

Impact of glucose meter accuracy on the efficacy of glycemic control in critically ill patients after cardiovascular surgery

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Background: The impact of glucose monitor accuracy on patient outcomes during glycemic control remains controversial. We studied the impact of glucose meter accuracy on the efficacy of glycemic control, as measured by glycemic variability and time within target glucose range, among critically ill patients immediately following cardiovascular surgery.

Methods: During Period 1 (September-November 2012) patients placed on glycemic control following cardiovascular surgery had hourly insulin dose adjustments based upon glucose levels measured with an AccuChek Inform (Roche Diagnostics, Indianapolis IN). During Period 2 (December 2013-March 2014) patients in the same cardiovascular surgery intensive care unit (St Marys Hospital, Rochester MN) had insulin dose adjustments based upon glucose levels measured with a Nova StatStrip (Nova Biomedical, Waltham MA). The target glucose range (110-150 mg/dL), insulin dosing categories, and frequency of glucose monitoring did not differ between periods. Accuracy of glucose meters was assessed in a separate study comparing AccuChek Inform (n= 1602) and StatStrip (n=1093) whole blood to laboratory serum glucose using paired (collected within 5 minutes) samples. During Period 1, 45 (24 non-diabetic and 21 diabetic) patients on intravenous insulin therapy who had 12-24 consecutive (obtained within 30-120 minutes) glucose measurements performed in the cardiovascular ICU had records reviewed to determine median (interquartile range, IQR) glucose level, median (IQR) glycemic variability as measured by both standard deviation (SD) and Continuous Net Glycemic Action (CONGA), and median (IQR) percent time within target glucose range. The same information was obtained for 53 (29 non-diabetic and 25 diabetic) patients who had 12-24 consecutive glucose measurements during glycemic control during Period 2. Statistical significance of differences in median glucose levels was determined using generalized estimating equations to account for multiple measurements per patient; whereas statistical significance of differences in SD, CONGA, and time in therapeutic range was determined using a Wilcoxon rank sum test.

Results: Median (IQR) bias between glucose meter and laboratory serum glucose decreased from 11 (6,18) to 1 (-5,5) mg/dL between Period 1 (Inform) and Period 2 (StatStrip). Median glucose value among the 21 diabetic patients during Period 1 (148 mg/dL) was higher than the median glucose (141 mg/dL) among the 25 diabetic patients during Period 2 (p=0.02); likely due to an institutional initiative during Period 2 to manage intraoperative glucose levels for diabetic patients. Among non-diabetic patients median glucose during Period 1 (134 mg/dL) did not differ from median glucose during Period 2 (134 mg/dL) (p=0.16); suggesting that the overall process of glycemic control in the cardiovascular ICU did not differ between periods. Glycemic variability as measured by median SD decreased from 22.4 to 15.4 mg/dL (p < 0.0001); while glycemic variability by CONGA decreased markedly from 20.5 to 12.1 mg/dL (p < 0.001). Median time (percent) within target glucose range increased from 62.5% to 71.1% (p=0.003).

Conclusion: The results suggest that improving glucose monitor accuracy for patients on glycemic control after cardiovascular surgery improved the efficacy of glycemic control as measured by glycemic variability and time within target glucose range.