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ORIGINAL ARTICLE

The impact of solid organ transplant history on inpatient complications, mortality, length of stay, and cost for primary total shoulder arthroplasty admissions in the United States

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Background: There is a growing population of patients with history of solid organ transplant (SOT) surgery among total joint patients. Patients with history of SOT have been found to have longer lengths of stay and higher inpatient hospital costs and complications rates after hip and knee arthroplasty. The purpose of this study was to determine whether this is true for shoulder arthroplasty in SOT patients.

Methods: The Nationwide Inpatient Sample was queried to describe relative demographic, hospital, and clinical characteristics, perioperative complications, length of stay, and total costs for patients with a history of SOT (International Classification of Diseases-9th Edition-Clinical Modification V42.0, V42.1, V42.7, V42.83) undergoing shoulder arthroplasty (81.80, 81.88) from 2004 to 2014.

Results: A weighted total of 843 patients (unweighted frequency = 171) and 382,773 patients (unweighted frequency = 77,534) with and without history of SOT, respectively, underwent shoulder arthroplasty. SOT patients were more often younger and more likely to be male, have Medicare, and undergo surgery in a large teaching institution in the Midwest or Northeast ($P < .001$). SOT patients had higher or similar comorbid disease prevalence for 27 of 29 Elixhauser comorbidities. The risk of any complication was significantly higher among SOT patients (15.5% vs. 9.3%, $P = .007$). SOT patients experienced inpatient admissions an average 0.27 days longer ($P < .001$) and \$1103 more costly ($P = .06$) than non-SOT patients.

Conclusions: Patients with history of SOT undergoing shoulder arthroplasty appear to remain a unique population due to their specific vulnerability to minor complications and inherently increased inpatient resource utilization.

Level of evidence: Level III; Retrospective Cohort Design using Large Database; Treatment Study

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Keywords: Shoulder arthroplasty; total shoulder arthroplasty; reverse shoulder arthroplasty; perioperative outcomes; solid organ transplant; complications

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For the past 2 decades, the prevalence and survival of solid organ transplant (SOT) patients has continued to increase for almost every solid organ.²⁰ By 2015, the number of living patients with functioning renal transplants exceeded 200,000, more than doubling since the year 2000.⁵ From years 2004 to 2015, the prevalence of living patients with a functioning hepatic transplant nearly doubled to more than 74,000 patients.⁷ In 2016, there was an all-time high of 33,500 organ transplants.¹³ The combination of improving surgical techniques with the new immune-suppressing medical therapies make it likely that SOTs will continue to be effective life-saving procedures that increase in prevalence. As more patients with SOT are able to live to longer, it is reasonable to expect

that more of these patients will require joint arthroplasties due to vascular necrosis from chronic immunosuppression or age-related degenerative diseases.

Patients undergoing joint arthroplasty after SOT present unique challenges to consider. Since 1998, the rate of primary hip and knee arthroplasty after SOT has increased more than 48% and 400%, respectively,^{10,14} with frequencies increasing each year. Overall, the prevalence of transplanted solid organs among total hip and knee patients has been estimated between 0.07% and 0.3%.^{8,10,14} Primary hip and knee arthroplasty after SOT has been associated with longer inpatient length of stay and higher total costs and complication rates.^{1,10,14} Due to these patient's suppressed immune system,

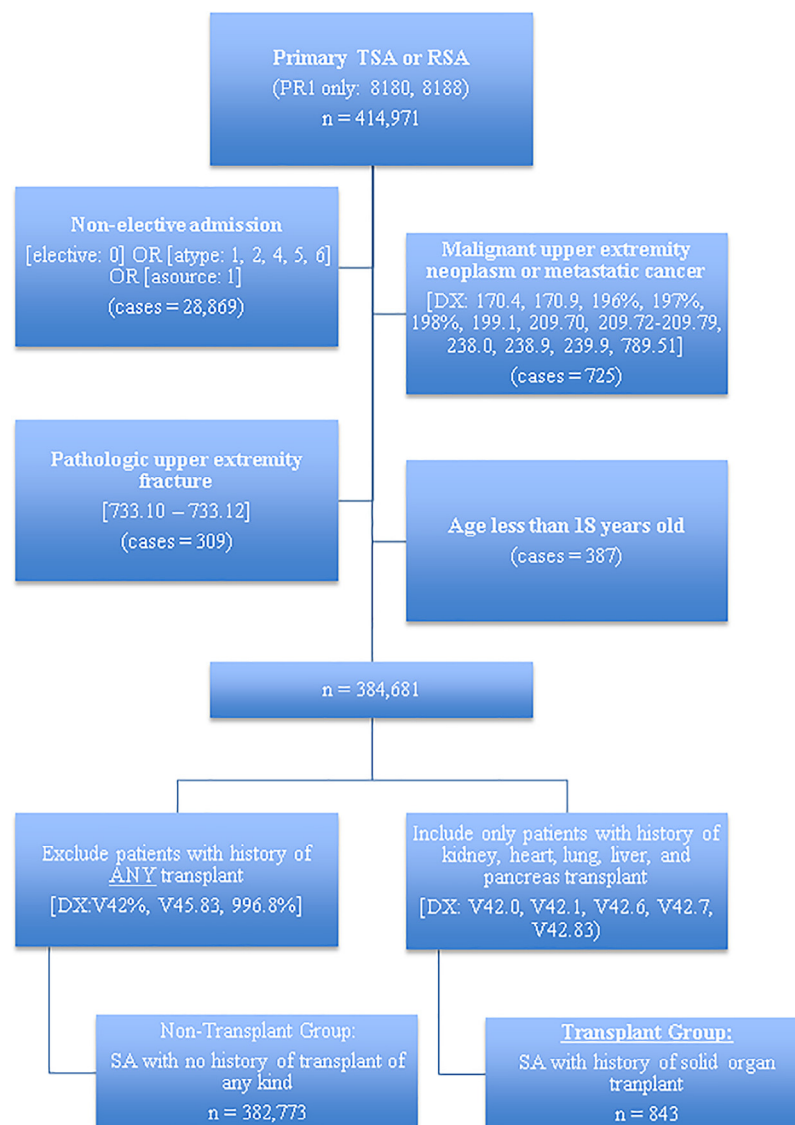


Figure 1 Shoulder arthroplasty transplant vs. nontransplant patient selection from 2004 to 2014. Schematic of inclusion and exclusion criteria leading to ultimate cohort selection. The “n” indicates estimated national prevalence calculated using sampling weights provided by the Nationwide Inpatient Sample. Diagnosis codes ending in “%” include all respective 4-digit diagnosis codes, unless otherwise specified. All diagnosis and procedural codes: *TSA*, total shoulder arthroplasty; *RSA*, reverse shoulder arthroplasty; *atype*, admission type; *asource*, admission source; *DX*, International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) diagnosis codes, principal (*DX1*) and secondary (*DX2-DX25*); *PR*, ICD-9-CM procedure codes, principal (*PR1*) and secondary (*PR2-PR15*).

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