Comparison of perioperative complications after total elbow arthroplasty in patients with and without diabetes

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Background: Few studies have analyzed the effect of diabetes on outcomes after total elbow arthroplasty (TEA). We investigated the perioperative complications after TEA in patients with and without diabetes.

Methods: We evaluated the Nationwide Inpatient Sample (NIS) database from 2005 to 2010 for patients who underwent a TEA. Our retrospective study included 3184 patients based on International Classification of Diseases-Ninth Revision, Clinical Modification codes. We compared outcomes in 488 patients with diabetes and in 2696 patients without diabetes.

Results: Patients with diabetes had a significantly older mean age (66.8 vs 58.5 years, $P < .001$). There was no statistically significant difference when comparing length of stay (4.1 vs 3.7 days, $P = .056$) and cost of surgery ($56,582 vs $56,092, $P = .833$). A significantly higher percentage of diabetic patients underwent TEA for the indication of fracture (73.4% vs 65.3%), but a lower percentage for rheumatoid arthritis (10.2% vs 19.2%). They also had significantly increased rates of pneumonia (odds ratio [OR], 2.7), urinary tract infection (OR, 2.2), blood transfusion (OR, 2.1), and nonroutine discharge (OR, 1.9). After adjusting for significantly increased rates of comorbidities in diabetic patients, our multivariate analysis showed that having diabetes was independently associated with an increased risk of pneumonia (relative risk [RR], 2.6), urinary tract infection (RR, 1.9), and cerebrovascular accident (RR, 9.1). However, diabetes was not independently associated with hospital length of stay ($P = .75$), after correction, hospital cost ($P = .63$), or proportion of routine discharges ($P = .12$).

Conclusion: Patients with diabetes have higher rates of comorbidities and perioperative complications after TEA.

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

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Keywords: Total elbow arthroplasty; diabetes; perioperative outcome; complication

The prevalence of diabetes mellitus continues to increase due to increasing rates of obesity and life expectancy. Diabetes has direct deleterious effects on the vascular and immune systems, making it more difficult for patients with diabetes to recover from common illnesses and injuries.[11,19,20] Recent studies have shown the prevalence of diabetes peaks in the age group of 60 to 74 years.[6] This is

particularly important in the elderly population, which represents a large proportion of patients seeking medical care for osteoarthritis and bone fragility fractures. Many of these elderly patients will be referred for surgical care, specifically joint replacements, to alleviate pain and extend quality of life. Concurrent joint osteoarthritis has been reported in approximately 52% of patients with diabetes.[5] Thus, a better understanding of the effect of diabetes on the outcomes of joint replacement surgeries is important.

Studies have suggested that patients with diabetes are at higher risk for postoperative surgical and systemic complications, including death.[4,23] Marchant et al[18] found that poor glycemic control in diabetic patients was associated with increased systemic complications and hospital length of stay. These studies, however, focus on outcomes specifically after total knee or total hip arthroplasty. Relatively few studies have analyzed the effect of diabetes after joint replacement of the elbow. Recent national trends have shown that the growth rates of upper extremity arthroplasty are comparable to the growth rates of total knee and hip arthroplasty.[7] Thus, we wished to specifically study the perioperative outcomes of diabetic patients undergoing total elbow arthroplasty (TEA). Our hypothesis was that patients with diabetes would demonstrate significantly higher rates of perioperative complications, hospitalization cost, and length of stay.

Materials and methods

Database

We used the Nationwide Inpatient Sample (NIS) database to collect data from 2005 to 2010. The NIS is the largest all-payer inpatient database in the United States. It is publicly available and is part of the Healthcare Cost and Utilization Project (HCUP) sponsored by the Agency for Healthcare Research and Quality. The database is representative of the national population because it includes patients covered by Medicare, Medicaid, private insurance, or no insurance.

Patient records include clinical information extracted from inpatient and discharge data. It contains records from approximately 8 million hospital admissions per year from approximately 1000 hospitals to achieve a 20% stratified sample of hospitals in the United States. The patient population and their data used in this study were selected based on procedural coding in accordance with the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM). Quality control procedures performed by HCUP have demonstrated reliability and accuracy, specifically when it pertains to the principal diagnosis and dates of hospitalization.[1,2] Thus, results extracted from this database can be reliably used to represent the population of patients undergoing TEA in the United States.

Sample selection

Inclusion criteria included the ICD-9-CM procedure code for primary TEA (81.84). Patients were then categorized into 2 groups: those with diabetes (including type 1 and type 2) and those with no diabetes. Patients were excluded if they had an ICD-9-CM diagnosis code for pathologic fracture, metastatic cancer, or infection of the elbow.

Main outcome measures

The main outcome measures were inpatient perioperative complications, death, hospital length of stay, discharge disposition (routine or nonroutine), and inflation-adjusted hospitalization charges (billed to patients). Routine discharge was defined as discharge to home with or without home health care, and nonroutine discharge was defined as discharge to any care facility other than home. Specific complications studied were death, pneumonia, deep vein thrombosis (DVT), pulmonary embolism (PE), hematoma, acute mental status changes, cerebrovascular accident (CVA), myocardial infarction (MI), ileus, urinary tract infection (UTI), blood transfusion, and proportion of patients requiring irrigation and debridement. Complications were identified from the NIS by using ICD-9-CM diagnosis or procedure codes.

Demographics and comorbidities

Patient-specific covariates included age, gender, race, median household income classified by zip code, primary payer source, and hospital size (number of beds), location, and type (teaching vs nonteaching). In addition, data involving whether patient underwent surgery electively or nonelectively were included.

The incidence of comorbidities was also analyzed and compared between the 2 groups. Patients' comorbidity data was collected via ICD-9-CM diagnosis codes.

Statistical analysis

The differences in covariate data, comorbidity data, and main outcome measures for the 2 groups were analyzed. Analysis of variance was used to compare linear variables, and χ^2 tests were used to compare categoric data. Multivariate analysis was used to adjust for the differences in demographics and rates of medical comorbidities in our patient groups. Patients without diabetes were used as the reference group in the multivariate analysis. Only variables with $P < .10$ in the initial univariate analysis were used in the multivariate analysis. The level of significance for all statistical comparisons and modeling was set at $P < .05$.

Results

We identified 3184 patients who underwent TEA from the NIS database between the years 2005 and 2010. Of those, 488 patients were identified as having diabetes, and 2696 patients were identified as not having diabetes.

Significant demographic differences between patients with and without diabetes were observed when analyzing age, gender, primary payer, and hospital region (Table I). Diabetic patients who underwent TEA were significantly older (mean age, 66.8 vs 58.5 years), had a greater