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Cost and Complications Associated with Total Joint Arthroplasty Patients

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Introduction

Total joint arthroplasty (TJA) is one of the most commonly performed procedures in the United States (US) with projections of continuous growth. Recent studies have shown that in the US alone, more than one million TJAs are performed annually.(1) TJA imposes a substantial economic burden on healthcare resources.(2) The impact of major perioperative complications on this cost remains uncertain. Using a large database, we aim to describe the association between major complications and the costs associated with TJA.

Materials and Methods

This study was approved by the Institutional Review Board at our hospital (IRB#2012-050). The requirement for written informed consent was waived given the de-identified nature of the data. We used the Premier Healthcare database to identify patients undergoing Total Hip and Knee Arthroplasty (THA/TKA) from 2006 to 2021 (Premier Healthcare Solutions, Charlotte, North Carolina, USA). Major complications were identified using International Classification of Diseases, Ninth and Tenth Revision (ICD-9/ICD-10) codes, including myocardial infarction, congestive heart failure, arrhythmia, pulmonary embolism, acute renal failure, delirium, and cerebral. Total costs to treat the patient during the hospital encounter were identified using a built-in variable from Premier. Using the US Consumer Price Index for medical care expenses, the total costs were adjusted over time to account for inflation, with the adjustments reflecting the equivalence in 2022 US dollars.(3)

Costs were presented as median and interquartile ranges (IQR), stratified by each complication only, two complications, three and more complications, and no complication and being discharged within 4 days of hospitalization. Mixed-effects models with a gamma distribution were applied to compare costs between complication groups and the no complication plus being discharged within 4 days of hospitalization group. Models were adjusted for age, race, sex, type of insurance, Elixhauser Comorbidity index group, year of surgery, hospital location, bed size, and hospital teaching status. A random intercept term that varies at the level of each hospital was included in the model, accounting for the cluster effect of patients within hospitals as they are likely to experience similar care. Estimates were presented as percent changes and 95% CIs. All analyses were conducted using SAS V.9.4. Statistical significance was established at a p-value threshold of less than 0.05.

Results/Case Report

A total of 3,241,624 TJA patients were identified. As shown in Table 1, patients having any complication or multiple complications have higher costs compared to patients with no complication and discharged within 4 days. Among the TKA patients, the no complication group has a median cost of \$16,518 (IQR: \$13,528-\$20,562). The highest cost complications groups are patients with 3 or more complications (median: \$39,095; IQR: \$27,825-\$59,185), myocardial infarction only (median: \$29,900; IQR: \$22,831-\$41,102), and 2 complications (median: \$27,687; IQR: \$20,493-\$38,558). For THA cohort, the no complication group has a median cost of \$16,819 dollars (IQR: \$13,7667-\$20,791). Similarly, the top 3 cost conditions are having 3 or more complications, myocardial infarction only, followed by having 2 complications.

After adjusting for hospital random effect and other covariates, all complication conditions are associated with higher costs during hospitalization. The lowest cost condition is arrhythmia only, which is associated with 28% (95% CIs: 28%-29%) and 27% (95% CIs: 27%-28%) increase in cost compared to no complication in TKA and THA respectively. The highest cost for a single complication is myocardial infarction, which is associated with 94% (95% CIs: 90%-100%) and 89% (95% CIs: 85%- 93%) increase in cost in TKA and THA respectively. (Table 2)

Discussion

Major complications are associated with significantly higher in-hospital costs for TJA patients compared to those without complications. Even a single major complication can lead to an increase in costs ranging from almost 30% to 100%. Future studies are warranted to explore in detail the specific areas contributing to these costs.

References

1. Peacock S, Wolfstadt J, Peer M, Gleicher Y. Rapid implementation of an outpatient arthroplasty care pathway: a COVID-19-driven quality improvement initiative. *BMJ Open Qual.* 2022;11(1).
2. Cutler DM, Ghosh K. The potential for cost savings through bundled episode payments. *N Engl J Med.* 2012;366(12):1075-7.
3. Consumer Price Index US Bureau of Labor Statistics [Available from: <https://www.bls.gov/cpi/tables/supplemental-files/home.htm>].

Disclosures

No

Tables / Images

Table 1. Complications and costs among TKA and THA cohorts

	Total Knee Arthroplasty		Total Hip Arthroplasty	
	N	Median [IQR]	N	Median [IQR]
No complication and discharged within 4 days	1,308,319	\$16,518 [\$13,528, \$20,562]	749,751	\$16,819 [\$13,767, \$20,791]
Myocardial infarction only	914	\$29,900 [\$22,831, \$41,102]	686	\$29,623 [\$22,736, \$39,798]
Congestive heart failure only	1682	\$24,824 [\$19,706, \$32,364]	672	\$25,644 [\$20,324, \$33,296]
Arrhythmia only	33,612	\$20,587 [\$16,190, \$26,880]	17,847	\$20,335 [\$16,261, \$26,542]
Pulmonary Embolism only	4347	\$26,165 [\$20,439, \$34,283]	632	\$26,848 [\$21,164, \$35,455]
Acute renal failure only	26,382	\$21,349 [\$16,703, \$28,431]	13,958	\$21,413 [\$16,961, \$28,336]
Delirium only	10,954	\$21,588 [\$17,435, \$27,388]	4828	\$22,082 [\$17,540, \$28,161]
Cerebral only	1137	\$24,491 [\$18,611, \$34,501]	717	\$25,305 [\$18,970, \$35,283]
2 complications	8159	\$27,687 [\$20,493, \$38,558]	3825	\$28,045 [\$20,772, \$40,231]
3 and more complications	1473	\$39,095 [\$27,825, \$59,185]	739	\$41,296 [\$28,564, \$61,587]

Table 2. Mixed model outcomes for complications and costs stratified by TKA and THA cohorts

Complications	Total Knee Arthroplasty		Total Hip Arthroplasty	
	% change (95% CIs)	p-value	% change (95% CIs)	p-value
Ref group= No complication and discharged within 4 days				
Myocardial infarction only	94% (90%, 100%)	<.001	89% (85%, 93%)	<.001
Congestive heart failure only	57% (54%, 60%)	<.001	69% (65%, 73%)	<.001
Arrhythmia only	28% (28%, 29%)	<.001	27% (27%, 28%)	<.001
Pulmonary Embolism only	62% (60%, 64%)	<.001	71% (67%, 76%)	<.001
Acute renal failure only	38% (38%, 39%)	<.001	41% (40%, 42%)	<.001
Delirium only	32% (31%, 33%)	<.001	37% (36%, 38%)	<.001
Cerebral only	64% (60%, 68%)	<.001	69% (66%, 73%)	<.001
Two complications	85% (84%, 87%)	<.001	95% (93%, 97%)	<.001
Three and more complications	185% (180%, 191%)	<.001	204% (198%, 211%)	<.001