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Impact of diabetes on early postoperative outcomes after total elbow arthroplasty

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Background: Diabetes is known to be associated with poorer perioperative outcomes after hip, knee, and shoulder arthroplasty. This study is the first, to our knowledge, to examine the association between diabetes and in-hospital complications, length of stay, non-homebound discharge, transfusion risk, and total charges after total elbow arthroplasty (TEA).

Methods: By use of *International Classification of Diseases, Ninth Revision* codes, epidemiologic as well as patient and hospital demographic data for all patients undergoing TEA were extracted from the Nationwide Inpatient Sample from 2007 through 2011. We found 13,698 patients who underwent TEA and subsequently separated them into 2 cohorts, those patients with (16.5%) and without (83.5%) diabetes. Specific outcome measures between the diabetic and nondiabetic cohorts were compared through bivariate and multivariate analyses.

Results: Diabetic patients had significantly longer lengths of stay, increased rates of needing a transfusion perioperatively, and higher rates of a number of complications after TEA compared with the nondiabetic group. Significant differences in demographic factors in diabetic patients compared with nondiabetic patients included age, gender, insurance type, and geography. Diabetes was an independent predictor of both prolonged hospital stay and non-homebound discharge after TEA.

Discussion: Diabetic patients have significantly higher rates of several perioperative complications, and diabetes is an independent risk factor for prolonged hospital stay, as well as increased risk of non-homebound discharge. Future studies need to further investigate this relationship between diabetes and poorer TEA outcomes.

Level of evidence: Level III, Retrospective Cohort Design, Treatment Study.

Keywords: Total elbow arthroplasty; diabetes; length of stay; discharge; complications; blood transfusion; Nationwide Inpatient Sample

This study was exempt from approval by our Institutional Review Board because we used the Nationwide Inpatient Sample database, in which all data used were properly deidentified.

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The Centers for Disease Control and Prevention reports that roughly 18.8 million people were diagnosed with diabetes mellitus in 2010, a number that is expected to rise further to 30 million by 2030 because of alarmingly high obesity rates, as well as a progressively increasing trend toward sedentary lifestyles.[6,16,20] Concern over this rapidly

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Table I Patient and hospital variables in diabetic and nondiabetic patients undergoing total elbow arthroplasty

Variable	Total sample	Diabetes group	Nondiabetic group	*P* value
Count	13,698	2,270	11,428	
Age, y				
Mean (SD)	60.18 (36.42)	66.37 (26.29)	58.95 (37.52)	<.0001
Median (50%)	61	67	59	
Gender, n (%)				
Male	4,344 (31.83)	498 (21.93)	3,846 (33.81)	<.0001
Female	9,302 (68.17)	1,772 (78.07)	7,530 (66.19)	
Race, n (%)				
White	8,454 (74.69)	1,448 (75.00)	7,006 (74.62)	.4916
Black	911 (8.05)	159 (8.26)	751 (8.00)	
Hispanic	1,387 (12.25)	243 (12.59)	1,143 (12.18)	
Asian or Pacific Islander	165 (1.46)	21 (1.07)	144 (1.54)	
Other	403 (3.55)	60 (3.08)	344 (3.66)	
Expected primary payer, n (%)				
Medicare	6,236 (45.62)	1,449 (64.11)	4,787 (41.96)	
Medicaid	933 (6.83)	104 (4.61)	829 (7.27)	<.0001
Private, including HMO	4,346 (31.79)	504 (22.29)	3,842 (33.68)	
Self-pay	687 (5.02)	36 (1.57)	651 (5.71)	
No charge	107 (0.78)	15 (0.65)	92 (0.81)	
Other	1,360 (9.95)	153 (6.77)	1,207 (10.58)	
Hospital region, n (%)				
Northeast	2,634 (19.23)	338 (14.88)	2,296 (20.09)	
Midwest	3,009 (21.97)	542 (23.86)	2,467 (21.59)	<.0001
South	5,145 (37.56)	979 (43.14)	4,166 (36.45)	
West	2,911 (21.25)	411 (18.12)	2,500 (21.87)	

HMO, health maintenance organization.

expanding comorbidity has resulted in a flurry of studies delving into the deleterious effects of diabetes mellitus on outcomes after joint arthroplasty. In fact, the negative impact of diabetes on outcomes such as perioperative morbidity is well documented in the literature, particularly for total hip and knee arthroplasty.[1,4,12,15,18] Although the number of studies analyzing the effect of diabetes on shoulder arthroplasty is more limited, the literature also notes inferior outcomes in diabetic patients.[10,17] Not surprisingly, there is a paucity of literature investigating the effects of diabetes on outcomes after total elbow arthroplasty (TEA).

The number of TEAs is anticipated to increase in the future, with one study reporting an annual growth rate of 7.6% for TEA from 1993 to 2007.[7] Furthermore, the number of surgeons describing shoulder and elbow as a practice focus increased from 24% in 1992 to 44% in 2004 according to the American Academy of Orthopaedic Surgeons census.[7,19] Given the growing importance and impact of this procedure, as well as the dearth of literature examining the effects of diabetes mellitus after TEA, this study scrutinizes and investigates this critical issue using a nationally representative database. The purpose of this study is to evaluate the association between diabetes and perioperative complications, hospital length of stay (LOS), discharge status, and cost after TEA. We hypothesized that diabetic patients will have a longer LOS and will have more perioperative complications that nondiabetic patients.

Materials and methods

The Nationwide Inpatient Sample (NIS) was the database used for this study. Developed by the Agency for Healthcare Research and Quality in 1988 and updated on a yearly basis, the NIS represents roughly 20% of US hospitals and takes data from 46 different states, making it the largest all-payer inpatient health care database in the United States. Roughly 8 million discharges are recorded annually, and furthermore, these data can be weighted to produce statistically valid national estimates.[9] Correspondingly, these data have been used extensively in the literature in various specialties across all fields of medicine.[2,3,5,11]

Our study group consisted of all patients treated between January 1, 2007, and December 31, 2011, from the NIS who were identified through the procedure code (*International Classification of Diseases, Ninth Revision, Clinical Modification*) for TEA (81.84). Within this group, a subpopulation of patients diagnosed with type 1 and type 2 diabetes was identified based on the *International Classification of Diseases, Ninth Revision, Clinical Modification* diagnosis codes 250.00 to 250.93. The remainder of the population was identified as the nondiabetic group. The data were then weighted based on predetermined NIS guidelines.

Patient and hospital demographic variables studied in the comparison between the diabetic and nondiabetic groups included age, gender, race, primary payer, and hospital region (Table I). Outcome variables of interest included average LOS, total charges (in US dollars), perioperative complications, non-homebound discharges, and need for a blood transfusion (Table II). The perioperative complications specifically studied were