The Journal of Arthroplasty 30 (2015) 2290–2295

Contents lists available at ScienceDirect

The Journal of Arthroplasty

journal homepage: www.arthroplastyjournal.org

Hypoalbuminemia More Than Morbid Obesity is an Independent Predictor of Complications After Total Hip Arthroplasty

Jason D. Walls, MD [a], Daniel Abraham, MD [a], Charles L. Nelson, MD [b], Atul F. Kamath, MD [b], Nabil M. Elkassabany, MD, MSCE [a,b], Jiabin Liu, MD, PhD [a,b]

[a] Department of Anesthesiology & Critical Care, Perelman School of Medicine, the University of Pennsylvania, Philadelphia, Pennsylvania
[b] Department of Orthopaedic Surgery, Perelman School of Medicine, the University of Pennsylvania, Philadelphia, Pennsylvania

ARTICLE INFO

Article history:
Received 12 March 2015
Accepted 4 June 2015

Keywords:
total hip arthroplasty
hypoalbuminemia
morbid obesity
morbidity
mortality
30-days

ABSTRACT

Health care reform is directing clinical practice towards improving outcomes and minimizing complications. Preoperative identification of high-risk patients and modifiable risk factors present opportunity for clinical research. A total of 49,475 total hip arthroplasty patients were identified from National Surgical Quality Improvement Program between 2006 and 2013. We compared morbidly obese patients (BMI ≥ 40 kg/m^2) and non-morbidly obese patients (BMI 18.5–40 kg/m^2). We also compared patients with hypoalbuminemia (serum albumin <3.5 g/dL) against those with normal albumin. Our study demonstrates that hypoalbuminemia is a significant risk factor for mortality and major morbidity among total hip arthroplasty patients, while morbid obesity was only associated with an increased risk of superficial surgical site infection. Impressively, hypoalbuminemia patients carried a 5.94-fold risk of 30-day mortality.

Total hip arthroplasty (THA) is a highly successful and cost effective surgical treatment to improve quality of life for patients with advanced arthritis [1]. In the United States alone, nearly 200,000 primary THA procedures are performed each year, with projections of over half a million cases by the year 2030 [2,3]. With healthcare reform and an emphasis on value-based healthcare, there is greater emphasis on identifying patients with modifiable risk factors to minimize complications and improve outcomes. However, some "modifiable" risk factors such as morbid obesity may be less modifiable than others, particularly in the setting of limited mobility. Therefore, precluding these patients from receiving highly effective interventions may lead to disparate healthcare for this population. There are a number of publications that reported various risk factors for adverse outcomes in patients undergoing THA, including advanced age [4], history of arrhythmia [5], history of severe cardiac disease [5], pulmonary circulatory disease [6,7], dementia [8], renal disease [8], and cerebrovascular disease [8]. There are also other potentially modifiable risk factors that might have more significant impact on clinical practice, including coagulopathy [9], electrolyte and fluid abnormality [9,10], low total lymphocyte count [11], and low hemoglobin level at hospital admission [11].

Morbid obesity, as a potential modifiable risk factor, has been associated with increased risks of perioperative complications in patients undergoing THA [12,13]. However, other studies have not supported the association between morbid obesity and adverse outcomes [14–16]. Similarly, preoperative nutrition status, another potential risk factor among arthroplasty patients, has had mixed results in regards to its association with adverse outcomes [17–20]. There appears to be an association between morbid obesity and malnutrition [21]. However, it is not clear whether morbid obesity, malnutrition, or both are associated with major increased risks of perioperative complications after total joint arthroplasty. Most studies combine THA and total knee arthroplasty (TKA), while both morbid obesity and malnutrition may influence THA and TKA differently.

By reviewing a large representative dataset from the National Surgical Quality Improvement Program (NSQIP), this study aimed to evaluate the effects of preoperative nutritional deficiency and morbid obesity on 30-day postoperative complications specifically for patients undergoing THA. We hypothesized that both hypoalbuminemia and morbid obesity were associated with higher risks of 30-day postoperative complications.

Material and Methods

This study was exempted by the institutional review board.

Study Sample

We acquired a dataset from the American College of Surgeons National Surgical Quality Improvement Program (NSQIP) from 2006 to 2013 (http://

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.2015.06.003.

Reprint requests: Jiabin Liu, MD, PhD, Department of Anesthesiology and Critical Care, the Perelman School of Medicine, University of Pennsylvania, 3400 Spruce Street, Philadelphia, PA, USA 19104.

http://dx.doi.org/10.1016/j.arth.2015.06.003
0883-5403/

site.acsnsqip.org). The NSQIP prospectively collects data on 140 variables under a standardized protocol. The data include demographic information, comorbidities, pre-operative laboratory results, intraoperative variables, and 30-day postoperative complications. To define our study cohort, we only included patients with the principal current procedural terminology (CPT) code for THA (CPT 27130). There were a total of 51,961 entries. We excluded patients categorized as "emergency" (453 entries), American Society of Anesthesiologist (ASA) class 4 (1038 entries), and ASA class 5 (3 entries). We also excluded patients with bilateral THA as defined by the relevant concurrent CPT code (265 entries). We then excluded patients with missing information on body mass index (BMI) (126 entries), or BMI <18.5 kg/m^2 (601 entries). We intentionally excluded low BMI patients in the current study due to small number of patients, and focused on hypoalbuminemia in both non-morbidly obese and morbidly obese patients. The final cohort included 49,475 subjects (Fig. 1).

Study Variables

Patients were separated into two groups, hypoalbuminemia (serum albumin <3.5 g/dL) and normal albumin (serum albumin ≥ 3.5 g/dL). We also divided patients into morbidly obese (BMI ≥ 40 kg/m^2) and non-morbidly obese (BMI between 18.5 and 40 kg/m^2) groups. We analyzed data on mortality and 21 complications as reported in the NSQIP database (including superficial incisional surgical site infection, deep incisional surgical site infection, organ space surgical site infection, surgical wound disruption, pneumonia, unplanned intubation, pulmonary embolism, on ventilator >48 hours, progressive renal insufficiency, acute renal failure, urinary tract infection, stroke/CVA, coma >24 hours, peripheral nerve injury, cardiac arrest requiring CPR, myocardial infarction, bleeding transfusion, prosthesis failure, DVT, sepsis, and septic shock). We also developed three composite complication variables, including any infection, cardiac/pulmonary complications, and any major complications. The full lists of compositions were summarized in Table 1.

Statistical Analysis

All data analysis was executed in STATA 12.1 statistical software (StataCorp LP, College Station, TX). Continuous variables were analyzed via Student t-test, and categorical variables were analyzed with chi-square test. For each complication, multivariable logistic regression analysis was applied to evaluate its association with hypoalbuminemia, morbid obesity, and their synergistic effect. The process utilized backward elimination with a threshold of $P < 0.2$ for variable inclusion in the final regression model. The independent variables included age, gender, race, BMI, ASA classification, year of surgery, and Charlson Comorbidity Index. Adjusted odds ratio (OR), 95% confidence interval (CI), and P values were reported. Each regression model was evaluated with C-statistics for modeling sufficiency.

Study Cohort

The final cohort included 49,475 entries, including 3580 subjects with BMI >40 kg/m^2 and 45,895 subjects with BMI 18.5–40 kg/m^2. There were 1122 patients with serum albumin <3.5 g/dL and 23,116 patients with albumin ≥3.5 g/dL (Fig. 1). There were statistically significant differences, without likely clinical importance, with respect to age, gender, and race (Table 2). The average length of stay (LOS) was significantly different between normal albumin and hypoalbuminemia groups (3.18 ± 4.13 vs. 4.67 ± 6.05 days, $P < 0.01$). There was no difference in LOS between non-morbidly obese patients and morbidly obese patients (3.20 ± 4.65 vs. 3.33 ± 2.98 days, $P = 0.11$).

There were several significant differences in pre-existing comorbidities between study groups (Table 3). Morbidly obese patients had a higher ASA classification, Charlson comorbidity burden, worse functional health status, hypertension, dyspnea, and diabetes. Patients with hypoalbuminemia showed a generalized higher prevalence of comorbidities when compared to patients with normal albumin (Table 3).

Results

The incidence of 30-day mortality was low in both morbidly obese and non-morbidly obese groups (0.20 vs. 0.06%, $P = 0.06$, Table 4). However, mortality was significantly higher among patients with hypoalbuminemia when compared to patients with normal albumin levels (1.25 vs. 0.13%, $P < 0.01$).

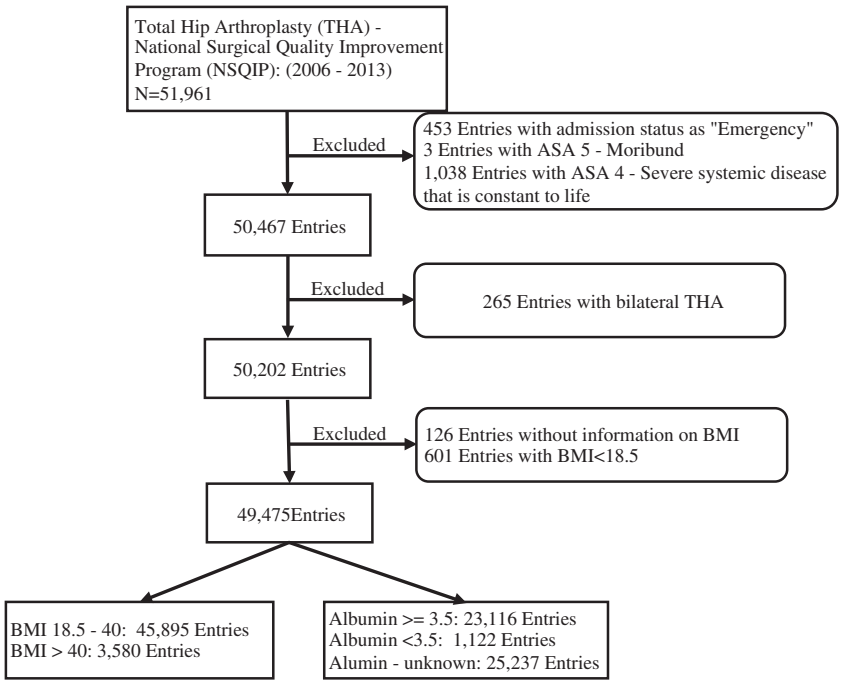

Fig. 1. Flowchart of patient selection process.