G135 Postmortem Distribution of 3-Beta-Hydroxybutyrate

Cristian Palmiere, MD, Centre Univ, Romand de Medecine Legale, Rue du Bugnon 21, Lausanne, SWITZERLAND; Patrice Mangin, MD, PhD, Centre Univ, Romand de Medecine Legale, Rue du Bugnon 21, Lausanne, SWITZERLAND; Dominique Werner, PhD, Lausanne Univ Hospital, Laboratory of Clinical Chemistry, Lausanne, SWITZERLAND*

After attending this presentation, attendees will understand how metabolic and biochemical disturbances existing at the time of death and potentially leading or contributing to death can be better characterized by 3-beta-hydroxybutyrate (3HB) determinations in blood and in biological fluids such as urine, vitreous, pericardial, and cerebrospinal fluids.

This presentation will impact the forensic science community by demonstrating how simultaneous determinations of 3HB in blood, urine, vitreous, pericardial, and cerebrospinal fluids may provide useful information pertaining to the duration of the death process. Indeed, the equilibrium between blood and other body compartment fluids (especially vitreous, pericardial, and cerebrospinal fluids) is established over time. The presence of comparable vitreous, pericardial, and cerebrospinal fluid 3HB values to blood 3HB values can thereby confirm that metabolic and biochemical disturbances and the death process developed over several hours. Additionally, this presentation will impact the forensic community by demonstrating that cerebrospinal fluid 3HB levels exceeding 2000µmol/l can be regarded as biochemical markers of concomitant, pathological blood 3HB increases, thus allowing metabolic and biochemical disturbances leading to death to be reliably diagnosed.

A total of 158 subjects were selected for this study. Case inclusion criteria were postmortem interval, circumstances of death, and availability of all biological fluids upon autopsy. After having performed postmortem investigations including native CT scan, autopsy, histology, biochemistry, and toxicology, 12 fatal diabetic ketoacidosis cases and eight free-ethanol hypothermia fatalities were identified. Furthermore, five other cases concerning sudden deaths in subjects presenting chronic alcohol abuse and no previous diagnosis of diabetes mellitus according to medical records were included, as well as 20 bodies presenting mild decompositional changes with all biological fluids upon autopsy. According to the medical records, all these cases were non-diabetics. All biological samples were transferred to the laboratories immediately after collection. When analyses were delayed, biological samples were stored at -20°C. Biochemical investigations including blood acetone, vitreous glucose, blood glycated hemoglobin as well as blood, vitreous, urine, pericardial and cerebrospinal fluid 3HB determinations were systematically performed.

The results of the study indicated that vitreous and pericardial fluid 3HB levels were reliable markers of underlying metabolic disturbances leading to death in diabetic ketoacidosis cases. In hypothermia fatalities, 3HB concentrations in pericardial fluid were the most representative compared to those in blood. In bodies presenting mild decompositional changes, vitreous and pericardial fluid 3HB levels were the closest to blood levels. Lastly, in sudden deaths related to chronic alcohol consumption, vitreous and pericardial fluid 3HB levels were the closest to blood 3HB concentrations.

Increases in blood 3HB concentrations seem to be reflected in parallel increases in pericardial fluid 3HB levels, irrespective of the cause of death. Vitreous humor can be considered a further, alternative, biological substrate for 3HB determination. Conversely, the interpretation of urine 3HB levels in diagnosing pathologically significant ketoacidosis requires more cautiousness. Lastly, markedly increased cerebrospinal fluid 3HB levels (over 2000µmol/l) can be considered a reliable indicator of underlying metabolic disturbances potentially leading to death and can be used to diagnose pathologically significant ketoacidosis.

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 ** Presenting Author*