



K46 Postmortem Toxicological Investigation of Alcoholic Ketoacidosis

Ingrid Bosman, PhD, and Rianne Vincenten, PhD, Netherlands Forensic Institute, Laan van Ypenburg 6, Den Haag, 2497 GB, NETHERLANDS*

After attending this presentation, attendees will understand the importance of performing toxicological investigations for alcoholic ketoacidosis to provide a possible cause of death in postmortem cases with no anatomical and toxicological cause of death where victim has a history of alcohol abuse.

This presentation will impact the forensic science community by providing recommendations how to establish postmortem toxicological investigations of alcoholic ketoacidosis.

Ketoacidosis is a biochemical disturbance in the body. If no glucose is available, the body will utilize fatty acids as an alternative fuel pathway and ketone bodies will be produced. The increase of ketone bodies (acetoacetate, acetone and betahydroxybutyrate (BHB) or 3- hydroxybutyrate) in the blood will lower the blood pH. Two particular forms of ketoacidosis exist, alcoholic ketoacidosis as a result of chronic alcohol abuse and diabetic ketoacidosis as a result of a reduction in insulin. In contrast to diabetic ketoacidosis in which hyperglycemia occurs, alcohol ketoacidosis produces usually a hypoglycemia although a slight hyperglycemia can exist. The symptoms for the two forms are very similar and include nausea, vomiting, abdominal pains, loss of appetite, lethargy, weakness, and unconsciousness.

In this presentation, the toxicological results of postmortem cases at the Netherlands Forensic Institute from January 2006 with no anatomical cause of death and the victim having a history of alcohol abuse were examined. The goal was to evaluate the importance of toxicological investigations for alcoholic ketoacidosis to provide a possible cause of death in such cases. Included were those cases with no anatomical cause of death, the victim having a history of alcohol abuse, and toxicological analysis of BHB. All cases were toxicologically screened for the presence of alcohol, drugs of abuse and prescription drugs.

In total six cases were included; four male and two female with age ranging between 39 and 59 years. In five cases, the bodies were found dead in their homes and in one case the victim was found by her husband at her home needing resuscitation and subsequently died in the hospital. At autopsy, the pathologist found no anatomical cause of death or clear cause of death. Toxicological analysis for the presence of alcohol, drugs of abuse, and prescription drugs resulted in no indications for a toxicological cause of death. Alcohol was detected in blood in three cases in concentrations of 0.003, 0.032, and 0.18 g/dL, respectively, and in urine in four cases in concentrations varying from 0.006 to 0.24 g/dL. In four cases, prescription drugs were found. In all cases, acetone was detected in blood, urine, or both in the standard alcohol analysis method.

Further analysis on BHB and acetoacetate in blood, urine or vitreous humor was performed to determine possible ketoacidosis and

concentrations of glucose and lactate in blood, urine, or vitreous humor were analyzed to determine possible hypo- or hyperglycemia. Based on the combined glucose and lactate levels in vitreous humor, in one case an indication for hypoglycemia was found (measured concentration lower than 7.5 mmol/L) and in another case hyperglycemia was concluded (measured concentration was 30 mmol/L). Acetoacetate could not be detected except in a low concentration in one case, because it spontaneously decarboxylates to acetone. Measured concentrations of BHB varied from 1 to 14 mmol/L in blood and from 1 to 11 mmol/L in vitreous humor. In literature, BHB concentrations are considered normal below 0.5 mmol/L, elevated up to 2.5 mmol/L, and high and pathologically significant over 2.5 mmol/L. The measured BHB concentrations in this study are all elevated or high. Because no anatomical cause of death and toxicological cause of death due to alcohol or drugs were found, it was concluded that alcoholic ketoacidosis could have contributed to death in five cases and ketoacidosis due to hyperglycemia in one case.

In conclusion, in cases with no anatomical and toxicological cause of death, a history of alcohol abuse, and the presence of acetone in blood or urine, analysis of BHB in blood and vitreous humor may provide a possible cause of death by alcoholic ketoacidosis.

Alcoholic Ketoacidosis, Beta-Hydroxybutyrate, Postmortem