

Blood Glucose Measurements in Arterial Blood of Intensive Care Unit Patients Submitted to Tight Glycemic Control: Agreement between Bedside Tests

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Abstract

Background:

Implementing tight glycemic control (TGC) in intensive care unit (ICU) patients requires accurate blood glucose (BG) monitoring. We evaluated the performance of two commercially available bedside glucometers, Accu-Chek® and HemoCue®, in patients admitted to the ICU and in whom TGC was applied.

Methods:

Thirty-seven adult ICU patients were prospectively included. During 48 hours, BG was determined simultaneously on the same arterial blood sample using the two point-of-care testing (POCT) glucometers as compared with the standard technique. Data of 452 paired measurements were analyzed using linear regression, Clark error grid analysis (EGA), the method of Bland–Altman, and the GLYCENSIT procedure.

Results:

Both tested glucometers showed satisfactory results when evaluated with linear regression and EGA. Correlation coefficients were above 0.9, and 100% of all the glucose readings were within the safe zones A and B using EGA. However, when applying more appropriate tests, both sensors failed to provide sufficient accuracy in the setting of TGC in ICU patients. The Hemocue revealed a bias of >10 mg/dl with a trend to systematically overestimate the actual BG value. The bias for the Accu-Chek was 6 mg/dl with wide limits of agreement and a variable over- and underestimation of the actual BG value depending on the level of BG (hypo-, normo-, or hyperglycemia).

Conclusions:

When TGC is implemented in ICU practice, caution is warranted when adjusting insulin rates based only on BG readings obtained by the tested glucometers. ICU practitioners should weigh the advantages and disadvantages of such devices: a greater bias but with a more predictable error and measurement behavior versus a somewhat lower bias but with an unpredictable direction of the difference.

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Abbreviations: (BG) blood glucose, (EGA) error grid analysis, (ICU) intensive care unit, (ISO) International Organization for Standardization, (POCT) point of care testing, (SD) standard deviation, (TGC) tight glycemic control

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