



Predictive Value of Admission Hemoglobin A_{1c} on Inpatient Glycemic Control and Response to Insulin Therapy in Medicine and Surgery Patients With Type 2 Diabetes

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High hemoglobin A_{1c} (A1C) levels are associated with poor clinical outcomes in hospitalized patients. Recent guidelines have recommended performing A1C measurements in hospitalized patients with hyperglycemia to differentiate between stress hyperglycemia and undiagnosed diabetes, to assess the level of glycemic control prior to admission in patients with diabetes, and to tailor appropriate diabetes therapy regimens at hospital discharge (1).

To study the predictive role of admission A1C on inpatient glycemic control in medical and surgical hospitalized patients with type 2 diabetes, we combined inpatient data from four randomized controlled trials of patients treated with a basal-bolus insulin regimen (2–5). We adopted the definition of optimal glycemic control as a combination of blood glucose (BG) levels below 180 mg/dL without hypoglycemia (BG <70 mg/dL) after 24 h of insulin therapy. Logistic regression models were used to evaluate the predictive role of three categories of A1C ($\leq 7\%$, $>7\text{--}9\%$, and $>9\%$) on inpatient glycemic control and hypoglycemia. We adjusted for potential predictors including age, race, sex, BMI, duration of diabetes, creatinine, and hospital setting via multivariate logistic regression models.

Among 402 patients (mean \pm SD admission BG 209 ± 88 mg/dL, A1C $8.6 \pm 2.4\%$), a total of 134 (33.3%), 127 (31.5%), and 139 (34.6%) patients had an admission A1C $\leq 7\%$, $>7\text{--}9\%$, and $>9\%$, respectively. Mean hospital BG was 152 ± 35 , 161 ± 29 , and 178 ± 38 mg/dL in patients with A1C $\leq 7\%$, $>7\text{--}9\%$, and $>9\%$, respectively ($P < 0.001$). Patients with A1C $\leq 7\%$ received a lower total daily insulin dose (28 ± 20 units/day) compared with patients with

A1C $>7\text{--}9\%$ (36 ± 21 units/day) and $>9\%$ (40 ± 23 units/day) ($P < 0.001$). Patients with higher A1C levels had lower odds of having optimal glucose control of ≥ 70 mg/dL and < 180 mg/dL compared with patients with A1C $\leq 7\%$ (A1C $>7\text{--}9\%$, odds ratio 0.45 [95% CI 0.22–0.92]; A1C $>9\%$, 0.37 [0.17–0.75]), as well as lower but nonsignificant odds of hypoglycemia (A1C $>7\text{--}9\%$, 0.57 [0.23–1.39]; and A1C $>9\%$, 0.47 [0.17–1.24]) (Table 1).

Table 1—Association of hypoglycemia and glycemic control with categories of admission A1C

	Unadjusted model	Model 1 ^a	Model 2 ^b
Hypoglycemia (<70 mg/dL)			
A1C $\leq 7\%$	1 (reference)	1 (reference)	1 (reference)
A1C $>7\text{--}9\%$	0.74 (0.39–1.4)	0.68 (0.35–1.31)	0.57 (0.23–1.39)
A1C $>9\%$	0.48 (0.24–0.95)	0.46 (0.23–0.94)	0.47 (0.17–1.24)
All BG <180 mg/dL (>24 h)^c			
A1C $\leq 7\%$	1 (reference)	1 (reference)	1 (reference)
A1C $>7\text{--}9\%$	0.39 (0.23–0.65)	0.40 (0.23–0.68)	0.39 (0.19–0.81)
A1C $>9\%$	0.29 (0.18–0.49)	0.29 (0.17–0.51)	0.34 (0.16–0.71)
All BG ≥ 70 and < 180 mg/dL (>24 h)^c			
A1C $\leq 7\%$	1 (reference)	1 (reference)	1 (reference)
A1C $>7\text{--}9\%$	0.42 (0.25–0.71)	0.44 (0.26–0.75)	0.45 (0.22–0.92)
A1C $>9\%$	0.32 (0.19–0.53)	0.33 (0.19–0.57)	0.37 (0.17–0.75)

Data are odds ratio (95% CI). ^aModel 1: adjusted for age, race, sex, and BMI. ^bModel 2: model 1 + adjustment for duration of diabetes, creatinine, and hospital setting. ^cEffect estimated after 24 h of therapy with basal-bolus therapy.

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It is well established that both hyperglycemia and hypoglycemia are associated with worse outcomes in hospitalized patients (1). Our results highlight the role of A1C beyond its current utilization to assess previous glycemic control or to tailor regimens at hospital discharge in patients with diabetes. A1C can estimate the risk of hypoglycemia and glycemic control in patients treated with insulin therapy and could potentially help redefine the best insulin initiation strategies on admission. A scheduled basal-bolus regimen with a total daily insulin dose calculated based on patient's body weight is currently recommended, but the role of A1C on these estimations should be further investigated.

In summary, our results show that A1C level on admission is an excellent predictor of glycemic control and response to insulin treatment with basal-bolus during hospitalization in patients with type 2 diabetes. Patients with higher A1C levels on admission were less likely to achieve glycemic control compared with patients admitted

with A1C $\leq 7\%$, despite an incremental adjustment of insulin therapy. Our results suggest that A1C on admission to the hospital should be considered in the estimation of initial total daily dose insulin requirements.

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such, had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

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