OPEN Research Article

After Primary Total Shoulder Arthroplasty, Factors Associated with Returning to the Same Surgeon for Subsequent Total Shoulder Arthroplasty

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ABSTRACT

Background: Total shoulder arthroplasty (TSA) is commonly done for degenerative conditions. Patients may need additional contralateral TSA or ipsilateral revision TSA. As a marker of patient satisfaction and practice integrity, factors associated with return to the same or different surgeon are of interest.

Methods: Patients undergoing TSA were abstracted from the PearlDiver data set. Subsequent TSA within 2 years was identified. Factors analyzed included age, sex, comorbidity burden, prior depression diagnosis, insurance type, reverse versus anatomic TSA, ipsilateral versus contralateral surgery, and postoperative adverse events. Patients returning to the same surgeon versus different surgeon were compared with multivariable analysis.

Results: 98,048 TSA patients were identified, with 8483 patients (8.7%) undergoing subsequent TSA within 2 years. Of those, 1,237 (14.6%) chose a different surgeon. Factors associated with changing surgeons were revision surgery on the ipsilateral shoulder (OR:2.47), Medicaid insurance (OR:1.46), female sex (OR:1.36), any adverse events (OR:1.23), and higher Elixhauser Comorbidity Index (OR:1.07 per point), while prior depression diagnosis was associated with decreased odds (OR:0.74) of changing surgeon ($P < 0.05$ for all).

Discussion: When pursuing a subsequent TSA, only a minority of patients changed to a different surgeon. Factors identified associated with changing to a different surgeon may help guide measures to improve patient satisfaction and practice integrity.

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Total shoulder arthroplasty (TSA) is a common procedure performed for degenerative conditions of the shoulder, with more than 100,000 cases performed each year.[1] The number of TSAs performed in the United States has risen and projected to continue to grow in the coming decades.[2] As most primary TSAs are due to osteoarthritis,[3] which is common

bilaterally,[4] it is not uncommon for patients to require a second TSA for their contralateral shoulder.[5] Furthermore, ipsilateral revision TSA may be required for some patients, with revision TSA making up 5% to 12% of all shoulder arthroplasty and becoming increasingly common in the United States.[6,7]

One such marker of a patient's satisfaction and trust in a surgeon is if they choose to return to that surgeon for a subsequent related operation. Past work in total hips and knee arthroplasty by Moore et al[8] demonstrated specific factors such as age or experiencing an adverse event after a patient's index surgery were associated with the patients choosing a different surgeon to perform a subsequent related surgery. It was proposed that understanding factors associated with continuing with the same surgeon or choosing a different surgeon for such subsequent surgeries would help better understand mechanisms of what leads to patient's approval of their surgeon and their operation.

Previous studies have investigated what affects patient perception of success with surgical interventions. Khatib et al[9] also showed that clinical and nonclinical patient factors, such as comorbidity burden and type of insurance, were markedly associated with patient's satisfaction and perception of success after total knee arthroplasties. Other fields, such as colorectal surgery, have shown that complications after surgery have been associated with decreased patient's trust in one's physician and markedly hinder the physician-patient relationship.[10,11] Notably, good physician communication with proper expectation management before their surgery has been shown to minimize harm to the physician-patient relationship.[10] Patients with higher degrees of trusts in their physicians have been linked to having improved outcomes[12,13] and better protocol adherence.[14]

With increasing incidence of TSA and the potential need for revision TSA or contralateral TSA, understanding factors associated with staying with the same surgeon/changing surgeon is of interest. This study aimed to leverage a large, national database to assess clinical and nonclinical factors that might affect a patient's decision to return to the same surgeon versus choosing a different surgeon for subsequent TSA.

Methods

Patient Cohort

This study used data from the 2015 – Q1 2022 M161Ortho PearlDiver Mariner Patient Claims Database (PearlDiver Technologies, Colorado Springs), a large national data set that contains both inpatient and outpatient information from multiple insurances across the United States. This data set has been extensively used prior in the literature for shoulder studies.[15-19] Our Institutional Review Board has determined that studies using this are exempt from requiring review as data output in aggregated and deidentified form.

Patients undergoing primary TSA were identified using International Classification of Disease (ICD)-10 procedural codes ICD-10-P-0RRJ00Z, ICD-10-P-0RRK00Z for reverse TSA and ICD-10-P-0RRJ0JZ, ICD-10-P-0RRK0JZ, ICD-10-P-0RRJ0J6, ICD-10-P-0RRK0J6, ICD-10-P-0RRJ0J7, ICD-10-P-0RRK0J7, ICD-10-P-0RRJ07Z, ICD-10-P-0RRK07Z, ICD-10-P-0RRK0KZ, and ICD-10-P-0RRJ0KZ for anatomic TSA. The sidedness of each surgery was determined based on the ICD-10 codes, and patients with "unspecified sidedness" were excluded. In addition, patients who present with concomitant trauma, neoplasm, and infection were excluded. Patients were then filtered for their first instance of these codes in the data set to identify their first surgery.

Patient characteristics were identified and tabulated, including age, sex, Elixhauser Comorbidity Index (ECI, a comorbidity burden index often used in shoulder and elbow literature),[20] prior depression diagnosis, insurance plan, if they had any adverse events within 90 days after their index surgery (adverse events were based on aggregated complications as described by prior literature),[21-23] whether their indexed surgery was done as either anatomic or reverse TSA, and whether their subsequent surgery was done on the ipsilateral or contralateral side of the indexed surgery. Adverse events were an aggregated variable of the following individual adverse events: surgical site infection, sepsis, deep vein thrombosis, pulmonary embolism, myocardial infarction, cardiac arrest, pancreatitis, pneumonia, urinary tract infection, acute kidney injury, wound dehiscence, transfusion, or hematoma.

Subsequent Total Shoulder Arthroplasty

Patients with a subsequent TSA within the next 2 years after the index surgery were identified using ICD-10 procedural codes. The sidedness of the second surgery was determined (based on whether it was a contralateral or ipsilateral revision compared with the index procedure). Notably, this was then filtered to ensure that only the first subsequent TSA for each patient was captured.

The surgeon of the subsequent TSA was determined to be the same or different of the surgeon of the indexed procedure. To do so, Pearldiver Bellwether Software

determines the number of surgeons that the patient had for their TSAs and determines if the subsequent surgeon had the same or different physician identifier as the index surgery.

Data Analysis

Univariable analysis was done to compare differences in patients who returned to the same surgeon versus those who chose a different surgeon. All continuous variables (age and ECI) were compared with a Student *t*-test, while categorical variables (sex, depression, insurance plan, type of TSA, location of subsequent TSA, and adverse events) were compared with a chi-square test. Then, multivariable logistical regression was done to determine independent factors associated with changing surgeons. Odds ratios and 95% confidence intervals (CI) were determined.

All analysis was done using PearlDiver Bellwether's built in RSuite software (Pearldiver Inc). All figures were created using GraphPad Prism 10 (GraphPad Software). Significant values were determined as $P < 0.05$ for all analysis.

Results

A total of 98,048 TSA patients identified of whom 8483 patients (8.7%) underwent a subsequent TSA within 2 years. Of those patients, 1,237 (14.6%) had a different surgeon perform the second procedure (Figure 1).

Patients change to a different surgeon were significantly younger (67.2 vs. 68.9 years of age, $P = 0.007$), more likely to be female (60.6% vs. 54.3%, $P < 0.001$), of higher ECI (7.7 vs. 6.6, $P < 0.001$), more likely to have commercial insurance (55.6% vs. 51.7%, $P < 0.001$), more likely to have their subsequent surgery performed on the ipsilateral shoulder (48.0% vs. 26.8%), and more likely to have a postoperative adverse event (12.7% vs. 8.3%, $P < 0.001$). No statistically significant difference was observed in depression or the type of primary TSA (reverse vs. anatomic; Table 1).

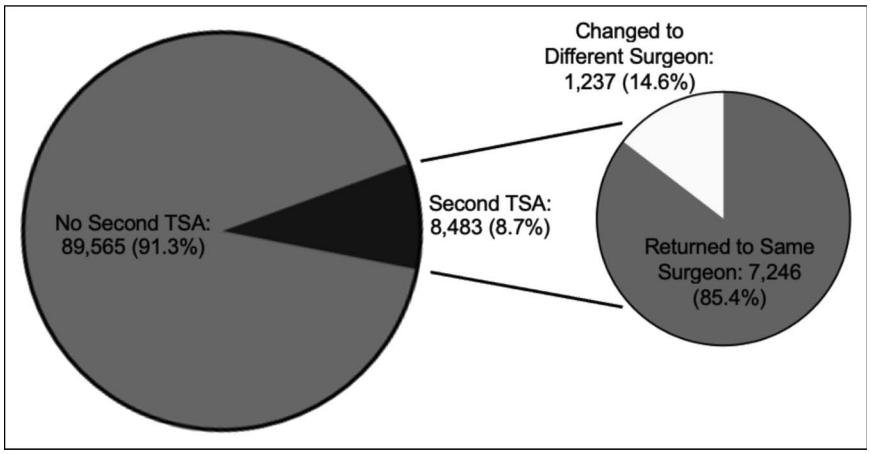
On multivariable analysis, factors associated with changing surgeon (in descending OR): operation on the ipsilateral shoulder (OR: 2.47, 95% CI: 2.17-2.80, $P < 0.001$), Medicaid insurance (OR: 1.46, 95% CI: 1.05-1.99, $P = 0.020$), female sex (OR: 1.36, 95% CI: 1.20-1.55, $P < 0.001$), any adverse events after their initial surgery (OR: 1.23, 95% CI: 1.00-1.49, $P = 0.042$), and ECI (OR: 1.07 per point, 95% CI: 1.05-1.09, $P < 0.001$). Prior depression diagnosis was associated with decreased odds (OR: 0.74, 95% CI: 0.64-0.85, $P < 0.001$) of changing surgeons for one's subsequent TSA (Table 1). No significant differences were observed in odds for age, commercial insurance, or type of primary TSA (reverse vs. anatomic; $P > 0.05$, Figure 2).

Discussion

With the growing number of index TSAs performed each year, it is of interest to define how often patients who need subsequent TSA (contralateral primary or ipsilateral revision) choose to return to their same versus different surgeons. This had not previously been assessed in the TSA patient population.

This study identified 98,048 TSA patients of whom 8,483 (8.7%) had a subsequent TSA within two years. Of those,

Figure 1



A pie chart showing all patients who underwent total shoulder arthroplasty (TSA) and how many underwent a subsequent TSA within 2 years. A subplot is shown dividing patients based on whether they returned to same surgeon or changed to a different surgeon for their subsequent surgery.

Table 1. **Patient Characteristics of Those Who Returned Versus Those Who Changed Surgeons for Their Subsequent Total Shoulder Arthroplasty and Multivariable Analysis of Factors Associated With Changing Surgeons**

Characteristics	Univariable Analysis		Multivariable Analysis (Odds of Changing Surgeons)		
	Return to Same Surgeon	Change to Different Surgeon	*P*	OR (95% CI)	*P*
Cohort size (n)	7246 (84.4%)	1237 (14.6%)			
Age	68.9 (8.7)	67.2 (8.8)	**0.007**	1.01 (0.94-1.09)	0.630
Sex			**<0.001**		
Male	3314 (45.7%)	487 (39.4%)		REF	REF
Female	3932 (54.3%)	750 (60.6%)		1.36 (1.20-1.55)	**<0.001**
ECI	6.6 (3.8)	7.7 (4.0)	**<0.001**	1.07 Per Point (1.05-1.09)	**<0.001**
Depression	2893 (39.9%)	512 (41.4%)	0.347	0.74 (0.64-0.85)	**<0.001**
Insurance			**<0.001**		
Medicare	3162 (43.6%)	466 (37.7%)		REF	REF
Commercial	3743 (51.7%)	688 (55.6%)		1.12 (0.98-1.28)	0.085
Medicaid	249 (3.4%)	60 (4.9%)		1.46 (1.05-1.99)	**0.020**
Primary TSA			0.680		
Reverse	4085 (56.4%)	689 (55.7%)		REF	REF
Anatomic	3161 (43.6%)	548 (44.3%)		1.06 (0.93-1.20)	0.388
Secondary TSA			**<0.001**		
Contralateral shoulder	5302 (73.2%)	643 (52.0%)		REF	REF
Ipsilateral shoulder	1944 (26.8%)	594 (48.0%)		2.47 (2.17-2.80)	**<0.001**
Any adverse event after initial surgery	600 (8.3%)	157 (12.7%)	**<0.001**	1.23 (1.00-1.49)	**0.042**

ECI = Elixhauser Comorbidity Index, TSA = total shoulder arthroplasty
Bold indicates significance of $P < 0.05$.

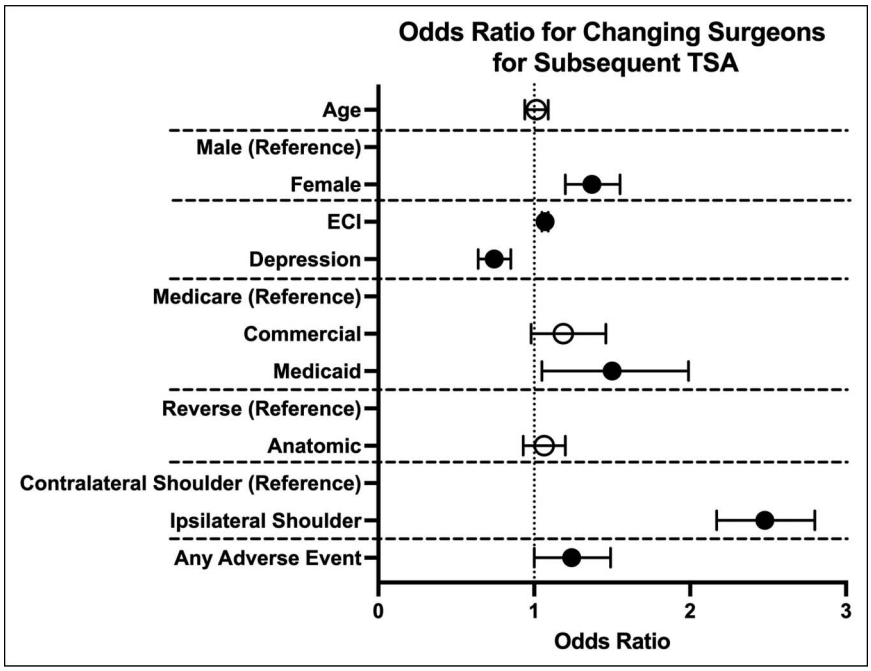
only a minority of patients (1,237, 14.6%) changed surgeons for their subsequent surgery. Compared with total hip and total knee arthroplasty,[8] this represents a relatively low percentage of patients who change surgeons for their subsequent TSA and may be linked to the very high patient satisfaction previously reported for this procedure.[24,25,26,27]

Two outcome-related events were associated with patients choosing to change surgeons for a subsequent TSA: revision of ipsilateral shoulder (OR:2.47) and experiencing an adverse event within 90 days of index surgery (OR: 1.23). Requiring revision of the same shoulder was the strongest predictor of changing surgeons. Shields et al demonstrated that patients who require revision arthroplasty have markedly lower satisfaction scores, possibly due to pessimism regarding their functional outcomes.[28] This outlook likely contributes to patient's decisions to change to a different surgeon given their views.

Similarly, experiencing a postoperative complication has been strongly associated with decreased trust in the physician and markedly lower satisfaction with the outcome.[29-31] In an analogous fashion, patients undergoing total hip and knee arthroplasty who more likely to choose a different surgeon if they experience an adverse event.[8] Although complications can greatly affect a patient's trust in the patient-physician relationship, surgery is not without risks, and some complications may be unavoidable. It is important to emphasize proper communication and education with patients, which has been shown to minimize this effect.[10]

Specific patient factors, including female sex (OR: 1.36) and ECI (1.06 per point), were also associated with changing surgeons for subsequent surgery. Previous literature has suggested that sex corelates with clinical outcomes after TSA, with women having less

Figure 2



Forest plot showing odds ratio and 95% confidence intervals of changing surgeons for subsequent TSAs.

improvement in postoperative scoring compared with their male counterparts.[32,33] This difference in clinical and functional outcomes may contribute to female patients seeking a different surgeon due to less satisfactory patient-reported outcomes compared with men.

A notable nonclinical factor associated with changing surgeons was Medicaid insurance (OR:1.44). Over the last decade, Medicaid expansion in many states in the United States has led to increase access for patients,[34] which may have contributed to choosing a different surgeon for their subsequent surgery. Another factor which may have contributed to a patient changing surgeons is that the surgeon themselves no longer accepts Medicaid insurance, and thus, the patients were effectively limited from returning to the same surgeon. This is in contrast to the total hips and joints literature, which had suggested that Medicaid patients were less likely to change surgeons for their subsequent surgeon.[8] This difference could be attributed to overall difference in the patient's population between the cohorts.

Depression was the only factor analyzed which was associated with decreased odds of changing surgeons. The reason for this association is unclear, given that depression has been linked to decreased satisfaction with their healthcare experience.[35] Other factors, such as age and type of TSA, were nonstatistically significant in their contribution toward changing surgeons for subsequent TSA. Past studies have suggested a relationship between patient's age and surgical satisfaction[36,37]; however, this does not seem to have independently affected patients in this study.

This study is not without its limitations. It relies on retrospective data collection of administrative data and thus is unable to make causative statements, only associations. In addition, precise individual patient information is not available; thus, exact factors that might have affected where certain patients did or did not choose to return could not be determined. Finally, it is important to acknowledge that a surgeon is just one member of a large multidisciplinary team and that the other members of the team can have a notable influence on an individual patient's surgical experience that would not have been captured by this study.

In conclusion, among primary TSA patients who underwent either revision ipsilateral or primary contralateral shoulder TSA surgery, only a minority of patients (14.6%) changed to a different surgeon from their index procedure. Revision surgery on the ipsilateral shoulder, Medicaid insurance, female sex, adverse events during the initial surgery, and higher ECI score were associated with changing surgeons.

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