



## Pathology Biology Section – 2011

### G108 Postmortem Vitreous Beta- Hydroxybutyrate: Interpretation in a Forensic Setting

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After attending this presentation, attendees will be aware of the range and frequency of postmortem vitreous beta-hydroxybutyrate (BHB) levels likely to be encountered in a forensic setting.

This presentation will impact the forensic science community by providing a more thorough basis for interpreting vitreous BHB levels.

Beta-hydroxybutyrate is one of three ketone-related substances commonly measured in the clinical laboratory and is also useful in postmortem testing. Ketones increase when the primary metabolic fuel source switches from glucose to fatty acids. Ketones are most useful as a marker for diabetic ketoacidosis and are also increased in alcoholic ketoacidosis, starvation states, and severe infectious disease processes. They can be measured in many body fluids including blood, urine, and vitreous fluid during postmortem investigations.

The medical examiner is often faced with an elevated vitreous BHB level that appears to have little or no bearing on the case. When can elevated vitreous ketones be safely ignored? This retrospective study was undertaken in order to gain a better understanding of the frequency and usefulness of postmortem vitreous BHB levels in the forensic setting. Moderately elevated levels were common and were not often related to the cause of death. More severely elevated levels of BHB were related to the cause of death with increasing frequency as the levels increased. Markedly elevated vitreous BHB coupled with elevated vitreous glucose usually indicated diabetic ketoacidosis. When vitreous BHB was elevated and the vitreous glucose was low, an alcohol related death was common.

A computer database was searched for postmortem vitreous beta- Hydroxybutyrate (BHB) levels measured in 1,795 forensic cases over a six year period (2003 to 2009) in the normal course of death investigation. Levels ranged from 0 to 22.7 mmol/L and averaged 1.2 mmol/L. 562 (31.3%) were less than 0.4mmol/L . 637 (35.5%) were between 0.4 and 1.2 mmol/L. 439 (24.5%) were between 1.2 and 2 mmol/L. 105 (5.85%) were between 2 and 6 mmol/L. 52 (2.9%) were greater than 6 mmol/L. Comparison of vitreous BHB with vitreous glucose levels in 1,781 cases showed moderately good correlation  $r=0.731$ . Comparison with blood alcohol levels in 1,561 cases showed no correlation  $r= -0.053$ . Diabetic ketoacidosis was diagnosed in 76.9% of the cases with vitreous BHB above 6 mmol/L; 37.5% to 13.5% of cases with decreasing BHB levels from six to two mmol/L and less than 2% of cases with BHB less than 2.0 mmol/L. Alcoholic ketoacidosis appeared in only 4 cases. Conditions thought to be ketogenic (diabetes, alcoholism, severe infections) were found in over 92% of the cases with BHB above 6 mmol/L and a third of the cases with BHB levels below 2.0, 1.2, and 0.4 mmol/L. Cases of sudden violent death, age 20-40 and less than 90 minutes from incident to pronouncement time, and with no obvious reason for elevated BHB amounted to 11 cases and showed vitreous BHB levels closer to normal with an average of 0.57 mmol/L. The BHB level was elevated (0.4 – 1.72 mmol/L) in 32 of 34 SIDS-like cases included in the study.

**Beta-Hydroxybutyrate, Death Investigation, Sudden Infant Death Syndrome**