DIABETES MELLITUS IN A FORENSICS PRACTICE

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Introduction:

Diabetes mellitus is one of the most common diseases of civilisation and moreover, it has become one of the major causes of natural death in people younger than 60 years of age. Over the past three decades, the number of people with diabetes mellitus has more than doubled globally, making it one of the largest public health challenges. In the realm of autopsy (pathological-anatomical, clinical or forensic), acute complications of diabetes mellitus both type 1 and 2 as cause of death may be difficult to diagnose due to missing characteristic macroscopic and microscopic findings [2]. Nevertheless, when biochemical investigations complement autopsy and histological findings, fatal diabetic complications can be diagnosed. However, the problems arise with advanced changes with decomposition for which a recent literature does not permit a clear interpretation. Beta-hydroxybutyrate was chosen as the main marker for ketoacidosis for this study as it demonstrates exceptional stability compared to larger molecules such as acetone and acetoacetate which undergo decomposition at a faster rate. Also, during ketosis, Beta-hydroxybutyrate levels may increase more than that of the levels of Acetone and Acetoacetate [1].

Objectives:

The aim of this study was to create an advertisement in which autopsy-performing specialists can associate the influence of diabetes mellitus to the stability of beta-hydroxybutyric acid in post-mortem periods depending on putrefactive changes.

Methods:

The deceased with a history of diabetes (group No.1) were identified. Further selection was made after autopsy based on examination of acetone and isopropanol concentrations (group No. 2). Accordingly, deaths with increased acetone (and isopropanol) concentrations in blood and/or urine were included in the study group. Amongst the deaths identified from both groups (N = 19), an analysis via gas chromatography (GC-MS) was performed to detect beta-hydroxybutyrate in blood, urine and vitreous humour. The deceased with a finding of beta-hydroxybutyric acid in the urine and/or blood subsequently underwent decomposition in vitro at laboratory temperature of 25 ˚C, and in a fridge with a temperature of 4 ˚C in vitro. Beta-hydroxybutyric acid concentrations were measured on the third, seventh, and fourteenth days following autopsy.

Conclusion:

Based on the data, Beta-hydroxybutyrate is likely to be a suitable marker to assess the effect of ketoacidosis on the cause of death, in cases of advanced putrefactive changes and when autopsy findings are inconclusive.

References:

[1] Felby, S. (2007). The Postmortem distribution of ketone bodies between blood, vitreous humor, spinal fluid and urine. *Forensic Sci Med Pathol*. 4, 100-107.
[2] Hockenhull, J. (2011). Investigation of markers to indicate and distinguish death due to Alcoholic Ketoacidosis, Diabetic Ketoacidosis and Hyperosmolar Hyperglycemic State using post-mortem samples. *Forensic Science International*, 142-147.

Results & Discussion:

The results of the analysis indicate significant stability of beta-hydroxybutyrate for 14 days, both with simulated decomposition at 4 ° C and with decomposition at 25 ° C in vitro. Beta-hydroxybutyrate is most likely to be a suitable marker (along with acetone or isopropanol levels and an autopsy finding) to assess the effect of ketoacidosis on the cause of death, even in advanced putrefactive changes when the autopsy finding is unclear and new acetone or isopropanol formation may occur post-mortem.

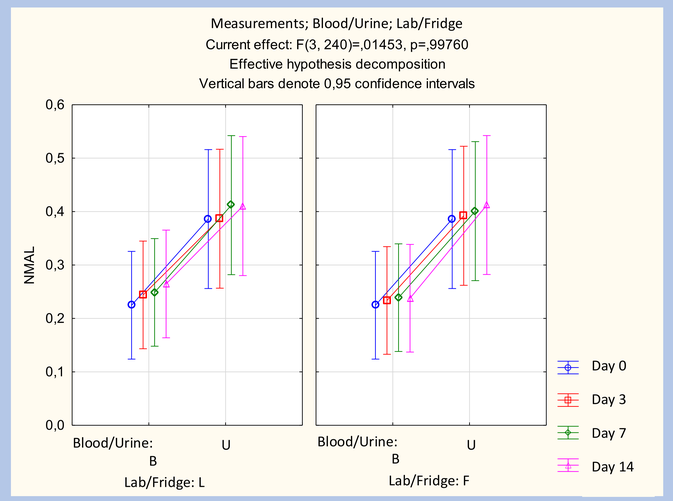

Figure 1: Median concentrations of Beta-Hydroxybutyrate in both blood and urine in laboratory (25 ˚C) and fridge (4 ˚C) temperatures in vitro, on days 0, 3, 7 and 14 following autopsy

As displayed in figure 1, it is suggested that the levels of Beta-hydroxybutyrate remain fairly stable over the 14 days following autopsy, implying that it may be a suitable diagnostic marker for ketoacidosis for at least 14 days during the post-mortem period. It is also suggested based on the data that the stability of beta-hydroxybutyrate remains slightly higher in urine in comparison to blood. However, due to the small sample size of this study, further investigation will be required on a larger sample of deceased in order to confirm this hypothesis.