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Fatal Ethanol Intoxication from Household Products Not Intended for Ingestion

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ABSTRACT: Fatal acute ethanol intoxication is frequently encountered in medicolegal practice. Although the vast majority of acute ethanol toxicity deaths follow the ingestion of conventional alcoholic beverages, ethanol can be obtained from a variety of commercial products, which often contain high levels of ethyl alcohol but are not manufactured or designed for consumption. Such products may be easily purchased in locales where statutory limitations restrict liquor availability on Sundays or during the early morning hours. Several acute ethanol fatalities have been encountered in New Mexico that were directly related to consumption of non-beverage ethanol-containing products, all of them occurring during times when alcoholic beverage sales were restricted. Despite the fact that manufacturers deliberately include compounds in these products that discourage ingestion, this policy apparently does little to deter individuals who are searching for a source of ethanol when no conventional beverages are available. The products that were consumed in these fatalities also contained other compounds which would be toxic at much greater concentrations, but which were inconsequential in their effects in comparison with the direct toxic effect of ethanol. Investigation of the scene and awareness that alcohol-containing products can be fatally abused are essential to detecting these unconventional ethanol sources.

KEYWORDS: toxicology, ethanol, intoxication, death

The vast majority of fatal ethanol intoxications follow the ingestion of alcoholic beverages that are specifically manufactured, marketed, and purchased for consumption. Acute ethanol toxicity is commonly encountered in the medical examiner's office, and it is usually exemplified either by the chronic alcoholic who ingests massive quantities of alcoholic beverages during a binge, or by the teenage neophyte drinker who unwittingly consumes a large amount of distilled spirits during a dare or an impromptu drinking contest. However, it is not generally recognized that a myriad of other commercial products that are readily available on grocery and drugstore shelves contain a high percentage of ethanol, although they are not designed for or specifically intended for ingestion. Any of these products can be easily purchased and consumed by an individual seeking alcoholic beverages. These products are not regulated in the same way that alcoholic beverages are and can be bought by minors, even at times when the sale of conventional alcoholic beverages is restricted or regulated.

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Cases Studied

The Office of the Medical Investigator for the State of New Mexico has assembled several cases of fatal acute alcohol intoxication in which the beverage source was a product that contained a high percentage of ethanol, yet was clearly not intended for ingestion. In each of these cases, very high blood ethanol levels were easily achieved. Both the autopsy examination and the scene investigation are valuable in enabling the pathologist to detect deaths caused by consumption of unconventional ethanol-containing products.

Case 1

A 37-year-old Native American man was discovered unresponsive, lying on his back in an outdoor area frequented by transients, on a Sunday evening. He had been seen earlier that evening, drinking with three other people. There were no signs of a struggle or altercation, and no visible external injuries were identified. An empty Listerine®-brand mouthwash container was near the body.

An autopsy performed the next day revealed only fatty change in the normally sized liver. There was no internal injuries. The stomach contained 300 mL of a brown liquid with a mint-like aroma, suggestive of mouthwash. The postmortem blood alcohol concentration was 0.502 g/dL. Microscopic evaluation of the major organs revealed marked hepatic steatosis but no other natural disease.

Case 2

A 37-year-old Native American man was found dead on a Sunday evening, lying supine along a dirt road which ran parallel to a railroad track. His head was resting upon a tire, as if he were sleeping. Another individual, who was alive but unconscious, was found 9 m (30 ft) away. Numerous empty, generically labeled antiseptic mouthwash containers were found in the immediate vicinity.

An autopsy revealed fatty hepatic metamorphosis, both grossly and microscopically. There were no external or internal injuries. Both the stomach contents and the urine had a sweet, minty odor, characteristic of mouthwash. The postmortem blood alcohol concentration was 0.565 g/dL. The blood alcohol of the surviving companion, who recovered in the hospital, was reported as greater than 0.5 g/dL.

Case 3

A 29-year-old Native American woman was found in a field behind a grocery store, early on a Monday afternoon in November. This area was a well-known gathering place for transients and alcoholics. Her pants were slightly pulled down, and her blouse was pulled up, although no injuries were identified. Rigor mortis and livor mortis were fully fixed. More than 40 empty hair spray containers were scattered in the immediate area.

The autopsy revealed hepatomegaly (4030 g), with extremely severe fatty metamorphosis. The blood alcohol concentration was 0.340 g/dL, and no other drugs or chemicals were found within the blood. As she was dressed quite inadequately for the cold weather, the death was certified as being caused by cold exposure due to acute alcohol intoxication.

Discussion

Accidental alcohol intoxication from drinking mouthwash has been reported in children, with occasional fatalities [1-3]. Deaths following the intentional ingestion of mouthwash or other supposedly innocuous ethanol-containing household products (such as hair

spray) for the express purpose of satisfying an ethanol addiction have not been reported in recent literature.

According to the National Data Collection System of the American Association of Poison Control Centers, 6% of the reported 251 012 human poisonings in 1983 involved alcohols or glycols. Of these cases, 86.2% involved children under the age of six. It is probable that the vast majority of adult ethanol poisonings are unreported [4]. Two recent studies that examined the cause of death in alcoholics reported that 2.5% of 118 and 18.6% of 500 cases died from acute alcohol intoxication, in comparison with the more widely recognized chronic alcoholic sequelae [5,6]. Neither study reported any deaths from poisoning by household products that contained ethanol, methanol, ethylene glycol, or other related substances.

New Mexico, like many other states, prohibits the sale of bottled conventional alcoholic beverages on Sundays. Therefore, an alcoholic is forced either to stockpile enough beer, wine, or liquor to last through this "dry" day or to utilize other products that contain ethanol but are not intended for consumption. Abstinence is the only other alternative. Financial resources are meager and sporadic for many transient or homeless alcoholics, limiting their ability to purchase alcoholic beverages in quantity in anticipation of the liquor stores being closed on Sunday.

Innumerable household products contain ethyl alcohol, either as unadulterated ethanol or as "specially denatured" (SD) alcohol. These products include perfumes, after-shaves, elixirs, cough syrups, antiseptics, polishes, hair care products, lotions, deodorants, external pharmaceuticals, cleaning solutions, insecticides, and fungicides [4]. When a product contains the SD form, a wide variety of denaturants can be employed, including methanol, benzene, pine tar, ethyl ether, acetone, tert-butyl alcohol, and numerous aromatic oils. Each product that contains SD ethanol will have a number/letter code that designates the specific denaturant employed, as delineated in the *Federal Register* [7]. The specific identity of coded denaturants is maintained by most poison control centers.

Mouthwashes contain ethanol in percentages varying from 14 to 26.9%, with the Listerine brand containing the highest concentration (Fig. 1). Other mouthwash ingredients may possibly be toxic in higher concentrations, but the ethanol is by far the most significant in producing intoxication and will reach potentially lethal blood levels long before the other ingredients will exert a toxic effect. Obviously, the fact that mouthwashes are intended for intraoral (but not ingestion) purposes limits the amount, quantity, and type of denaturant that can be utilized without compromising the product's safety.

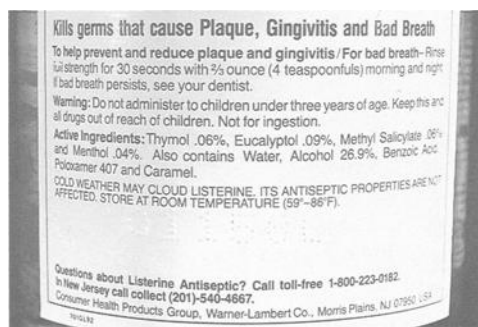


FIG. 1—Label from the back of a Listerine®-brand mouthwash bottle. Note the ethanol content of 26.9% and the warning against ingestion. The other ingredients are in concentrations that are too low to be toxic unless this product is consumed in large quantities, whereupon the toxic effect of the ethanol alone would then produce a lethal effect.

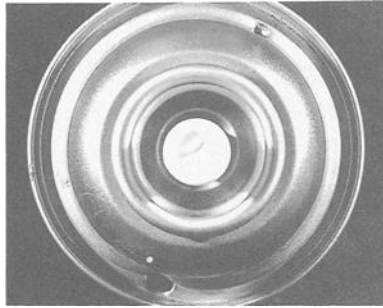


FIG. 2—Top view of an aerosol hair spray can that was emptied and consumed by the decedent in Case 3. Note the symmetrical punctures on either side of the rim (“vampire bites”), used to vent the propellant and then pour the contents into another container.

As illustrated in Case 3, very unusual ethanol sources may produce intoxicating or lethal levels if intentionally consumed. The product, Aqua Net® hair spray, lists SD alcohol 40 as the primary ingredient, which is ethanol denatured with 0.125% tert-butyl alcohol. This hair spray is 79% alcohol (158 proof). Interviews with alcoholics who utilize this unconventional alcohol source reveal that these individuals typically buy as many cans of hair spray as they can afford on a Sunday, and then make a small puncture along the upper rim, where the top joins the side. Once the pressure is released, a similar and often larger puncture is placed on the opposite side, giving a configuration known as “vampire bites” (Fig. 2). Then, the hair spray is poured out and mixed with a soft drink, often ginger ale or a lemon-lime flavored soda, to make an effervescent concoction termed “ocean.”

In the cases presented here, there was no question that ethanol was the primary factor causing death, and additional toxicologic studies revealed no other toxic agents. The scene evidence revealed that the alcoholic liquids consumed were not conventional liquors, wines, or beers but products not intended for such consumption. Without this physical evidence or other information, the obvious assumption would have been that the decedents drank large amounts of alcoholic beverages that were meant for human ingestion. The pathologist and scene investigators must give attention to containers that are seemingly out of place but which originally were filled with products that have high ethanol concentrations, as these may be the real sources of lethal ethanol intoxications. Routine enzymatic and gas/liquid chromatography methods will detect only the ethanol in these products, giving no other information as to its origin. A peculiar odor to the stomach contents that suggests mouthwash or other household or personal hygiene products may also give the attentive pathologist a clue to an unconventional source.

References

- [1] Leung, A. K. C., “Ethanol-Induced Hypoglycemia from Mouthwash,” *Drug Intelligence and Clinical Pharmacology*, Vol. 19, No. 6, June 1985, pp. 480–481.
- [2] Weller-Fahy, E. R. and Berger, L. R., “Mouthwash: A Source of Acute Ethanol Intoxication,” *Pediatrics*, Vol. 66, No. 2, February 1980, pp. 302–305.
- [3] Selbst, S. M., DeMaio, J. G., and Boening, D., “Mouthwash Poisoning: Report of a Fatal Case,” *Clinical Pediatrics*, Vol. 24, No. 3, March 1985, pp. 162–163.
- [4] Litovitz, T., “The Alcohols: Ethanol, Methanol, Isopropanol, Ethylene Glycol,” *Pediatric Clinics of North America*, Vol. 33, No. 2, April 1986, pp. 311–323.
- [5] Copeland, A. R., “Sudden Death in the Alcoholic,” *Forensic Science International*, Vol. 29, No. 3–4, November–December 1985, pp. 159–169.

[6] Clark, J. C., "Sudden Death in the Chronic Alcoholic," *Forensic Science International*, Vol. 36, No. 1-2, January-February 1988, pp. 105-111.

[7] Rumack, B., "Ethanol Management," *Poisindex*, ed. 56, Micromedix Inc., Denver, CO, 1989.

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