

Uncontrolled Diabetes Mellitus in the Year Prior to Total Hip or Knee Arthroplasty Is Associated With Similar Perioperative Glucose Control, Early Complication Rates, and Early to Mid-term Reoperation Rates After Preoperative Diabetes Mellitus Optimization

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INTRODUCTION:

The purpose of this study was to compare patients undergoing primary TJA who required preoperative DM optimization in the year prior to surgery (defined as hemoglobin A1C \geq 8%) versus patients with DM who did not require preoperative DM optimization to compare: 1) postoperative glycemic control; 2) 90-day complications; and 3) incidence of revision arthroplasty over the study period. This is one of the first studies to examine the results of DM optimization prior to joint replacement surgery.

METHODS:

This is a retrospective, single-center analysis. Patients undergoing primary TJA with a diagnosis of DM (hemoglobin A1C $>$ 6.5%) were eligible for inclusion (N=585). Patients with previously uncontrolled DM requiring optimization (hemoglobin A1C \geq 8.0%) in the year prior to surgery (N=164) were compared to patients with controlled DM (N=421). All patients had hemoglobin A1C $<$ 8% preoperatively. Outcomes included median and peak perioperative glycemic control (POD0-POD2), 90-day complications, and incidence of revision arthroplasty at final follow-up. Multivariable logistic regressions evaluated associations of underlying preoperative demographic and treatment characteristics with outcomes. Patient demographics in both groups are shown in Table 1. Preoperative DM medication usage was recorded in Table 2.

RESULTS: Early postoperative median serum glucose and peak serum glucose were similar between patients with controlled versus optimized DM after controlling for relevant confounding variables. Higher preoperative hemoglobin A1C and peak hemoglobin A1C in the year prior to surgery was associated with worse median and peak serum glucose. 90-day complication rates were similar in patients needing DM optimization versus controlled DM patients (OR 1.67; 95% CI 0.91-2.88; $p=0.10$) (Table 3). Metformin use was independently associated with lower complication rates. Reoperations were similar between patients requiring preoperative DM optimization versus controlled DM (OR 1.60; 95% CI 0.59-4.36; $p=0.35$).

DISCUSSION AND CONCLUSION:

Diabetes mellitus is a known risk factor for adverse events including PJI after primary TJA, and measures of preoperative DM control are frequently used internationally as surgical eligibility criteria. We found similar perioperative serum glucose control in patients who required DM optimization prior to TJA relative to patients with controlled DM, however, preoperative hemoglobin A1C and peak hemoglobin A1C in the year prior to surgery predicted worse early perioperative glycemic control. 90-day complication rates and reoperation rates were similar between controlled versus optimized patients. Metformin use was associated with lower complication rates, and this was independent of its effects on glycemic control. This study suggests that current DM optimization efforts prior to TJA are warranted, and further studies on the optimal medication usage and timing would be important to refine our management of these patients.

Table 1: Demographics for the Patients Based on Preoperative Peak One Year Glycemic Control

Parameter	Optimized (Hemoglobin A1C \geq 8.0) (N=164)	Controlled (Hemoglobin A1C $<$ 8.0) (N=421)	Total (N=585)	P-Value
Age, years (mean, [SD])	67.9 (8.0)	69.8 (8.5)	69 (8.6)	0.02*
Sex N (%)				0.29
Women	70 (43)	200 (48)	270 (46)	
Men	94 (57)	221 (52)	315 (54)	
Race N (%)				0.66
White	139 (85)	364 (86)	503 (86)	
Non-White	25 (15)	57 (14)	82 (14)	
Ethnicity N (%)				0.77
Non-Hispanic	159 (97)	412 (98)	571 (97)	
Hispanic	4 (3)	9 (2)	13 (2)	
Anatomic Location N (%)				0.045*
Knee	82 (50)	249 (59)	331 (57)	
Hip	82 (50)	172 (41)	254 (43)	
Peak One Year Hemoglobin A1C (mean, [SD])	8.3 (1.3)	7.0 (0.5)	7.7 (1.3)	<0.01*
Preoperative Hemoglobin A1C (mean, [SD])	7.3 (0.8)	6.9 (0.4)	7.0 (0.6)	<0.01*
Insulin Dependent N (%)	69 (42)	62 (15)	131 (22)	<0.01*
BMI Preop (Mean, [SD])	33.8 (5.0)	33.2 (4.9)	33.2 (4.9)	0.53
Charlson Comorbidity Index (mean, [SD])	4.7 (1.7)	4.2 (1.4)	4.3 (1.6)	0.38
Current Smoking N (%)	9 (5)	13 (3)	22 (4)	0.43
Albumin (Mean, [SD])	4.4 (0.4)	4.4 (0.3)	4.4 (0.3)	0.88
Length of Stay (Mean, [SD])	2.1 (1.3)	2.1 (1.7)	2.1 (1.6)	0.65
Duration of Follow up in Months (Mean, [SD])	62 (21)	63 (19)	64 (20)	0.18

* $p<0.05$; N: patients; BMI: body mass index, SD: standard deviation

Table 2: Preoperative Diabetes Mellitus Treatments Based on Peak One Year Glycemic Control

Parameter	Optimized (Hemoglobin A1C \geq 8.0) (N=164)	Controlled (Hemoglobin A1C $<$ 8.0) (N=421)	Total (N=585)	P-Value
Treatment Status N (%)				<0.01*
Diet Control	2 (1)	124 (29)	126 (22)	
Oral Medications	29 (17)	230 (55)	329 (56)	
Insulin Only	26 (16)	27 (6)	53 (9)	
Combine Oral and Insulin	3 (2)	30 (7)	38 (7)	
Number of Oral Medications N (%)				<0.01*
0	29 (17)	151 (36)	179 (31)	
1	1 (0)	180 (43)	181 (31)	
2	27 (16)	81 (19)	108 (19)	
3	5 (3)	9 (2)	14 (2)	
Metformin Use N (%)	105 (64)	230 (55)	335 (57)	0.039*
GLP-1 RA Use N (%)	22 (13)	29 (7)	51 (9)	0.012*

* $p<0.05$; N: patients; BMI: body mass index, SD: standard deviation

Table 3: Association of Preoperative Risk Factors and Postoperative Complications

Preoperative Variable	Diabetes Status	Lower OR	Upper OR	P-Value
Peak Hemoglobin A1C One Year Pre	Yes	1.57	1.42	0.18
Preoperative Hemoglobin A1C	Yes	0.87	1.42	0.50
Diabetes Treatment Status				
Diet Control	Reference			
Oral Medications	0.68	0.20	1.34	0.008
Insulin Only	0.68	0.20	1.29	0.04
Oral and Insulin	0.78	0.36	1.71	0.36
Combine Oral and Insulin	0.52	0.18	0.94	<0.001*
Medications Use	0.62	0.33	1.18	0.10
GLP-1 RA Use	1.00	0.50	1.96	0.10
Age				
Gender				
Female	Reference			
Male	0.81	0.36	1.75	<0.001*
Race (Ethnicity)				
Black, Not Hispanic	Reference			
Black, Not Hispanic	2.10	1.11	4.10	0.04*
Hispanic, Any Race	1.21	0.43	3.28	0.49
Other Race or Ethnicity				
Anesth. Location				
Hip	Reference			
Knee	1.80	1.08	2.99	0.03*
Site	1.00	1.00	1.00	0.004*
Flow/Convergency	1.00	0.50	1.38	0.32
Current Smoking				
Yes	0.81	0.34	2.10	0.19
No	Reference			
Albumin	0.68	0.36	1.44	0.18

* $p<0.05$; BMI: body mass index, SD: standard deviation