Perioperative Hyperglycemia is an Independent Risk Factor for Venous Thromboembolism Events After Operative Treatment of Geriatric Femur Fractures

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INTRODUCTION: As the population continues to age, the number of geriatric patients with femoral fractures continues to rise. Geriatric femur fractures occur in complex hosts that pose significant challenges in perioperative management, with venous thromboembolism (VTE) as a well described complication. Hyperglycemia, prevalent in the perioperative period, has been implicated in increasing thrombotic risk in a variety of surgical settings. However, data on its impact on outcomes following femur fracture fixation in the elderly population remains limited. The purpose of this study was to examine the effect of postoperative glycemic control on outcomes following operative fixation of femoral fractures in geriatric patients.

METHODS: An Institutional Review Board (IRB) approved retrospective cohort analysis was conducted on adults over 60 years old undergoing operative fixation of an isolated femur fracture (AO/OTA 31, 32, 33) over a consecutive three-year period. Inclusion criteria were age ≥ 60 years, availability of postoperative glucose values, and operative fixation of an isolated femur fracture. Polytrauma patients, those with impending pathologic or pathologic fractures, atypical fractures secondary to medications, or any patient without at least two postoperative glucose values recorded in the electronic medical record were excluded. Demographic information, postoperative blood glucose values, and complications following surgery were collected from the electronic medical record. The primary analysis evaluated patients with an average postoperative glucose of 180 mg/dL or greater against those with an average postoperative glucose under 180 mg/dL. A secondary analysis compared patients with a DM diagnosis to those without a diagnosis to evaluate baseline demographics and outcomes/complications between these groups. Continuous variables were analyzed via multiple independent two-sided t-tests, while categorical variables were analyzed with Chi-square or Fischer exact tests. A p-value of < 0.05 was considered statistically significant.

RESULTS: Six hundred and fourteen patients met inclusion criteria. Mean age was 78.7 ± 10.0 years, with 30.3% male and 25.0% having a DM diagnosis. The mean BMI was 27.0 ± 7.7, the mean age adjusted CCI was 9.8 ± 3.1, and the mean ASA score was 3.0 ± 0.6 (Table 1). Patients with mean postoperative glucose values ≥ 180 mg/dL were younger, had higher CCI, BMI, and hemoglobin A1C levels. Patients with mean postoperative glucose values ≥ 180 mg/dL had significantly higher rates of PE (7.8% vs. 1.8%, p = 0.014) and VTE (10.9% vs. 3.1%, p = 0.003) within 90 days (Table 2). Multivariable analysis revealed average blood glucose values ≥ 180 mg/dL as an independent predictor for PE (p = 0.039) and VTE (p = 0.012) when controlling for age, sex, DM diagnosis, and CCI. Those with a DM diagnosis had higher rates of sepsis (6.0% vs. 1.3%, p = 0.003) but not PE, VTE, or other complications (all p > 0.05) compared to those without a DM diagnosis.

DISCUSSION AND CONCLUSION: Acute perioperative hyperglycemia, regardless of DM diagnosis, is an independent risk factor for VTE and PE following geriatric femur fracture fixation. Strict glycemic control in the postoperative period represents a modifiable risk factor and potential opportunity to improve outcomes in this patient population. Further research is needed to explore effects of prolonged hyperglycemia and optimize management strategies.

Table 1. Entire patient cohort demographics. Continuous variables described as mean ± standard deviation, while categorical variables defined as number (percentage).

Demographic (n = 614)	Mean ± Standard Deviation
Age (years)	78.7 ± 10.0
Sex (male/female)	186M (30.3%)
	428F (69.7%)
DM Diagnosis	152 (25.0%)
BMI (kg/m²)	27.0 ± 7.7
CCI	6.1 ± 2.9
Age Adjusted CCI	9.8 ± 3.1
ASA Score	3.0 ± 0.6
ASA Score Groups	1: 3
	2: 64
	3: 397
	4: 94
	5: 0
	6: 0
Fracture Type	Vancouver B1: 14
	Vancouver B2: 3
	Vancouver C: 14
	Periprosthetic distal: 55
	Femoral neck: 161
	Intertrochanteric: 252
	Subtrochanteric: 43
	Femoral shaft: 22
	Supracondylar: 50

Table 2. Cohort demographics and outcome measures separated based on average postoperative glucose values. Variables are displayed as mean ± standard deviation or number of patients (percentage).

Demographic / Outcome Measure	Glucose Cutoff		P Value
	< 180 (n=550)	> 180 (n=64)	
Age (years)	78.9 ± 10.1	75.9 ± 9.2	0.021
Sex (male/female)	162M / 388F	24M / 40F	0.20
DM Diagnosis	96 (17.5%)	56 (87.5%)	<0.001
BMI (kg/m²)	26.5 ± 7.6	31.0 ± 7.5	<0.001
Fracture Type	Vancouver B1: 13 Vancouver B2: 3 Vancouver C: 14 Periprosthetic distal: 50 Femoral neck: 144 Intertrochanteric: 228 Subtrochanteric: 35 Femoral shaft: 20 Supracondylar: 43	Vancouver B1: 1 Vancouver B2: 0 Vancouver C: 0 Periprosthetic distal: 5 Femoral neck: 17 Intertrochanteric: 24 Subtrochanteric: 8 Femoral shaft: 2 Supracondylar: 7	0.62
CCI	6.0 ± 2.8	6.9 ± 3.6	0.023
Age Adjusted CCI	9.8 ± 3.0	10.1 ± 3.5	0.40
ASA Score	3.0 ± 0.6	3.0 ± 0.4	0.89
Admission Glucose (mg/dL)	129.2 ± 40.2	211.1 ± 83.4	<0.001
Morning of Operation Glucose (mg/dL)	124.0 ± 30.0	195.9 ± 62.2	<0.001
Hemoglobin A1C (mg/dL)	6.1 ± 1.7 (n=118)	7.6 ± 1.9 (n=44)	<0.001
LOS (days)	7.1 ± 4.3	7.6 ± 4.2	0.35
PE	10 (1.8%)	5 (7.8%)	0.014
VTE	14 (3.1%)	7 (10.9%)	0.003
SSI 30d	23 (4.2%)	2 (3.1%)	1.00
SSI 90d	13 (2.4%)	1 (1.6%)	1.00
Superficial Infection	17 (3.1%)	1 (0.2%)	0.71
Deep Infection	20 (3.6%)	3 (4.7%)	0.72
Hardware Infection	2 (0.4%)	0 (0%)	1.00
Sepsis	12 (2.2%)	3 (4.7%)	0.20
Reoperation	46 (8.4%)	7 (10.9%)	0.48
Nonunion	13 (2.4%)	2 (3.1%)	0.67
30 Day Mortality	18 (3.3%)	2 (3.1%)	1.00