

Use of a Continuous Glucose Sensor in an Extracorporeal Life Support Circuit

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Abstract

Background:

Standard care for infants on extracorporeal life support (ECLS) relies on intermittent measurement of blood glucose (BG); however, this can lead to significant changes in BG that go unrecognized for several hours. The present study was designed to assess performance and clinical applicability of a subcutaneous glucose sensor technology modified for use as a blood-contacting sensor within the ECLS circuit.

Methods:

Twelve children, aged 3 years or less, requiring ECLS support were studied. Three continuous glucose sensors (Medtronic MiniMed) were inserted into hubs placed in line with the ECLS circuit. Blood glucose was assessed with a laboratory analyzer (BG_{LAB} ; Bayer Rapidlab 860) approximately every 5 h (mean 4.9 ± 3.3 h) with more frequent samples obtained with a bedside monitor (HemoCue) as needed. Sensor current (I_{SIG}) was transmitted to a laptop computer and retrospectively calibrated using BG_{LAB} . Sensor performance was assessed by mean absolute relative difference (MARD), linear regression slope and intercept, and correlation, all with BG_{LAB} as reference.

Results:

The BG_{LAB} averaged 107.6 ± 36.4 mg/dl (mean $\pm$ standard deviation) ranging from 58 to 366 mg/dl. The MARD was 11.4%, with linear regression slope (0.86 ± 0.030) and intercept (9.0 ± 3.2 mg/dl) different from 1 and 0, respectively ($p < .05$), and correlation ($r^2 = 0.76$; $p < .001$). The system was not associated with any adverse events, and placement and removal into the hubs was easily accomplished. Instances in which more frequent BG values were obtained using a bedside HemoCue (BG_{HEMO}) monitor showed the sensor to respond rapidly to changes.

Conclusions:

We conclude that continuous sensors can be adapted for use in an ECLS circuit with accuracy similar to or better than that achieved with the subcutaneous site. Continuous glucose monitoring in this population can rapidly detect changes in BG that would not otherwise be observed. Further studies will be needed to assess the benefit of continuous glucose monitoring in this population.

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Abbreviations: (BG) blood glucose, (CF) calibration factor, (ECLS) extracorporeal life support, (MARD) mean absolute relative difference, (OS) offset current, (SC) subcutaneous, (SG) sensor glucose

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