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ORIGINAL ARTICLES

Automated Near-Continuous Glucose Monitoring Measured in Plasma Using Mid-Infrared Spectroscopy

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Abstract

Objective:

There are increasing calls for a precise, automated system to enable tight glycemic control and to avoid hypoglycemia in an intensive care unit setting. OptiScan Biomedical has developed a glucose monitor based on mid-infrared spectroscopy that withdraws blood samples (120 μl) and measures plasma glucose. The goal of this study was to validate the performance of the OptiScan Model 5000 over a wide range of glycemic levels in patients.

Research Design and Methods:

Sixty people with type 1 (n = 18) or type 2 (n = 42) diabetes who were otherwise healthy were connected to OptiScanners. Their blood glucose concentrations were kept in a euglycemic, hypoglycemic (<75 mg/dl), and hyperglycemic (>180 mg/dl) range by intravenous administrations of insulin and glucose. OptiScanner venous blood samples were automatically withdrawn every 15 minutes. Reference measurements were done using the YSI 2300 glucose analyzer.

Results:

The aggregate data points (1155 paired readings) were within International Organization for Standardization standards, with 98.6% of the glucose values within ±20% above 75 mg/dl and ±15 mg/dl below this value. A Clarke error grid analysis showed a total of 1139 points (98.6%) in zone A. Points outside of A exceeded the A zone boundary by an average of 4.3%. The r^2 was 0.99. The total coefficient for variance was 6.4%.

Conclusions:

These results show that the OptiScanner is highly accurate in healthy patients with diabetes across a wide range of glucose values. Mid-infrared spectroscopy may become the method of choice for highly accurate, high frequency, automated glucose measurements and may thus enable better glycemic control in critically ill patients.

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Abbreviations: (CEG) Clarke error grid, (ICU) intensive care unit, (ISO) International Organization for Standardization, (IV) intravenous, (mid-IR) mid-infrared, (NICE-SUGAR) Normoglycaemia in Intensive Care Evaluation and Survival Using Alogrithm Regulation, (PVC) polyvinyl chloride, (SEE) standard error of the estimate, (TGC) tight glycemic control, (YSI) Yellow Springs Instrument

Keywords: continous glucose monitoring, spectroscopy

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