Two-year Burden of Antibiotic Use for Prosthetic Joint Infection following Total Knee Arthroplasty

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INTRODUCTION: Prosthetic joint infection (PJI) is one of the most challenging complications following total knee arthroplasty (TKA). Unfortunately, 1-2% of TKA patients develop PJI, and the number is expected to be increasing. PJI is the most common indication for TKA revision and is associated with higher morbidity and mortality. In addition, it poses a substantial economic burden on patients and the healthcare system as it increases and lengthens hospital stays, requires long-term antibiotic therapy, and almost always needs at least one surgical intervention. Our study is to estimate the total days and cost of therapeutic antibiotic use among patients with prosthetic joint infection (PJI) after total knee arthroplasty (TKA).

METHODS:

An observational cohort study was conducted with a 2-year follow-up using the IBM Watson Health MarketScan Commercial Claims and Encounters Database. Patients with osteoarthritis who underwent primary TKA between January 1 and September 30, 2017 were included. Patients who had switched insurance providers, or had a second TKA during the follow-up period were excluded. Primary exposure was the diagnosis of PJI within 90 days post-TKA. The primary outcome was the days of antibiotics use, and the secondary outcome was the costs associated with antibiotics, both over the 2-year period post-TKA. Propensity score matching analysis was performed matching with patient and provider characteristics.

RESULTS:

A total of 13,201 patients (female 59.0%, age 59.4±8.4, PJI 1.0%) were included in the study. After propensity score matching, patients with PJI had 131.6 days more on antibiotic use when compared to patients without PJI (165.1 days vs 33.5 days, *P*<0.001). They also spent $2063.7 more on antibiotics when compared to patients without PJI ($2242.0 vs $178.3, *P*<0.001).

DISCUSSION AND CONCLUSION:

PJI patients spent an average of 165.1 days and $2242.0 on antibiotic use over the first two years following TKA. By extrapolating the result of this study, the total cost of antibiotics use for PJI patients is estimated to be over $10 million over two years in the United States.

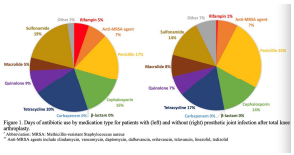

Figure 1. Days of antibiotic use by medication type for patients with (left) and without (right) prosthetic joint infection after total knee arthroplasty
*Abbreviation: MRSA: Methicillin-resistant Staphylococcus aureus
** Anti-MRSA agents include clindamycin, vancomycin, daptomycin, dalbavancin, oritavancin, telavancin, linezolid, tedizolid

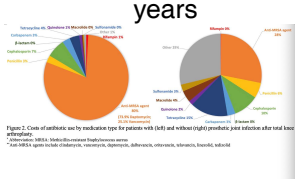

Figure 2. Costs of antibiotic use by medication type for patients with (left) and without (right) prosthetic joint infection after total knee arthroplasty
*Abbreviation: MRSA: Methicillin-resistant Staphylococcus aureus
**Anti-MRSA agents include clindamycin, vancomycin, daptomycin, dalbavancin, oritavancin, telavancin, linezolid, tedizolid

Table 1. Characteristics of patients with and without acute prosthetic joint infection (PJI) after total knee arthroplasty (TKA)

	Overall (N= 13,201)	Patients with PJI within 90 days post-TKA (N= 134)	Patients without PJI within 90 days post-TKA (N=13,067)	*P*-value
Days of antibiotic use over 2 years post-TKA, mean (SD)[1]	35.3 (84.1)	165.1 (212.4)	34.0 (80.7)	<0.001
Cumulative duration[2] of antibiotic use over 2 years post-TKA, (%)				<0.001
< 1 month	9182 (69.6%)	35 (24.6%)	9149 (70.0%)	
1-2 months	2468 (18.7%)	30 (22.4%)	2438 (18.7%)	
2-6 months	1179 (8.9%)	32 (23.9%)	1147 (8.8%)	
6-12 months	189 (1.4%)	19 (14.2%)	170 (1.3%)	
≥ 12 months	183 (1.4%)	20 (14.9%)	163 (1.2%)	
Cost of antibiotic use over 2 years post-TKA, mean (SD)	152.1 (1472.3)	2242.0 (5580.3)	130.7 (1351.9)	<0.001
Age, mean (SD)	59.4 (8.4)	59.3 (9.9)	59.4 (8.4)	0.86
Female, (%)	7792 (59.0%)	53 (39.6%)	7739 (59.2%)	<0.001
History of comorbidities				
Hypertension, (%)	5833 (44.2%)	59 (44.0%)	5774 (44.2%)	0.97
Type 2 Diabetes Mellitus, (%)	2047 (15.2%)	29 (20.8%)	1979 (15.1%)	0.07
Malignancy, (%)	96 (0.7%)	2 (1.5%)	94 (0.7%)	0.29
Obesity, (%)	3660 (27.7%)	38 (28.4%)	3622 (27.7%)	0.87
Smoking, (%)	529 (4.0%)	5 (3.7%)	524 (4.0%)	0.87
Season of undergoing TKA				
Spring, (%)	3076 (23.3%)	33 (24.6%)	3043 (23.3%)	0.31
Summer, (%)	3093 (23.4%)	37 (27.6%)	3056 (23.4%)	
Autumn, (%)	3464 (26.2%)	26 (19.4%)	3438 (26.3%)	
Winter, (%)	3568 (27.0%)	38 (28.4%)	3530 (27.0%)	
Hospital setting				0.56
Inpatient hospital, (%)	9523 (70.6%)	101 (75.4%)	9222 (70.6%)	
Hospital-based outpatient department, (%)	2910 (22.0%)	24 (17.9%)	2886 (22.1%)	
Ambulatory surgery center, (%)	648 (4.9%)	5 (3.7%)	643 (4.9%)	
Other, (%)	320 (2.4%)	4 (3.0%)	316 (2.4%)	
Region of the United States				0.87
Northeast, (%)	1527 (11.6%)	14 (10.4%)	1513 (11.6%)	
Midwest, (%)	3753 (28.4%)	34 (25.4%)	3719 (28.5%)	
South, (%)	6222 (47.1%)	68 (50.7%)	6154 (47.1%)	
West, (%)	1675 (12.7%)	18 (13.4%)	1657 (12.7%)	
Other, (%)	24 (0.2%)	0 (0.0%)	24 (0.2%)	

[1]Abbreviation: SD: standard deviation
[2]Duration of use was cumulative but not necessarily consecutive over 2 years post-TKA

Table 2. Days and cost of antibiotic use among patients with and without prosthetic joint infection (PJI) after total knee arthroplasty (TKA)[1]

	Patients with PJI within 90 days post-TKA (n= 134)	Patients without PJI within 90 days post-TKA (n= 13,043)	Difference	SE[2]	*P*-value
Days of antibiotic use over 2 years post-TKA (days)	165.1	33.5	131.6	19.4	<0.001
Cost over 2 years post-TKA ($)	2242.0	178.3	2063.7	493.1	<0.001

[1]Propensity score matching with variables including age, gender, comorbidities, season of operation, hospital type, and region in the US.
[2]Abbreviation: SE: standard error