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Time dependent decrease in blood glucose levels after sampling potentially affects intensive insulin therapy in the intensive care unit

Accepted: 10 August 2008

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Intensive insulin therapy (IIT) has been shown to decrease the morbidity and mortality in patients in the intensive care unit (ICU) [1, 2]. It is beyond doubt that in order to implement IIT safely, adequate assessment of glucose levels is a prerequisite.

We hypothesized that glucose values decrease rapidly over time after sampling which leads to a gap between point of care and central laboratory measurements.

Fifteen consecutive critically ill patients admitted to an university-affiliated teaching hospital in the Netherlands (Gelre Hospitals, Apeldoorn), were included. All patients were treated according to IIT with blood glucose levels between 4.4 and 6.1 mmol/L. From every patient blood from waste material during one regular blood sampling was simultaneously divided among three different containers, one containing sodium fluoride/potassium oxalate (Greiner Bio-one, Austria), one containing lithium heparin (Greiner), and one arterial blood sampler with balanced heparin (70 IU), (Bayer AG, Germany). Blood glucose levels were measured immediately and 10, 20, 30, 45, and 60 min thereafter using a point of care system. So blood sampling took place only at baseline, but measurement of the samples took place at different time intervals. We used the ACCU-CHEK Inform

(Roche, Switzerland) with a CV <3.1% at a blood glucose level of 7.1 mmol/L and a SD <0.10 mmol/L. The necessity for informed consent was waived because all measurements were performed in waste material during regular blood sampling as part of standard care. Changes in glucose levels over time per container type and differences of glucose levels between the three containers were analyzed using Friedman's and Mann-Whitney *U* tests. A *P* value < 0.05 was considered statistically significant.

The median blood glucose level of all three different containers of all patients at baseline was 5.8 mmol/L [interquartile range (IQR) 4.9–9.1]. Blood glucose levels decreased to 5.7 (4.7–8.5), 5.6 (4.5–8.8), 5.6 (4.5–8.6), 5.4 (4.4–7.8), and 5.2 mmol/L (4.3–8.0) when measured at 10, 20, 30, 45 and 60 min after sampling, respectively (*P* < 0.01). The median decrease of glucose level measured immediately and after 10 min was 0.2 mmol/L (IQR 0.1–0.5). The median difference between glucose level at baseline and measured after 60 min was 0.6 mmol/L (IQR 0.4–0.9). The decrease in blood glucose levels was observed in all three container types (Fig. 1) and was statistically significant (*P* < 0.01 in each container type). There were no significant differences between the three different container types at the different time points, nor was initial glucose level related to the change over time. Hemoglobin level [5.7 (IQR 5.5–6.5)], and leukocyte count [$13.7 \times 10^9/l$ (12.0–22.6)] were not related to the observed change in glucose levels.

In conclusion, the present study found a significant decrease in blood glucose levels when samples were measured only 10 min later. Although the observed effect appears to be moderate, the time between blood sampling and measuring glucose levels may affect IIT. Nevertheless, a

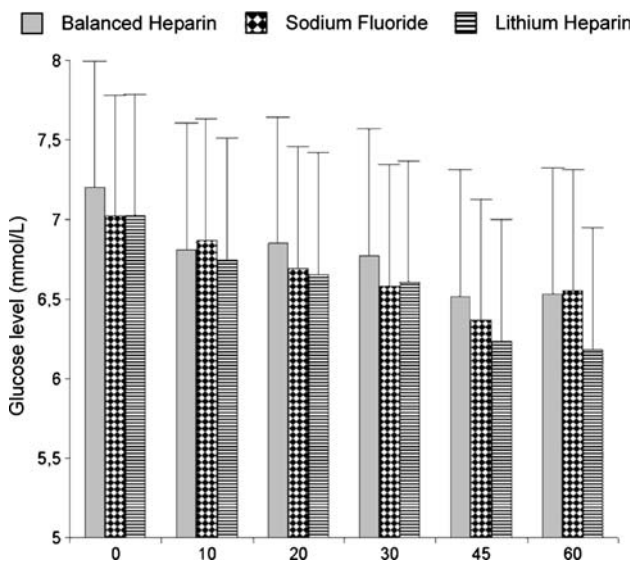


Fig. 1 Mean (SEM) of measured glucose levels in three different containers after arterial sampling at *T* = 0 min

larger study, including high blood glucose levels as well as low blood glucose levels, is necessary to determine whether the time delay may affect management decisions pertaining to IIT.

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