



## Pathology Biology Section - 2012

### G133 Two Unique Cases of Volatile Substance Abuse Death: Huffing Halogenated Hydrocarbons With Plastic Bag Over Head

*Saranjit Kaur, MS\*, Dennis J. Chute, MD, and Kari B. Reiber, MD, Office of the Medical Examiner, Dutchess County Department of Health, 387 Main Street, Poughkeepsie, NY 12601*

The goal of this presentation is to elucidate the mechanism by which two individuals died from inhalation of a halogenated hydrocarbon, assisted by securing a plastic bag around their necks.

This presentation will impact the forensic science community by better understanding of the mechanism of death in volatile substance abuse cases.

The inhalation of volatile substances for their intoxicating effect, an act popularly referred to as “huffing,” is a relatively new form of recreational drug abuse in the United States. These volatile substances are commonly found in consumer aerosol sprays, such as keyboard cleaners and air fresheners. Easy access and low costs make these products particularly attractive to adolescents.<sup>1</sup> Presented in this study are two unique cases in which individuals died from inhaling an aerosol spray (containing halogenated hydrocarbons) within the confines of a plastic bag secured around the neck. The plastic bag serves to potentiate the intoxicating effects of the aerosol, by increasing the concentration of chemicals in the user’s breathing space. Given the presence of the plastic bags, the cause of death in both cases was certified as asphyxiation by placement of plastic bag over the head while huffing. In both cases, the volatile substances of abuse were halogenated hydrocarbons: difluoroethane and chloroethane. The purpose of this study is to investigate the mechanism(s) of death, i.e. determine its toxic effect. There are a number of possible mechanisms that may have contributed to death in these cases: anoxia, aspiration, vagal inhibition, respiratory depression, suffocation after loss of consciousness, and cardiac arrhythmia (due to sensitization of the myocardium by the chemical agent and/or from carbon dioxide in the user’s environment).<sup>2</sup> In addition, volatile substance abuse puts the user at risk for “sudden sniffing death syndrome,” a fatal cardiac arrhythmia caused directly by the sensitization of the myocardium to endogenous epinephrine. This later mechanism is supported by animal experiments which show that numerous halogenated hydrocarbons are capable of inducing cardiac arrhythmias. In the forensic setting, the postmortem diagnosis of a cardiac arrhythmia is often a diagnosis of exclusion due to the lack of pathognomonic changes within the heart.<sup>3</sup> Arrhythmias are reported in the literature as being the most likely cause of death in volatile substance abuse cases, but this is usually speculation and cannot be proven without more specific postmortem evidence of cardiac arrhythmia.<sup>4</sup> In the two huffing cases another significant variable was the placement of plastic bags secured over the head. It is proposed that hypoxia also plays a role in the abuser’s death possibly by contributing to a fatal cardiac arrhythmia. Hypoxia has direct effects on the cardiovascular system and may heighten the cardiac response to epinephrine. For example, animal experiments suggest that cardiac sensitization is amplified by both volatile substances and the presence of hypoxia. It may be that the combination of a volatile halogenated inhalant, elevated epinephrine blood levels and hypoxia has the most cardiotoxic effect.<sup>2</sup> These two cases seem to demonstrate this triad of causation; alternatively, depression of central nervous system function and subsequent asphyxiation by plastic bag remains another possible explanation. Further studies are required for a more exact diagnosis.

#### References:

1. [http://en.wikipedia.org/wiki/Inhalant\\_abuse](http://en.wikipedia.org/wiki/Inhalant_abuse)
2. Sheperd RT. Mechanism of sudden death associated with volatile substance abuse. *Hum Toxicology*. 1989;8:287-297.
3. Williams JF, Storck M; American Academy of Pediatrics Committee on Substance Abuse; American Academy of Pediatrics Committee on Native American Child Health. Inhalant abuse. *Pediatrics*. 2007 May;119:1009-1017.
4. Avella J, Wilson JC, Lehrer M. Fatal cardiac arrhythmia after repeated exposure to 1,1-difluoroethane (DFE). *Am J Forensic Med Pathol*. 2006;27:58-60.

#### Huffing, Difluoroethane, Chloroethane