

Insurance Status Affects Complication Rates After Total Hip Arthroplasty

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J Am Acad Orthop Surg 2018;00:1-6

DOI: 10.5435/JAAOS-D-17-00635

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Abstract

Introduction: Previous studies have examined the relationship between total hip arthroplasty (THA) and insurance status in small cohorts. This study evaluates the effect of patient insurance status on complications after primary elective THA using the Nationwide Inpatient Sample.

Methods: All patients undergoing primary elective THA from 1998 to 2011 were included. Patient demographics, comorbidities, and complications were collected and compared based on insurance type. Multivariable logistic regression and a matched cohort analysis were performed.

Results: About 515,037 patients (53.7% Medicare, 40.1% private insurance, 3.9% Medicaid/uninsured, and 2.2% other) were included, who underwent elective THA. Privately insured patients had fewer medical complications (odds ratio, 0.80; $P < 0.001$), whereas patients with Medicaid or no insurance demonstrated no notable difference (odds ratio, 1.03; $P = 0.367$) compared with Medicare patients. Similar trends were found for both surgical complications and mortality, favoring lower complication rates for privately insured patients. Furthermore, patients with private insurance tend to go to higher volume hospitals for total hip replacement surgery compared to those with Medicare insurance.

Discussion: Patients with government-sponsored insurance (Medicare or Medicaid) or no insurance have higher risk of medical complications, surgical complications, and mortality after primary elective THA compared with privately insured patients. Insurance status should be considered an independent risk factor for stratifying patients before THA procedures.

More than 300,000 total hip arthroplasty (THA) surgeries are performed annually, making it one of the most common surgeries performed in the United States.¹ THA predictably results in tremendous improvements in quality of life for patients suffering from osteoarthritis and other hip pathologies, such as osteonecrosis, rheumatoid, and post-traumatic arthritis.²⁻⁴ Unfortunately,

complications occur not infrequently after THA, inflicting considerable physical, mental, and financial burden on patients and their families and caretakers, as well as on the healthcare system.⁵⁻⁷ Infection, in particular, is a devastating complication for both the patient and the healthcare system after total joint arthroplasty (TJA).⁸

Factors associated with complications after TJA have been well described

in the literature.^{9,10} In recent years, increased attention has been paid toward psychosocial and socioeconomic factors¹¹ and their effect on outcomes and complications after TJA, including treatment at a safety net hospital,¹² mental health problems,¹³⁻¹⁵ and race.¹⁶ Insurance status has also previously been associated with worse outcomes after TJA.¹⁷⁻²⁰

Previous studies assessing the relationship between insurance status and TJA complications were all conducted in small cohorts¹⁸ or primarily focused on comparisons between Medicaid and Medicare populations.¹³ Our study uses a large all-payer inpatient healthcare database to evaluate the effect of patient insurance status and other associated patient factors on the medical complication, surgical complication, and mortality rates after primary elective THA. Both hemiarthroplasties, revisions, and total hip arthroplasties performed urgently for trauma were excluded from this study.

Methods

Data were obtained from the Healthcare Cost and Utilization Project Nationwide Inpatient Sample (NIS) between 1998 and 2011. The NIS is the largest national database of all-payer inpatient discharge information, sampling approximately 20% of all nonfederal US hospitals and including approximately 9 million hospital admissions each year. Each NIS entry includes *International Classification of Diseases, 9th Revision, Clinical Modification* diagnosis and procedure codes of activity during the patient's hospitalization at the time of discharge, as well as patient demographics, hospital characteristics, and duration of stay.

Patients undergoing THA were selected based on *International Classification of Diseases, 9th Revision* procedural coding (total hip replacement, 81.51). Only primary surgeries

and admission types that were classified as elective were included in the analysis. Admissions that were classified as urgent or emergent and revisions were excluded from this study. Patient demographics (sex, age, race, and admission type) and comorbidities using the Charlson comorbidity index were collected and analyzed. Age was divided into four categories: less than 40 years, 40 to 64 years, 65 to 79 years, and more than 80 years. All patient factors were separated based on insurance type (Medicare, private insurance, Medicaid/Uninsured, and "other"). The primary outcomes were medical and surgical complications including mortality during the same hospitalization. Medical complications included myocardial infarction, pulmonary edema, venous thromboembolism, cerebrovascular accident, acute kidney injury, pneumonia, sepsis, and urinary tract infection (UTI). Surgical complications included septic shock, hematoma, accidental puncture, wound dehiscence, retained foreign body, postop infection, nonhealing surgical wound, and other surgical complications. For statistical analysis, Pearson's chi-squared test was used to compare baseline characteristics on each insurance cohort. Multivariable logistic regression was used to determine the influence of insurance type on complications.

A secondary analysis was performed using a matched cohort comparing patients with Medicare with those with private insurance. Each Medicare patient was matched one-to-one with a private insurance patient on the basis of age, sex, and other demographics and comorbidities using the coarsened exact matching algorithm. Matching improves the covariate estimation in predicting outcomes through decreasing the demographic imbalance between the Medicare and the private insurance groups. The matching algorithm sorts patients based on matching demographics and then discards pa-

tients who do not have any matching demographics with a corresponding Medicare/private insurance patient. All the analyses were performed using R 3.0.3 (R Foundation, www.r-project.org).

Results

Demographics

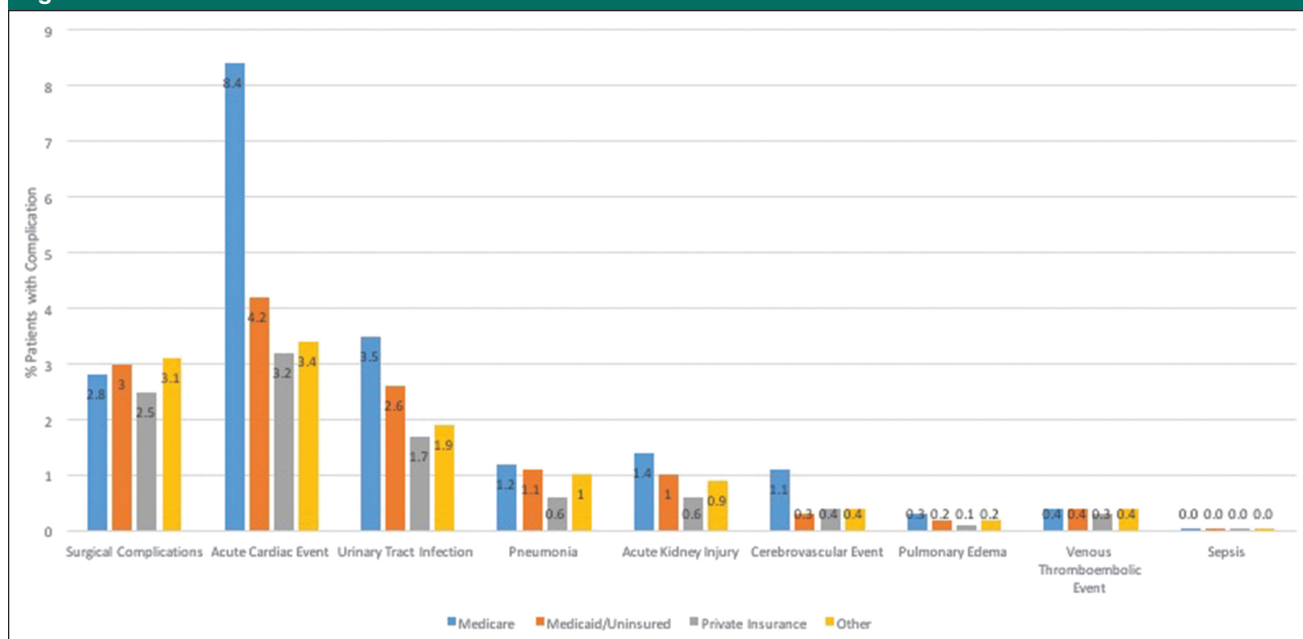
Overall, 515,037 patients fulfilled criteria for inclusion into the study. The payer mix included 53.7% (276,695) patients with Medicare, 40.1% (206,692) patients with private insurance, 3.9% (20,153) patients with Medicaid or no insurance, and 2.2% (11,497) patients from other programs (ie, worker's compensation, Civilian Health and Medical Program of the Uniformed Services, Civilian Health and Medical Program of the Department of Veterans Affairs, Maternal and Child Health Services Block Grant [Title V of the Social Security Act], and other governmental programs).

Demographic information is reported in Table 1 (see Supplemental Digital Content 1, <http://links.lww.com/JAAOS/A250>). Most of the patients were white, followed by black and Hispanic. Most of the patients with Medicaid and private insurance were younger than 65 years. Patients with government-sponsored insurance tended to be less healthy, as indicated by their higher comorbidity index. Stark contrast exists between the Medicaid/uninsured patients and the private insured patients, where 46.2% of Medicaid/Uninsured patients versus only 28.7% of the private insured patients went to low-volume hospitals (<149 cases per year) for their primary hip replacement surgery (see Table 1, Supplemental Digital Content 1, <http://links.lww.com/JAAOS/A250>).

Overall Complications

The most common complication overall was cardiac events that occurred in

Figure 1



Types of medical and surgical complications based on insurance types.

8.4% of Medicare patients, at almost three times the rate of patients on private insurance (3.2%) (Figure 1). UTIs and pneumonia were the next two most frequent medical complications, both seen more commonly in those with government-sponsored insurance. UTI was seen in 2.6% of Medicaid/Uninsured patients and 3.5% of Medicare patients compared with 1.7% in the private patient population. Pneumonia was seen in 1.1% of Medicaid/Uninsured patients and 1.2% of Medicare patients compared with 0.6% in patients with private insurance. The most complications seen overall, irrespective of the type of hip replacement surgery, was found in the Medicare population, followed by the Medicaid/Uninsured, other insurances, and privately insured patient populations.

Medical Complications

The multivariable logistic regression analysis found that having private insurance was associated with less overall medical complications com-

pared with Medicare (odds ratio [OR], 0.8; 95% confidence interval [CI], 0.78 to 0.82; $P < 0.001$) (see Table 2, Supplemental Digital Content 2, <http://links.lww.com/JAAOS/A251>). Additionally, patients with Medicaid or no insurance did not have a markedly higher risk of medical complications compared with patients with Medicare (adjusted OR, 1.03; 95% CI, 0.97 to 1.09; $P = 0.367$).

Additionally, white patients had more medical complications than black, Hispanic, or Asian patients (adjusted OR, 0.89, 0.78, and 0.57, respectively, compared with white patients with $P < 0.001$). Increasing age and comorbidity index were substantially associated with medical complications. Compared with patients younger than 40 years, patients aged 40 to 64 years had two times (OR, 2.23; 95% CI, 2.04 to 2.44; $P < 0.001$), patients aged 65 to 79 years had nearly four times (OR, 3.58; 95% CI, 3.27 to 3.93; $P < 0.001$), and those older than 80 years had six times (OR, 5.98; 95% CI, 5.44 to 6.56; $P < 0.001$) higher odds

of having a medical complication. The trend is similar for those with increasing comorbidity index, in which those with comorbidity index ≥ 3 are 20 times (OR, 20.44; 95% CI, 19.69 to 21.23; $P < 0.001$) higher odds of having a medical complication compared with those with a comorbidity index of zero.

Surgical Complications

Similar to medical complications, in comparing the incidence of surgical complications (see Table 2, Supplemental Digital Content 2, <http://links.lww.com/JAAOS/A251>) between insurance types, patients with private insurance had a statistically significant lower risk of surgical complications (OR, 0.92; 95% CI, 0.87 to 0.97; $P = 0.002$) compared with patients with Medicare, whereas patients who have Medicaid or no insurance had no notable difference (OR, 1.04; 95% CI, 0.94 to 1.14; $P = 0.458$) compared with patients with Medicare insurance. Black, Hispanic, and Asian patients had a

statistically significant increase in surgical complications compared with white patients. Patients with comorbidities had an increased risk of surgical complications, although the effect is not as dramatic as it is for medical complications. Finally, a statistically significant increase is observed in surgical complications in younger patients (aged less than 40 years) and in male patients.

Mortality

The overall mortality rate in our study group was 0.1% ($n = 693$). Compared with Medicare patients, patients with Medicaid or no insurance had no difference in mortality (OR, 1.31; 95% CI, 0.81 to 2.1; $P = 0.273$) and those with private insurance had a markedly lower mortality risk (OR, 0.56; 95% CI, 0.42 to 0.75; $P < 0.001$). Female patients (OR, 0.65; 95% CI, 0.56 to 0.76; $P < 0.001$) had a lower risk of mortality compared with male patients (see Table 2, Supplemental Digital Content 2, <http://links.lww.com/JAAOS/A251>). Patients who were older and had more comorbidities also had higher mortality risk.

Matched Cohort Analysis

The demographic information for matched cohort between the Medicare and the private insurance patients is reported in Table 3 (see Supplemental Digital Content 3, <http://links.lww.com/JAAOS/A252>), which demonstrates similar baseline characteristics and comorbidities among the two study groups. Table 4 (see Supplemental Digital Content 4, <http://links.lww.com/JAAOS/A253>) compares the proportions of complications between the two insurance groups when controlling for both demographic and risk factors. Patients with Medicare had a markedly higher risk of complications from central nervous system, cardiovascular, respiratory, genitourinary, hematoma/seroma,

postoperative infection, postoperative anemia, and mortality. We found no notable difference in the rates of peripheral vascular, gastrointestinal, wound dehiscence, deep vein thrombosis, and pulmonary embolism complications between the two matched cohorts of Medicare and private insurance patients after primary elective THA.

Discussion

Demand for primary hip arthroplasties is projected to rise dramatically over the next decade and beyond.²¹ This rise in use makes it even more imperative to identify and understand complications that occur after hip arthroplasty. To our knowledge, this is the largest and most comprehensive analysis of outcomes and complications after THA as they relate to insurance status. Our multivariable regression analysis found that after primary elective hip arthroplasty, postoperative in-hospital complication were associated with the patient's insurance status and other patient factors. A secondary analysis matching demographics and comorbidities between Medicare and private insurance patients confirmed these results, demonstrating that complications were more common in government-sponsored insurance (Medicare) patients than in those with private insurance after primary elective THA.

Multivariable regression analysis from more than half of a million patients included in this study indicates that patients with Medicare and those with Medicaid or no insurance were more likely to have medical complications, most commonly cardiac complications, UTIs, and pneumonia, compared with private insurance patients. However, patients with Medicare and Medicaid or no insurance had no notable difference in both the medical and surgical

complications or mortality risk compared with each other. In comparison, those with private insurance had markedly fewer medical and surgical complications and decreased risk of mortality. These findings are in keeping with previous literature on the joint arthroplasty which indicates decreased clinical outcomes and higher complications in patients with government-sponsored insurance (Medicaid), which may be associated with their poor socioeconomic status and access to care.¹⁷⁻¹⁹ Similar large database studies in the trauma literature also showed an increase in mortality²²⁻²⁴ and poorer outcomes^{25,26} in uninsured patients after trauma.

To add credence to our multivariable regression analysis of all patients, when accounting for patient characteristics and potential confounding variables in a matched cohort model, the rates of complications were still markedly higher in many categories in the Medicare group than in the private insurance group. All complications that had a statistically significant ($P < 0.05$) difference between Medicare and private insurance patients showed a higher relative risk for patients with Medicare insurance. Medicare patients had a higher risk of complications because of central nervous system (relative risk [RR], 1.25), cardiovascular (RR, 1.18), respiratory (RR, 1.30), genitourinary (RR, 1.25), hematoma (RR, 1.07), postoperative infection (RR, 1.42), postoperative anemia (RR, 1.06), and mortality (RR, 1.45). The most common complication, postoperative anemia, occurred in 33.3% of Medicare patients compared with 31.5% of private insurance patients. All other medical complications occurred in less than 5% of the patients in either insurance population. This underscores the importance of monitoring all patients closely for postoperative anemia because it occurs in many patients recovering from THA.

A similar study using the NIS database performed by Browne et al¹³ looked at complications in a matched group of Medicaid and non-Medicaid patients who underwent primary hip and knee arthroplasty. They found a higher rate of wound dehiscence, infection, and anemia in the Medicaid patients and a higher rate of cardiac complications in the non-Medicaid patients.²⁰ For our analysis, we performed both a multivariable logistic regression to analyze the overall effect of insurance on outcomes and a matched cohort of patients with Medicare versus private insurance. With the matching scheme, our analysis better used the whole national cohort of patients without missing any “unmatched” patient data. Additionally, we excluded all hemiarthroplasties, revision total hip arthroplasties, and any total hip replacement done in the urgent setting to strengthen our findings while minimizing bias. We believe that our results reflect the real-world population well, especially in the overall complication and mortality rates after primary elective THA procedure.

In our study, we were able to analyze a large number of patient records to find statistical trends that may not otherwise be discernible in smaller, retrospective, single or multisite studies. The database is a nationwide sampling of all elective primary total hip arthroplasties, so it can be seen as broadly applicable. However, because of the nature of a retrospective study, we are limited in our ability to analyze causality. For example, our study found that the surgical complication rates are markedly higher among patients younger than 40 years than in patients aged between 40 and 80 years. One possible explanation for this finding is that younger patients (aged less than 40 years) may have more complex hip pathology if indicated for a THA (eg, hip dysplasia, posttraumatic arthritic, osteonecrosis) than older patients with

standard arthritis, resulting in a greater risk of surgical complication due to complexity of hip pathology. However, given the nature of the study and limitations of results drawn from a national database, we are unable to imply causality with this association. The data are from a NIS and only have information on a single hospital discharge, so no data are available on follow-up rates, readmissions, or delayed complications that occur after the patient is discharged. Additionally, another interesting finding was inhomogeneity between the different groups in terms of where most patients had their surgery performed because it relates to their insurance status. Patients with private insurance were more likely to get their surgeries done at high-volume centers (>293 cases per year) and in an urban setting, whereas patients with Medicare or Medicaid/Uninsured were more likely to have their surgery performed at hospitals with annual volume of less than 149 cases and in a rural setting. Previous studies have demonstrated that hospital volume alone may be associated with increased mortality and complications rates.^{27,28} And finally, although statistical significance can be demonstrated in a large database study such as this, the clinical relevance of small but statistically significant differences is an area of debate.

Our data show that, in general, patients with government-sponsored (Medicare) or no insurance were sicker and older and had more medical and surgical complications including mortality. Older patients or those with more comorbidities were more likely to have medical and surgical complications including death. Using a matched cohort to minimize confounding variables between the groups of Medicare and private insurance patients, the risk of postoperative medical and surgical complications including mortality was also higher in Medicare patients. Further research investigating the disparity

of outcomes between insurance types should be performed to optimize patient outcomes after THA.

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