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Does BMI Affect Perioperative Complications Following Total Knee and Hip Arthroplasty?

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Background. **Orthopedic surgeons are reluctant to perform total knee (TKA) or hip (THA) arthroplasty on patients with high body mass index (BMI). Recent studies are conflicting regarding the risk of obesity on perioperative complications. Our study investigates the effect of BMI on perioperative complications in patients undergoing TKA and THA using a national risk-adjusted database.**

Methods. **A retrospective analysis was performed using the 2005–2007 American College of Surgeons-National Surgical Quality Improvement Program ACS-NSQIP dataset. Inclusion criteria were patients between 18 and 90 y of age who underwent TKA or THA. Patients were stratified into five BMI categories: normal, overweight, obese class I, obese class II, and morbidly obese. Demographic characteristics, length of stay, co-morbidities, and complication rates were compared across the BMI categories.**

Results. **A total of 1731 patients met the inclusion criteria, with 66% and 34% undergoing TKA and THA, respectively. A majority were female (60%) and >60 y (70%) in age. Of the patients who underwent TKA, 90% were either overweight or obese, compared with 77% in those undergoing THA. The overall preoperative comorbidity rate was 73%. The complication and mortality rates were 7% and 0.4%, respectively. When stratifying perioperative complications by BMI categories, no differences existed in the rates of infection ($P = 0.368$), respiratory ($P = 0.073$), cardiac ($P = 0.381$), renal ($P = 0.558$), and systemic ($P = 0.216$) complications.**

Conclusions. **Our study demonstrates no statistical difference in perioperative complication rates in patients undergoing TKA or THA across BMI categories. Performing TKA or THA on patients with high BMI may increase mobility leading to improved quality of life.**

Key Words: **obesity; total knee arthroplasty; total hip arthroplasty; body mass index; perioperative complications.**

INTRODUCTION

The National Health and Nutrition Examination Survey reports that obesity in the United States from 2007 to 2008 has grown to 32.2% among adult men and 35.5% among adult women [1]. These epidemic proportions of obesity translate into increased rates of musculoskeletal diseases, specifically osteoarthritis. Osteoarthritis is the most common cause of disability in both the high and low middle-income countries [2] and the most common cause of disability in the U.S. population [1]. The increased body weight leads to activation of several mechanoreceptors within the cartilage itself [3] and there is a 36% increased chance of developing degenerative joint disease for every 2-unit (5 kg) increase in body mass index (BMI) [4]. Osteoarthritis impacts quality of life as patients age and gain a significant amount of weight [5]. Total knee (TKA) and hip (THA) arthroplasties have rendered a solution to degenerative joint disease by eliminating or reducing pain, while returning physical function [6]. Despite the growing number of obese patients, orthopedic surgeons are reluctant to operate on those with high BMI (BMI $\geq$ 35). Recent studies are conflicting on the rates of perioperative complication with increase in BMI.

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TABLE 1

Characteristics of Patients Who Received TKA or THA in 2005–2007 ACS NSQIP Dataset (n = 1731)

	TKA (%)	THA (%)
Procedure	66.3	33.7
Gender		
Male	35.6	48.8
Female	64.4	51.2
Ethnicity		
White	73.2	77.9
Black	6.2	8.2
Hispanic	12.6	7.9
Asian or Pacific Islander	2	1
American Indian or Alaska Native	0.5	0.3
BMI categories		
Normal (18–24.9 kg/m^2)	9.7	22.8
Overweight (25–29.9 kg/m^2)	28.7	34.4
Obese Class I (30–34.9 kg/m^2)	28.3	24.3
Obese Class II (35–39.9 kg/m^2)	17.9	11
Obese class III ($\geq$40 kg/m^2)	15.6	7.5
Mean age (years)	65.6	64.1

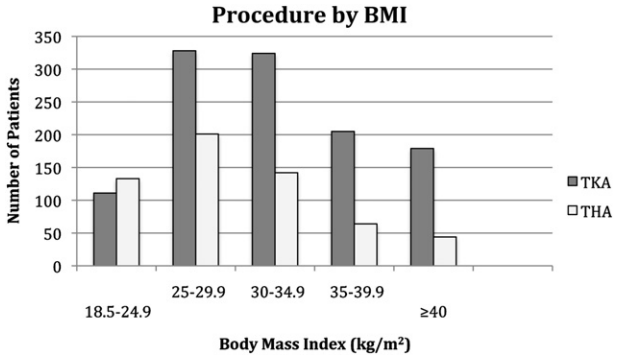

FIG. 1. Frequency of patients who underwent TKA and THA by BMI category.

Some studies have demonstrated an increase in the rate of perioperative complications [7–10], while others, no increase in perioperative complications [11–14]. The conflicting data have raised concerns among orthopedic surgeons, who consequently may choose not to operate. The aim of our study is to examine the effects of BMI on perioperative complications in TKA and THA using a national risk-adjusted database.

METHODS

We performed a retrospective analysis of the American College of Surgeons-National Surgical Quality Improvement Program (ACS-NSQIP) dataset of cases captured between 2005 and 2007. The ACS-NSQIP was developed to improve the quality of surgical care in adults, and has over 250 participating institutions. It contains data on patients undergoing major surgical procedures, both in the inpatient and outpatient setting, and in different surgical specialties. It has 135 variables related to preoperative risk factor assessment, intraoperative information, and 30-d postoperative morbidity and mortality outcomes.

Inclusion criteria were patients between 18 and 90 y of age, who underwent TKA or THA as defined by the Current Procedural Terminology (CPT) codes: 27445, 27446, 27447 for TKA and 27130, 27132, 27134 for THA. Patients were stratified into five BMI categories: normal (18.5–24.9 kg/m^2), overweight (25–29.9 kg/m^2), obese class I (30–34.9 kg/m^2), obese class II (35–39.9 kg/m^2), and obese class III or morbidly obese ($\geq$40 kg/m^2). Bivariate analysis was conducted using Pearson's χ^2 and Fisher's exact test for categorical variables and Student's t-test for continuous variables with a level of significance set at $\leq$0.05. Patient demographic characteristics, preoperative co-morbidities, hospital length of stay (LOS), and perioperative complication rates and mortality were compared across the BMI categories.

The outcome variables were perioperative complications, including surgical site infections (superficial, deep incisional, and organ/space), deep vein thrombosis, respiratory (pneumonia, unplanned intubation, pulmonary embolism, failure to wean from the ventilator within 24 h of surgery), cardiovascular (cardiac arrest requiring cardiopulmonary resuscitation, myocardial infarction, and stroke/cerebrovascular accident with neurological deficit), renal (progressive renal insufficiency, acute renal failure, urinary tract infection), and systemic (coma, sepsis, septic shock) complications. Multivariate regression was performed adjusting for age, BMI, gender, ethnicity, type of operation, and preoperative co-morbidities. Sample size power analysis was performed assuming a 6.5% difference in complication rate between overweight and obese patients *versus* normal weight patients. We assumed this difference in complication rate was of clinical importance. When using a power of 0.8 and an α of 0.05, a sample size of 197 patients is needed per group. Our number of patients within each BMI category, therefore, seems sufficient. Statistical analyses were

TABLE 2

Bivariate Analysis of Preoperative Comorbidities and Risk Factors by BMI Categories

Co-morbidities and risk factors	18.5–24.9 (%)	25–29.9 (%)	30–34.9 (%)	35–39.9 (%)	$\geq$40 (%)	P value
Cardio*	55.33	61.25	74.25	76.21	76.23	<0.001
Pulmonary†	9.43	12.29	14.81	15.99	24.66	<0.001
Renal‡	0.41	0.57	0	0.37	0.45	0.428
Type II diabetes mellitus	8.2	10.78	19.53	23.79	30.94	<0.001
Open wound/wound infection	2.05	0.57	0.86	0.37	1.35	0.258
Steroid use for chronic condition	7.38	3.78	3.65	1.86	3.14	0.035
Bleeding disorders	2.46	2.84	3.65	1.86	2.69	0.739

*Cardio includes history of congestive heart failure, history of myocardial infarction, previous percutaneous intervention, previous percutaneous surgery, history of angina, hypertension with medication, history of peripheral vascular disease, and rest pain.

†Pulmonary includes history of COPD, current pneumonia, and dyspnea.

‡Renal includes renal failure and dialysis.