

TECHNICAL NOTE

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Prevention of Occupational Cyanide Exposure in Autopsy Prosectors

REFERENCE: Nolte, K. B. and Dasgupta, A., "Prevention of Occupational Cyanide Exposure in Autopsy Prosectors," *Journal of Forensic Sciences*, JFSCA, Vol. 41, No. 1, January 1996, pp. 146-147.

ABSTRACT: Autopsy prosectors examining individuals with cyanide poisoning are at risk for occupational cyanide exposure. No protective autopsy precautions to mitigate this risk have been published. We report an autopsy on an individual with cyanide poisoning where the procedure was performed in a negatively pressured isolation room and the stomach was opened under a biosafety cabinet hood. None of the three autopsy prosectors had measurable cyanide in pre or post procedure blood specimens. We recommend that similar precautions be taken in all autopsies where cyanide is suspected as a possible cause of death.

KEYWORDS: forensic science, pathology and biology, biosafety cyanide exposure, occupational hazard autopsy

Forensic pathologists performing autopsies on individuals who died of cyanide poisoning have anecdotally reported symptoms of nausea, mucosal burning, and dizziness. One study identified toxic concentrations of cyanide in autopsy personnel (1). Although industrial standards require ventilatory devices to prevent cyanide poisoning and set a maximum allowable concentration of 10 ppm, no autopsy safety precautions have been published (2). Safety precautions and autopsy room ventilation systems vary significantly among forensic offices. No study has assessed the efficacy of a negatively pressured room and a biosafety cabinet or fume hood in preventing cyanide exposure in autopsy prosectors. We report the pre and post exposure toxicologic findings from a pathologist and two technicians who performed an autopsy under ideal circumstances on an individual who died from cyanide poisoning.

Methods

A 32-year-old man was found dead at home. A suicide note, a partially consumed bottle of orange juice, a container of potassium cyanide and a sheet of paper listing the toxic properties of cyanide were present at the scene.

An autopsy was performed in a 17'10" × 19'4" × 8'6" isolation room ventilated with negative pressure through a biosafety cabinet

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Received for publication 22 March 1995; accepted for publication 16 June 1995.

hood. The room airflow supply rate was 500 cubic feet per minute and the exhaust rate was 941 cubic feet per minute. The autopsy was performed by a pathologist and two technicians. None of the autopsy personnel were smokers. The exposure time was 43 minutes for the pathologist and 56 minutes for the technicians. The stomach was opened under the biosafety cabinet hood and the contents were poured into a container and sealed. The gastric contents were not evaluated by sniffing. Blood was obtained from the decedent. The container of orange juice was preserved.

Blood was obtained from the pathologist and technicians before the autopsy began and from the pathologist 18 minutes after autopsy exposure and from the technicians 22 and 25 minutes after autopsy exposure.

Cyanide analyses were performed within 2 hours of specimen procurement. Cyanide was volatilized from blood and orange juice by addition of sulfuric acid and scrubbed into a weak sodium hydroxide solution. Stomach contents were homogenized with a sodium hydroxide solution and then sulfuric acid was added in excess to volatilize cyanide as hydrogen cyanide gas. These solutions were complexed with pyridine-barbiturate to form a purple chromophore. The absorption of these solutions at 578 nanometers is proportional to the cyanide concentration.

Results

Autopsy findings included pink livor mortis. The stomach contained 300 mL of orange liquid. The gastric mucosa was diffusely hemorrhagic.

Blood from the decedent contained 5.7 µg/mL of cyanide. Stomach contents and orange juice contained 655 and 670 µg/mL of cyanide respectively.

No cyanide was detected in the blood of any of the three autopsy prosectors either before or after the autopsy. However, the pathologist experienced headache and a burning throat sensation during the autopsy. One technician reported light headedness and slight throat burning. The other technician was asymptomatic.

Discussion

Safety precautions to prevent the occupational exposure of autopsy prosectors to cyanide have not been described. However, this case illustrates that prosectors can mitigate their risk by performing autopsies in well ventilated isolation rooms and by opening the stomach under an air evacuating hood. Although cyanide may vaporize from autopsy tissues, the major risk to autopsy prosectors

is when the stomach is opened. Ingested cyanide salts are found in the stomach in the highest concentration. In the acid gastric environment hydrocyanic gas is generated (3). This compound is extremely volatile with a boiling point of 26 degrees centigrade (4). Prosectors who open the stomach outside of a fume hood or a biosafety cabinet risk inhaling potentially toxic concentrations of hydrocyanic gas (1).

It is interesting that both the pathologist and one technician experienced minor symptoms. These may have been due to cyanide exposure without a measurable accumulation. Approximately 50% of absorbed cyanide may be inactivated by the liver within 1 hour of exposure (5). As 18 to 25 minutes elapsed between the end of the autopsy and the procurement of the blood specimens, low cyanide concentrations may have become undetectable. Susceptibility to suggestion or other psychological factors could also produce symptoms (1).

For laboratory workers handling toxicology specimens potentially containing cyanide, gloves, face and eye protection and laminar-flow fume hoods are indicated (1). It is surprising that similar precautions have never been recommended for pathologists. We suggest that autopsies on cyanide poisoning victims be performed in negatively pressured isolation rooms and that the stomach be opened under a hood. Using the minimal number of autopsy personnel and experienced prosectors can also decrease exposure. If these conditions cannot be met prosectors are at risk for cyanide poisoning. If a consulting toxicology laboratory can provide rapid

cyanide analysis on blood aspirated during an external examination, the need for autopsy in these cases may be obviated, depending on the circumstances of the case.

Acknowledgment

The authors appreciate the willingness of autopsy technicians Kara Richmond and Charles Emmons to participate in this study. The editorial comments of Drs. Bronwyn E. Wilson, James L. Luke, Julia C. Goodin and Ross E. Zumwalt are also appreciated.

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