

# Increased Risk of In-Hospital Complications and Costs after Total Hip Arthroplasty for Primary and Secondary Osteonecrosis

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## INTRODUCTION:

Recent studies have shown an increase in the proportion of patients undergoing total hip arthroplasty (THA) for both osteoarthritis (OA) and osteonecrosis (ON). While patients with ON represent only 10% of all THA cases annually, their rates of comorbidities and surgical risk factors are far greater than those with OA only. Given the advent of bundled reimbursement models for total joint arthroplasty (TJA), understanding perioperative complication rates is critical. The purpose of our study was to quantify the specific in-hospital complications and resource utilization of patients undergoing THA for ON versus OA.

**METHODS:** The Healthcare Cost and Utilization Project (HCUP) Nationwide Inpatient Sample (NIS) database was queried to identify patients undergoing primary hip arthroplasty from January 2016 to December 2019. ON and OA were defined using ICD-10CM codes. Demographics, in-hospital complications, costs, length of stay, and disposition at discharge for patients with primary and secondary ON were compared to patients with OA only. To control for potential confounders, binary logistic regression analysis controlled for age, race, ethnicity, comorbidities, Medicaid coverage, and income status.

**RESULTS:** A total of 1,383,880 patients had a previous diagnosis of OA, 21,080 had a previous diagnosis of primary ON, and 54,335 had a diagnosis of secondary ON. Patients with ON were often younger, African American or Hispanic, and had more comorbidities. Patients with primary ON had a significantly higher risk of most perioperative complications when compared with patients with OA, most notably myocardial infarction (OR 1.8), postoperative blood transfusion (OR 2.5), and intraoperative bleeding (OR 2.9), (all p<0.01). Similarly, patients with secondary ON had substantially higher risk of most perioperative complications, including myocardial infarction (OR 2.1), postoperative blood transfusion (OR 2.4), intraoperative bleeding (OR 3.4), and postoperative bleeding (OR 4.7), (all p<0.01). Total hospital costs and length of stay were significantly higher for both primary ON (\$16,404, 2.01 days) and secondary ON (\$16,358, 2.16 days) when compared to patients with OA only (\$16,158, 1.87 days), (all p<0.01). Both cohorts of patients with ON were less likely to be discharged home.

## DISCUSSION AND CONCLUSION:

Patients undergoing THA for both primary and secondary ON have significantly higher risk for nearly all perioperative complications in comparison with those undergoing THA for OA. Importantly, patients with either etiology of ON incur higher costs, longer lengths of stay, and are less likely to be discharged home postoperatively. While rates of both short- and long-term complications have decreased over recent decades in patients undergoing THA for ON in comparison with non-ON cohorts, ON patients still have poorer outcomes even when controlling for comorbidity differences. Patients with secondary ON seem to fare worse postoperatively than those with primary ON. Bundled payment systems and pre- and postoperative management strategies for these different patient cohorts should be considered separately.

**Table 1. Risk of perioperative complications for osteonecrosis patients compared to primary osteoarthritis patients after total hip arthroplasty.**

Complication	OA patients	Primary ON patients	OR (95% CI)	p
Myocardial Infarction	0.17 (70)	NA	1.81 (2.24)	<0.01
Myocardial Ischemia	0.17 (70)	13 (25)	1.81 (2.14)	<0.01
Heart Failure	0.17 (70)	23 (45)	1.81 (2.17)	<0.01
Stroke	0.17 (70)	13 (25)	1.81 (2.14)	<0.01
Pneumonia	0.17 (70)	13 (25)	1.81 (2.14)	<0.01
Pneumonia Bacterial	0.17 (70)	13 (25)	1.81 (2.14)	<0.01
Pneumonia Viral	0.17 (70)	13 (25)	1.81 (2.14)	<0.01
Pneumonia Fungal	0.17 (70)	13 (25)	1.81 (2.14)	<0.01
Pneumonia Unknown	0.17 (70)	13 (25)	1.81 (2.14)	<0.01
Pulmonary Embolism	0.17 (70)	13 (25)	1.81 (2.14)	<0.01
Deep Vein Thrombosis	0.17 (70)	13 (25)	1.81 (2.14)	<0.01
Superficial Thrombophlebitis	0.17 (70)	13 (25)	1.81 (2.14)	<0.01
Postoperative Hemorrhage	0.17 (70)	13 (25)	1.81 (2.14)	<0.01
Intraoperative Bleeding	0.17 (70)	13 (25)	1.81 (2.14)	<0.01
Postoperative Bleeding	0.17 (70)	13 (25)	1.81 (2.14)	<0.01
Transfusion	0.17 (70)	13 (25)	1.81 (2.14)	<0.01
Transfusion Blood	0.17 (70)	13 (25)	1.81 (2.14)	<0.01
Transfusion Platelets	0.17 (70)	13 (25)	1.81 (2.14)	<0.01
Transfusion Plasma	0.17 (70)	13 (25)	1.81 (2.14)	<0.01
Transfusion Cryoprecipitate	0.17 (70)	13 (25)	1.81 (2.14)	<0.01
Transfusion Whole Blood	0.17 (70)	13 (25)	1.81 (2.14)	<0.01
Transfusion Other	0.17 (70)	13 (25)	1.81 (2.14)	<0.01
Transfusion Unknown	0.17 (70)	13 (25)	1.81 (2.14)	<0.01
Transfusion Complication	0.17 (70)	13 (25)	1.81 (2.14)	<0.01
Transfusion Reaction	0.17 (70)	13 (25)	1.81 (2.14)	<0.01
Transfusion Infection	0.17 (70)	13 (25)	1.81 (2.14)	<0.01
Transfusion Toxicity	0.17 (70)	13 (25)	1.81 (2.14)	<0.01
Transfusion Other	0.17 (70)	13 (25)	1.81 (2.14)	<0.01
Transfusion Unknown	0.17 (70)	13 (25)	1.81 (2.14)	<0.01

OR: Odds Ratio  
CI: Confidence Interval

**Table 2. Risk of perioperative complications for osteonecrosis patients compared to secondary osteoarthritis patients after total hip arthroplasty.**

Complication	OA patients	Secondary ON patients	OR (95% CI)	p
Myocardial Infarction	0.17 (70)	0.17 (70)	2.11 (2.32)	<0.01
Myocardial Ischemia	0.17 (70)	0.17 (70)	2.11 (2.32)	<0.01
Heart Failure	0.17 (70)	0.17 (70)	2.11 (2.32)	<0.01
Stroke	0.17 (70)	0.17 (70)	2.11 (2.32)	<0.01
Pneumonia	0.17 (70)	0.17 (70)	2.11 (2.32)	<0.01
Pneumonia Bacterial	0.17 (70)	0.17 (70)	2.11 (2.32)	<0.01
Pneumonia Viral	0.17 (70)	0.17 (70)	2.11 (2.32)	<0.01
Pneumonia Fungal	0.17 (70)	0.17 (70)	2.11 (2.32)	<0.01
Pneumonia Unknown	0.17 (70)	0.17 (70)	2.11 (2.32)	<0.01
Pulmonary Embolism	0.17 (70)	0.17 (70)	2.11 (2.32)	<0.01
Deep Vein Thrombosis	0.17 (70)	0.17 (70)	2.11 (2.32)	<0.01
Superficial Thrombophlebitis	0.17 (70)	0.17 (70)	2.11 (2.32)	<0.01
Postoperative Hemorrhage	0.17 (70)	0.17 (70)	2.11 (2.32)	<0.01
Intraoperative Bleeding	0.17 (70)	0.17 (70)	2.11 (2.32)	<0.01
Postoperative Bleeding	0.17 (70)	0.17 (70)	2.11 (2.32)	<0.01
Transfusion	0.17 (70)	0.17 (70)	2.11 (2.32)	<0.01
Transfusion Blood	0.17 (70)	0.17 (70)	2.11 (2.32)	<0.01
Transfusion Platelets	0.17 (70)	0.17 (70)	2.11 (2.32)	<0.01
Transfusion Plasma	0.17 (70)	0.17 (70)	2.11 (2.32)	<0.01
Transfusion Cryoprecipitate	0.17 (70)	0.17 (70)	2.11 (2.32)	<0.01
Transfusion Whole Blood	0.17 (70)	0.17 (70)	2.11 (2.32)	<0.01
Transfusion Other	0.17 (70)	0.17 (70)	2.11 (2.32)	<0.01
Transfusion Unknown	0.17 (70)	0.17 (70)	2.11 (2.32)	<0.01
Transfusion Complication	0.17 (70)	0.17 (70)	2.11 (2.32)	<0.01
Transfusion Reaction	0.17 (70)	0.17 (70)	2.11 (2.32)	<0.01
Transfusion Infection	0.17 (70)	0.17 (70)	2.11 (2.32)	<0.01
Transfusion Toxicity	0.17 (70)	0.17 (70)	2.11 (2.32)	<0.01
Transfusion Other	0.17 (70)	0.17 (70)	2.11 (2.32)	<0.01
Transfusion Unknown	0.17 (70)	0.17 (70)	2.11 (2.32)	<0.01

OR: Odds Ratio  
CI: Confidence Interval

**Table 3. Mean and relative cost associated with osteonecrosis compared to primary osteoarthritis patients undergoing total hip arthroplasty.**

Resource	OA patients	Primary ON patients	p value
Total Cost (\$)	16,158	16,404	<0.01
Length of Stay (days)	1.87	2.01	<0.01
Disposition	0.01	0.01	0.01
Postoperative Facility	0.01	0.01	0.01

Median was used for total costs.  
Total costs were adjusted for inflation to 2019 US dollars.

**Table 4. Mean and relative cost associated with osteonecrosis compared to secondary osteoarthritis patients undergoing total hip arthroplasty.**

Resource	OA patients	Secondary ON patients	p value
Total Cost (\$)	16,158	16,358	<0.01
Length of Stay (days)	1.87	2.16	<0.01
Disposition	0.01	0.01	<0.01
Postoperative Facility	0.01	0.01	<0.01

Median was used for total costs.  
Total costs were adjusted for inflation to 2019 US dollars.