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First insights into the performance of the Dexcom G6 Continuous Glucose Monitoring (CGM) system during cardiac surgery using hypothermic extracorporal circulation

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To the editor:

Our group has previously published the article "Performance of a factory-calibrated, real-time continuous glucose monitoring system during elective abdominal surgery" in Diabetes, Obesity and Metabolism (Tripyla *et al.*, 2020). This brief report demonstrated satisfying accuracy of the Dexcom G6 CGM during complex abdominal surgery. However, it is not known whether the Dexcom G6 sensor functions properly during non-pulsatile extracorporeal circulation (ECC) and hypothermia, which alter subcutaneous circulation with potential impact on glucose exchange dynamics between blood and interstitial compartments.

In this letter, we present first insight into the performance of the Dexcom G6 sensor during cardiac surgery at mild and deep hypothermia in two patients with type 2 diabetes. The factory calibrated Dexcom G6 sensor was inserted with consent of the patient on the lateral abdominal wall 12h prior to surgery onset. Approval for the assessment of two pilot cardiac surgery patients was granted by the local ethics committee by an extension of the study reported by Tripyla et al., 2020 (BASEC-ID 2019-00751). Intra-operative CGM readings were compared to venous plasma glucose values measured routinely using a blood gas analyzer (BGA, GEM Premier 4000). No CGM calibration occurred during surgery. Mean absolute relative difference (MARD) was reported per patient.

Patient 1 was treated with insulin degludec/metformin. Degludec was reduced to 50% of the normal dose on the day of surgery according to institutional protocol, metformin was discontinued on the day of surgery, and underwent coronary artery bypass graft (CABG) surgery with ECC at 34°C. In this patient, CGM measurement showed good agreement with glucose concentrations obtained from BGA measurements. The upper panel in figure 1 shows the extracted CGM readings and BGA results obtained at specific time points during surgery (MARD 4.3±3.8%). Esophageal temperatures are provided in figure 1 with the BGA glucose results. Initiation and discontinuation of ECC (grey shaded area), aortic cross-clamp time (red shaded area), intravenous continuous insulin infusion rate (black dotted line) and bolus applications are depicted. Figure 2 shows the relationship between Dexcom G6 CGM readings and BGA of both patients. The sensor functioned properly throughout its normal ten day life cycle postoperatively without any sensor drop-outs.

Patient 2 was treated with metformin/sitagliptin (discontinued on the day of surgery) and was scheduled for CABG surgery, aortic valve replacement and replacement of the ascending aorta and aortic arch in deep hypothermic cardiocirculatory arrest (DHCA). The patient was cooled to 28°C for replacement of the ascending aorta and aortic hemi-arch. For DHCA, ECC was stopped for 19 minutes with only selective antegrade perfusion of the carotid arteries for 11 minutes. Subsequently, the patient was slowly rewarmed to normothermia for the remainder of the surgery. Even during DHCA, when blood flow to the entire body with exception of the brain was stopped, the Dexcom G6 CGM provided readings with acceptable deviation from the BGA measurements (MARD 8.1±5.6%). Larger deviations from BGA occurred later during the surgery, after four intravenous insulin boli were administered and continuous intravenous insulin infusion was instated. These deviations likely result from the lag for

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detection of subcutaneous glucose oscillations compared to the intravascular compartment. The lower panel in figure 1 outlines the trajectories of glucose values. Core temperatures obtained from the urinary catheter tip and DHCA time (blue shaded area) is shown. The sensor had to be removed on the fourth postoperative day, due to an emergency MRI scan, until then the sensor functioned normally.

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In conclusion, these two cases demonstrate the feasibility of glucose detection by the Dexcom G6 CGM in comparison to measurements by BGA in more extreme pathophysiologic conditions, i.e. deep hypothermia and even cardiocirculatory arrest during cardiac surgery. More studies are now warranted to systematically assess the accuracy of next generation CGM systems in such challenging conditions. In the face of emerging subcutaneous closed loop systems depending on CGM, the accuracy of CGM in such conditions is of paramount importance for safe perioperative glucose management.

Tripyla A, Herzig D, Joachim D, Nakas CT, Amiet F, Andreou A, Gloor B, Vogt A, and Bally L (2020) Performance of a factory-calibrated, real-time continuous glucose monitoring system during elective abdominal surgery. *Diabetes, Obesity and Metabolism* **22**:1678–1682.

Figure 1

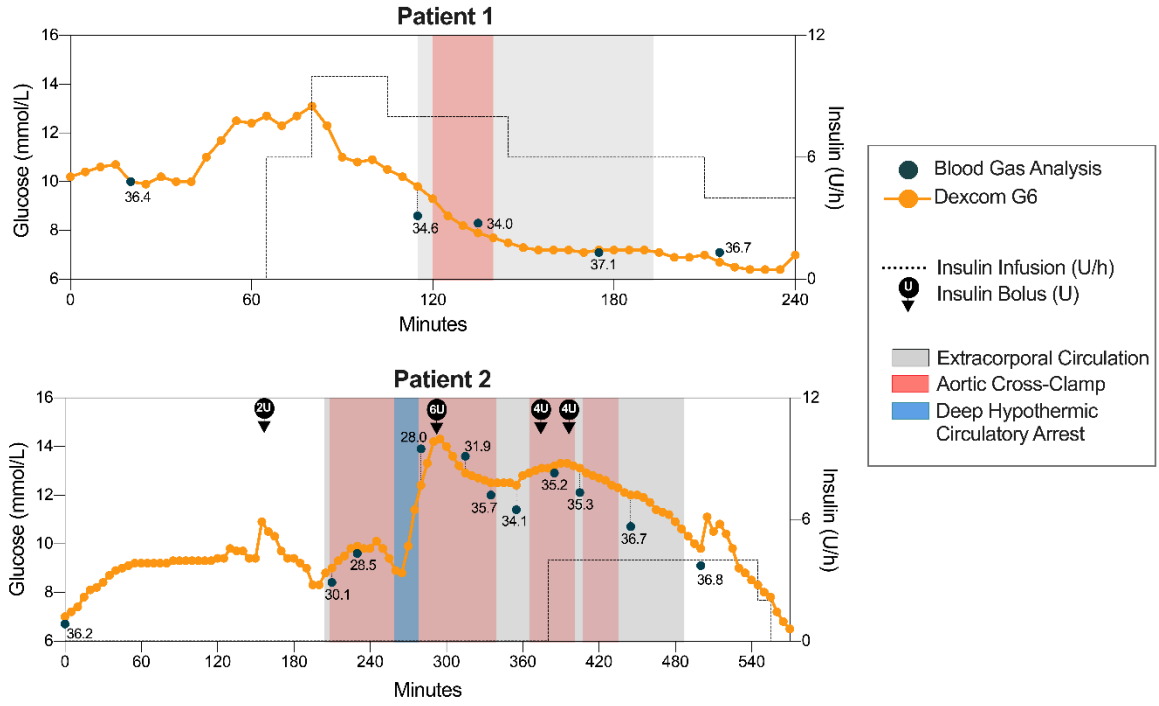

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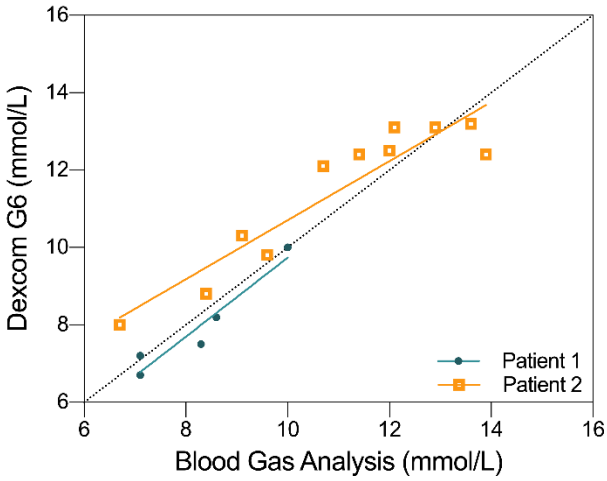
Figure 2



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