Postoperative Complications in Heart Failure Patients Undergoing Elective Joint Arthroplasty: Comparing Reduced vs. Preserved Ejection Fraction Subtypes

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INTRODUCTION:

Total hip arthroplasty (THA) and total knee arthroplasty (TKA) are among the most common elective orthopaedic procedures, frequently performed due to aging populations and rising osteoarthritis prevalence. Despite advancements in perioperative care, older patients with significant cardiovascular comorbidities, particularly heart failure (HF), face higher risks of postoperative complications. Heart failure can be classified into reduced ejection fraction (HFrEF) and preserved ejection fraction (HFpEF), each differing significantly in pathophysiology, associated comorbidities, and outcomes. Historically, orthopaedic research has often treated HF as a single category, neglecting subtype distinctions. This study aims to clarify differences in postoperative complication risks at 90 days and 1 year between patients with HFrEF and HFpEF undergoing primary elective THA and TKA, providing insights to improve surgical risk stratification and perioperative management.

METHODS:

We conducted a retrospective cohort study using the TriNetX US Collaborative Network, a national database of de-identified electronic health records. The study period spanned 2005 to 2024. Adult patients undergoing primary elective THA or TKA with a diagnosis of heart failure were included. HFrEF was defined as left ventricular ejection fraction (LVEF) ≤40% and HFpEF as LVEF ≥50%. Patients with preoperative diagnoses of acute kidney failure (AKF), pneumonia, sepsis, pulmonary embolism, cerebral infarction, deep vein thrombosis, or prior revision arthroplasty were excluded. Propensity score matching was performed separately for THA and TKA using logistic regression, matching on 27 variables including demographics, comorbidities, labs, and medications. Balance was assessed using absolute standardized differences. Postoperative outcomes were evaluated at 90 days and 1 year. The seven outcomes included AKF, myocardial infarction, mortality, cardiac arrest, stroke, sepsis, and atrial fibrillation. Odds ratios with 95% confidence intervals were calculated, and statistical significance was defined as $P < 0.05$.

RESULTS:

After 1:1 propensity score matching, 560 HFrEF and 560 HFpEF patients were included in the THA cohort, while 950 HFrEF and 950 HFpEF patients were included in the TKA cohort.

In the THA group, HFrEF patients experienced higher rates of AKF at both 90 days (7.3% vs 5.0%; OR 1.50, P = 0.0155) and 1 year (11.3% vs 7.3%; OR 1.63, P = 0.001). Myocardial infarction was more common in the HFrEF cohort at 90 days (3.6% vs 2.2%; OR 1.66, P = 0.0124) and at 1 year (5.0% vs 3.6%; OR 1.40, P = 0.0489). Stroke incidence was significantly elevated among HFrEF patients at 90 days (3.8% vs 1.2%; OR 3.11, P = 0.0013) and 1 year (5.2% vs 2.7%; OR 1.97, P = 0.0152). Atrial fibrillation occurred more frequently in the HFrEF cohort at 90 days (7.7% vs 5.1%; OR 1.56, P = 0.001) and 1 year (10.9% vs 7.4%; OR 1.53, P = 0.0007). Although 90-day mortality showed a trend toward significance (2.5% vs 1.5%; OR 1.71, P = 0.0549), 1-year mortality was significantly higher in the HFrEF group (6.3% vs 4.2%; OR 1.54, P = 0.0435). No significant differences were observed for cardiac arrest or sepsis.

In the TKA cohort, HFrEF patients again demonstrated elevated risks of adverse outcomes. AKF occurred more frequently at 90 days (6.1% vs 4.6%; OR 1.36, P = 0.0277) and 1 year (10.6% vs 7.5%; OR 1.45, P = 0.0019). Myocardial infarction rates were higher at both 90 days (3.8% vs 2.1%; OR 1.86, P = 0.0003) and 1 year (6.0% vs 3.3%; OR 1.93, P = 0.0001). Atrial fibrillation was more common among HFrEF patients at 90 days (6.8% vs 4.5%; OR 1.56, P = 0.001) and 1 year (9.6% vs 7.6%; OR 1.28, P = 0.0112). Mortality was significantly elevated at both 90 days (2.5% vs 1.4%; OR 1.84, P = 0.009) and 1 year (5.3% vs 3.0%; OR 1.85, P = 0.0006). Cardiac arrest was significantly more frequent at 1 year (2.5% vs 1.1%; OR 2.37, P = 0.0106), with a non-significant trend at 90 days (1.7% vs 0.9%; OR 2.02, P = 0.0657). No significant differences were observed in stroke or sepsis at either time point.

DISCUSSION AND CONCLUSION:

Our study highlights that patients with HFrEF undergoing THA and TKA face significantly greater postoperative risks compared to their HFpEF counterparts. These outcomes align with pathophysiologic distinctions; HFrEF is characterized by reduced cardiac output, elevated neurohormonal activation, and renal hypoperfusion, exacerbating postoperative AKF and myocardial infarction risk. Elevated natriuretic peptide levels, indicative of chronic myocardial stress, further underscore this increased vulnerability.

Interestingly, complication patterns varied by procedure type; TKA was associated with higher rates of mortality and cardiac arrest, likely due to the greater systemic inflammatory burden and mobilization challenges. Conversely, stroke was more pronounced post-THA, potentially linked to longer operative duration and embolic risks. The consistent emergence of atrial fibrillation as a complication underscores the proarrhythmic substrate present in HFrEF patients, driven by atrial dilation and neurohormonal alterations. Given these findings, perioperative protocols should incorporate detailed HF subtype assessment, integrating biomarker surveillance and cardiology consultations to optimize outcomes.

Despite the inherent limitations of a retrospective design, including potential unmeasured confounders and coding discrepancies, the strength of propensity matching and consistency across outcomes enhance the validity of our findings. This study provides critical evidence supporting differentiated, subtype-specific perioperative pathways, which could significantly mitigate risks and improve surgical outcomes for the growing population of HF patients undergoing joint arthroplasty.