



### K26 An Unusual Case of Ethanol/Methanol Poisoning: Or Was It? The Million Dollar Question!

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After attending this presentation, attendees will be able to: (1) Recognize common problems that can confound the correct interpretation of blood ethanol determinations, (2) Identify issues that can reduce the reliability of postmortem blood ethanol or methanol test results, and (3) Develop a set of questions which should be addressed regarding the integrity of any blood sample obtained from the living or deceased.

This presentation will impact the forensic community by explaining the confounding issues in the interpretation of blood ethanol test results can be reduced by obtaining the answers to several probative questions regarding person, site, and methods of blood drawing and storage.

Common problems can confound the correct interpretation of typical blood ethanol or drug tests, especially when the blood has been taken from a dead body. The presented case is an example of some of the difficulties that can be encountered, and provides a set of questions which should be addressed about the integrity of any blood sample, but most importantly, a blood sample that has been obtained from a dead body.

A professional truck driver in Alaska was found dead in the cab of his truck after it was driven off the road and had rolled down a hill. Three empty beer cans and a sandwich wrapper were found in the cab behind the driver. Toxicology analyses from a certified laboratory reported a blood ethanol level of 0.086% (single value) and a blood methanol level of 0.15%. If the driver was impaired at the time of the accident, worker's compensation would not pay death benefits to the decedent's wife and family. However, if impairment was not proven, then the family would receive insurance and death benefits.

The insurance company claimed the driver had been impaired and retained a forensic pathologist who reviewed the laboratory tests and signed an affidavit stating that the decedent had ingested both ethanol and methanol (from Sterno) prior to death and had been impaired at the time the truck rolled down the hill. This author was retained by the attorney for the widow and the family to investigate the circumstances of the ethanol and methanol blood analyses.

When the attorney called, I asked, "Who drew the blood sample?" He responded, "I don't know." I asked, "Where was the blood sample drawn, in the hospital?" "No, it was drawn in a mortuary." This answer provided the critical information to infer that the sample was unreliable, and, knowing that embalming fluid contained both formaldehyde and methanol, that the blood sample most likely was obtained after the body had been embalmed.

The rest of the case was easy. Take the mortician's deposition, determine the body site from which the sample was obtained, discover the name of the company that supplied the chemicals used to embalm the body, and get copies of the Material Safety Data Sheets (MSDS) to ascertain the chemical composition of the embalming fluids. The deposition also indicated that the mortician had not obtained a true blood sample. Instead, he had found a small collection of blood-tinged fluid in the body cavity and had submitted that for testing labeled as "blood." The MSDS for one of the two chemicals used to embalm the body stated that the product contained 20% methanol.

When blood samples are obtained in a hospital or by law enforcement, appropriate procedures are followed in order to assure the sterility and integrity of the sample in order to conform to existing standards and ensure the reliability of the results. When blood samples are obtained from dead bodies, often the sterility of the sample cannot be assured, and contamination of the sample by bacteria can lead to the production of postmortem ethanol both *in situ* and *in vitro* (Zumwalt et al, 1982), which can lead to unreliable results. Bacterial degradation and metabolism of endogenous substances like glucose (Clark et al, 1982), lactate (Bogusz et al, 1970), glycerol (from fat), and amino acids (Corry, 1977) also have been shown to produce ethanol in dead bodies.

While collecting and analyzing blood, other body fluids like vitreous humor and urine (Levine et al, 1993) can be helpful in determining the source of the ethanol in blood, and asking a few simple questions about the acquisition of the blood sample also can be illuminating. Such questions include: Who drew the blood sample? Who performed the analysis? What were the qualifications of the operator? From what anatomical site was the blood sample obtained? Was a preservative like sodium fluoride or sodium azide used? Was an anticoagulant like EDTA, Ca oxalate, Ca citrate, or heparin used? Was the blood "spun down" before storing? Was there any hemolysis present in the sample? Under what conditions was the sample stored? How much time elapsed between sample drawing and analysis? Which laboratory did the testing? For ethanol, was the testing done with a non-specific Alcohol Dehydrogenase assay that measures NADH production or other screening-level test, or by gas chromatography? What was the specificity of the test procedure? What was the sensitivity of the test procedure? Was the sample collected, transported and processed under a Chain of Custody? Was a "test kit" used or a laboratory protocol? If so, can you get a copy of the manufacturer's labeling or the laboratory's protocol? Only questions provide answers.

#### **Integrity of a Blood Sample, Reliability of Test Results, Solving a Case**