

Poorly Controlled Diabetes: Glycosylated Hemoglobin (HA1c) Levels >8% are the Tipping Point for Significantly Worse Outcomes following Hip Fracture in the Middle-Aged and Geriatric Populations

Lauren A Merrell, Garrett Esper, Kester L Gibbons, Abhishek Ganta¹, Kenneth A Ego², Sanjit R Konda²
¹NYU Hospital For Joint Diseases, ²NYU Langone Medical Center

INTRODUCTION:

The presence of diabetes has been associated with increased mortality risk after hip fracture, however, little has been published about the lab values of these diabetic patients and the role high labs play in morbidity and mortality. The purpose of this study is to quantify the severity of diabetes that is associated with worse outcomes in hip fracture patients.

METHODS:

A consecutive series of 2,430 patients >55 years old who sustained a hip fracture between October 2014-November 2021 were reviewed for demographics, hospital quality measures, and outcomes. Each patient with a diagnosis of diabetes mellitus (DM) was reviewed for hemoglobin-A1c (HA1c) and glucose values at admission. Univariable comparisons and multivariable regression analyses were conducted to assess the impact of diabetes and elevated lab values (HA1c) on outcomes such as hospital quality measures, inpatient complications, readmission rates, and mortality rates.

RESULTS:

A total of 565 patients (23%) carried a diagnosis of diabetes mellitus at the time of their injury. Considerable demographic and comorbidity differences between diabetic and non-diabetic cohorts indicated that the diabetic cohort was less healthy. The diabetic cohort had longer hospitalizations, higher rates of minor complications, readmissions within 90-days, and mortality within 30-days/1-year. Stratification by HA1c levels found patients with a HA1c>8% had a significantly higher rate of major complications, and mortality at all timepoints (inpatient/30-day/1-year). Multivariable regression found HA1c>8% to be independently associated with a higher rate of inpatient/30-day/1-year mortality in comparison to a diagnosis of diabetes alone which was not independently significant.

DISCUSSION AND CONCLUSION:

While all patients with DM experienced worse outcomes than those without, those with poorly controlled diabetes (HA1c>8%) at the time of hip fracture injury experienced poorer outcomes compared to those with well-controlled diabetes. Treating physicians must recognize these patients with poorly controlled DM at the time of arrival to adjust care planning and patient expectations accordingly.

Table 1: Demographics

Demographics	Diabetes n (%)	No Diabetes n (%)	Total n (%)	P-Value
N	565	1865	2430	
Variables				
Age (years; mean ± std)	79.66 ± 9.53	81.02 ± 10.37	80.71 ± 10.20	<0.01
Body Mass Index	23.37 ± 7.02	23.81 ± 6.25	24.17 ± 4.93	<0.01
Charlson Comorbidity Index	2.44 ± 1.64	1.23 ± 1.64	1.51 ± 1.72	<0.01
STROMA Score	2.53 ± 6.76	1.45 ± 5.08	1.70 ± 5.53	<0.01
Gender				<0.01
Male	209 (36.99%)	534 (28.63%)	743 (30.58%)	
Female	356 (63.01%)	1331 (71.37%)	1687 (69.42%)	
Race				<0.01
White	320 (56.64%)	1408 (75.50%)	1728 (71.11%)	
Black	59 (10.44%)	121 (6.49%)	180 (7.41%)	<0.01
Hispanic	50 (8.85%)	74 (3.97%)	124 (5.10%)	<0.01
Asian	79 (13.98%)	131 (6.99%)	200 (8.23%)	<0.01
Other	9 (1.59%)	35 (1.88%)	44 (1.81%)	0.764
Unknown	13 (2.31%)	80 (4.29%)	113 (4.65%)	0.110
Ambulatory Status				<0.01
Community Ambulator	346 (61.24%)	1303 (69.87%)	1649 (67.86%)	<0.01
Household Ambulator	193 (34.16%)	492 (26.38%)	685 (28.19%)	<0.01
Non-Ambulatory/Wheelchair	26 (4.60%)	69 (3.70%)	95 (3.91%)	0.317
Glasgow Coma Scale	14.89 ± 0.41	14.87 ± 0.76	14.87 ± 0.63	0.222
ABS Head/Neck	0.03 ± 0.28	0.03 ± 0.27	0.03 ± 0.27	0.441
ABS Chest	0.01 ± 0.12	0.02 ± 0.21	0.02 ± 0.19	0.070
Fracture Classification				0.530
31A	308 (54.51%)	974 (52.23%)	1282 (52.76%)	
31B	233 (41.24%)	818 (43.86%)	1051 (43.23%)	
32A	18 (0.32%)	45 (2.41%)	63 (2.59%)	
32B	1 (0.18%)	2 (0.11%)	3 (0.12%)	
32C	5 (0.88%)	26 (1.39%)	31 (1.28%)	
Treatment				0.203
Short Cephalomedullary Nail	238 (42.12%)	736 (39.46%)	974 (40.08%)	
Long Cephalomedullary Nail	74 (13.10%)	262 (14.05%)	336 (13.83%)	
Hemiarthroplasty	134 (23.72%)	426 (22.84%)	560 (23.05%)	
Total Hip Arthroplasty	27 (4.78%)	126 (6.76%)	153 (6.30%)	
Sliding Hip Screw	29 (5.13%)	72 (3.86%)	101 (4.16%)	
CRPP	37 (6.55%)	173 (9.28%)	210 (8.64%)	
Non-Operative	26 (4.60%)	70 (3.75%)	96 (3.95%)	

ABS=Abbreviated Injury Score; CRPP=Closed Reduction Percutaneous Pinning

Table 2: Hospital Quality Measures and Outcomes of the Diabetic Cohort Stratified by Hemoglobin A1c Values on Admission. Post-Hoc Analysis Utilizing the Tukey Test for ANOVA and Adjusted Cell Residuals for the Chi-Square Test Determine the Significance of Each Specific HA1c Cohort.

Outcomes	18-65 n (%)	66-74 n (%)	75-79 n (%)	80-89 n (%)	90-99 n (%)	10+ n (%)
N	1865	371	74	69	32	27
Complications						
Major Complications	201 (10.79%)	28 (8.60%)	14 (18.97%)	7 (10.14%)	9 (28.12%)	6 (28.57%)
Minor Complications	498 (27.23%)	90 (28.56%)	33 (44.59%)	30 (43.48%)	15 (46.88%)	11 (48.15%)
Hospital Quality Measures						
LOS (d; mean ± std)	6.34 ± 4.29	6.98 ± 5.10	6.89 ± 4.33	6.29 ± 2.21	9.70 ± 9.16	9.58 ± 11.31
Need for ICU	360 (18.23%)	52 (22.51%)	14 (18.92%)	10 (14.49%)	10 (31.25%)	5 (23.81%)
Discharged Home	490 (24.13%)	64 (27.71%)	11 (14.96%)	19 (27.54%)	4 (12.50%)	5 (18.57%)
Readmissions						
Within 30 days	139 (7.45%)	19 (6.23%)	10 (13.51%)	10 (14.49%)	4 (12.50%)	1 (4.76%)
Within 90 days	260 (13.93%)	39 (12.93%)	19 (25.68%)	13 (18.71%)	3 (9.38%)	4 (14.81%)
Mortality						
Inpatient	35 (1.88%)	4 (1.35%)	0 (0.00%)	3 (4.29%)	3 (9.38%)	1 (3.70%)
Within 30 days	81 (4.34%)	17 (5.36%)	3 (4.05%)	0 (0.00%)	6 (18.75%)	4 (19.05%)
1 Year	204 (10.94%)	37 (12.67%)	8 (10.81%)	4 (5.80%)	10 (31.25%)	8 (38.10%)

LOS=Length of Stay

Table 3: Hospital Quality Measures and Outcomes of the Diabetic Cohort Stratified by Hemoglobin A1c >8% or <8% on Admission

Outcomes	A1c >8% n (%)	A1c <8% n (%)	Total n (%)	P-Value
N	77	378	455	
Complications				
Major Complications	18 (23.38%)	43 (11.38%)	61 (13.41%)	<0.01
Minor Complications	33 (42.86%)	157 (41.53%)	190 (41.76%)	0.788
Hospital Quality Measures				
LOS (d; mean ± std)	7.81 ± 6.82	6.86 ± 4.34	7.02 ± 5.04	0.066
Need for ICU	16 (20.78%)	78 (20.63%)	94 (20.66%)	0.926
Discharged Home	12 (15.58%)	94 (24.87%)	106 (23.30%)	0.098
Readmissions				
Within 30 days	8 (10.39%)	39 (10.32%)	47 (10.33%)	0.778
Within 90 days	13 (16.88%)	70 (18.52%)	83 (18.24%)	0.988
Mortality				
Inpatient	7 (9.09%)	5 (1.32%)	12 (2.64%)	<0.01
Within 30 days	12 (15.58%)	21 (5.56%)	33 (7.25%)	<0.01
1 Year	23 (29.87%)	49 (12.96%)	72 (15.82%)	<0.01

LOS=Length of Stay