The Journal of Arthroplasty xxx (2016) 1–5

Contents lists available at ScienceDirect

The Journal of Arthroplasty

journal homepage: www.arthroplastyjournal.org

Original Article

Super Obesity Is an Independent Risk Factor for Complications After Primary Total Hip Arthroplasty

Brian C. Werner, MD [a], Matthew D. Higgins, MD [a], Hakan C. Pehlivan, MD [a], Joshua T. Carothers, MD [b], James A. Browne, MD [a,*]

[a] Department of Orthopedic Surgery, University of Virginia, Charlottesville, Virginia
[b] New Mexico Orthopaedics, Center for Joint Replacement, Albuquerque, New Mexico

ARTICLE INFO

Article history:
Received 8 March 2016
Received in revised form
17 July 2016
Accepted 1 August 2016
Available online xxx

Keywords:
primary total hip arthroplasty
postoperative complications
obesity
super obesity
revision hip arthroplasty

ABSTRACT

Background: Recent studies have reported higher postoperative complication rates in obese and morbidly obese patients undergoing total hip arthroplasty (THA). Less data are available regarding super-obese (body mass index [BMI] >50 kg/m^2) patients. This study aims to quantify the risk of complications after THA in super-obese patients on a national scale and to put these risks in context by comparing them to patients of other BMI classes as well as those undergoing revision THA.

Methods: Utilizing a national insurance database, complication rates after THA in super-obese patients (n = 3244) were compared to nonobese, obese, and morbidly obese patients undergoing primary THA and all patients undergoing revision THA. A logistic regression analysis controlling for demographic and comorbidity variables was utilized to determine the independent effect of super obesity on complication rates after THA.

Results: Super-obese patients had significantly higher rates of most complications than nonobese, obese, morbidly obese, and revision THA patients, including venous thromboembolism, infection, blood transfusion, medical complications, dislocation, readmission, and revision THA.

Conclusion: Super-obese patients (BMI >50 kg/m^2) have higher rates of postoperative complications after THA than nonobese, obese, morbidly obese, and revision THA patients. Super obesity is an independent risk factor for increased rates of most postoperative complications including the need for early revision THA.

Total hip arthroplasty (THA) has been demonstrated to be clinically effective with excellent long-term survivability [1,2]. By the year 2030, it is estimated that the demand for THA will surpass 500,000 cases annually in the United States. The estimated rates of revision arthroplasty are expected to exceed 95,000 cases annually by the same year [3]. Major and minor complications have a relatively low incidence after primary THA but can be devastating and lead to substantial morbidity [4]. Higher rates of mortality as well as medical and surgical complications have been reported after revision hip arthroplasty compared with primary surgery [5]. Considering the increasing demand for primary and revision hip arthroplasty, determining risk factors for complications is imperative for both patient selection and counseling.

The prevalence of obesity in the United States has recently been estimated to be 37.7% [6]. Obesity has been shown to increase the risk of developing osteoarthritis and requiring a total joint arthroplasty [7]. Obesity and its effect on total joint arthroplasty is a topic of recent debate [8,9]. Numerous studies have reported higher rates of major complications, component malposition, increased operative time, infection, poorer component survival, and lower clinical scores in those with elevated body mass index (BMI) undergoing THA [10-13].

Recently, the term “super obese” has been defined as a BMI of >50 kg/m^2 [14]. Despite the growing literature concerning obesity and its effect on THA, there is scant literature evaluating complications after THA in patients with this most severe form of obesity [15-17]. The purpose of our study was to use a nationwide database to evaluate the postoperative complication rate in the super obese undergoing primary THA and compare this to complication rates in

One or more of the authors of this paper have disclosed potential or pertinent conflicts of interest, which may include receipt of payment, either direct or indirect, institutional support, or association with an entity in the biomedical field which may be perceived to have potential conflict of interest with this work. For full disclosure statements refer to http://dx.doi.org/10.1016/j.arth.2016.08.001.

* Reprint requests: James A. Browne, MD, Department of Orthopedic Surgery, University of Virginia, P.O. Box 800159, Charlottesville, VA 22908.

http://dx.doi.org/10.1016/j.arth.2016.08.001
0883-5403/

patients of other BMI groups and to revision THA to put these risks into context.

Material and Methods

Database

Data for the present study were derived from a for-fee database of patients, the PearlDiver Patient Records Database (www.pearldiverinc.com; PearlDiver Inc, Fort Wayne, IN). The database contains procedure volumes and demographics for patients with International Classification of Diseases, 9th Revision (ICD-9) diagnoses and procedures or Current Procedural Terminology (CPT) codes. Data for the present study were derived from the Medicare database within the PearlDiver records, which has over 100 million individual patient records from 2005 to 2012. Access to the database was granted by PearlDiver Technologies for the purpose of academic research. The database was stored on a password-protected server maintained by PearlDiver. A waiver of Institutional Review Board (IRB) approval was obtained.

Study Groups

Patients who underwent THA from 2005 to 2012 were identified using ICD-9 procedure code 81.51. These patients were then divided into nonobese (BMI <30 kg/m^2), obese (BMI 30-39.9 kg/m^2), morbidly obese (BMI 40-49.9 kg/m^2), and super-obese (BMI 50+ kg/m^2) cohorts using ICD-9 codes for obesity (278.00), morbid obesity (278.01), BMI 30-39.9 (V85.30-V85.39), BMI 40-49.9 (V85.41-V85.42), and BMI >50 (V85.43-V85.45). A revision total hip cohort with BMI <40 kg/m^2 was created using ICD-9 and CPT codes (Table 1) and patients with BMI >40 kg/m^2 excluded using the aforementioned ICD-9 codes for morbid obesity, BMI 40-50 kg/m^2 and BMI 50+ kg/m^2. This created five distinct cohorts: (1) primary THA in nonobese (BMI <30 kg/m^2) patients, (2) primary THA in obese (BMI 30-40 kg/m^2) patients, (3) primary THA in morbidly obese (BMI 40-50 kg/m^2) patients, (4) primary THA in super-obese (BMI 50+ kg/m^2) patients, and (5) revision THA (BMI <40 kg/m^2).

Patients in each cohort were queried for basic demographics including sex, age (<65, 65-80, >80 years), and smoking status. Comorbidities for each cohort were assessed, including diabetes mellitus (DM), obstructive sleep apnea, hyperlipidemia (HLD), hypertension (HTN), peripheral vascular disease (PVD), congestive heart failure (CHF), coronary artery disease (CAD), chronic kidney disease (CKD), chronic lung disease, and chronic liver disease (CLD) using ICD-9 codes for each disease.

Table 1
ICD-9 and CPT Codes Used to Define Postoperative Complications.

Description	CPT/ICD-9 Code
Local complications	
Diagnosis of postoperative infection	ICD-9 998.5, 998.51, 998.59, 996.66, 996.67, 996.69
Postoperative irrigation and debridement	CPTs 10180, 20005, 27030
Dislocation	ICD-9 996.42, CPT 27265, 27266
Revision THA	ICD-9s 00.70-00.73, 81.53, CPTs 27134, 27137, 27138
Systemic complications	
Pulmonary embolism	ICD-9 415.1, 415.11, 415.19
Deep vein thrombosis	ICD-9 453.4, 453.40, 453.41, 453.42
Acute myocardial infarction	ICD-9 410.00-410.02, 410.10-410.12, 410.20-410.22, 410.30-410.32, 410.40-410.42, 410.50-410.52, 410.60-410.62, 410.70-410.72, 410.80-410.82, 410.90-410.92
Respiratory failure	ICD-9 518.0, 518.51, 518.52, 518.81, 518.82
Cerebrovascular accident	ICD-9 430, 431, 432.0, 432.1, 432.9, 433, 433.0, 433.00, 433.01, 433.1, 433.10, 433.11, 433.2, 433.20, 433.21, 433.3, 433.30, 433.31, 433.8, 433.80, 433.81, 433.9, 433.90, 433.91, 434, 434.0, 434.00, 434.01, 434.1, 434.10, 434.11, 434.9, 434.90, 434.91
Urinary tract infection	ICD-9 098.0, 098.1, 098.10, 098.19, 599.0, 996.64
Pneumonia	ICD-9 480.0-480.9, 481, 482.0-482.9
Acute renal failure	ICD-9 584.5-584.9, 580.0-580.9, 586
Acute cholecystitis	ICD-9 575.0, 574.00, 574.01
Postoperative blood transfusion	CPT 36430, ICD-9 V58.2, 990.0, 990.2, 990.3, 990.4

ICD-9, International Classification of Diseases, 9th Revision; CPT, Current Procedural Terminology; THA, total hip arthroplasty.

Postoperative Complications

Each cohort was then queried for postoperative complications utilizing ICD-9 and CPT codes. Complications assessed within 90 days postoperatively were venous thromboembolism (VTE, including pulmonary embolism and deep vein thrombosis), infection (including diagnosis and/or operative procedure), blood transfusion, and other medical complications (including myocardial infarction, respiratory failure, cerebrovascular accident, urinary tract infection, pneumonia, acute renal failure and cholecystitis). Hospital readmission for any reason (medical or surgical) was queried within 90 days postoperatively for all cohorts. Periprosthetic dislocation was assessed using both ICD-9 codes and CPT codes for a reduction procedure within 6 months postoperatively. Revision THA was assessed for all groups but the revision group within the confines of the database (up to 8 years postoperatively). Table 1 provides the CPT and ICD-9 codes used to define all postoperative complications.

Statistical Analysis

A multivariate binomial logistic regression analysis was used to compare complication rates between the super-obese study cohort and other groups. This analysis allowed an evaluation of the independent effect of super obesity on the complication of interest, while controlling for numerous demographic and comorbidity variables. The logistic regression analysis employed controlled for age, gender, tobacco use, alcohol abuse, and presence of the following medical comorbidities: inflammatory arthritis, depression, hypercoagulable state, DM, HLD, HTN, PVD, CHF, CAD, CKD, use of hemodialysis, chronic lung disease, CLD, and hypothyroidism. Adjusted odds ratios and 95% confidence intervals were calculated for each comparison. $P < .05$ was considered statistically significant.

Results

A total of 891,567 unique patients who underwent primary THA and 142,351 patients who underwent revision THA were identified from 2005 to 2012. Of the patients undergoing primary THA, 702,360 were nonobese, 123,407 were obese, 62,556 were morbidly obese, and 3244 were super obese.

A comparison of each cohort's demographics and medical comorbidities is provided in Table 2. The groups were demographically and medically different, with increasing rates of most medical comorbidities noted with increased BMI. As BMI increased, patients were more frequently female, more frequently younger in age, and more frequently tobacco users. These differences were controlled for statistically using a logistic regression analysis.

Table 3 and Figure 1 present the rates of postoperative complications for all five cohorts; the statistical comparisons are