The Journal of Arthroplasty 31 (2016) S207–S211

Contents lists available at ScienceDirect

The Journal of Arthroplasty

journal homepage: www.arthroplastyjournal.org

Complications - Other

Lingering Risk: Bariatric Surgery Before Total Knee Arthroplasty

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ARTICLE INFO

Article history:
Received 2 December 2015
Received in revised form
16 February 2016
Accepted 23 February 2016
Available online 15 March 2016

Keywords:
obesity
gastric bypass
total knee arthroplasty
complications
bariatric surgery

ABSTRACT

Background: Obesity continues to increase in the United States with an estimated 35% obesity and 8% bariatric (body mass index >40) rate in adults. Bariatric patients seek advice from arthroplasty surgeons regarding the temporality of bariatric surgery (BS), yet no consensus currently exists in the literature.
Methods: A total of 39,014 patients were identified in a claim-based review of the entire Medicare database with International Classification of Diseases, Ninth Revision codes to identify patients in 3 groups. Patients who underwent BS before total knee arthroplasty (group I: 5914 experimental group) and 2 control groups that did not undergo BS but had either a body mass index >40 (group II: 6480 bariatric control) or <25 (group III: 26,616 normal weight control). International Classification of Diseases, Ninth Revision, Clinical Modification codes identified preoperative demographics or comorbidities and evaluated short-term medical (30 day) and long-term surgical (90 days and 2 years) complications.
Results: Group I had the greatest female predominance, youngest age, and highest incidence of: deficiency anemia, cardiovascular disease, pulmonary disease, liver disease, ulcer disease, polysubstance abuse, psychiatric disorders, and smoking. Medical and surgical complication incidences were greatest in group I including: 4.98% deep vein thrombosis; 5.31% pneumonia; 10.09% heart failure; and 2-year infection, revision, and manipulation rates of 5.8%, 7.38%, and 3.13%, respectively. These values were significant elevation compared to III and slightly greater than II.
Conclusions: This study demonstrates that BS before total knee arthroplasty is associated with greater risk compared to both nonobese and obese patients. This is possibly due to a higher incidence of medical or psychiatric comorbidities determined in the Medicare BS patients, wound healing difficulties secondary to gastrointestinal malabsorption, malnourishment from prolonged catabolic state, rapid weight loss before surgery, and/or age.

Obesity, defined as body mass index (BMI) ≥30 kg/m^2, is widely acknowledged as an independent risk factor for developing knee osteoarthritis [1-5], and an estimated 56.5% patients undergoing total knee arthroplasty (TKA) are obese [6]. Beyond osteoarthritis, obesity is associated with higher incidence of multiple comorbidities including type II diabetes, cardiovascular diseases, asthma, and chronic back pain, as well as, increased risk of morbidity and mortality [7]. Obesity rates continue to increase in the United States; currently there is an estimated 35% obesity rate [8] and 8% bariatric rate (BMI >40) in adults [8]. The most recent dynamic model predicts a bariatric rate plateau of 9% by 2030 [9]. Counseling, lifestyle, and/or pharmacotherapy yield only modest results for long-term weight control, whereas bariatric surgery (BS) promotes large amounts of sustainable weight loss [10,11].

In addition to sustained weight loss, BS provides additional benefits to obesity-related comorbidities including insulin resistance and type 2 diabetes mellitus, hypertension, dyslipidemia, cardiovascular disease, stroke, sleep apnea, gallbladder disease, gout, osteoarthritis, and reduces relative risk of death [12-14]. This has led to the term “metabolic surgery” because of the beneficial effects beyond weight loss [15,16]. Consequently, there is a steady demand for BS with 220,000 performed in the United States and Canada between 2008 and 2009 [17]. The most definitive indication for BS is BMI ≥40 [18], and the average weight loss after BS is 15

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.2016.02.075.

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http://dx.doi.org/10.1016/j.arth.2016.02.075
0883-5403/

BMI units, with many postoperative patients achieving normal weight, defined as BMI 18.5-25 [19]. Such dramatic weight loss often precedes panniculectomy (about 25%) [19] and/or joint arthroplasty.

Conversely, a bariatric patient may initially present to the arthroplasty surgeon to discuss options for their end-stage knee osteoarthritis. Intuitively, if BS reduces preoperative BMI and comorbidities it would be an excellent option to reduce risk before a subsequent procedure. However, endocrinology and general surgery literature suggests otherwise [20-27], and no consensus exits in arthroplasty literature. Five orthopedic studies [28-32] examined BS before TKA, but the conclusions are contradictory, cohorts underpowered, and all lack 2-year outcomes. The imminent demand for TKA in obese patients reinforces the importance of determining the link between BS and TKA.

We investigated the relationship between BS and TKA by (1) identifying preoperative demographics and comorbidities associated with complication risk; (2) evaluating the short-term medical (30 days), and long-term surgical (90 days and 2 years) risk associated with BS before TKA.

Materials and Methods

Medicare patient data from January 1, 2005 to December 31, 2012 were reviewed using the PearlDiver Technologies database (Warsaw, IN). The database includes the Medicare Standard Analytical Files, which have 100% of inpatient and outpatient facility data for all Medicare patients. International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) procedural codes and Boolean language were used to identify patient cohorts of interest based on a diagnosis of osteoarthritis, presence of BS before TKA, and BMI between 2005 and 2011.

A claim-based review of the entire Medicare database was performed, and ICD-9 codes were used to identify patients who underwent TKA for osteoarthritis with the following specifics to obtain 3 separate patient groups. Those who underwent BS before TKA (group I) and 2 control groups that did not undergo BS but had either a BMI >40 (group II: bariatric patient control) or <25 (group III: normal weight patient control). Using appropriate search connectors, the search was tailored to patients who either never underwent BS (2 control groups) or underwent BS before TKA. ICD-9-CM diagnosis codes were used to identify comorbidities and medical/surgical complications (Tables 1–3) of interest for TKA. All cohorts were cross referenced for the occurrence of each complication at 30 days for medical complications and 90 days and 2 years overall for surgical complications. We excluded patients in all cohorts who had TKA after December 31, 2010 to ensure the opportunity for minimum 2-year follow-up data on all complications. The initial search yielded a total of 39,014 patients who underwent TKA during the identified time frame. Out of this cohort, a total of 5914 underwent BS before TKA, and 26,616 qualified to serve as the bariatric control group, and 6480 had a normal BMI of less than 25. Comorbidities were identified using the Elixhauser method, and demographic information is displayed in Table 1. Odds ratios (ORs) and *P*-values were calculated using chi-squared and Fisher exact tests for Tables 2 and 3.

Results

Preoperative demographics and comorbitities of the 3 cohorts are depicted in Table 1. As hypothesized, patients with history of gastric bypass (group I) were younger and medically more complex exhibiting the highest prevalence of: deficiency anemia, cardiovascular disease, pulmonary disease, liver disease, ulcer disease, polysubstance abuse, psychiatric disorders, and smoking ($P < .05$).

Table 1
Demographics and Comorbidity.

	Group I, BS Before TKA, n = 5918 (%)	Group II, BMI >40, n = 26,616 (%)	Group III, BMI <25, n = 6480 (%)
Female	83.05	76.38	62.75
Less than 65	57.77	27.18	4.78
Congestive heart failure	15.85	13.80	4.80
Valvular disease	12.45	8.23	9.97
Peripheral vascular disease	12.59	9.14	9.09
Hypertension	83.25	74.17	60.32
Other neurological disorders	16.09	7.05	6.10
Chronic pulmonary disease	40.35	28.54	15.68
Diabetes without chronic complications	46.77	42.06	13.94
Diabetes with chronic complications	11.64	10.28	2.36
Hypothyroidism	30.60	21.02	17.50
Renal failure	8.58	8.63	4.58
Liver disease	9.75	3.36	1.50
Chronic peptic ulcer disease	1.35	0.17	0.19
HIV/AIDS	1.54	0.85	1.06
Deficiency anemias	43.68	21.83	22.24
Alcohol abuse	3.90	1.29	1.31
Drug abuse	6.94	1.83	1.03
Psychoses	18.22	6.65	3.01
Depression	44.00	18.16	10.12
Smoking	25.77	14.97	15.48

BS, bariatric surgery; TKA, total knee arthroplasty; BMI, body mass index; HIV, human immunodeficiency virus.

The prevalence of the comorbidities among patients in group II and group III declined in a progressive fashion with group III having the lowest incidence of the previously mentioned comorbidities ($P < .05$). The rate of deficiency anemia of patients in group I was double (44% vs 22%) both group II and group III, which could be related to malabsorption.

Thirty-day medical complications of the 3 cohorts are shown in Table 2. Patients in group I had the highest incidence of every complication examined when compared with normal BMI patients (group III). Most notable were incidences of respiratory failure 1.82% vs 0.37% (OR 5.0), pneumonia 5.31% vs 1.34% (OR 4.12), and heart failure 10.09% vs 2.67% (OR 4.09). Other significant differences in complications were noted in deep vein thrombosis (OR 1.87), pulmonary embolus (OR 2.49), stroke (OR 2.09), acute renal failure (OR 3.86), urinary tract infection (OR 2.44), and mortality (OR 2.85). When compared to obese patients without history of prior gastric bypass (group II), all examined complications in group I except myocardial infarction and respiratory failure reached statistically significant differences. The most significant differences were detected in the incidences of stroke (0.96% vs 0.41%), pneumonia (5.31% vs 1.82%), urinary tract infection (17.08% vs 10.82%), deep vein thrombosis (4.98% vs 2.99%), and mortality (0.22% vs 0.06%).

A comparison of each group's 90-day and 2-year surgical complications is presented in Table 3. When comparing 90-day surgical complications, patients in group I had higher rates of revision surgery (1.03%) when compared with Group II (0.69%) and group III (0.29%). Similarly, there was a higher incidence of extensor mechanism rupture in group I (0.63%) compared with group II (0.43%) and group III (0.31%). There was also an increased incidence of periprosthetic infection between group I (1.76%) and group III (0.57%). Analysis of the 2-year surgical complication incidences showed significantly higher incidence of all complications except vascular or neurological complications when compared to the obese group (group II). Notable 2-year incidences in group I include: periprosthetic infection 5.8%, revision surgery 7.38%, manipulation 3.13%, and extensor rupture in 2.11%. The comparison between group I and the nonobese group III cohort showed significant differences in all but vascular or neurological injury.