Impact of Congestive Heart Failure on Postoperative Outcomes of Primary Total Knee Arthroplasty: A NSQIP Analysis between 2008 and 2016

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INTRODUCTION: Total knee arthroplasty (TKA) is a commonly performed procedure in elderly patients due to arthritis or other causes of chronic disability. Due to an elderly patient population, congestive heart failure (CHF) is a common comorbidity. Currently, there is a paucity of data on the impact of CHF on postoperative TKA outcomes. This study aims to identify patient demographics and postoperative outcomes in patients with CHF undergoing TKA.

METHODS: The American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) database was queried via CPT codes between 2008 and 2016 for patients undergoing TKA (CPT code 27447). CHF status was identified via the "HXCHF" variable in the database. 1:1 propensity score matching controlled for gender, age, BMI and estimated morbidity probability. Patient demographics, comorbidities, and 30-day postoperative outcomes were compared using univariate analysis. Binary logistic regression models were used to identify congestive heart failure as a risk factor for adverse postoperative outcomes after TKA.

RESULTS: 225,475 patients that underwent TKA between 2008 and 2016 were identified (623 with CHF, 224,852 without CHF). Using 1:1 propensity score matching, 559 patients with and without CHF were identified. 62.1% of patients were female and 88.3% were white (Table 1). Average patient age was 66.6 ± 9.6, with an average body mass index (BMI) of 33.0 ± 7.0. Patients stayed at the hospital an average of 3.0 ± 3.2 days. A large majority, 98.5%, of patients were independent prior to surgery. 19,291 (8.6%) of patients smoked. The most common comorbidities identified were hypertension requiring medication (147923 patients, 65.6%), diabetes (40734, 18.1%), and anemia (40640, 18.0%). 26,999 patients (12.0%) experienced any kind of adverse event. The most common postoperative complications identified were wound complications (16526, 7.3%) followed by cardiac complications (2601, 1.2%). 6,556 (2.9%) of patients required readmission and 2,370 (1.1%) required reoperation. There was a 0.1% mortality rate. Patients with CHF undergoing TKA were more likely to be younger (71.2 vs. 73.2; p<0.001) and have a higher BMI (35.0 vs. 34.1; p=0.046) (Table 2). They also tended to have longer hospital stays (4.2 days vs. 3.4; p=0.003) and had higher estimated probability of both morbidity and mortality (both, p<0.001). Patients with CHF were more likely to be ASA 3 or 4 (93.7% vs. 88.9%; p=0.004), have COPD (19.1% vs. 12.3%; p=0.002), hypertension requiring medication (89.1% vs. 83.9%; p=0.011), or a bleeding disorder (11.3% vs. 7.7%; p=0.041). Using binary logistic regression, CHF was found to be an independent predictor of higher risk for pulmonary complications (OR 2.8), renal complications (OR 2.6), and readmission (OR 1.7) (Table 3). There was no increased risk of cardiac complications (p=0.528), reoperation (p=0.728), or mortality (p=0.068).

DISCUSSION AND CONCLUSION: CHF was found to increase the risk of a number of postoperative complications including pulmonary and renal complications, but not cardiac complications. It was also found to correlate to an increased risk of readmission but not reoperation or mortality. This study can be used to guide clinical decision making in patients with CHF that are undergoing TKA, and risk factors need to be explained to patients pre-operatively based on this knowledge.

Variables	Frequency/Mean	Percentage/SD
Gender		
Male	85505	37.9
Female	139830	62.1
Race		
White	176615	88.3
African American or Black	16563	8.4
Asian	4672	2.4
Native American or Alaska Native	1149	0.6
Hawaiian Native or Pacific Islander	746	0.4
Age (years)	66.6	9.6
BMI (kg/m²)	33.0	7.0
Total Length of Hospital Stay (days)	3.0	3.2
Operative Time (min)	89.6	38.4
Estimated Probability of Morbidity	0.0300	0.0127
Estimated Probability of Mortality	0.0032	0.0015
ASA Class		
1 - No Disturb	4574	2.0
2 - Mild Disturb	111560	49.4
3 - Severe Disturb	105343	46.8
4 - Life Threat	3760	1.7
5 - Moribund	75	0.0
ASA 3 or 4	109303	48.5
Functional Status Prior to Surgery		
Independent	220818	98.5
Partially Dependent	3337	1.4
Totally Dependent	115	0.1
Comorbidity		
Diabetes	40734	18.1
Smoking	19291	8.6
Ventilator dependence	13	0.0
COPD	8099	3.6
Asthma	41	0.0
Hypertension requiring medication	147923	65.6
Renal failure	60	0.0
Dialysis	355	0.2
Disseminated Cancer	256	0.1
Open wound with or without infection	629	0.3
Weight loss (>10% in 6 months)	278	0.1
Transfusion within 72 hours prior to surgery	110	0.1
Steroid Use	7965	3.5
Bleeding disorder	5255	2.3
Anemia	40640	18.0
Any Adverse Events	26999	12.0
Any Postoperative Complication	22766	10.1
Wound Complications	16526	7.3
Superficial SSI	1245	0.6
Deep SSI	1265	0.6
Wound dehiscence	467	0.2
Bleeding requiring Transfusion	14743	6.5
Pulmonary Complications	2358	1.0
Pneumonia	781	0.3
Pulmonary Embolism	1394	0.6
Failure to wean (Ventilator > 48 hours)	139	0.1
Unplanned Intubation	359	0.2
Renal Complications	2355	1.0
Progressive Renal Insufficiency	273	0.1
Acute renal failure	144	0.1
Urinary tract infection	1975	0.9
Neuro Complications (CVA/Stroke)	195	0.1
Cardiac Complications	2601	1.2
Cardiac arrest	185	0.1
Myocardial Infarction	480	0.2
DVT/Thrombophlebitis	1996	0.9
Sepsis-Related Complications	904	0.4
Sepsis	474	0.2
Septic Shock	145	0.1
Organ/Space SSI	329	0.2
Readmission	6556	2.9
Reoperation	2370	1.1
Mortality	315	0.1

Table 1: Demographic Information for Patients With and Without CHF

Postoperative Outcomes	No CHF N (%)	CHF N (%)	P-value
Adverse Events	125 (22.4%)	141 (25.2%)	0.261
Any Postoperative Complication	106 (19.0%)	113 (20.2%)	0.598
Wound Complications	86 (15.4%)	75 (13.4%)	0.394
Superficial SSI	5 (0.9%)	8 (1.4%)	0.403
Deep SSI	1 (0.2%)	3 (0.5%)	0.624
Wound dehiscence	5 (0.9%)	5 (0.9%)	1.000
Bleeding requiring Transfusion	77 (13.8%)	66 (11.8%)	0.325
Pulmonary Complications	7 (1.3%)	19 (3.4%)	0.017
Pneumonia	3 (0.5%)	9 (1.6%)	0.082
Pulmonary Embolism	4 (0.7%)	5 (0.9%)	1.000
Failure to wean (Ventilator > 48 hours)	0 (0.0%)	2 (0.4%)	0.500
Unplanned Intubation	1 (0.2%)	6 (1.1%)	0.124
Renal Complications	8 (1.4%)	20 (3.6%)	0.022
Progressive Renal Insufficiency	3 (0.5%)	8 (1.4%)	0.130
Acute renal failure	0 (0.0%)	3 (0.5%)	0.249
Urinary tract infection	5 (0.9%)	9 (1.6%)	0.282
Neuro Complications (CVA/Stroke)	0 (0.0%)	3 (0.5%)	0.249
Cardiac Complications	10 (1.8%)	13 (2.3%)	0.527
Cardiac arrest	1 (0.2%)	4 (0.7%)	0.374
Myocardial Infarction	1 (0.2%)	6 (1.1%)	0.124
DVT/Thrombophlebitis	8 (1.4%)	3 (0.5%)	0.130
Sepsis-Related Complications	7 (1.3%)	9 (1.6%)	0.615
Sepsis	4 (0.7%)	3 (0.5%)	0.705
Septic Shock	0 (0.0%)	3 (0.5%)	0.249
Organ/Space SSI	3 (0.5%)	3 (0.5%)	1.000
Readmission	36 (6.4%)	60 (10.7%)	0.010
Reoperation	16 (2.9%)	18 (3.2%)	0.728
Mortality	1 (0.2%)	7 (1.3%)	0.069

Table 2: Rate of Adverse Postoperative Outcomes Between the CHF and non-CHF Cohorts.

Postoperative Outcomes	OR (95% CI)	P-Value
Adverse Events	1.2 (0.9 - 1.5)	0.261
Any Postoperative Complication	1.1 (0.8 - 1.5)	0.598
Wound Complications	0.9 (0.6 - 1.2)	0.349
Superficial SSI	1.6 (0.5 - 4.9)	0.407
Deep SSI	3.0 (0.3 - 29.0)	0.340
Wound Dehiscence	1.0 (0.3 - 3.5)	1.000
Bleeding Requiring Transfusion	0.8 (0.6 - 1.2)	0.325
Pulmonary Complications	2.8 (1.2 - 6.7)	0.022
Pneumonia	3.0 (0.8 - 11.3)	0.097
Pulmonary Embolism	1.3 (0.3 - 4.7)	0.738
Failure to Wean (Ventilator > 48 hours)	-	-
Unplanned Intubation	6.1 (0.7 - 50.5)	0.096
Renal Complications	2.6 (1.1 - 5.9)	0.026
Progressive Renal Insufficiency	2.7 (0.7 - 10.2)	0.145
Acute Renal Failure	-	-
Urinary Tract Infection	1.8 (0.6 - 5.4)	0.289
Neuro Complications (CVA/Stroke)	-	-
Cardiac Complications	1.3 (0.6 - 3.0)	0.528
Cardiac Arrest	4.0 (0.4 - 36.1)	0.214
Myocardial Infarction	6.1 (0.7 - 50.4)	0.096
DVT/Thrombophlebitis	0.4 (0.1 - 1.4)	0.145
Sepsis-Related Complications	1.3 (0.5 - 3.5)	0.615
Sepsis	0.7 (0.2 - 3.4)	0.706
Septic Shock	-	-
Organ/Space SSI	1.0 (0.2 - 5.0)	1.000
Readmission	1.7 (1.1 - 2.7)	0.011
Reoperation	1.1 (0.6 - 2.2)	0.728
Mortality	7.1 (0.9 - 57.7)	0.068

Table 3: Odd Ratios of Postoperative Complications in Those With CHF Compared to Those Without.