Continuous glucose monitoring in newborn infants: How do errors in calibration measurements affect detected hypoglycemia

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Objective:

Neonatal hypoglycemia is common and can cause serious brain injury. Continuous glucose monitoring (CGM) could improve hypoglycemia detection, while reducing the number of blood glucose (BG) measurements. Calibration algorithms use BG measurements to convert sensor signals into CGM data. Thus, inaccuracies in calibration BG measurements directly affect CGM values and any metrics calculated from them. This research aimed to quantify the effect of timing delays and calibration BG measurement errors on hypoglycemia metrics in newborn infants.

Method:

Data from 155 babies were used. Two timing error models and three BG meter error models (Abbott Optium Xceed, Roche Accu-chek Inform II, Nova Statstrip) were created using empirical data. Monte-Carlo methods were employed and each simulation was run 1000 times. Each set of patient data in each simulation had randomly selected timing and/or measurement error added to BG measurements before CGM data were calibrated. The number of hypoglycemic events, duration of hypoglycemia and hypoglycemic index were then calculated using the CGM data and compared to baseline values.

Results:

Timing error alone had little effect on hypoglycemia metrics, but measurement error caused substantial variation. Abbott results under reported the number of hypoglycemic events by up to 8 and Roche over reported by up to 4. Nova results were closest to baseline. Similar trends were observed in the other hypoglycemia metrics.

Conclusion:

Errors in blood glucose concentration measurements used for calibration of CGMs can have a clinically important impact on detection of hypoglycemia. Overall, if CGMs are going to be used clinically for assessing events such as hypoglycemia it is important to understand ~~of~~ the impact of these errors ~~can have~~ on CGM data.