



H181 The Usefulness of a Hand-Held Blood Glucose and Ketone Monitoring Device as a Postmortem Indicator of Diabetic Ketoacidosis (DKA)

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Learning Overview: The goal of this presentation is to describe the preliminary results of a study aimed at assessing the performance of a point-of-care blood glucose and ketone monitoring device in measuring glucose and β -hydroxybutyrate concentrations in postmortem vitreous and blood samples.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by raising awareness of the potential usefulness of hand-held point-of-care devices in screening cases of DKA in a postmortem setting.

Background: DKA is a potentially life-threatening complication of type 1 diabetes mellitus. Glucose and ketone bodies such as β -Hydroxybutyrate (BHB) can be measured postmortem in Vitreous Humor (VH) to assess antemortem hyperglycemia and ketoacidosis. However, such analyses may be technically challenging and expensive as they involve sophisticated biochemical methods. As Point-Of-Care (POC) Blood Glucose and Ketone Monitoring Devices (BGMD) are known to provide rapid and accurate results in living patients, they may be used as a reliable and cost-effective approach to screen potential DKA cases at the autopsy, as suggested by prior research.¹ This preliminary study aimed to assess the performance of such a device in measuring glucose and BHB concentrations in postmortem VH and blood samples.

Materials and Methods: VH and blood samples were collected from patients known or suspected to be diabetics at the autopsy. VH and blood specimens were collected in dry and lithium heparin tubes, respectively. Glucose and BHB concentrations in VH were measured twice in both eyes, before and after centrifugation (5,000g, 5min), with a commercially-available FreeStyle® Precision Neo BGMD, according to the manufacturer's instructions. BHB levels were also measured in blood using the same device. The results were compared to those obtained with validated biochemical methods. For glucose, reference levels were measured from perchloric acid precipitated VH samples with enzymatic hexokinase/glucose-6-phosphate dehydrogenase method. Values ≥ 7 mmol/L were considered to be elevated. BHB concentrations in VH and blood were measured with enzymatic Hydroxybutyrate Dehydrogenase (HBDH) method. Values ≥ 3 mmol/L were considered to indicate ketoacidosis. The study was approved by the Ethics Committee of the University Hospital of Montpellier.

Results: Forty-five subjects (33 males, 12 females) were included, with a mean age of 56.1 ± 13.4 . Twenty-six subjects were known to be diabetic patients. The postmortem interval was 3.4 ± 2.1 days. No statistically significant difference was shown between both eyes for glucose and BHB levels, and this study observed a high reproducibility of measurements in each eye. Glucose and BHB levels measured before VH centrifugation were not significantly different from those after centrifugation. There was a strong correlation between VH glucose concentrations measured with the BGMD and the validated method ($R^2=0.74$, $\rho=0.72$, $p<0.0001$). The mean values obtained with the BGMD were significantly higher to those obtained with the validated method (7.4mmol/L vs. 5.2mmol/L, $p<0.05$). The sensitivity of the BGMD to detect cases with elevated VH glucose levels was 1.0 and the specificity 0.97 when the threshold value was set to 10mmol/L. No correlation was found between BHB values measured with the BGMD and the validated method, whether in VH or in blood. The sensitivity of the BGMD to detect elevated BHB levels in VH was 1.0 but its specificity 0.38 with a threshold value of 2.5 mmol/L, while they were both 1.0 to detect high BHB concentrations in blood with a threshold value of 3.0mmol/L.

Conclusion: This preliminary study confirms that BGMD may be useful in identifying potential DKA cases in postmortem settings. The results obtained so far suggest that glucose can be reliably investigated in VH, regardless of the eye and without any prior centrifugation, whereas BHB analysis should rather be considered in blood. Further analysis on additional samples is underway for confirming these preliminary results and for better delineating appropriate threshold values.

Reference(s):

1. Walta, Anna-Mari, Terhi Keltanen, Katarina Lindroos, et Antti Sajantila. The Usefulness of Point-of-Care (POC) Tests in Screening Elevated Glucose and Ketone Body Levels Postmortem. *Forensic Science International* 266 (septembre 2016): 299-303.

Point-of-Care Device, Diabetic Ketoacidosis, Postmortem Screening