients.

DISCUSSION AND CONCLUSION:
RTSA is now the dominant treatment modality in the surgical management of proximal humerus fractures in elderly patients. RTSA is associated with lower LOS but higher hospital costs, likely secondary to implant costs. Index hospital complications are reduced in RTSA patients compared to ORIF patients, driven largely by a lower rate of blood transfusion in RTSA patients compared to ORIF patients.