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	ALEC Use	for Ages 6	5 and Over 2	017-1/11/3	1000		
90-day ALL-CAUSE READMISSION	Non-818 (137)	C Lhage 363)	AURC (N=3	55age 5,137)	Tatal (N+251,506)		prote
	н	Col %	N	Col %	N	Call %	
Tes	1,622	0.9	\$10	1.1	2,437	1.0	<.0005
No	175,742	99.1	73,327	58.9	345,069	98.0	
90-day REVISION DUE TO P.8	N	Col %	N	Col %	N	OFS	
Tes	250	0.1	210	0.3	641	1.0	<.0005
No	177,119	98.9	73,546	99.7	251,065	99.8	

	Nov 811 (Nr-17	C Lhage 7,368	AURC (36-3	5.137)	1H-25	1,506	pula
AGE	н	Call %	N	Col %	N	Call %	
Mean Age, y a Sib-confidence limits	213	45.9	71.0	45.8	73.5	459	E-3002
11.60	57.000	17.4	34 816	17.6	97.949	27.5	0.002
30.33	80.151	510	22.615	63.1	100.000	510	
80.80	35.578	15.0	23.695	10.4	23 255	14.9	
-00	1.006	0.6	170	0.6	1.576	0.6	
	1,000				-		
SEA	n and a second	100%		00.5		COLUMN.	
ronae	4.07,644	04.5	40,418	10.5		00.0	Calles.
stat	66,65.7	34.0	28,804	44.4	90,088	34.0	
second or concreae.		0.6	218	0.4	4,479	0.4	
RACIVETHINICITY							
Non-Higganic Write	244,807	61.4	1000	11	111.107	00.0	
Manual Providence Providence	7.474	10	1.871	40	12.000	- 22	- 0000
Monutemania (When	600	31	3 662	34	4,122	- 22	
Minning or Linkspore.	12437	22	5.954	7.3	18,221	23	
CHARLSON COMORBIDITY INDEX	N	CHIN	N	Call	N	CHN	
Mean (1) Service & 50 and 55%	0.5	110	36	11	65		4,0000
confidence limita	10.5	0.51	0.6	0.0	0.5	0.51	
CO Score 0	133,724	73.7	52,671	79.2	182,795	72.7	<.0001
CO Score 3	25,650	145	11.522	15.1	37,552	14.2	
CO Score 2	11,727	5.6	5.433	7.3	17,190	5.8	
CO Score all	9.358	52	4.711	64	11.999	56	
PREOPERATIVE INFLAMMATORY	N	CHIN	N	Call %	N	CHIN	
No.	228	0.2	141	0.2	A10	0.2	6-3602
his	177.001	00.0	73.000	60.6	364.043	00.0	
	117,001	24.4	72,874	11.4	134,041	21.0	
FEGAN.	13,203	11.5	11 (/ 3	11.4	13,000	43.6	- 0000
Farthau	64.774	10.0	33733	11.0	38.000	34.6	0.0004
	20,773	114	20,527	47.5	10,000	Can NA	
Sec. 4	##,403	14.9	44,000	413	vu,077	149	
Nei.	45,728	33.4	30,045	25.4	65,573	18.1	
PATIENT SM	N	Call %	N	Col %	N	Call N	
Mean EMI 2 32 and \$5N coefficience limits	014	21.2	317	10.1	015	21.5	< 0001
Dedenweight	353	0.2	124	0.2	587	0.2	<.0001
Normal	15,721	8.9	5.629	7.6	21,550	8.5	
Fre-Obesity	40,153	22.6	34,515	19.6	54,668	21.7	
Obesity Class I	35,090	21.5	34,025	18.9	52,116	29.7	
Obesity Class II	21,589	12.2	6,859	12.0	30,445	12.1	
(Perity Child	11.145	61	4.435	6.0	15.580	62	
Manhood and Mathematica	60.388	18.4	34 6.4.8	11.0	74.037	32.6	

Cavariate	Point Estimate (Hazards Ratio)	95% Lower Confidence Limit	95% Upper Coefidence Limit	Public <.001 0.0196 <.001 0.0196 0.0196 0.0197 0.0198 0.0198 0.0198 0.0198 0.0198 0.0198 0.0198 0.0198 0.0198
ALIC Usage (ref. No)	2.175	1.698	2.797	<.0001
Age (cantineous)	1.025	1.004	1.045	0.52200
Sex (ref. Male)	0.473	0.371	0.604	<.0001
Race/Vithrakity: Non-Hispanic Black (vet Hon-Hispanic White)	1.607	1.035	2.538	0.2182
Race/Inthnicity: Hispanic (ref. Non-Hispanic White)	0.644	0.329	13	0.2181
Reen/Information New Hispanic Other (net: Non-Hispanic White)	0.688	0.305	1.559	0.3681
Region: North East (rol: Midwest)	1.257	0.875	1.748	0.2253
Region: South (ref. Midwest)	1.068	0.766	1.487	0.6983
Region: West (ref: Midwest)	0.991	0.713	1.07	0.8575
Charbon Comerbidity Index (continuous)	1.387	1.106	1.272	<.0001
Preoperative inflammatary attritis (raf. No)	2.174	0.305	25.515	0.4380

Cavariate Point Estimate 55% Lower (Hazards Ratio) Confidence Limit		95% Upper p-salae Coefidence Limit		Cavariate		95% Lower Confidence Limit	55% Upper Confidence Limit	peaks	
ALBC Usage (rvf: No)	2.175	1.698	2.797	<.0001	ALIC Usage (ref. No)	1.012	0.928	1.134	0.7
Age (cantineous)	1.025	1.004	1.045	0.0106	Age (continuous)	1.022	1.055	1.03	<.0
Sec(ref. Male)	0.473	0.371	0.604	<.0001	Sex (ref. Male)	8.855	0.787	0.991	0.3
Race/Vithrakity: Non-Hispanic Black (vet Hon-Hispanic White)	1.607	1.035	2.518	0.2882	Race/Vehrsicity Non-Wapanic Black (ref. Non-Hispenic White)	8.827	0.654	1.085	0.1
Race/Inthnicity: Hispanic (ref. Non-Hispanic White)	0.644	0.329	13	0.2193	Race/Vehnicity: Hispanic (ref: Nan-Hispanic White)	1053	1.00	126	0.56
Reen/Information New Hispanic Other (net: Non-Hispanic White)	0.688	0.305	1.559	0.3687	Razy/ethnicity: Non-Hispanic Other (ref: Non-Hispanic White	8.695	0.537	4.898	0.00
Region: North East (of: Midwest)	1.257	0.875	1.745	0.2292	Region: North East (of: Midwest)	8.735	0.604	1.849	0.00
Region: South (ref. Midwetz)	1.068	0.766	1.487	0.6982	Region: South (ref. Midwerd)	8.658	0.575	0.153	<.00
Region: West (ref: Midwest)	0.991	0.713	1.377	0.8575	Ragios: West Inst. Midward)	E.664	0.404	0.487	<8
Charbon Comerbidity Index (continuous)	1.387	1.106	1.272	<.0001	Charbon Comerbidity Index (continuous)	1.174	116	1.295	<.00
Preoperative inflammatary arthritis (ref. No)	2.174	0.305	25.516	0.4386	Preoperative inflammatory arthritis (ref. Ho)	1.825	0.994	3.564	0.17
BMI (ref: 8MI +35)	1.59	1.221	2.071	0.0006	8A4 (ref: 8A4 x35)	1.165	1.057	3.28	0.00