

Continuous Glucose Monitoring System in a Rural Intensive Care Unit: A Pilot Study Evaluating Accuracy and Acceptance

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Abstract

Background:

Glucose management in an intensive care unit (ICU) is labor-intensive. A continuous glucose monitoring system (CGMS) has the potential to improve efficiency and safety in this setting. The goal of this study was to determine if the Medtronic Guardian® REAL-Time CGMS was accurate and tolerated by patients in a rural hospital ICU unit.

Method:

Differences between individual finger stick blood glucose (FSBG) and CGMS values were compared to American Diabetes Association (ADA) and International Organization for Standardization (ISO) standards. Continuous glucose monitoring system accuracy was evaluated over four ranges: <75, 75–140, 140–200, and >200 mg/dl. Other accuracy measures [mean absolute deviation (MAD), mean absolute relative difference (MARD), and coefficient of linear regression of CGMS on FSBG] were calculated. Nursing staff and patients were surveyed regarding use of the CGMS in the ICU.

Results:

Twenty-nine participants had 320 FSBG and corresponding CGMS readings. Sixty-two percent of participants were admitted with diabetic ketoacidosis (DKA). Two hundred and thirteen (66.6%) were accurate within the ISO standard, whereas only 70 out of 320 (21.9%) were within the 5% ADA standard. The CGMS was most accurate in euglycemia. Technical difficulties, such as adequate time for “wetting” and calibration of electrodes, arose with the sensors. The MAD was 28.3 mg/dl, the MRAD was 17.4%, and the linear regression coefficient of CGMS on FSBG was 0.834 ($p < 0.001$).

Conclusions:

The CGMS is well tolerated by ICU patients but, at present, is not sufficiently accurate to be used for therapeutic decisions in the acute setting, particularly in patients with diabetic ketoacidosis. There is a need to find resolution to the technical issues regarding electrode “wetting” and calibration if CGMS use in the ICU setting is to provide an effective means of diabetes care and management.

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Abbreviations: (ADA) American Diabetes Association, (BMI) body mass index, (CCU) coronary care unit, (CGMS) continuous glucose monitoring system, (DKA) diabetic ketoacidosis, (DM) diabetes mellitus, (FSBG) finger stick blood glucose, (ICU) intensive care unit, (ISO) International Organization for Standardization, (MAD) mean absolute deviation, (MARD) mean absolute relative difference

Keywords: continuous glucose monitor, diabetes, glucose sensor, intensive care unit

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