

Concurrent Continuous Glucose Monitoring in Critically Ill Patients: Interim Results and Observations

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Hyperglycemia in intensive care is a prevalent, much debated problem. Glycemic control (GC) can reduce mortality,¹ but in some cases, GC has also increased hypoglycemia.² Continuous glucose monitoring (CGM), with 1–5 min measurements, has the potential to aid GC and provide early warning of potential hypoglycemia.³ Continuous glucose monitoring could also ease nursing burden by reducing blood glucose (BG) measurements to 3–4 per day for CGM device calibration.⁴

Off-the-shelf CGM devices are currently being trialed in the Christchurch Hospital intensive care unit. Each patient has a Medtronic Guardian Real-Time and a Medtronic iPro2 (retrospective) CGM placed on their abdomen and a second Medtronic iPro2 on their thigh. This configuration allows assessment of interdevice and intersite variability in sensor glucose (SG), and 12–14 independent BG measurements per day provide a comparator.

This preliminary analysis uses data from 10 recruited patients. The median (interquartile range) BG levels were 124 (112–137) mg/dl, indicating patients were well controlled. The mean absolute relative difference for the abdomen Guardian SG data was 24.0%, compared with 11.8% and 12.4% for the abdomen and thigh iPro2 SG data, respectively. However, some of the error can be attributed to the reference BG measurements from point-of-care glucometers. Comparing intersite discrepancies in SG to interdevice discrepancies in SG, our data suggest that the CGM device type and thus calibration has a larger impact on observed performance than sensor site.

Overall, the reliability/accuracy of CGM devices can vary between patients, and performance could be influenced by illnesses or drugs/therapies among other factors. A particularly interesting observation from this study was a patient with severe edema who had approximately 18 liters of additional fluid located primarily in the abdominal region. Sensor insertion was difficult due to fluid seeping from the insertion site, and two abdominal sensors failed to adhere to the skin (one of which was replaced).

The top plot in **Figure 1** shows the SG and BG data collected from this patient. However, the main focus of this discussion is the lower plot, which shows the raw current (ISIG) from each sensor. During the first few days, abdominal ISIG is much lower than the thigh, where there was much less excess fluid. As patient condition improved and excess fluid decreased, abdominal sensor ISIG rose to match the thigh sensor, and they tracked each other well for the remainder of monitoring. However, these observations could be due to other factors, such as the sensor itself or

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Abbreviations: (BG) blood glucose, (CGM) continuous glucose monitoring, (GC) glycemic control, (SG) sensor glucose

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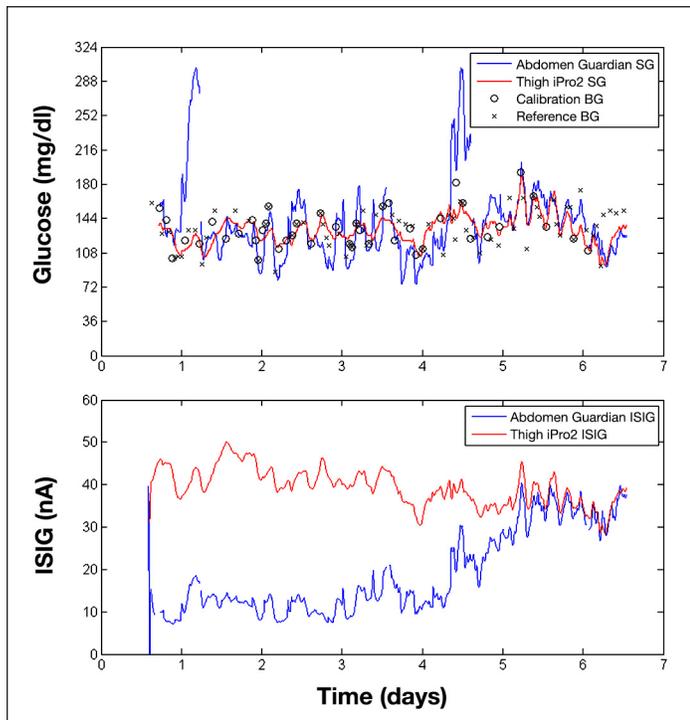


Figure 1. The SG and ISIG data from two CGM devices monitoring a patient with severe edema.

drugs/therapies. Further investigation with a larger cohort containing patients with severe edema is required to determine whether or not it has a major effect on CGM performance.

This limited data set and preliminary analysis indicates that CGM devices have the potential to improve GC in critically ill patients. Such improvements include using SG measurements to drive insulin therapy and/or using SG data for hypoglycemia detection and alarming. However, further understanding of the clinical factors that affect CGM performance is needed before improvements to GC can be realized.

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