K4 Gamma-Hydroxybutyrate (GHB) - Withdrawal With Severe Rhabdomyolysis, Hyperkalemia, and Cardiac Arrest

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After attending this presentation, attendees will learn about the presentation of severe GHB withdrawal.

This presentation will impact the forensic community and/or humanity by informing the forensic community that severe GHB toxicity leading to death can occur in the absence of proper treatment.

Gamma-Hydroxybutyrate (GHB) is well known to the forensic toxicology community for its euphoric, soporific, and intoxicating properties. Fatalities have occurred from recreational use of GHB at clubs or "Raves," and when GHB has been added surreptitiously to anther person's beverage, usually to facilitate a sexual assault (Drug Facilitated Sexual Assault, DFSA). However, chronic use of GHB produces a dependence similar to that of ethanol, and a withdrawal syndrome very similar to ethanol-related delirium tremens (DTs) has been reported in the literature.

In this case, the decedent was a 28-year-old a male with a long- term, high dose dependence on GHB. In order to ensure his supply of GHB, the man distributed GHB. At the time of his cardiac arrest, the decedent was in police custody for possession and trafficking of GHB. During the booking process, the decedent complained of symptoms of GHB withdrawal. Over a further two-day period of abstinence, the decedent became disoriented, agitated, began to hallucinate and injure himself. To prevent further injury, he was restrained in a "pro-straint" chair with restraints at the wrists, chest, and ankles. The next day, he was less combative but continued to have hallucinations and exhibit rambling speech. After 22.5 hours, he was released from restraints and transferred to a soft-walled cell equipped with video monitoring. He subsequently was observed walking around the cell, but by the end of the second hour, he was observed slumped in the corner of his cell. Guards entered the cell and found him unresponsive, pulse less and apneic. EMS personnel were summoned and also reported him as pulse less and apneic, with a cardiac monitor indicating pulseless sinus tachycardia. CPR was started, the patient was intubated and given naloxone and dopamine, and he was transported to the hospital emergency room (ER).

In the ER, the patient was initially hypotensive but his blood pressure stabilized and dopamine was tapered and stopped. A CAT scan of the head and chest x-ray were normal. However, serum potassium was 8.0 mEq/L, urea nitrogen was 97, serum creatinine was 4.1 and creatine phosphokinase (CPK) was 75,000 IU/L with a heart muscle fraction (CK-MB) of 0.3%. Serum troponin was negative. Urine drug screening was negative for ethanol, salicylates, phencyclidine, cocaine, amphetamines, cannabinoids, opiates, barbiturates, and tricyclic antidepressants. Urine drug screening was positive for benzodiazepines. The admitting MD's assessment was cardiac arrest, probably secondary to acute hyperkalemia and secondary to acute renal failure secondary to rhabdomyolysis secondary to polydrug abuse; liver failure; coagulopathy; and respiratory failure. The patient's clinical course worsened. He became increasingly anuric and his CPK continued to rise along with liver function tests. Four days after admission to the ER, a follow up CAT scan of the head showed diffuse cerebral edema with herniation which led to his being declared brain dead. Autopsy findings included anoxic encephalopathy, cerebral edema, herniation, and necrosis of the cerebellar tonsils, secondary compression, and necrosis of the cervical spine; rhabdomyolysis with necrosis of skeletal muscle cells; acute renal failure with acute renal tubular necrosis of kidneys; bronchopneumonia, and centrilobular necrosis of the liver (shock liver). The cause of death was listed as anoxic encephalopathy following resuscitation from cardiac arrest due to GHB withdrawal syndrome, and the manner of death was listed as natural. The Medical Examiner offered the following comment in his report: "The suddenness of collapse and development of rhabdomyolysis are suggestive of seizures as the mechanism of cardiac arrest during withdrawal in this case." Neither the record of incarceration nor video monitoring included any reference to a witnessed seizure. There were no bite marks on the tongue. The ME was on the right track, but has not quite accounted for the markedly elevated CPK and muscle death which led to the liberation of sufficient intracellular potassium to raise normal serum potassium levels (3.5-5.3 mEq/L) up to 8.0 mEq/L and cause a cardiac arrest.

The key to understanding this case was the development of rhabdomyolysis with the associated release of myoglobin that got trapped in the kidneys' glomeruli and caused renal failure which potentiates the hyperkalemia caused by release of potassium from intracellular sites in skeletal muscle cells. While a seizure can cause both hyperpyrexia and physical damage to muscle cells, the order of magnitude of the cell death and associated hyperkalemia that led to this patient's death indicated massive muscle death

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and release of sufficient potassium to raise serum potassium approximately 3 mEq/L. A better explanation for the massive tissue damage would be the hyperpyrexia and dehydration generated from agitation and "fighting with the restraints." Elevated catecholamine and potassium levels are often cited as possible physiological triggers; however, GHB can also cause DTs similar to those of ethanol withdrawal, which include autonomic hyperactivity and typically occur 72-96 hours following abstinence.

Gamma-Hydroxybutyrate (GHB) Withdrawal, Rhadbomyolysis, Hyperkalemia

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