

Demographics and Outcomes of Commercial Antibiotic Cement Usage for Infection Prophylaxis During Primary Total Knee Arthroplasty In Patients Over 65 Years Old: An American Joint Replacement Registry Study

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INTRODUCTION:

The use of antibiotic-laden bone cement (ALBC) for infection prophylaxis in the setting of primary total knee replacement (TKA) remains controversial. Large cohort studies from the United States suggest that it is not cost effective in selectively studied populations, however, European Registries suggest decreased infection rates with the use of prophylactic antibiotic cement. Despite evidence to the contrary, the use of commercially available ALBC for infection prophylaxis in primary TKA continues in both North American and Internationally. Its use varies from less than 50% of cases in North America to greater than 90% of cases in some parts of Northern Europe. We propose a retrospective cohort study in collaboration with the American Joint Replacement Registry with the purposes: 1) examine the demographics of ALBC usage in the United States to further clarify practice patterns; and 2) identify the effect of prophylactic commercially available ALBC on revision for prosthetic joint infection (PJI) after primary TKA. We hypothesize that its usage is not associated with higher risk patient populations but regional based on surgeon preference and ALBC usage will not decrease revision rates for PJI.

METHODS:

We used a retrospective cohort design of prospectively collected data from the American Joint Replacement Registry from 2017-2020. Patients over age 65 undergoing primary cemented TKA with or without the use of commercially available antibiotic cement were eligible for enrollment. Data was linked to available Medicare claims data over the same study period to maximize revision outcomes capture. Exclusion criteria included primary cementless TKA, revision TKA, or incomplete follow up over the study period. Demographics including age, sex, race/ethnicity, Charlson Comorbidity Index, preoperative inflammatory arthritis, region, and BMI class were recorded for each patient. Outcome variables included 90-day revision for PJI and 90-day all-cause readmission. Early revision was defined as a revision procedural case within 90 days of a primary procedure matched on case identifier, laterality, and procedure site. Early readmission was defined as a hospital readmission within 90 days of a primary procedure. Differences between demographic variables and outcomes between groups were assessed using chi-square or independent t-tests as appropriate. Cox proportional hazards regression analysis was used to evaluate the association between the two outcome measures and ALBC usage. Revision of non-target diagnoses was considered a competing risk for 90-day revision. Case data from institutions that did not submit postoperative data were excluded from readmission regression analyses. All regression models were adjusted for potential confounders (SAS Version 9.4).

RESULTS:

Demographic characteristics for ALBC usage in primary cemented TKA are shown in Table 1 with 251,506 patients meeting inclusion criteria. Patients undergoing primary cemented TKA with ALBC were more likely to be Non-Hispanic Black ($p < 0.001$), have a CCI of 2 or 3 ($p < 0.001$), reside in the South ($p < 0.001$), and had a higher mean BMI (31.4 [6.2] versus 31.7 [6.1]) ($p < 0.001$). Patients in the ALBC group also had higher rates of 90-day readmissions (1.1% versus 0.9%) and 90-day revision due to PJI (0.3% versus 0.1%) ($p < 0.001$) relative to non-ALBC group. In the regression models, ALBC usage was associated with increased risk of 90-day revision for PJI (hazards ratio [HR] 2.175 [95% confidence interval (CI): 1.698-2.787]) ($p < 0.001$) and was not associated with 90-day all cause readmissions (HR 1.012 [95% CI: 0.928-1.104]) (Table 2 and 3). Male sex, higher CCI, and BMI > 35 were all independently associated with 90-day revision for PJI (Table 2). Older age, male sex, Midwest region, higher CCI, and BMI > 35 were independently associated with 90-day readmissions (Table 3).

DISCUSSION AND CONCLUSION:

Despite the use of ALBC in patients with higher rates of comorbidities and higher BMI, commercial ALBC usage in patients over 65 years old for primary TKA was associated with increased risk of 90-day revision for PJI and was not associated with 90-day readmission rates in the American Joint Replacement Registry. This is one of the largest series in the United States studying the use of ALBC for primary TKA, and it supports prior studies that question its efficacy in infection prophylaxis when applied across a diverse population for primary TKA.

Table 1 (continued) Characteristics of AISC Use for Ages 10 and Over 2007-2010 (USD)

Category	2007-2008		2009-2010		Total (2007-2010)	p-value
	N	%	N	%		
REASON FOR CAUSE REVISION						
None	142	0.9	411	1.1	553	<0.001
Yes	174,710	88.1	72,427	18.9	247,137	
REASON FOR USE TO FA						
None	35	0.1	104	0.3	139	<0.001
Yes	17,111	86.9	7,446	18.7	24,557	

Table 1. Characteristics of AISC Use for Ages 10 and Over

Category	2007-2008		2009-2010		Total (2007-2010)	p-value
	N	%	N	%		
AGE						
10-14	17,111	8.1	7,446	18.7	24,557	<0.001
15-19	47,241	22.4	24,241	6.1	71,482	
20-24	62,424	29.5	30,424	7.7	92,848	
25-29	14,241	6.7	7,446	1.9	21,687	
30-34	14,241	6.7	7,446	1.9	21,687	
35-39	14,241	6.7	7,446	1.9	21,687	
40-44	14,241	6.7	7,446	1.9	21,687	
45-49	14,241	6.7	7,446	1.9	21,687	
50-54	14,241	6.7	7,446	1.9	21,687	
55-59	14,241	6.7	7,446	1.9	21,687	
60-64	14,241	6.7	7,446	1.9	21,687	
65-69	14,241	6.7	7,446	1.9	21,687	
70-74	14,241	6.7	7,446	1.9	21,687	
75-79	14,241	6.7	7,446	1.9	21,687	
80-84	14,241	6.7	7,446	1.9	21,687	
85-89	14,241	6.7	7,446	1.9	21,687	
90-94	14,241	6.7	7,446	1.9	21,687	
95-99	14,241	6.7	7,446	1.9	21,687	
100+	14,241	6.7	7,446	1.9	21,687	
EDUCATION COMPLETION INDEX						
None	14,241	6.7	7,446	1.9	21,687	<0.001
High School	14,241	6.7	7,446	1.9	21,687	
Some College	14,241	6.7	7,446	1.9	21,687	
College Graduate	14,241	6.7	7,446	1.9	21,687	
Postgraduate	14,241	6.7	7,446	1.9	21,687	
EDUCATION COMPLETION INDEX (D)						
None	14,241	6.7	7,446	1.9	21,687	<0.001
High School	14,241	6.7	7,446	1.9	21,687	
Some College	14,241	6.7	7,446	1.9	21,687	
College Graduate	14,241	6.7	7,446	1.9	21,687	
Postgraduate	14,241	6.7	7,446	1.9	21,687	
EDUCATION COMPLETION INDEX (E)						
None	14,241	6.7	7,446	1.9	21,687	<0.001
High School	14,241	6.7	7,446	1.9	21,687	
Some College	14,241	6.7	7,446	1.9	21,687	
College Graduate	14,241	6.7	7,446	1.9	21,687	
Postgraduate	14,241	6.7	7,446	1.9	21,687	
EDUCATION COMPLETION INDEX (F)						
None	14,241	6.7	7,446	1.9	21,687	<0.001
High School	14,241	6.7	7,446	1.9	21,687	
Some College	14,241	6.7	7,446	1.9	21,687	
College Graduate	14,241	6.7	7,446	1.9	21,687	
Postgraduate	14,241	6.7	7,446	1.9	21,687	

Table 2. Cox Proportional Hazard Regression Models Assessing the Effect of AISC Usage on 30-Day Mortality Risk

Exposure	Point Estimate (95% CI)	95% CI Lower Confidence Limit	95% CI Upper Confidence Limit	p-value
AISC Usage (ref. No)	1.00	1.00	1.00	<0.001
Yes	1.15	1.08	1.22	<0.001
High School	1.10	1.04	1.16	<0.001
Some College	1.05	0.99	1.11	<0.001
College Graduate	1.00	0.94	1.06	<0.001
Postgraduate	0.95	0.89	1.01	<0.001
High School (ref. No)	1.00	1.00	1.00	<0.001
Some College	1.05	1.00	1.10	<0.001
College Graduate	1.10	1.05	1.15	<0.001
Postgraduate	1.15	1.10	1.20	<0.001
High School (ref. No)	1.00	1.00	1.00	<0.001
Some College	1.05	1.00	1.10	<0.001
College Graduate	1.10	1.05	1.15	<0.001
Postgraduate	1.15	1.10	1.20	<0.001
High School (ref. No)	1.00	1.00	1.00	<0.001
Some College	1.05	1.00	1.10	<0.001
College Graduate	1.10	1.05	1.15	<0.001
Postgraduate	1.15	1.10	1.20	<0.001

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High School (ref. No)	1.00	1.00	1.00	<0.001
Some College	1.05	1.00	1.10	<0.001
College Graduate	1.10	1.05	1.15	<0.001
Postgraduate	1.15	1.10	1.20	<0.001
High School (ref. No)	1.00	1.00	1.00	<0.001
Some College	1.05	1.00	1.10	<0.001
College Graduate	1.10	1.05	1.15	<0.001
Postgraduate	1.15	1.10	1.20	<0.001
High School (ref. No)	1.00	1.00	1.00	<0.001
Some College	1.05	1.00	1.10	<0.001
College Graduate	1.10	1.05	1.15	<0.001
Postgraduate	1.15	1.10	1.20	<0.001

Note: All p-values are less than 0.05, indicating a statistically significant association.