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Are all total Movement Disorders the Same? Total Joint Arthroplasty in Patients with Tardive Dyskinesia and Parkinson's Disease in the National Inpatient Sample 2000-2013

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Abstract

Background: As the number of total joint arthroplasty (TJA) procedures increases, orthopedic surgeons encounter more complex patients with a variety of comorbidities and polypharmacy.TJA in patients with a movement disorder can present additional challenges and considerations for the orthopedic surgeon. Current evidence suggests impaired outcomes following TJA for patients with Parkinson's disease (PD). Patients with tardive dyskinesia (TD) likely experience similar outcomes. We used the Healthcare Utilization Project National Inpatient Sample (HCUP-NIS) to describe perioperative outcomes in patients with tardive TD following TJA and compared results to a similar cohort of patients with PD.

Methods: We included patients who underwent primary total knee arthroplasty (TKA) or primary total hip arthroplasty (THA) between 2000-2013. We extracted and analyzed demographic information of patients with TD and PD, and compared length of stay, hospital charges, and risk of in-hospital complications following TJA.

Results: Of the estimated 10.3 million TJA cases in 2000-2013, 0.3% were patients with TD and 0.5% patients with PD. Those with TD were significantly younger and more likely to be female, Caucasian, and carry private insurance. After adjusting for these confounders, there was no significant difference in length of inpatient stay and cost of hospitalization between TD and PD patients following TJA. Complication risk was similar for patients with TD and PD; patients with TD were more likely to have gastrointestinal complications and less likely to require blood transfusions.

Conclusion: Patients with TD undergoing TJA can anticipate a similar perioperative course to patients with PD.

Keywords: *Total knee Arthroplasty (TKA); Total Hip Arthroplasty (THA); Movement Disorder; Parkinson's Disease; Tardive Dyskinesia*

Introduction

Total joint arthroplasty (TJA) is a proven and effective intervention for the relief of joint pain. Approximately 2 million implants are placed annually, accounting for approximately $5 billion in reimbursements [1]. The number of procedures is projected to increase over the next several decades [2, 3]. As the incidence of TJA increases and captures a greater segment of the population, orthopedic surgeons will encounter patients with a variety of comorbidities and corresponding poly pharmacy. Accordingly, surgeons must be aware of their effects on outcome and the potential for surgical complications.

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Tardive dyskinesia (TD), a movement disorder that affects between 5-24% of long-term dopaminergic antagonist users, is increasing in prevalence [4-6]. TD has a range of influence on musculoskeletal control, characterized by involuntary muscle movements, including oro-buccal-lingual movements such as repetitive jaw, face, and lingual movements. TD can also limit control of pelvic, trunk, and limb movements [7, 8] which can have potentially deleterious effects on patient outcomes following TJA.

Current literature contains scant data on outcomes for TJA in patients who have neurological conditions with a musculoskeletal component [9]. For surgeons encountering a patient with TD, a natural reference might be patients with Parkinson's disease (PD). Research shows additional challenges and impaired outcomes for TJA recipients with PD [10]. It is unknown whether the experience of patients with TD will be similar to those with PD, or whether each movement disorder is unique and thus should be individually analyzed, especially given the increase of TJA in patients with movement disorders. We analyzed a large, nationally-representative sample of

patients undergoing TJA to characterize TD patients who had the surgery, and to determine whether their outcomes differed from those of PD patients undergoing the same surgery.

Methods

We used the Healthcare Utilization Project National Inpatient Sample (HCUP-NIS) 2000-2013 to investigate patients with TD and PD who underwent TJA. The NIS is a nationally-representative, stratified clustered sample of hospital discharges managed by the Agency for Healthcare Research and Quality [11]. We extracted all cases of inpatient total knee or total hip replacement using codes from the International Classification of Diseases, 9th revision (ICD-9 81.54 or 81.51). We identified patients with TD using the ICD-9 codes 333.85 (Tardive dysinesia); 333.82 (oral-facial dyskinesia); 333.99, 781.0 (akathisia); 333.71 (athetosis); 307.3 (stereotypy); 307.20, 351.8 (facial tics); 333.81 (blepharospasm). We identified patients with Parkinson's disease using the ICD-9 codes 332.0 and 332.1. We extracted demographics for each patient, including age, sex, race, geographical region (by US Census Division), and primary insurance.

For each inpatient stay, we extracted HCUP-NIS data on total charges and the length of stay, and noted the presence of complications prior to discharge: central nervous system (including stroke), cardiac (including acute myocardial infarction), peripheral vascular, respiratory, gastrointestinal, genitourinary, bleeding, post-operative infection, cellulitis, pneumonia, pulmonary embolism, pulmonary insufficiency, lower-extremity venous thrombotic events, blood transfusion, incision/debridement, dislocation of prosthetic joint, periprosthetic fracture around prosthetic joint, post-operative shock, wound problems, sepsis and mortality. Due to NIS data usage restrictions on publishing cell counts smaller than 10, we aggregated TKA and THA complication daa. We analyzed all hospital charge data in 2013 US Dollars [12].

To account for the complex sampling design of HCUP-NIS, we used the SVY commands in Stata v14.2 to obtain nationally-representative estimates (Stata Corp, College Station, TX). We used chi-square and t-tests to compare patients with TD to those with PD. We used linear regression models to compare the mean length of stay and mean hospital charges between patients with TD and PD. Logistic regression models were used to compare the odds of complications between the two patient populations. All models included demographic covariates to control for potential confounding. We conducted all analyses with a two-sided alpha level of 0.05.

Results

Among patients in the HCUP-NIS who had TJA (2,175,448 cases; 67% TKA, 33% THA) from 2000-2013, we identified 6,617 patients with TD and 11,650 patients with PD of the estimated 10.3 million national TJA cases from 2000-2013, 0.3% were patients with TD [Table 1, 31,610 estimated surgeries, 95% CI: 29,664 to 33,556] and 0.5% were patients with PD (56,252 estimated surgeries, 95% CI: 53,859 to 58,645). Relative to patients with Parkinson's Disease, those with Tardive dyskinesia were significantly younger, and were more likely to be female, white, have private insurance, and live in the East North Central States (OH, WI, MI, IL, IN). Patients with Parkinson's disease were significantly more likely to be Hispanic or Asian/Pacific Islander, to have Medicare, and to live in Mid-Atlantic or Pacific States (NY, PA, NJ; CA, WA, OR, AK, HI).

For total knee arthroplasty, patients with Tardive dyskinesia did not differ from patients with Parkinson's disease with respect to length of hospital stay,after controlling for age, sex, race, insurance coverage, and geographic region [Table 2]. Similarly, the duration of hospital stay after total hip arthroplasty did not differ significantly between patients with TD and those with PD, after adjusting for the these confounders. Total charges for TKA and THA were slightly higher for patients with PD relative to patients with TD, although these differences were not statistically significant after adjusting for the aforementioned confounders.

Inpatient complication risk following TJA was low in patients with movement disorders. For most complications, the risk was less than 1%, and did not differ between patients with TD and PD: central nervous system (including stroke), cardiac (including acute myocardial infarction), peripheral vascular, respiratory, bleeding, post-operative infection, cellulitis, pneumonia, pulmonary embolism, pulmonary insufficiency, lower-extremity venous thrombotic events, incision /debridement [Table 3]. After TJA, patients with TD were significantly more likely to have gastrointestinal complications relative to patients with PD, after controlling for age, sex, and race (OR=1.74, 95% CI:1.08, 2.79). Patients with TD were less likely than PD to require transfusions, after adjusting for age, sex, and race (OR=0.85, 95% CI: 0.77, 0.95). Due to small cell counts (smaller than 10), we were unable to quantify the risk of dislocation of prosthetic joint, periprosthetic fracture around prosthetic joint, post-operative shock, or wound problems, as per requirements of the HCUP-NIS data usage agreement.

Discussion

This is the first study to compare TJA outcomes in a nationally-representative cohort of patients with Tardive dyskinesia and Parkinson's disease. In our analysis of over two million cases of total knee arthroplasty and total hip arthroplasty, we found that after controlling for demographics, patients with TD had, on average, hospital stays of similar length to patients with PD. Patients with TD had no significant differences in hospital charges for total knee arthroplasty or total hip arthroplasty relative to patients with PD. Similarly, there were no significant differences in risk of in-hospital complications between the two groups, with the exception that patients with TD were more likely to develop gastrointestinal complications and less likely to require blood transfusions. The observed increase in GI complications in patients with TD is likely due to the antipsychotic medications linked to this disorder; these antipsychotics act as dopamine antagonists, increasing risk of GI dismotility. The observed increase in transfusions for PD patients is most likely reflective of the increased surgical dissection and effort required to obtain adequate exposure to perform TJA in these patients. Overall our findings suggest that surgeons treating patients with TD should expect similar outcomes in their patients with PD.

We found that patients with TD were more likely to be younger, Caucasian, female, and have private insurance than patients with Parkinson's disease. These findings are consistent with the proposed dose- dependent antipsychotic induced etiology of TD [13, 14] and the fact that PD has high prevalence among older adults, affecting approximately 1% of the population over age 60 [15]. Although a relatively small proportion of patients undergoing TJA have either TD or PD (0.3% and 0.5%, respectively) this represents over 87,000 cases nationwide over the study period, underscoring the importance of examining such subpopulations. Orthopedic surgeons can expect increased likelihood of encountering this patient group, given the increasing prevalence of movement disorders in an aging population and a higher than anticipated prevalence of drug related movement disorders in younger demographics with exposure to antipsychotic therapeutics [16, 17].

Table 1: Characteristics of Patients with Tardive Dyskinesia or Parkinson's disease Undergoing Total Knee Arthroplasty or Total Hip Arthroplasty in the National Inpatient Survey,

		Tardive Dyskinesia	Parkinson's Disease	p
	Cases Nationwide	31,610 (29,664-33,556)	56,252 (53,859-58,645)	-
	% of all TKA cases	0.3 (0.3-0.3)	0.5 (0.5-0.6)	-
Age	Mean	68.2 (67.9-68.5)	72.8 (72.6-72.9)	<0.001*
Sex	Male (%)	31.4 (30.2-32.5)	48.5 (47.5-49.5)	<0.001*
Race	White (%)	92.9 (92.0-93.9)	89.7 (88.9-90.5)	<0.001*
	Black (%)	3.0 (2.4-3.5)	3.0 (2.6-3.3)	0.931
	Hispanic (%)	1.9 (1.5-2.4)	4.3 (3.7-4.8)	<0.001*
	Asian or Pacific Islander (%)	0.5 (0.3-0.7)	0.9 (0.7-1.2)	0.003*
	Native American (%)	0.2 (0.1-0.4)	0.2 (0.1-0.3)	0.811
	Other (%)	1.4 (0.9-2.0)	1.9 (1.5-2.3)	0.075
Insurance	Medicare (%)	65.9 (64.5-67.4)	81.0 (80.2-81.8)	<0.001*
	Medicaid (%)	2.1 (1.7-2.5)	1.2 (1.0-1.4)	0.001*
	Private insurance (%)	29.7 (28.3-31.0)	16.2 (15.5-16.9)	<0.001*
	Self-pay (%)	0.3 (0.2-0.5)	0.4 (0.2-0.5)	0.805
	No charge (%)	0.01 (0.00-0.04)	0.04 (0.00-0.09)	0.287
	Other (%)	2.0 (1.6-2.4)	1.2 (1.0-1.5)	<0.001*
Location	New England (%)	4.3 (2.7-5.8)	3.8 (2.9-4.7)	0.592
	Mid-Atlantic (%)	9.9 (7.5-12.2)	13.8 (11.9-15.8)	0.004*
	East North Central (%)	23.0 (19.5-26.6)	17.7 (15.7-19.6)	0.005*
	West North Central (%)	9.6 (7.4-11.8)	10.4 (8.9-11.9)	0.523
	South Atlantic (%)	17.0 (14.0-20.1)	18.9 (17.0-20.9)	0.274
	East South Central (%)	7.9 (5.1-10.6)	5.6 (4.4-6.7)	0.109
	West South Central (%)	11.1 (8.6-13.5)	9.7 (8.1-11.3)	0.313
	Mountain (%)	7.5 (5.3-9.6)	6.7 (5.4-8.0)	0.517
	Pacific (%)	9.9 (7.5-12.2)	13.4 (11.7-15.2)	0.011*

2000-2013 (National Estimates with 95% Confidence Intervals)

Table 2: Outcomes of Total Joint Arthroplasty in Patients with Tardive Dyskinesia or Parkinson's Disease, National Inpatient Survey, 2000-2013 (National Estimates with 95% CI)

	Tardive Dyskinesia	Parkinson's Disease	Adjusted Mean Difference* (PD-TD)	p
Total Knee Arthroplasty				
Mean Total Charges	$43,165 ($42,107-$44,224)	$47,247 ($46,100-$48,393)	$2,297	0.184
Mean Length of Stay, days	3.8 (3.7-3.9)	3.9 (3.8-3.9)	0.09 days	0.426
Total Hip Arthroplasty				
Mean Total Charges	$46,639 ($44,978 - $48,302)	$52,944 ($51,410 - $54,477)	$1,697	0.490
Mean Length of Stay, days	4.07 (3.95, 4.19)	4.80 (4.68, 4.92)	0.17 days	0.355

*Adjusted for age, sex, race, primary payer, and geographic region.

Table 3: of Total Joint Arthroplasty in Patients with Tardive Dyskinesia or Parkinson's Disease, National Inpatient Survey, 2000-2013 (National Estimates with 95% CI)

	Tardive Dyskinesia	Parkinson's Disease	Adjusted Odds Ratio	p
Central Nervous System, including Stroke (%)	0.18% (0.07-0.28)	0.16% (0.08-0.23)	1.59 (0.71-3.60)	0.257
Cardiac, including Myocardial Infarction (%)	0.81% (0.60-1.03)	1.10% (0.91-1.29)	1.08 (0.76-1.53)	0.686
Peripheral Vascular (%)	0.17% (0.06-0.27)	0.18% (0.10-0.25)	0.71 (0.26-1.89)	0.488
Respiratory (%)	0.89% (0.67-1.11)	0.74% (0.58-0.90)	1.21 (0.81-1.81)	0.333
Gastrointestinal (%)	0.54% (0.36-0.73)	0.46% (0.34-0.59)	**1.74 (1.08-2.79)**	0.022
Genitourinary (%)	5.30% (4.75-5.86)	6.63% (6.16-7.10)	0.97 (0.83-1.12)	0.648
Bleeding (%)	0.97% (0.74-1.20)	1.25% (1.03-1.46)	0.93 (0.66-1.31)	0.688
Post-operative Infection (%)	0.16% (0.07-0.26)	0.26% (0.17-0.36)	0.76 (0.36-1.62)	0.478
Cellulitis (%)	0.22% (0.11-0.34)	0.34% (0.24-0.45)	0.66 (0.35-1.25)	0.206
Pneumonia (%)	0.72% (0.52-0.92)	1.05 % (0.87-1.24)	1.10 (0.76-1.61)	0.610
Pulmonary Embolism (%)	0.36% (0.22-0.51)	0.34% (0.24-0.46)	1.08 (0.57-2.03)	0.821
Pulmonary Insufficiency (%)	0.25% (0.13-0.37)	0.36% (0.25-0.47)	0.72 (0.37-1.41)	0.341
Lower-Extremity Venous Thrombotic Events (%)	0.43% (0.27-0.59)	0.40% (0.28-0.52)	1.20 (0.71-2.03)	0.497
Blood Transfusion (%)	16.5% (15.3-17.7)	20.4% (19.4-21.1)	**0.85 (0.77-0.95)**	0.003
Incision and Debridement (%)	0.20% (0.09-0.31)	0.15% (0.08-022)	2.05 (0.90-4.71)	0.089

*Adjusted for age, sex, and race

Potential limitations to our study include the well-documented restrictions of national databases. For example, our reliance on ICD-9 codes to identify patients with TD and PD could have imperfect sensitivity and specificity. Similarly, underreporting of complications in the HCUP-NIS could result in an underestimate of the true individual and national risk, especially given that NIS records only complications that occur before discharge; however, this is unlikely to affect our main outcomes of interest (length of stay, total charges, and odds ratios for complications), as any underreporting would likely be non-differential across groups. In any secondary data analysis, researchers are limited to the data available, and thus we could not investigate important outcomes such as complications after discharge, changes in functional outcomes, or quality of life following TJA. For example, we were unable to assess the risk of dislocation, which has been estimated at 7.7% in patients with PD [18]. Similarly, small cell counts also prohibited the investigation of rare complications: eg. periprosthetic fracture around prosthetic joint, post-operative shock/ sepsis, and wound problems such as dehiscence. Finally, a potential limitation of HCUP-NIS is a healthy user bias, in that only the healthiest and highest functioning patients were operated upon. Though this would not affect the internal validity of our study, it raises the possibility that our findings might not be generalizable to all patients with TD or PD who are considering TJA.

In conclusion, it is important for both surgeons and patients to be aware of the potential for additional challenges and impaired outcomes for TJA patients with movement disorders. Ultimately, our analysis did not reveal significant differences between short-term outcomes and complication rates between patients with PD and those with TD, except that patients with TD may have higher risk for gastrointestinal complications following an invasive surgical procedure such as TJA. This study serves as a reference for the surgeon to frame preoperative consultation for patients with Tardive dyskinesia by acknowledging both the similarities and additional challenges within this cohort of patients in relation to patients with other neurological movement disorders.

Appendix: ICD-9 Codes Used to Identify Acute Hospital Complications.

	ICD-9 Code
Dislocation of prosthetic joint	996.42
Periprosthetic fracture around prosthetic joint	996.44
Central nervous system, including stroke	997.0
Cardiac, including acute myocardial infarction	997.1, 410
Peripheral vascular	997.2
Respiratory	997.3
Gastrointestinal	997.4
Genitourinary, including acute renal failure and urinary tract infection	997.5, 584, 599.0, 595.0
Postoperative shock	998.0
Bleeding (hemorrhage, hematoma, seroma, hemarthrosis)	998.1, 719.15
Postoperative infection	998.5, 996.66, 996.67, 996.69
Wound problems, including dehiscence, non healing surgical wound, lower extremity open wound	998.3, 998.83, 890, 891, 894
Cellulitis	682.6, 686.9
Pneumonia	480, 481, 482, 483, 484, 485, 486, 487.0
Sepsis	995.91, 995.92
Pulmonary embolism	415.1
Dislocation of prosthetic joint	996.42
Periprosthetic fracture around prosthetic joint	996.44
Central nervous system, including stroke	997.0
Cardiac, including acute myocardial infarction	997.1, 410

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