

Research Article

Postoperative Outcomes by Timing of Total Hip and Knee Arthroplasty Following Coronary Revascularization

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Background

Current guidelines recommend delaying elective surgery after coronary revascularization, but the relationship between timing for total joint arthroplasty (TJA) and postoperative outcomes remains unclear. We investigated the association between timing of TJA after percutaneous coronary intervention (PCI) or coronary artery bypass grafting (CABG) and postoperative outcomes.

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[Conflicts of Interest Statement for Dr. Zachary Fuller](#)

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Methods

The PearlDiver database was used to identify patients undergoing primary total hip arthroplasty (THA) or total knee arthroplasty (TKA) within 24 months after PCI or CABG between 2010 to 2022. Patients were stratified by timing of surgery: <6 months, 6-12 months, or 12-24 months post-revascularization. Propensity score matching was performed to balance baseline demographics and comorbidities. Primary outcomes included 90-day complications and 2-year implant-related complications.

Results

Among matched cohorts, TJA within 6 months of CABG was associated with significantly higher odds of acute kidney injury (THA: OR=2.75, 95% CI=1.53-5.26, P=0.001; TKA: OR=2.59, 95% CI=1.40-5.19, P=0.004) and transfusion needs (THA: OR=2.40, 95% CI=1.32-4.66, P=0.006; TKA: OR=1.87, 95% CI=1.08-3.43, P=0.032). TJA within 6 months of PCI did not show increased odds of major adverse events compared to later intervals (all P>0.05). Cardiac arrest odds were elevated when THA, but not TKA, was performed 12-24 months after CABG (OR=7.97, 95% CI=1.57-145.42, P=0.046) or PCI (OR=7.38, 95% CI=2.17-46.23, P=0.007).

Conclusions

For patients undergoing TJA following coronary revascularization, postoperative risk profiles appear to differ by intervention type. Patients undergoing TJA ≥6 months after PCI had comparable odds of major adverse events to later intervals. In contrast, patients undergoing TJA after CABG demonstrated persistently elevated risks of acute kidney injury across time intervals, suggesting that perioperative risk may remain heightened beyond the early postoperative period. These findings highlight potential differences in risk trajectories by revascularization modality and suggest that further investigation is needed to better inform timing recommendations.

INTRODUCTION

Total hip arthroplasty (THA) and total knee arthroplasty (TKA) are among the most frequently performed elective orthopaedic procedures, with over one million procedures performed annually in the United States (Singh et al. 2019). Total joint arthroplasty (TJA) is commonly performed in elderly patients with cardiovascular comorbidities, and an estimated 10-13% have pre-existing coronary artery disease (Okpara et al. 2024; Menendez et al. 2015). Many of these patients have undergone prior coronary revascularization via percutaneous coronary intervention (PCI) or coronary artery bypass grafting (CABG).

The relationship between timing of TJA after coronary revascularization and postoperative outcomes remains unclear despite evolving guidelines. The 2024 American College of Cardiology/American Heart Association (ACC/AHA) guidelines recommend delaying elective noncardiac surgery for at least 6 months after drug-eluting stent (DES) placement for chronic coronary disease ("Correction to: 2024 AHA/ACC/ACS/ASNC/HRS/SCA/SCCT/SCMR/SVM Guideline for Perioperative Cardiovascular Management for Noncardiac Surgery: A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines" 2024). In time-sensitive cases, surgery may be considered after 3 months. For patients undergoing CABG, guidance on the timing of elective noncardiac surgery remains limited. Current recommendations focus on the duration of dual antiplatelet therapy rather than specific surgical timing ("2016 ACC/AHA Guideline Focused Update on Duration of Dual Antiplatelet

Therapy in Patients With Coronary Artery Disease: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines: An Update of the 2011 ACCF/AHA/SCAI Guideline for Percutaneous Coronary Intervention" 2016). The European Society of Cardiology (ESC) 2022 guidelines take a similar approach, recommending delays of 6 months after elective PCI and 12 months after acute coronary syndrome (ACS) ("Correction to: 2022 ESC Guidelines on Cardiovascular Assessment and Management of Patients Undergoing Non-Cardiac Surgery: Developed by the Task Force for Cardiovascular Assessment and Management of Patients Undergoing Non-Cardiac Surgery of the European Society of Cardiology (ESC) Endorsed by the European Society of Anaesthesiology and Intensive Care (ESAIC)" 2023).

Recent evidence has highlighted the importance of timing elective TJA after coronary interventions. The landmark study by Kaluza et al (Kaluza et al. 2000) first demonstrated catastrophic outcomes when surgery was performed soon after coronary stenting, with a 20% mortality rate when the surgery occurred within 6 weeks after stenting. Other studies have similarly identified poor postoperative outcomes up to a year after coronary revascularization (Hawn et al. 2013; Holcomb et al. 2014). As such, the timing of elective TJA after coronary revascularization requires careful consideration of competing risks. Premature surgery may increase the risk of major adverse cardiac events (MACE), including stent thrombosis after PCI and graft-related complications after CABG, as well as mortality (Rossini et al. 2008; 2011). However, data specific to TJA populations re-

main limited, with most evidence derived from mixed surgical cohorts.

The objective of this study was to determine the relationship between timing of THA and TKA after coronary revascularization and postoperative outcomes. We hypothesized that TJA performed within 6 months of coronary revascularization would be associated with higher rates of complications compared to procedures performed thereafter.

METHODS

DATA SOURCE

This retrospective cohort study utilized the PearlDiver database (Colorado Springs, Colorado, USA), a large, de-identified national insurance claims database containing records from Medicare, Medicaid, and commercial insurance plans. The database includes comprehensive inpatient and outpatient claims data with longitudinal follow-up capabilities. This study was exempt from institutional review board approval since it used de-identified patient data.

STUDY POPULATION

We identified all adult patients (≥ 18 years) who underwent primary THA or TKA between January 2010 and December 2022 using Current Procedural Terminology (CPT) and International Classification of Diseases (ICD-9/10) codes. From this cohort, we selected patients who had undergone PCI or CABG within 24 months before their TJA (**Supp Table 1**). Exclusion criteria included: (1) revision arthroplasty procedures, (2) bilateral simultaneous TJA, (3) traumatic indications for TJA, (4) active malignancy, and (5) less than 2 years of postoperative follow-up.

Patients were stratified into three groups based on the interval between coronary revascularization and TJA: < 6 months, 6–12 months, 12–24 months. These intervals were selected to approximate clinically meaningful perioperative risk windows described in cardiac guidelines, including the early high-risk period (< 6 months), an intermediate recovery phase (6–12 months), and a more remote, relatively stable period beyond 1 year. A control group of TJA patients without prior coronary revascularization was also identified for comparison, with separate propensity-matched control cohorts generated for each procedure and revascularization type using the same matching criteria. To improve comparability and reduce confounding by underlying cardiovascular disease, control cohorts were restricted to patients with documented coronary artery disease who had not undergone PCI or CABG.

PATIENT CHARACTERISTICS

In total, 890,579 patients undergoing primary THA and 1,659,554 patients undergoing primary TKA were identified during the study period. Of these, 1,496 THA patients (0.17%) and 2,341 TKA patients (0.12%) had undergone CABG, while 3,289 THA patients (0.37%) and 5,168 TKA pa-

tients (0.31%) had undergone PCI within the preceding 24 months.

Before propensity score matching, patients with prior coronary revascularization demonstrated significant baseline differences compared to controls, including older age, higher proportion of male patients, and greater comorbidity burden (all $P < 0.001$). After 1:1 propensity score matching, baseline characteristics were well-balanced between all comparison groups, with standardized differences < 0.1 for all covariates. (**Table 1-4**)

STUDY OUTCOMES

Primary outcomes included 90-day complications, including acute kidney injury (AKI), cardiac arrest, deep vein thrombosis (DVT), pulmonary embolism (PE), surgical site complications, wound hematoma, blood transfusion, and urinary tract infection (UTI); and 2-year implant-related complications, including aseptic loosening, instability/dislocation, periprosthetic fracture, periprosthetic joint infection (PJI), and revision surgery.

STATISTICAL ANALYSIS

Baseline characteristics were compared using chi-square tests for categorical variables and t-tests for continuous variables. To address confounding by indication, 1:1 propensity score matching using nearest-neighbor matching with a caliper of 0.2 standard deviations was performed. The propensity score was generated using age, sex, CCI, diabetes, obesity, tobacco use, and coronary artery disease as matching variables. These variables were selected a priori based on their established relevance to perioperative risk and their availability within the database, while minimizing overfitting from inclusion of highly correlated comorbid conditions.

In the matched cohorts, outcomes were compared using chi-square analyses, as well as conditional logistic regression to calculate odds ratios (OR) with 95% confidence intervals (CI). All analyses were performed using SAS version 9.4 (SAS Institute, Cary, NC). Statistical significance was set at $P < 0.05$.

RESULTS

POSTOPERATIVE COMPLICATIONS IN PATIENTS WITH A HISTORY OF CABG

TOTAL HIP ARTHROPLASTY

In the matched analysis of 320 patients per group, THA performed within 6 months of CABG was associated with significantly higher rates of 90-day AKI (10.6% vs. 4.4%, $OR = 2.75$, 95% $CI = 1.53-5.26$, $P = 0.001$) compared to controls. This elevated risk persisted for surgeries performed 6–12 months ($OR = 2.77$, 95% $CI = 1.55-5.29$, $P = 0.001$) and 12–24 months ($OR = 2.56$, 95% $CI = 1.43-4.89$, $P = 0.003$) after CABG.

Blood transfusion requirements were also higher when THA was performed within 6 months of CABG ($OR = 2.40$,

Table 1. Postoperative Complications Following Total Hip Arthroplasty in Patients with a History of Coronary Artery Bypass Grafting

	No CABG (N = 320)	<6M (N = 320)	6-12M (N = 320)	12-24M (N = 320)	P-value
Demographics					
Age	68.50 (7.45)	67.94 (7.29)	68.25 (7.35)	68.58 (7.34)	0.689
Female Sex	67 (20.94)	71 (22.19)	66 (20.63)	68 (21.25)	0.967
CCI	2.83 (2.07)	2.98 (2.51)	2.98 (2.37)	2.87 (2.16)	0.781
Diabetes	175 (54.69)	186 (58.13)	186 (58.13)	175 (54.69)	0.674
Obesity	65 (20.31)	72 (22.50)	78 (24.38)	66 (20.63)	0.576
Tobacco Use	167 (52.19)	171 (53.44)	173 (54.06)	168 (52.50)	0.963
Coronary Artery Disease	320 (100.00)	320 (100.00)	320 (100.00)	320 (100.00)	1.000
90-Day Complications					
AKI	14 (4.38)	34 (10.63)	34 (10.63)	33 (10.31)	0.011
Cardiac Arrest	1 (0.31)	2 (0.63)	3 (0.94)	7 (2.19)	0.092
DVT	7 (2.19)	7 (2.19)	3 (0.94)	3 (0.94)	0.355
PE	2 (0.63)	0 (0.00)	5 (1.56)	3 (0.94)	0.155
Surgical Site Infection	6 (1.88)	12 (3.75)	12 (3.75)	12 (3.75)	0.447
Hematoma	1 (0.31)	5 (1.56)	12 (3.75)	10 (3.13)	0.013
Transfusion	13 (4.06)	29 (9.06)	20 (6.25)	19 (5.94)	0.075
UTI	19 (5.94)	19 (5.94)	14 (4.38)	16 (5.00)	0.773
2-Year Complications					
Aseptic Loosening	0 (0.00)	1 (0.31)	1 (0.31)	0 (0.00)	0.572
Instability/Dislocation	2 (0.63)	2 (0.63)	2 (0.63)	4 (1.25)	0.751
Periprosthetic Fracture	0 (0.00)	2 (0.63)	3 (0.94)	0 (0.00)	0.143
Periprosthetic Joint Infection	7 (2.19)	2 (0.63)	4 (1.25)	4 (1.25)	0.385
Revision	9 (2.81)	7 (2.19)	9 (2.81)	8 (2.50)	0.952

95% CI=1.32-4.66, $P=0.006$), though this did not reach significance at later intervals (6-12 months: OR=1.54, 95% CI=0.83-3.06, $P=0.188$; 12-24 months: OR=1.48, 95% CI=0.79-2.94, $P=0.238$). Postoperative hematoma formation risk was elevated at 6-12 months (OR=12.82, 95% CI=2.68-229.94, $P=0.013$) and 12-24 months (OR=10.30, 95% CI 2.13-185.43, $P=0.023$). Cardiac arrest risk was significantly elevated at 12-24 months after CABG (OR=7.97, 95% CI=1.57-145.42, $P=0.046$), though event rates were low.

Two-year postoperative infection rates were significantly lower when THA was performed within 6 months of CABG (0.6% vs. 2.2%, OR=0.29, 95% CI 0.07-0.97, $P=0.050$). Results for the univariate and multivariate analyses can be found in [Table 1](#) and [Supp Table 2](#), respectively.

TOTAL KNEE ARTHROPLASTY

In the matched analysis of 314 patients per group, TKA performed within 6 months of CABG demonstrated similar patterns of increased AKI risk (9.6% vs. 3.8%, OR=2.59, 95% CI=1.40-5.19, $P=0.004$). This risk remained elevated at 6-12 months (OR=3.53, 95% CI=1.92-7.02, $P<0.001$) and 12-24 months (OR=2.99, 95% CI=1.62-5.97, $P=0.001$).

Blood transfusion requirements were likewise higher when TKA was performed within 6 months of CABG

(OR=1.87, 95% CI=1.08-3.43, $P=0.032$), though not at later intervals (6-12 months: OR=1.31, 95% CI=0.73-2.45, $P=0.376$; 12-24 months: OR=1.66, 95% CI=0.95-3.05, $P=0.089$).

The two-year postoperative infection rates were lower at all intervals (<6 months: 1.0% vs 3.2%, OR=0.30, 95% CI=0.10-0.84, $P=0.024$; 6-12 months: 0.6% vs 3.2%, OR=0.19, 95% CI=0.05-0.60, $P=0.007$; 12-24 months: 0.6% vs 3.2%, OR=0.20, 95% CI=0.05-0.60, $P=0.007$). Results for the univariate and multivariate analyses can be found in [Table 2](#) and [Supp Table 3](#), respectively.

POSTOPERATIVE COMPLICATIONS IN PATIENTS WITH A HISTORY OF PCI

TOTAL HIP ARTHROPLASTY

In the matched analysis of 514 patients per group, THA after PCI showed no significant differences in 90-day AKI rates regardless of timing (<6 months: OR=1.33, 95% CI=0.81-2.26, $P=0.271$; 6-12 months: OR=0.97, 95% CI=0.58-1.68, $P=0.919$; 12-24 months: OR=1.12, 95% CI=0.67-1.93, $P=0.664$).

Blood transfusion requirements were significantly lower across all time intervals compared to controls (<6 months:

Table 2. Postoperative Complications Following Total Knee Arthroplasty in Patients with a History of Coronary Artery Bypass Grafting

	No CABG (N = 314)	<6M (N = 314)	6-12M (N = 314)	12-24M (N = 314)	P-value
Demographics					
Age	68.12 (6.50)	67.72 (6.69)	68.22 (6.86)	68.12 (6.50)	0.789
Female Sex	57 (18.15)	79 (25.16)	61 (19.43)	57 (18.15)	0.088
CCI	3.01 (2.24)	2.94 (2.49)	2.97 (2.27)	3.01 (2.24)	0.983
Diabetes	197 (62.74)	203 (64.65)	205 (65.29)	197 (62.74)	0.872
Obesity	61 (19.43)	68 (21.66)	63 (20.06)	61 (19.43)	0.885
Tobacco Use	174 (55.41)	169 (53.82)	173 (55.10)	174 (55.41)	0.975
Coronary Artery Disease	314 (100.00)	314 (100.00)	314 (100.00)	314 (100.00)	1.000
90-Day Complications					
AKI	12 (3.82)	30 (9.55)	38 (12.10)	33 (10.51)	0.002
Cardiac Arrest	1 (0.32)	0 (0.00)	6 (1.91)	3 (0.96)	0.037
DVT	4 (1.27)	1 (0.32)	9 (2.87)	5 (1.59)	0.072
PE	2 (0.64)	3 (0.96)	2 (0.64)	1 (0.32)	0.800
Surgical Site Infection	9 (2.87)	5 (1.59)	11 (3.50)	8 (2.55)	0.506
Hematoma	5 (1.59)	6 (1.91)	11 (3.50)	5 (1.59)	0.290
Transfusion	16 (5.10)	30 (9.55)	21 (6.69)	26 (8.28)	0.162
UTI	13 (4.14)	10 (3.18)	15 (4.78)	16 (5.10)	0.654
2-Year Complications					
Aseptic Loosening	2 (0.64)	3 (0.96)	1 (0.32)	0 (0.00)	0.341
Instability/Dislocation	1 (0.32)	2 (0.64)	0 (0.00)	2 (0.64)	0.530
Periprosthetic Fracture	1 (0.32)	1 (0.32)	1 (0.32)	0 (0.00)	0.801
Periprosthetic Joint Infection	10 (3.18)	3 (0.96)	2 (0.64)	2 (0.64)	0.014
Revision	7 (2.23)	3 (0.96)	2 (0.64)	6 (1.91)	0.280

3.3% vs 5.8%, OR=0.50, 95% CI=0.30-0.85, P=0.009; 6-12 months: 1.2% vs 5.8%, OR=0.18, 95% CI=0.09-0.35, P<0.001; 12-24 months: 0.4% vs 5.8%, OR=0.06, 95% CI=0.02-0.15, P<0.001). Cardiac arrest risk was only significantly elevated at 12-24 months after PCI (OR=7.38, 95% CI=2.17-46.23, P=0.007), though event rates were low.

Two-year all-cause revision rates were significantly higher when THA was performed within 6 months of PCI (OR=3.64, 95% CI=1.25-15.45, P=0.037), though event rates were low. Results for the univariate and multivariate analyses can be found in [Table 3](#) and [Supp Table 4](#), respectively.

TOTAL KNEE ARTHROPLASTY

In the matched analysis of 561 patients per group, TKA after PCI showed no increased risk of 90-day complications at any time interval. Specifically, AKI rates were similar across all groups (<6 months: OR=0.85, 95% CI=0.51-1.47, P=0.556; 6-12 months: OR=1.50, 95% CI=0.92-2.52, P=0.116; 12-24 months: OR=0.96, 95% CI=0.57-1.66, P=0.890).

Blood transfusion requirements were lower than controls at 6-12 months (OR=0.16, 95% CI=0.06-0.40, P<0.001) and 12-24 months (OR=0.44, 95% CI=0.22-0.92, P=0.027).

Two-year postoperative infection (OR=0.43, 95% CI=0.18-1.00, P=0.050) and revision (OR=0.21, 95% CI=0.07-0.53, P=0.002) rates were significantly lower than controls when TKA was performed 12-24 months after PCI. Results for the univariate and multivariate analyses can be found in [Table 4](#) and [Supp Table 5](#), respectively.

DISCUSSION

In this large database study, patients undergoing TJA after coronary revascularization demonstrated distinct patterns of postoperative complications risk by procedure. Specifically, THA and TKA performed within two years of CABG were associated with significantly higher rates of AKI, particularly within the first 6–12 months. Early post-CABG arthroplasty also carried increased risks of blood transfusion and, at later intervals, postoperative hematoma and cardiac arrest, though event frequencies were low. In contrast, arthroplasty after PCI was not associated with increased AKI risk, and notably, transfusion requirements were lower across all PCI time intervals. However, early THA after PCI was linked to higher two-year revision risk, while late TKA after PCI showed reduced infection and revision rates.

Table 3. Postoperative Complications Following Total Hip Arthroplasty in Patients with a History of Percutaneous Coronary Intervention

	No PCI (N = 514)	<6M (N = 514)	6-12M (N = 514)	12-24M (N = 514)	P-value
Demographics					
Age	68.37 (8.14)	69.11 (8.33)	68.74 (8.46)	68.38 (8.15)	0.426
Female Sex	167 (32.49)	181 (35.21)	178 (34.63)	167 (32.49)	0.706
CCI	2.94 (2.25)	3.18 (2.88)	3.11 (2.48)	2.96 (2.29)	0.337
Diabetes	244 (47.47)	266 (51.75)	246 (47.86)	245 (47.67)	0.459
Obesity	109 (21.21)	114 (22.18)	111 (21.60)	109 (21.21)	0.979
Tobacco Use	351 (68.29)	335 (65.18)	338 (65.76)	350 (68.09)	0.623
Coronary Artery Disease	514 (100.00)	514 (100.00)	514 (100.00)	514 (100.00)	1.000
90-Day Complications					
AKI	22 (4.28)	31 (6.03)	22 (4.28)	24 (4.67)	0.508
Cardiac Arrest	2 (0.39)	4 (0.78)	4 (0.78)	13 (2.53)	0.024
DVT	11 (2.14)	8 (1.56)	3 (0.58)	5 (0.97)	0.138
PE	5 (0.97)	5 (0.97)	1 (0.19)	0 (0.00)	0.055
Surgical Site Infection	5 (0.97)	1 (0.19)	2 (0.39)	1 (0.19)	0.187
Hematoma	5 (0.97)	9 (1.75)	1 (0.19)	3 (0.58)	0.049
Transfusion	30 (5.84)	17 (3.31)	6 (1.17)	2 (0.39)	<0.001
UTI	24 (4.67)	38 (7.39)	23 (4.47)	26 (5.06)	0.138
2-Year Complications					
Aseptic Loosening	3 (0.58)	2 (0.39)	1 (0.19)	2 (0.39)	0.800
Instability/Dislocation	8 (1.56)	5 (0.97)	8 (1.56)	6 (1.17)	0.798
Periprosthetic Fracture	4 (0.78)	8 (1.56)	6 (1.17)	7 (1.36)	0.702
Periprosthetic Joint Infection	6 (1.17)	7 (1.36)	6 (1.17)	6 (1.17)	0.989
Revision	3 (0.58)	11 (2.14)	9 (1.75)	9 (1.75)	0.206

The elevated risk of AKI following arthroplasty in patients with a recent history of CABG likely reflects the additive physiologic burden of two major surgeries within a limited recovery period. CABG patients often have baseline renal impairment from long-standing cardiovascular disease, exposure to cardiopulmonary bypass, and perioperative ischemia (Rosner and Okusa 2006). These factors, combined with hemodynamic shifts and potential hypotension during arthroplasty, may predispose to renal hypoperfusion and postoperative injury (Grams et al. 2016). The clustering of AKI within the first 6–12 months after CABG suggests that this timeframe represents a window of heightened vulnerability, during which renal and cardiovascular systems may not yet have fully recovered from the prior surgery. In contrast, PCI, which is less invasive and associated with minimal hemodynamic disruption, appears to carry a substantially lower risk of postoperative renal complications. These findings underscore the importance of aggressive renal protective measures in all post-CABG patients undergoing TJA, irrespective of the interval since cardiac surgery.

Differences in cardiac and hematologic complications between CABG and PCI cohorts further support the notion of prolonged physiologic stress after open cardiac surgery. The increased transfusion requirements observed in pa-

tients undergoing early post-CABG arthroplasty may be related to residual anemia, persistent platelet dysfunction, or ongoing use of dual antiplatelet therapy (Sung et al. 2024; Varma 2024; Westenbrink et al. 2011). Similarly, the elevated risks of postoperative hematoma and cardiac arrest at later intervals suggest that even beyond the early postoperative phase, CABG patients remain more susceptible to hemodynamic instability and coagulopathic events (Montrieff et al. 2018; Peretto et al. 2014). However, the observed increase in cardiac arrest should be interpreted with caution, as the absolute number of events was low, raising the possibility of statistical instability or residual confounding; alternatively, this finding may reflect progressive cardiac dysfunction or increasing comorbidity burden over time in this population. Conversely, the consistently lower transfusion rates among patients with prior PCI likely reflect more stable hematologic profiles and a reduced inflammatory response, enabling improved perioperative hemostasis (Wang et al. 2023).

The differential risk profiles observed between CABG and PCI patients underscore the importance of considering the type and timing of prior cardiac intervention when planning elective arthroplasty. CABG, as an open surgical procedure requiring cardiopulmonary bypass, induces a

Table 4. Postoperative Complications Following Total Knee Arthroplasty in Patients with a History of Percutaneous Coronary Intervention

	No PCI (N = 561)	<6M (N = 561)	6-12M (N = 561)	12-24M (N = 561)	P-value
Demographics					
Age	67.98 (7.24)	68.22 (7.60)	68.29 (7.77)	67.97 (7.25)	0.846
Female Sex	193 (34.40)	200 (35.65)	211 (37.61)	195 (34.76)	0.679
CCI	2.53 (2.21)	2.92 (2.47)	2.82 (2.36)	2.57 (2.32)	0.115
Diabetes	329 (58.65)	348 (62.03)	340 (60.61)	329 (58.65)	0.592
Obesity	125 (22.28)	146 (26.02)	139 (24.78)	125 (22.28)	0.355
Tobacco Use	318 (56.68)	323 (57.58)	334 (59.54)	318 (56.68)	0.742
Coronary Artery Disease	561 (100.00)	561 (100.00)	561 (100.00)	561 (100.00)	1.000
90-Day Complications					
AKI	23 (4.10)	24 (4.28)	23 (4.10)	34 (6.06)	0.325
Cardiac Arrest	2 (0.36)	2 (0.36)	5 (0.89)	7 (1.25)	0.209
DVT	7 (1.25)	10 (1.78)	7 (1.25)	5 (0.89)	0.619
PE	4 (0.71)	5 (0.89)	4 (0.71)	0 (0.00)	0.207
Surgical Site Infection	15 (2.67)	8 (1.43)	5 (0.89)	0 (0.00)	<0.001
Hematoma	3 (0.53)	5 (0.89)	4 (0.71)	4 (0.71)	0.918
Transfusion	16 (2.85)	13 (2.32)	3 (0.53)	8 (1.43)	0.019
UTI	21 (3.74)	30 (5.35)	28 (4.99)	23 (4.10)	0.536
2-Year Complications					
Aseptic Loosening	1 (0.18)	6 (1.07)	2 (0.36)	1 (0.18)	0.076
Instability/Dislocation	3 (0.53)	4 (0.71)	4 (0.71)	3 (0.53)	0.962
Periprosthetic Fracture	2 (0.36)	2 (0.36)	3 (0.53)	0 (0.00)	0.436
Periprosthetic Joint Infection	12 (2.14)	18 (3.21)	17 (3.03)	5 (0.89)	0.039
Revision	14 (2.50)	12 (2.14)	8 (1.43)	3 (0.53)	0.051

prolonged systemic inflammatory and metabolic response that may extend surgical risk for months to years. PCI, on the other hand, allows for faster physiologic recovery and earlier surgical optimization (Wang et al. 2023). The finding that early THA after PCI was associated with increased revision risk may reflect patient selection factors, mechanical challenges, or wound-related issues rather than systemic frailty. Meanwhile, the reduced infection and revision rates observed with later TKA after PCI suggest that, with adequate recovery time, these patients can safely undergo joint replacement with outcomes comparable or superior to controls (Feng et al. 2018; Hoveidaei et al. 2025). Collectively, these findings highlight the need for individualized perioperative risk assessment and careful optimization prior to TJA.

While some studies have demonstrated higher complication rates in patients undergoing TJA within 2 years of cardiac revascularization, the 2023 ACR/AAHKS guideline's emphasis on avoiding unnecessary delays aligns with our findings that prolonged waiting may not confer additional cardiac protection (Hannon et al. 2023). However, the persistent AKI elevation in post-CABG patients suggests these individuals require careful preoperative optimization regardless of timing, including nephrology consultation, vol-

ume status optimization, and avoidance of nephrotoxic medications. Modern perioperative protocols can further mitigate cardiac risk, as demonstrated by studies achieving remarkably low acute myocardial infarctions rates in large procedures (Petersen et al. 2018).

Several limitations merit consideration. The retrospective design precludes causal inference. Administrative databases lack clinical granularity, including specific stent types, CABG techniques, perioperative management, and use of anti-platelet or anti-coagulant agents. We could not assess antiplatelet therapy management, which has significant perioperative implications. Selection bias remains possible despite propensity matching, as surgical timing decisions likely reflect unmeasured clinical factors. Finally, our median 2-year follow-up may be insufficient to capture late complications.

CONCLUSION

This study emphasizes the critical role of surgical timing in optimizing total joint arthroplasty outcomes among patients with a history of coronary revascularization. While CABG patients may remain at elevated risk for renal, cardiac, and hematologic complications for up to two years,

PCI patients generally experience a more favorable perioperative profile. Surgeons should therefore consider delaying elective arthroplasty for at least 6–12 months following CABG to allow for physiologic stabilization, whereas patients with prior PCI may be suitable candidates for earlier intervention with appropriate medical optimization. A multidisciplinary approach involving cardiology, anesthesia, and orthopedic surgery teams is essential to balance cardiac safety with musculoskeletal function and to guide

evidence-based decision-making for this complex patient population. Future prospective studies are necessary to understand causal relationships and more accurate time-event relationships.

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