The Journal of Arthroplasty 33 (2018) 36–40

Contents lists available at ScienceDirect

The Journal of Arthroplasty

journal homepage: www.arthroplastyjournal.org

Health Policy & Economics

Perioperative Outcomes and Complications in Patients With Heart Failure Following Total Knee Arthroplasty

Gannon L. Curtis, MD, Jared M. Newman, MD, Jaiben George, MBBS, Alison K. Klika, MS *, Wael K. Barsoum, MD, Carlos A. Higuera, MD

Department of Orthopaedic Surgery, Cleveland Clinic, Cleveland, Ohio

ARTICLE INFO

Article history:
Received 24 April 2017
Received in revised form
7 July 2017
Accepted 25 July 2017
Available online 3 August 2017

Keywords:
total knee arthroplasty
heart failure
lengths-of-stay
readmission
discharge disposition
complications

ABSTRACT

Background: Heart failure (HF) is a common comorbidity in the aging population and they will require major elective surgery. The purpose of this study is to determine if HF is a risk factor for adverse perioperative outcomes and short-term complications following total knee arthroplasty.
Methods: The American College of Surgeons National Surgical Quality Improvement Program database was utilized to identify all patients who underwent total knee arthroplasty for osteoarthritis from 2008 to 2014. Any diagnosis other than osteoarthritis was excluded. A total of 111,634 patients were identified and 251 of these patients had a preoperative diagnosis of HF. The main outcomes included operative time, lengths-of-stay, discharge disposition, return to operating room, readmission, and short-term complications, including death.
Results: Patients with HF were found to have longer hospital stays ($\beta = 0.59$, 95% confidence interval [CI] 0.12-1.06) following total knee arthroplasty, and were more likely to return to the operating room (odds ratio 2.00, 95% CI 1.01-3.94) and be readmitted (OR 1.88, 95% CI 1.21-2.94). In addition, HF was found to be a risk factor for 1 or more complications (OR 1.41, 95% CI 1.05-1.90), wound dehiscence (OR 4.86, 95% CI 1.68-14.03), and myocardial infarction (OR 4.81, 95% CI 1.90-12.16) postoperatively.
Conclusion: Patients with HF are more likely to have a longer length-of-stay, return to the operating room, and be readmitted. Additionally, they have a higher risk for at least one postoperative complication, myocardial infarction, and wound dehiscence.

Heart failure (HF) is a highly prevalent medical condition that affects nearly 20% of Americans over the age of 40 years [1]. As of 2013, roughly 5.1 million Americans were living with HF and it is estimated that approximately 650,000 Americans will continue to be diagnosed annually [2–4]. HF can be caused by a variety of diseases, such as hypertension, diabetes, and coronary heart disease [5]. It is a clinical diagnosis characterized by fluid retention, fatigue, and dyspnea [6]. Furthermore, patients with HF are at increased risk of morbidity and mortality after surgery [7,8].

As the population ages and the prevalence of HF continues to rise [2], these patients may be part of the growing number of patients suffering from end-stage knee osteoarthritis that requires total knee arthroplasty (TKA) [9]. According to the Healthcare Cost and Utilization Project, in 2012, TKA was the most frequent elective surgical procedure that required inpatient admission [10], performed over 700,000 times annually. As these trends continue, physicians will care for an increasing number of patients with HF who will require TKA. HF has been identified in the literature as a risk factor for poor outcomes following noncardiac surgery [8,11]. However, to the best of our knowledge, we are not aware of any comprehensive studies that were designed to assess unfavorable perioperative outcomes and 30-day complications related to HF following TKA.

This study's purpose was to evaluate the perioperative and 30-day outcomes of patients with a diagnosis of HF following TKA. More specifically, we addressed the following questions: (1) what are the perioperative outcomes (ie, operative time, length of stay [LOS], discharge disposition, return to operating room, and readmission) for patients with HF following TKA, and (2) is HF a risk factor for 30-day complications following TKA?

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.2017.07.043.

* Reprint requests: Alison K. Klika, MS, Department of Orthopaedic Surgery, Cleveland Clinic, A41, 9500 Euclid Avenue, Cleveland, OH 44195.

http://dx.doi.org/10.1016/j.arth.2017.07.043
0883-5403/

Materials and Methods

Database

This study used the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) database. The ACS NSQIP database prospectively collects data from over 500 member institutions [12]. More than 150 variables are documented for each surgical case, including patient demographics, preoperative comorbidities, preoperative laboratory values, surgical data, and 30-day outcomes. Further information regarding the methods used by the ACS NSQIP database has been previously described [13–15].

Selection of Patients

All patients diagnosed with knee osteoarthritis (International Classification of Disease, 9th edition codes 715-715.98) who had primary TKA (Current Procedural Terminology 27447) from 2008 to 2014 were eligible for inclusion (n = 112,034). Patients who underwent nonelective surgery (n = 201) or had concurrent procedures during their admission (n = 209) were excluded from this study. Of the 111,624 patients included in the cohort, 251 patients were diagnosed with HF. The control group (ie, patients without HF) consisted of 111,383 patients. The NSQIP database defined HF as being diagnosed or having decompensated HF within 30 days prior to the index procedure [15]. Patient variables were separated into preoperative, perioperative, and postoperative groups. Preoperative variables included patient demographics, comorbidities, and laboratory values (Table 1). Perioperative variables included anesthesia type, operative time, LOS, discharge disposition, return to the operating room, and readmission. Postoperative complications included any complication, mortality, superficial surgical site infection (SSI), deep SSI, organ/space SSI, wound dehiscence, cardiac arrest, myocardial infarction (MI), pneumonia, reintubation, use of a ventilator for >48 hours, progressive renal insufficiency, acute renal failure requiring dialysis, stroke, urinary tract infection, blood transfusion, deep vein thrombosis, pulmonary embolism, systemic sepsis, and septic shock.

The 2 cohorts had substantial differences in demographics, comorbidities, and laboratory values (Table 1). Particularly, patients with HF were older (70.4 vs 66.8 years), less likely to be female (55% vs 63%), and were more obese (body mass index 34.8 vs 32.9). Additionally, HF patients had increased rates of hypertension (89% vs 67%), diabetes (34% vs 18%), chronic obstructive pulmonary disease (19% vs 4%), steroid use (8% vs. 3%), and bleeding disorders (14% vs 3%).

Statistical Analysis

All preoperative, perioperative, and postoperative variables were analyzed with univariate analysis. Variables were excluded from the analysis if more than 20% of cases were missing data [16]. Numerical variables were compared using the independent t-test, and categorical variables were analyzed using the chi-square test or Fisher's exact test. Only variables that were found to be statistically different were included in the multivariate regression models. Linear regression was utilized for continuous variables, while binary regression was used for categorical variables. This adjusted for confounding variables and permitted us to establish HF as a risk factor for each outcome of interest. A P-value of <.05 was used to determine statistical significance and all tests were 2-sided. All statistical analyses were run on IBM SPSS Statistics 23 for Mac (IBM Corporation, Armonk, NY).

Table 1
Patient Demographics, Comorbidity, and Preoperative Laboratory Value Comparison.

Demographics	Control Group (n = 111,373)	Heart Failure Group (n = 251)	P Value
Age (y) (mean ± SD)	66.8 ± 9.7	70.4 ± 9.9	<.001
Gender, female (%)	69,736 (63)	137 (55)	.008
Body mass index (kg/m^2) (mean ± SD)	32.9 ± 7.1	34.8 ± 7.8	<.001
ASA class ≥3 (%)	52,447 (47)	231 (92)	<.001
Anesthesia, general (%)	59,023 (53)	167 (67)	<.001
Current smoker (%)	9360 (8)	24 (10)	.509
Functional status (%)			<.001
Independent	108,767 (98)	232 (92)	
Partially independent	1864 (2)	19 (8)	
Totally dependent	67 (<1)	0 (0)	
Hypertension (%)	74,014 (67)	223 (89)	<.001
Diabetes (%)	19,801 (18)	86 (34)	<.001
COPD (%)	3942 (4)	47 (19)	<.001
Ascites (%)	19 (<1)	0 (0)	>.999
Acute renal failure (%)	29 (<1)	2 (<1)	.002
Dialysis (%)	157 (<1)	2 (<1)	.050
Cancer (%)	106 (<1)	1 (<1)	.214
Wound infection (%)	400 (<1)	3 (1)	.063
Steroid use (%)	3447 (3)	19 (8)	<.001
Bleeding disorder (%)	2831 (3)	35 (14)	<.001
Transfusion (%)	53 (<1)	0 (0)	>.999
Sodium (mEq/L)	139.5 ± 2.8	139.5 ± 3.3	.865
Blood urea nitrogen (mg/dL) (mean ± SD)	18.1 ± 7.0	23.2 ± 14.4	<.001
Creatinine (mg/dL) (mean ± SD)	0.9 ± 0.4	1.1 ± 0.5	<.001
White blood cell count (cells/mcL) (mean ± SD)	7.0 ± 2.1	7.4 ± 1.9	.001
Hematocrit (%)	40.6 ± 4.0	39.3 ± 4.5	<.001
Platelets (platelets/mcL) (mean ± SD)	244 ± 66	227 ± 62	<.001

ASA, American Society of Anesthesiologists; COPD, chronic obstructive pulmonary disease; SD, standard deviation.

Results

Perioperative Outcomes

LOS, discharge disposition, return to operating room, and readmission were significantly different between the 2 cohorts following univariate analysis, while operative time was not (Table 2). Mean LOS was significantly higher for TKA patients with HF (4.1 ± 3.3 days) compared to TKA patients without HF (3.2 ± 3.8 days, P < .001). After multivariate regression analysis (Table 3), HF was shown to be an independent risk factor for increased LOS (beta-coefficient [β] 0.59, 95% confidence interval [CI] 0.12-1.06, P = .015), return to the operating room (odds ratio [OR] 2.00, 95% CI 1.01-3.94, P = .046), and being readmitted to the hospital within 30 days (OR 1.88, 95% CI 1.21-2.94, P = .005), but not for discharge to a nonhome facility (OR 1.19, 95% CI 0.88-1.57, P = .276).

Postoperative Complications

Univariate analysis identified significant differences in eleven 30-day complication rates between the 2 groups (Table 2). Following multivariate regression, HF was discovered to increase the risk of numerous postoperative complications following TKA (Table 3). Patients with HF had increased risks of any complication (OR 1.41, 95% CI 1.05-1.90, P = .023), wound dehiscence (OR 4.86, 95% CI 1.68-14.03, P = .003), and MI (OR 4.86, 95% CI 1.90-12.16, P = .001) within 30 days of TKA compared to patients who did not have HF.