RESEARCH ARTICLE

Risk Factors and Outcomes Associated with Emergency Abdominal Surgery following Lower Extremity Total Joint Arthroplasty

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Abstract

Objectives: This study aims to identify potential risk factors and assess postoperative outcomes associated with requiring emergency abdominal surgery (EAS) within 30 days following total hip arthroplasty (THA) and total knee arthroplasty (TKA). We hypothesized that patients requiring EAS would carry a higher morbidity and mortality rates compared to patients that underwent the index operation alone.

Methods: We conducted a retrospective analysis using TriNetX, examining data from 2016-2024 from patients over 18 years old who underwent THA/TKA and required EAS within 30 days. Postoperative outcomes, including mortality and hospital readmission, were compared between patients requiring EAS and those who did not. Statistical analyses included measures of association and chi-squared tests. Patient demographic data, including age, sex, and comorbidities were analyzed.

Results: Patients requiring EAS within 30 days of a joint arthroplasty were significantly more likely to be older, overweight or obese, and to be diagnosed with comorbidities including diverticular disease, cholelithiasis, alcohol use disorders, and tobacco use. These patients had significantly higher mortality rates within 60 days of joint arthroplasty compared to patients without EAS, suggesting that the second operation contributed significantly to the increase in adverse outcomes.

Conclusion: This study emphasizes the importance of recognizing key risk factors for severe GI complications that require EAS. These findings highlight the need for careful patient selection, pre-operative evaluation of risk, and vigilant post-operative management, especially in those with many risk factors. Improved identification and management of high-risk patients may help reduce the likelihood of EAS and its associated mortality.

Level of evidence: III

Keywords: Arthroplasty, Emergency abdominal surgery, Mortality, Risk factors

Introduction

Morbidity within 30 days of operation and 90-day mortality from total hip arthroplasty (THA) has been reported as 4.9% / 0.5%[1,2] and 7.0% / 0.35% for total knee arthroplasty (TKA).[3,4] Risk factors leading to poor outcomes in these patients have been previously documented and include: older age, higher body mass index (BMI), and pre-existing systemic diseases such as Inflammatory Bowel Syndrome (IBS).[5,6] Gastrointestinal complications following total hip arthroplasty are uncommon, but compromise outcomes on a patient population with compromised mobility.[7] Outcomes in patients necessitating emergent abdominal surgery (EAS) following TJA are scarce, but one study reported postoperative gastrointestinal bleeding (GIB) and intestinal obstruction as the most common cause of EAS following TJA .[8] These patients were likely to have pre-existing peptic ulcer disease, steroid use, older age, hypotension, and a smoking history.[9-11] Other GI

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complications reported include acute colonic pseudo-obstruction, pancreatitis, diverticulitis, and intestinal ischemia.[12-14] the current literature suffers from institutional based analyses or by low powered studies. However, these studies uniformly document an increased morbidity and mortality resulting in longer length of hospital stay, and substantially higher hospital cost. An insight into the common gastrointestinal issues necessitating EAS following TJA is important for resource allocation and to allow for optimal patient selection in patients necessitating elective TJA.

This study was designed to determine the incidence and cause of EAS in patients 30 days following TJA. We hypothesize that patients requiring EAS within 30 days following TJA experience significantly higher morbidity and mortality compared to those undergoing TJA alone. This comparison aims to assess the magnitude of adverse outcomes that can be specifically attributed to EAS.

Materials and Methods

Data was collected from an aggregation of data from 57 healthcare organizations (HCOs) participating in the federated research network of TriNetX. Participating HCOs include hospitals, health systems, and academic medical centers. TriNetX aggregates data from sources such as electronic health records.[15] TriNetX can query and identify patient cohorts and provides advanced tools for data analysis while adhering to HIPAA and GDPR regulations to maintain data security and protect patient privacy. This study was deemed exempt from Institutional Review Board approval since it involves deidentified data from a database.

Patients were queried for instances of EAS within 30 days following total joint arthroplasty using current procedural terminology (CPT) codes. Patients under 18 years old were excluded. The CPT codes used for the emergency abdominal surgeries were as followed- appendectomies (1014622), laparoscopic procedures on the appendix (1007587), pancreatectomies (1007918, 1007923, 1007926, 48155), cholecystectomies (47562), colectomies (1007463, 1007468)), exploratory laparotomies (49000), diagnostic laparoscopies (49320), and repair procedures on the abdomen, peritoneum, and omentum (100800). Emergency abdominal surgeries occurring on the same day as joint arthroplasty were not included in the analysis. Patients were separated into four groups based on joint arthroplasty procedure (total hip arthroplasty (THA) 27130 or total knee arthroplasty (TKA) 27447) and instances of emergency abdominal surgeries – TKA patients requiring EAS, TKA patients not requiring EAS, THA patients requiring EAS, and THA patients not requiring EAS.

We assessed outcomes of mortality and hospital readmission within 30 days of EAS, and compared patient characteristics including race, age, gender, diagnoses of obesity, diabetes mellitus, tobacco use, psychoactive substance abuse, diverticular disease, and cholelithiasis between TKA patients with and without emergency abdominal surgeries, THA patients with and without EAS, and TKA and THA patients with EAS.

To determine whether the incidence of EAS was associated with certain categorical variables, we conducted chi-squared tests comparing TKA patients with and without emergency abdominal surgeries, THA patients with and without EAS, and TKA and THA patients requiring EAS.. To compare patient outcomes between cohorts, we ran a Measures of Association Analysis to determine the strength of EAS occurrence associated with mortality and hospital readmission. We calculated odd ratios with 95% confidence intervals (CI) to quantify the association between undergoing EAS and the outcomes of interest. P value <0.05 considered statistically significant. All statistical analyses were run using TriNetX.

Results

Patient Demographics:

Total Knee Arthroplasty (TKA)

Of 282,859 patients identified in the data set undergoing TKA, 127 required EAS (0.04%). Patient characteristics are summarized in [Table 1]. TKA patients requiring EAS were significantly more likely to be older (p<0.005), Asian (p < 0.0001), and certain racial minorities (p<0.01). These patients were also more significantly more likely to be overweight or obese (p<0.0001), diagnosed with diabetes mellitus (p<0.05), diverticular disease (p<0.0001), cholelithiasis (p<0.0001), alcohol related disorders (p<0.0001), and use tobacco (p<0.0001).

Table 1. TKA Patient Characteristics

Variable	TKA w/ EAS (n=127)	TKA w/o EAS (n=282,859)	p-value
Demographics			
Mean Age±SD	68.5±9.27	66.6±9.57	0.0275
Male %(n)	40% (51/127)	37% (104,861/282,859)	0.4717
Female	52% (66/127)	58% (163,510/282,859)	0.1829
Unknown Gender	8% (10/127)	5% (14,488/282,859)	0.1596
Not Hispanic or Latino	70% (89/127)	74% (208,378/282,859)	0.3585
Unknown Ethnicity	27% (34/127)	22% (61,058/282,859)	0.1556
Hispanic or Latino	8% (10/127)	5% (13,423/282,859)	0.0974
White	75% (95/127)	75% (210,876/282,859)	0.9481
Unknown Race	13% (16/127)	11% (31,626/282,859)	0.6123
Black or African American	9% (12/127)	9% (26,237/282,859)	0.9464
Asian	8% (10/127)	2% (5,722/282,859)	<0.0001

Table 1. Continued			
Other Race	8% (10/127)	3% (7,144/282,859)	0.0001
American Indian or Alaska Native	0% (0/127)	0% (695/282,859)	0.576
Native Hawaiian or Other Pacific Islander	0% (0/127)	0% (559/282,859)	0.616
Diagnoses			
Overweight and Obesity	49% (62/127)	32% (89,619/282,859)	<0.0001
Diverticular disease of intestine	35% (44/127)	14% (40,428/282,859)	<0.0001
Alcohol related disorders	10% (13/127)	3% (8,506/282,859)	<0.0001
Diabetes mellitus	28% (35/127)	20% (55,540/282,859)	0.0246
Cholelithiasis	23% (29 /127)	4% (11,133/282,859)	<0.0001
Tobacco use	8% (10/127)	2% (6,519/282,859)	<0.0001

Total Hip Arthroplasty (THA)

Of 203,087 patients undergoing THA, 103 required EAS within 30 days (0.05%). Patient characteristics are summarized in [Table 2]. THA patients requiring EAS were significantly more likely to be older ($p<0.01$), Hispanic or Latino ($p<0.0001$), and certain racial minorities ($p<0.0001$). These patients were also more significantly more likely to be overweight or obese ($p<0.0005$), diagnosed with diverticular disease ($p<0.0001$), cholelithiasis ($p<0.0001$), alcohol related disorders ($p<0.01$), and use tobacco ($p<0.0005$).

Table 2. THA Patient Characteristics			
Variable	**THA w/EAS (n=103)**	**THA w/o EAS (n=204,984)**	**p-value**
Demographics			
Mean Age±SD	68±11.1	64.6±11.8	0.0034
Male	48% (48/103)	43% (87,726/204,984)	0.4352
Female	52% (52/103)	51% (105,468/204,984)	0.8445
Unknown Gender	10% (10/103)	6% (11,790/204,984)	0.0847
Not Hispanic or Latino	83% (86/103)	77% (156,832/204,984)	0.0945
Unknown Ethnicity	15% (15/103)	21% (42,534/204,984)	0.1216
Hispanic or Latino	10% (10/103)	3% (5,618/204,984)	<0.0001
White	85% (88/103)	78% (159,344/204,984)	0.0603
Unknown Race	11% (11/103)	11% (21,960/204,984)	0.9913
Black or African American	10% (10/103)	9% (17,661/204,984)	0.6927
Asian	0% (0/103)	0% (1,817/204,984)	0.3372
Other Race	10% (10/103)	2% (3,534/204,984)	<0.0001
American Indian or Alaska Native	0% (0/103)	0% (374/204,984)	0.6644
Native Hawaiian or Other Pacific Islander	0% (0/103)	0% (294/204,984)	0.7005
Diagnoses			
Overweight and Obesity	40% (41/103)	24% (49,105/204,984)	0.0002
Diverticular disease of intestine	35% (36/103)	12% (24,914/204,984)	<0.0001
Alcohol related disorders	10% (10/103)	4% (8,996/204,984)	0.0084
Diabetes mellitus	17% (17/103)	15% (30,395/204,984)	0.6321
Cholelithiasis	17% (17/103)	3% (6,868/204,984)	<0.0001
Tobacco use	10% (10/103)	3% (6,980/204,984)	0.0004

THA vs. TKA

Patient characteristics are summarized in [Table 3]. TKA patients were significantly more likely to be Asian ($p<0.005$), an unknown ethnicity ($p<0.05$), and diagnosed with diabetes mellitus ($p<0.05$). THA patients were significantly more likely to be white ($p<0.05$) and non-Hispanic or Latino ($p<0.05$).

Emergent Abdominal Surgery following TJA

EAS counts are summarized in [Table 4]. THA patients were significantly more likely to undergo colectomy, partial or total while TKA patients were significantly more likely to

require a cholecystectomy ($p<0.05$). There were no significant differences noted in appendectomies or other abdominal procedures.

Patient Outcomes:

Total Knee Arthroplasty (TKA)

The outcomes of TKA patients are summarized in [Table 5]. Mortality rates within 60 days of TKA is 7.87% (n=10) in TKA patients requiring EAS and 0.09% (n=267) in TKA patients that did not need EAS. The risk difference between the two cohorts is 7.78% (CI 3.10%, 12.46%, $p<0.01$). The risk ratio (RR) is 83.39 (CI 45.45, 152.99) and the OR is 90.43 (CI 46.89, 174.40). Hospital readmission was observed in 0% (n=0) of TKA patients requiring EAS and 0.03% (n=69) of TKA patients that did not require surgery. The risk difference between the two cohorts is -0.03% (CI -0.03%, -0.02%, $p > 0.8$).

Table 3. THA w/EAS and TKA w/EAS Patient Characteristics

Variable	THA w/EAS (n=103)	TKA w/ EAS (n=127)	p-value
Demographics			
Mean Age±SD	68±11.1	68.5±9.27	0.7256
Male	47% (48/103)	40% (51/127)	0.8229
Female	50% (52/103)	52% (66/127)	0.3263
Unknown Gender	10% (10/103)	8% (10/127)	0.6234
Not Hispanic or Latino	83% (86/103)	70% (89/127)	0.0177
Unknown Ethnicity	15% (15/103)	27% (34/127)	0.0245
Hispanic or Latino	10% (10/103)	8% (10/127)	0.6234
White	85% (88/103)	75% (95/127)	0.0467
Unknown Race	11% (11/103)	13% (16/127)	0.653
Black or African American	10% (10/103)	9% (12/127)	0.9469
Asian	0% (0/103)	8% (10/127)	0.0036
Other Race	10% (10/103)	8% (10/127)	0.6234
American Indian or Alaska Native	0% (0/103)	0% (0/127)	-
Native Hawaiian or Other Pacific Islander	0% (0/103)	0% (0/127)	-
Diagnoses			
Overweight and Obesity	40% (41/103)	49% (62/127)	0.1717
Diverticular disease of intestine	35% (36/103)	35% (44/127)	0.9614
Alcohol related disorders	10% (10/103)	10% (13/127)	0.8945
Diabetes mellitus	17% (17/103)	28% (35/127)	0.0463
Cholelithiasis	17% (17/103)	23% (29 /127)	0.2327
Tobacco use	10% (10/103)	8% (10/127)	0.6234

Table 4. Comparison of Procedures in THA and TKA Patient Groups

Procedure	TKA (n=127)	THA (n=103)	p-value
Colectomy, partial or total	42	51	0.02
Cholecystectomy	44	22	0.03
Exploratory Laparotomy	15	12	1
Appendectomy and other laparoscopic procedures of the appendix	20	11	0.25
Diagnostic Laparascopy	10	10	0.8
Hernioplasty, Herniorraphy, Herniotomy procedures	44	31	0.4

Table 5. TKA Patient Outcomes

Variable	TKA w/ EAS (n=127)	TKA w/o EAS (n=282,756)	Odds Ratio (95% CI)	Risk Ratio (95% CI)	Risk Difference (95% CI)	p-value
Mortality	10	267	90.43 (46.89, 174.402)	83.39 (45.45, 152.99)	0.078 (0.03, 0.12)	<0.0001
Hospital Readmission	0	69	-	-	-0.0002 (-0.0003, -0.0002)	0.86

Total Hip Arthroplasty (THA)

The outcomes of THA patients are summarized in [Table 6]. Mortality rates within 60 days of THA is 9.71% (n=10) in THA patients requiring EAS and 0.16% (n=326) in THA patients that did not need EAS. The risk difference between the two cohorts is 9.55% (CI 3.83%, 15.27%, p <0.0001). The risk ratio (RR) is 60.41 (CI 33.19, 109.95) and the OR is 66.80 (CI 34.48, 129.40). Hospital readmission was observed in 0% (n=0) of THA patients requiring surgery and 0.02% (n=37) of THA patients that did not require surgery. The risk difference between the two cohorts is-0.02 %(CI -0.02%, -0.01%, p > 0.8).

Table 6. THA Patient Outcomes

Variable	THA w/EAS (n=103)	THA w/o EAS (n=202,841)	Odds Ratio (95% CI)	Risk Ratio (95% CI)	Risk Difference (95% CI)	p-value
Mortality	10	326	66.797 (34.480, 129.402)	60.409 (33.191, 109.946)	0.095 (0.038, 0.153)	0
Hospital Readmission	0	37	0	-	-	0.891

THA vs. TKA

The outcomes of TKA patients with EAS and THA patients with EAS are summarized in [Table 7]. As stated, mortality was observed in 9.71% of THA patients (n=10) and 7.87% (n=10) of TKA patients. The risk difference between the two cohorts is 1.84% (CI-5.56-9.23%, p > 0.6). The risk ratio (RR) is 1.23 (CI 0.53-2.85, p >0.05) and the OR is 1.26 (CI 0.50-3.15). Hospital readmission was observed in 0% of THA and TKA patients (n=0).

Table 7. THA w/EAS and TKA w/EAS Patient Outcomes

Variable	THA w/EAS (n=103)	TKA w/ EAS (n=127)	Odds Ratio (95% CI)	Risk Ratio (95% CI)	Risk Difference (95% CI)	p-value
Mortality	10	10	1.258 (0.502, 3.15)	1.233 (0.534, 2.848)	0.0184 (-0.0556, 0.0923)	0.6234
Hospital Readmission	-	-	-	-	-	-

Discussion

TJA is a commonly performed surgical intervention that carries low morbidity and mortality while improving patient's quality of life substantially.[16] While the complication rate for these interventions is considerably low compared to the benefits of the operation, unexpected in hospital events might lead to a much higher rate of poor outcomes in this patient population. A high-risk event that might drastically change the outcome of an index orthopedic procedure is emergent surgical operations. The current literature analyzing outcomes in patients requiring EAS following TJA suffers from their institutional based analysis or by low powered studies.[1,2,6,9,12,13] In the present report, we elected to analyze a large database inclusive of 220 healthcare organizations across 30 countries. The federated research network of TriNetX has been previously utilized for over 350 peer-reviewed studies and contributed to over 19,000 sponsored clinical trial opportunities.[15] This database is highly important, encompassing a large number of hospitals that provides a high power for analyses.

In the present study, we show that while the need for EAS following TJA is exceedingly low (0.04% and 0.05%), it carries a 60-fold for morbidity and mortality for THA, and 83-fold for TKA compared to patients without necessitating EAS. Thus, adverse outcomes should be attributed to the second insult compared to the index operation.

This study found that patients requiring EAS within 30 days of a joint arthroplasty were significantly more likely to be older, a racial minority (other than African American, American Indian, or Native Hawaiian), overweight or obese, diagnosed with diverticular disease, cholelithiasis, alcohol use disorders, and use tobacco. Patients with higher BMIs, particularly obese patients, are more likely to have co-morbidities such as hypertension and cardiovascular disease that may contribute to poorer perioperative outcomes,[17] which might contribute to the increased morbidity and mortality associated in patients requiring EAS. Obesity been associated with a higher incidence of surgical site infections following TJA, amongst other surgical procedures.[16,18] Surgical site infections may then result in higher risk of repeat general anesthesia, possible prolonged narcotic use, prolonged use of antibiotics and more immobilization all of which might lead to significant physiological related to GI System and thereby possible need for EAS. EAS patients were also significantly more likely to experience mortality within 60 days of joint arthroplasty, likely due to the high risk of complications associated with emergency abdominal surgery. One study following patients requiring emergency laparotomy reported 47% of 1,139 patients had major complications within 30 days of surgery, a 30-day mortality rate of 20.2%, and a one year mortality of 34%.[19]

Within THA patients, those requiring EAS were significantly

more likely to be readmitted to the hospital, which may be related to the surgical procedure performed. Within TKA patients, our results showed patients requiring EAS were significantly more likely to be Asian and diagnosed with diabetes mellitus. Other studies have identified high BMI and diabetes as key patient characteristics that may be associated with an increased risk of postoperative complications following TKA.[20-22] A study of 15.321 patients found that diabetes increased the risk of thirty-day mortality following TKA.[22] Diabetes mellitus has a well-established relationship with obesity and may contribute to an increased inflammatory response or immune system dysfunction, complicating wound healing and contributing to surgical site infections.[23] Ethnicity may also influence the relationship between TKA and EAS. Asian patients undergoing TKA have been reported to have higher prevalence of obesity and diabetes,[24] which may impact the risk of GI complications postoperatively.

Between THA and TKA patients requiring EAS, TKA patients were significantly more likely to be Asian and have diabetes mellitus. Several factors may play a role. Ethnicity may influence the relationship between obesity and knee osteoarthritis.

Our analysis found that colectomy was the most common EAS. While we could not determine the exact reason warranting an emergency colectomy, obstruction or GIB is likely, as found in institutional based study reported by Adenikinju et al. A colectomy, by itself carries a morbidity between 30.8% and 50.8% [25,26] and a 30-day mortality of 5.3% in emergent cases,[27] thus a combination of operations in this patient population caused the observed adverse outcomes reported in this study. The likelihood for colectomies is likely related to the high incidence of diverticulosis in this patient population, which might lead to diverticulitis or GIB requiring EAS.

Other surgical interventions are common is the general public as they are in the in house patients following a TJA. Thus, appendectomies and cholecystectomies were also commonly observed in this patient population. At this juncture, with such a low incidence of EAS followign TJA no firm recommendations can emerge from this analysis. However, this is is the first large-multi- insitutinal analysis documenting these crucial outcomes. The rate of mortality associated with the need of EAS following TJA is important to differentiate from the index operation.

This study has several limitations. We face the inherent limitations of chart reviews, including incomplete medical records, subjectivity in interpretation of medical records, and lack of blinding. We gathered data using TriNetX research network and thus relied on the use of CPT and ICD codes to find patients. Errors in these codes may have resulted in misidentified or unidentified patients leading to inaccurate results. It is also possible that outcomes such as EAS occurrence, readmissions or complications may not have been fully captured in patients that had postoperative admissions outside of the TriNetX network or even a secondary institution, leading to incomplete data collection. Additionally, our results may have been influenced by variables that have been unaccounted for, such as diagnoses of other GI related diseases. We were unable to account for certain variables such as cost of care and length of stay or run a more detailed analysis using TriNetX due to the restriction of access to patient information to maintain patient privacy and confidentiality. It is possible that mortality may have been due to complications unrelated to THA or EAS. The EAS cohorts were limited by small patient populations and lack of comprehensive data. Interestingly, no patients in the EAS cohorts were readmitted to the hospital following EAS and may be due to unidentified instances of hospital admission. More comprehensive data should be collected over extended follow-up times. Query criteria should be broadened to encompass a larger patient population. Other outcomes such as length of stay and cost of care should be explored to better understand and improve clinical outcomes following emergency abdominal surgery.

Conclusion

Older age, race (Asian), diverticular disease, cholelithiasis, alcohol use disorders, and tobacco use increase the risk of EAS within 30 days of TJA. TJA patients requiring EAS are significantly more likely to die within 30 days of EAS. TKA patients requiring EAS were more likely to be Asian, have a BMI of over 25 kg/m^2, and be diagnosed with diabetes mellitus when compared to THA patients requiring EAS and TKA patients that did not require EAS. THA patients were at higher risk of being readmitted to the hospital compared to TKA patients requiring EAS and THA patients not requiring EAS. The results of this study highlight key risk factors for severe GI complications that necessitate EAS and may be useful for patient selection, pre-operative evaluation of risk, and post-operative management. Considering the high risk of mortality following EAS, we suggest that those with many risk factors should be carefully observed post-operatively to reduce risk of EAS and subsequent mortality.

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