Sex-based Differences in Cardiovascular and Circulatory Illnesses Influence the Risk of Inpatient Mortality Following Total Hip Arthroplasty

Jonathan S. Lee¹, Bilal S. Siddiq¹, Stephen M. Gillinov¹, Kaveh Torabian¹, Kieran S. Dowley¹, Michael C. Dean¹, Nathan J. Cherian¹, Mark P. Cote¹, Scott D. Martin¹

1. Department of Orthopaedic Surgery, Massachusetts General Hospital, Boston, MA, USA.

Email of Presenting Author: jlee376@mgh.harvard.edu

INTRODUCTION: One of the most common orthopaedic surgeries, total hip arthroplasty (THA), serves to treat pain, increase mobility, and improve function in patients with multicompartamental degenerative changes of the knee. Between 2012 and 2019, the American Joint Replacement Registry (AJRR) reported that THA accounted for 33.3% (n=625,097) of all arthroplasty surgeries performed across the United States. By 2040, the number of inpatient THA performed each year is predicted to rise to 1.4 million, representing a growth of 294%. As the incidence of THA continues to rise, it becomes even more critical to optimize care and risk management by identifying factors that may increase mortality. Prior literature has explored the association between comorbidities and 30 and 90-day mortality; however, there remains a paucity of research on how these risk factors contribute to inpatient mortality in the acute postoperative period following THA. The primary goal of the present study was to evaluate patient and hospital characteristics that increase the odds of mortality. Second, we sought to explore potential explanations for sex-based differences in inpatient mortality for patients with cardiovascular and circulatory illnesses.

METHODS: The National Inpatient Sample (NIS) database was utilized to investigate trends in inpatient mortality among patients who underwent THA in the United States from 2012-2019. International Classification of Diseases (ICD)-9 and ICD-10 codes were utilized to identify patients. Patient age was categorized into four quartiles (<59, 60-66, 67-73, and >74 years). A multivariable-adjusted logistic regression analysis, controlling for patient characteristics including gender, race, age, elective admission type, smoking status, insurance type, and comorbidities as well as hospital characteristics including bed size and rurality, was performed to predict inpatient mortality. Comorbidities were selected based on known risk factors for hospital readmission and mortality following THA. Pearson’s χ² test and Fisher’s exact test were used to compare categorical variables; two-sample t-tests were used to compare continuous variables. To assess the logistic model’s ability to discriminate for inpatient mortality, area under the ROC curve (AUC) was measured. Results were considered significant for p-values < 0.05. All statistical analyses were performed using Stata software (version 18.0; StatCorp).

RESULTS: Of the 3,040,090 THA patient discharge records that were identified, 3,265 (0.10%) THA patients died during hospitalization. When comparing the 2012 and 2019 rate of inpatient mortality using Pearson’s χ² test, THA decreased by 36% (0.13%; n=405/320,365) to (0.08%; n=395/486,275) (p<0.001). Multivariable-adjusted logistic regression analysis was performed to identify factors associated with increased odds of inpatient mortality following THA. Factors associated with the greatest odds of mortality included gender, race, age, non-elective surgery, rurality, alcohol abuse, congestive heart failure, peripheral vascular disorder, chronic pulmonary diseases, pulmonary circulation disorder, and diabetes with chronic complications. When examining how inpatient mortality was influenced by the interaction of patient sex and comorbidities, congestive heart failure and diabetes were significantly protective against death and disproportionately affected females, despite males exhibiting a greater overall odds of inpatient mortality. Males with a pulmonary circulation disease or hypertension; however, had a significantly higher odds of death compared to females. Model discrimination for inpatient mortality following THA was good (AUC: 0.8733).

DISCUSSION: To our knowledge, the present study investigated the largest sample of inpatient mortality in THA and is the first study to report the association between sex differences and independent comorbidities in inpatient mortality following THA. Among the comorbidities assessed, congestive heart failure was associated with the greatest odds of inpatient mortality. When stratifying comorbidities by sex, females with cardiovascular illnesses exhibited a greater risk of mortality, while males were disproportionately affected by hypertension and pulmonary illnesses. These trends align with prior literature on sex-based differences in mortality for patients with the noted comorbidities. Identifying which comorbidities are associated with the greatest risk of inpatient mortality is important for optimizing pre- and perioperative management for patients undergoing THA and providing personalized postoperative care.

SIGNIFICANCE/CLINICAL RELEVANCE: These sex-based differences and comorbidities as predictive parameters for worse outcomes after THA should be used to inform patients of perioperative risk and guide clinical decision making.