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Original Article

Impact of Gender on 30-Day Complications After Primary Total Joint Arthroplasty

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ABSTRACT

Background: Impact of gender on 30-day complications has been investigated in other surgical procedures but has not yet been studied in total hip arthroplasty (THA) or total knee arthroplasty (TKA).
Methods: Patients who received THA or TKA from 2012 to 2014 were identified in the National Surgical Quality Improvement Program database. Patients were divided into 2 groups based on gender. Bivariate and multivariate analyses were performed to assess associations between gender and patient factors and complications after THA or TKA and to assess whether gender was an independent risk factor.
Results: THA patients consisted of 45.1% male and 54.9% female. In a multivariate analysis, female gender was found to be a protective factor for mortality, sepsis, cardiovascular complications, unplanned reintubation, and renal complications and as an independent risk factor for urinary tract infection, blood transfusion, and nonhome discharge after THA. TKA patients consisted of 36.7% male and 62.3% female. Multivariate analysis revealed female gender as a protective factor for sepsis, cardiovascular complications, and renal complications and as an independent risk factor for urinary tract infection, blood transfusion, and nonhome discharge after TKA.
Conclusion: There are discrepancies in the THA or TKA complications based on gender, and the multivariate analyses confirmed gender as an independent risk factor for certain complications. Physicians should be mindful of patient's gender for better risk stratification and informed consent.

Total knee arthroplasty (TKA) and total hip arthroplasty (THA) have been proven successful treatments for osteoarthritis of the hip and knee [1,2]. Persistently successful outcomes have led to an increase in the utilization of the procedure resulting in a steady rise over the past few decades. By the year 2030, the demand of primary THA and TKA has been predicted to grow by 174% and 673%, respectively [3,4]. The prevalence of hip and knee osteoarthritis has been reported as higher in women than men [5–7]. In addition, women seek the care of physicians for hip and knee issues more often than men [8]. Still, studies on how gender affects TKA and THA are limited.

The effect of gender on postoperative complications has been published in the vascular surgery literature [9–13]. These studies showed a higher risk of mortality and morbidity in women, whereas others showed no correlation with gender for postoperative complications. Large national databases such as American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) have made it feasible to consider gender as an independent risk factor for postoperative complications [14,15]. Gender disparities in total joint arthroplasty have been previously examined finding similar functional improvement in male and females after total joint arthroplasty [16]. Despite the rise in the number of arthroplasty procedures, there are little data on how gender affects outcomes postoperatively.

Under the hypothesis that risk factors for adverse postoperative outcomes would differ based on gender, the present study sought to elucidate risk factors for each gender using a national database.

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The study was qualified as exempt from the Mount Sinai Hospital Institutional Review Board.

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Methods

The present study uses a deidentified publicly available data set and, thus, was qualified as exempt by the institutional review board.

Data Source

The ACS NSQIP database was queried for the years 2012-2014. The database is a collection of approximately 150 patient variables—demographic data, comorbid conditions, Current Procedural Terminology (CPT) codes, hospital length of stay (LOS), and 30-day postoperative adverse events, including unplanned reoperation or readmission—abstracted from medical records, operative reports, and patient interviews. The ACS NSQIP initiative began in 1994 as a quality improvement effort within the Veteran's Administration health system, and the program was subsequently launched for private hospitals beginning in 1998 [17,18]. For 2014, the most recent database year queried for the present study, the database contained >750,000 admissions from roughly 500 hospitals. The quality of the database is maintained by trained onsite surgical clinical reviewers and internal auditing process, which controls inter-rater reliability [19].

Study Population, Patient Factors, and Outcome Variables

Only patients of age ≥18 years receiving elective surgery were included. Patients receiving THA were identified using CPT code 27130, and those receiving TKA were identified by CPT code 27447. Exclusion criteria were body mass index (BMI) <18.5 kg/m^2, hospital LOS >365 days, emergency cases, and incomplete patient demographics data. Those meeting the inclusion and exclusion criteria were divided into 2 groups based on gender recorded in the database.

Patient variables assessed in the study were age, race, obesity class, and preoperative functional status. Obesity classification defined by World Health Organization was used. Nonobese group referred to patients with a BMI of 18.5-29.9 kg/m^2, obesity class I was defined as a BMI of 30.0-34.9 kg/m^2, obesity class II was defined as a BMI of 35.0-39.9 kg/m^2; obesity class III was defined as a BMI of ≥40.0 kg/m^2. Dependent functional status is defined as requiring partial or total assistance for activities of daily living, which, in turn, is defined as "the activities usually performed in the course of a normal day in a person's life" and includes feeding, dressing, bathing, toileting, and mobility. Comorbid conditions investigated included diabetes (DM), current hypertension (HTN) requiring medication, history of congestive heart failure, pulmonary comorbidities (chronic obstructive pulmonary disorder or dyspnea), renal comorbidities (renal failure or currently on dialysis), anemia (hematocrit <36), bleeding disorder, corticosteroid use for chronic conditions, and smoking status. American Society of Anesthesiologists (ASA) class, divided into ASA classes 1-2 and 3-5, was assessed as well. ASA class is a subjective classification assigned by anesthesiologists before surgery. ASA class I refers to normal healthy patients, class II refers to patients with mild systemic diseases, patients in class III are those with severe systemic disease that is a limiting but not incapacitating, class IV refers to those with incapacitating disease that is a constant threat to life, and class V refers to patients in moribund state and those not expected to live >24 hours.

Postoperative complications investigated were mortality, sepsis/septic shock, cardiovascular complications (myocardial infarction (MI) or cardiac arrest requiring cardiopulmonary resuscitation), unplanned reintubation, pneumonia, renal complications (acute renal failure [ARF] or progressive renal insufficiency), stroke, wound-related infection (superficial surgical site infection [SSI], deep incisional SSI, and organ/space SSI), wound dehiscence, urinary tract infection (UTI), deep vein thrombosis, pulmonary embolism, and intraoperative/postoperative transfusion. Other outcomes variables assessed were prolonged LOS (postoperative hospital stay ≥4 days), unplanned return to the operating room, and unplanned readmission and discharge destination. Nonhome discharge destinations included skilled care facility (acute care facility, transitional care unit, subacute hospital, ventilator bed, or skilled nursing home), unskilled facility (nursing home or assisted facility, if not patient's home preoperatively), or rehabilitation facility.

Data Analysis

For all analyses, the SAS software (version 9.3; SAS Institute Inc, Cary, NC) was used. Exact same analyses were performed separately for THA and TKA patients. The Student *t* test and the chi-square test were used for continuous and categorical variables, respectively, to detect statistical significances. Bivariate analyses were performed to assess associations between gender (male or female) and patient factors, comorbid conditions, and postoperative complications. Multivariate analyses were performed to assess whether gender was an independent predictor of postoperative complications tracked in the ACS NSQIP. To control for potential confounders, we have included in our multivariate models preoperative patient factors (demographics, comorbid conditions) that were found to be associated with gender with *P* value <.2 in the bivariate analyses. Level of significance was maintained at a *P* value of .05.

Results

Total Hip Arthroplasty Cohort

Among patients who underwent THA, 24,582 (45.1%) were male and 29,920 (54.9%) were female. For the THA cohort, female gender was associated with older age, higher BMI, and dependent functional status. DM, HTN, bleeding disorder, and smoking were more prevalent among males, whereas pulmonary comorbidities, anemia, and corticosteroid use were more prevalent among females (Table 1). Postoperative complications were generally lower in female cohort except UTI. In addition, female gender was associated with intraoperative/postoperative blood transfusion, prolonged LOS, and nonhome discharge (Table 2).

In multivariate analysis adjusting for age, race, BMI, functional status, DM, HTN, pulmonary comorbidities, renal comorbidities, anemia, bleeding disorder, corticosteroid use, and smoking status, female gender was found to be a protective factor for mortality (odds ratio [OR], 0.46; 95% confidence interval [CI], 0.29-0.73; $P = .001$), sepsis (OR, 0.71; 95% CI, 0.52-0.97; $P = .032$), cardiovascular complications (OR, 0.54; 95% CI, 0.40-0.75; $P < .001$), unplanned reintubation (OR, 0.51; 95% CI, 0.34-0.77; $P = .001$), and renal complications (OR, 0.24; 95% CI, 0.14-0.41; $P < .001$) but was found to be an independent risk factor for UTI (OR, 1.82; 95% CI, 1.51-2.19; $P < .001$), blood transfusion (OR, 1.63; 95% CI, 1.53-1.72; $P < .001$), and nonhome discharge (OR, 1.75; 95% CI, 1.68-1.83; $P < .001$; Table 3).

Total Knee Arthroplasty Cohort

Among those that received TKA, 32,848 (36.7%) were male and 54,329 (62.3%) were female. Females receiving TKA were on average more obese than males undergoing TKA. Pulmonary comorbidities and anemia were more prevalent among females, whereas chronic corticosteroid use, DM, HTN, bleeding disorder, and smoking were more common among males (Table 4). Prevalence of all tracked postoperative complications except UTI, deep vein thrombosis/pulmonary embolism, and blood transfusion were