Continuous glucose monitoring; the way to go?

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Hyperglycaemia is likely to be harmful and glucose control, although not too tight, seems beneficial in certain intensive care unit (ICU) patients [1]. Van den Bergh et al. could not prove the value of tight glucose control (TGC) in all ICU patients, yet some quite large subgroups, for example, ICU length of stay > 2 days, thoraco-surgical patients, might benefit [2;3] from this. Griesdale et al. included the NICE-Sugar study in a meta-analysis on TGC, showing no decrease in mortality, whereas positive results were found in surgical patients in the studies by Finfer et al. [4] and Griesdale [5]. In the recently published SPRINT study, TGC resulted in faster resolution of organ failure than conventional glucose control and in reduced mortality [6]. So, there are indications of the existence of subgroups that benefit from TGC and other subgroups that are harmed by it. It has been suggested that part of the harm may be due to hypoglycaemic events, which obviously occur more frequently during TGC.

Meanwhile, glucose control has become standard practice in ICU’s worldwide. In achieving glucose control (and avoiding hypoglycaemia) an accurate and feasible bedside glucometry method (such as described by Vogelzang) is essential [7]. The anticipated advantages of continuous glucose monitoring systems include both fewer blood samples being taken, resulting in decreased workload for the nursing staff, and the possibility of limiting variability of glucose levels – which might be even more important than the mean glucose level itself [8]. In this issue of NJCC, Westhoff et al. evaluate two subcutaneous continuous glucose monitoring systems (CGMS) in 18 critically ill patients [9]. They report a correlation coefficient of around 0.80 for subcutaneous versus arterial blood glucose levels and conclude that real-time continuous glucose measurements are adequate and that the utility in TGC needs to be investigated. Corstjens et al. evaluated a subcutaneous CGMS in 60 critically ill patients and found a correlation coefficient of 0.87 compared to the point-of-care blood gas/glucose analyzer [10]. Vikova et al. conclude, based on a correlation coefficient of only 0.69 when comparing subcutaneous glucose values and laboratory blood glucose values in 15 patients, that subcutaneous devices should not be used in critically ill patients [11]. So, the question here is if a (for laboratory standards) moderate correlation coefficient justifies the use of a CGMS in a TGC protocol in a critically ill patient population. Recently, Holzinger et al. evaluated the impact of real-time continuous glucose monitoring on glycaemic control and risk of hypoglycaemia in 61 patients compared with 63 critically ill patients treated with the same algorithm guided by arterial blood samples [12]. Use of the CGMS did not improve glycaemic control; however, the rate of severe hypoglycaemia was lower in the real-time CGMS group than in the control group at 1.6% versus 11.5% respectively. Westhoff et al. (this issue) report that hypoglycaemia was indeed detected earlier when a CGMS was used [9]. However, the accuracy of subcutaneous CGMS in measuring very low glucose values in ICU patients remains questionable. The use of the Clarke Error Grid is a better way to look at the accuracy of a CGMS than calculating a simple correlation coefficient. In most studies mentioned above, the deviation of subcutaneous measurements remains in the wide clinically acceptable zones of the Clarke Error Grid. However, we found a difference of nearly 4 mmol/l in the lower glucose zone (reference blood glucose 2.8 mmol/l versus subcutaneous glucose of 6.5 mmol/l) in one patient. This could have severe consequences for this individual patient if it results in an incorrect increased insulin dosing during TGC with a CGMS [13]. Recently, we discontinued a study using a real-time CGMS in a TGC protocol, because of inaccurate readings in the low range in 2 patients, which led to false insulin dose adjustments (not yet published). Since, in our standard IC patient care, we use a computerized protocol based on arterial blood samples, which gives excellent glucose control with a negligible risk of hypoglycaemic events [14], we decided that continuing this CGMS study was unjustified.

To summarize, subcutaneous CGMS may not pave the way for TGC in the ICU. In the future, intravascular CGMS that is used in a closed feedback loop with insulin infusion, might be promising, but has not yet been evaluated in clinical studies in critically ill patients. For the present, the best point-of-care glucose analyzer and protocol reported to date should be used for glucose control in critically ill patients to avoid treatment related morbidity [7].
References