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Chemical suicide by inhalation of hydrogen sulfide in Sibiu County, Romania. Case report and literature review

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Abstract: This paper presents a rare case of suicide by inhalation of hydrogen sulfide. Chemical suicide records an increased incidence worldwide being one of "imported" autolytic methods, original from Japan, but propagated through websites. Intentional death by H_2S inhalation raises important issues as the lethal gas can be obtained by mixing substances available on the market and because it leads to high mortality rate in suicide attempts in rescuers, family members and forensic research teams.
Key Words: Hydrogen sulfide, suicide, case report, literature review.

Hydrogen sulfide (H_2S) is a toxic, flammable, volatile and colourless gas. It is soluble in water and petroleum. The gas is heavier than air and causes an immediate fire hazard after having been mixed with air. It can be spread on long distances and causes distant ignition. Being extremely toxic by inhalation, the gas has a highly lethal potential in enclosed spaces [1, 2]. Inhalation of H_2S causes symptoms depending on concentration [3, 4]. H_2S leads to an extremely high mortality rate in suicide attempts in rescuers, family members, police officers, caregivers or neighbours [5]. The mechanism of H_2S toxicity consists in H_2S binding with Fe3+ of cytochrome oxidase that inhibits mitochondrial enzymes and alters oxygen utilization at cell level, similar to cyanide poisoning [2].

After being originally cited in Japan in 2007, with over 2,000 incidents, mostly regarding industrial accidents, the method caused a chain reaction in the very next year, with 220 incidents during a 3-month period and 208 persons killed, in Japan. The most affected age group is 20-29 [2]. The Japanese recipe for H_2S, as posted on websites, contains bath additive and toilet detergent [1]. Bath additive contains lime sulfur. Toilet detergent contains acid and plays the role of an oxidant to produce H_2S gas [1]. The phenomenon was dubbed "Chemical suicide" or "Domestic suicide" by the media, because it involves common household cleaners, largely available from hardwares, groceries or by internet purchase. Suicide victims outside Japan replaced bath sulfur, less available on certain local markets, with pesticides. In the US, the method has gained popularity since 2008, when the news site Bloomberg.com, cited by the Regional Organized Crime Information Center [1], published the Japanese recipe for hydrogen sulfide and described it as "a quicker, less complicated method of suicide" [1]. PDF text guides and video materials became largely available on the internet. The websites also encourage leaving a warning note on the window or door in order to warn about the toxicity of the gas within [6]. Since 2008, US first responders reported an increase of documented incidents of chemical suicide: 2 incidents in 2008, 10 cases in 2009 and 18 cases in 2010 [7, 8]. An official surveillance on chemical suicide attempts in automobile identified 10 incidents reported in 6 states between 2006

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and 2010, that caused 9 deaths of suicide victims, 4 first responders injured, 32 persons decontaminated and 85 persons evacuated, while 9 of 10 incidents took place in residential areas [7]. Most victims were white males, less than 30 years old. In all cases a warning note was left in the cars [8]. The most recent chemical suicide affected 11 people, including first responders, after a chemical suicide attempt in Lowell, USA, June, 2015 [9].

In Europe, chemical suicide is rare and we didn't identify any cases of the above-mentioned intoxication reported in scientific journals. On-line resources have not identified similar cases in Romania.

CASE REPORT

In April 2014, the Police were called by a passerby who noticed a car parked on the outskirts of Sibiu. In the car was found a human body, in an immobile position, covered with a plastic wrap.

Crime scene investigation

The criminal investigation of the scene of death found a car whose windows were covered with white sheets of paper on which was written "Do not open. Poisonous gas H_2S. Call 112!" Near the car, there were two plastic empty buckets, and 5 plastic containers labelled "Acido puro 33%". On the driver's seat, there was a human body tapped with plastic wrap (Fig. 1). Ventilation holes on car's board were covered with tape. Given the biohazard warning, the intervention of the Inspectorate for Emergency Situations was requested. The intervention was conducted by wearing protective equipment. Inside the vehicle, there were found two other plastic buckets, each containing approximately 5 L of a yellowish-white liquid and a piece of paper which referred to a farewell message posted on the victim's PC tablet at his house. The victim was identified as being a 25 years old man from Sibiu. Biological samples were collected for toxicological analysis.

Forensic Autopsy

Forensic autopsy identified the body of a Caucasian male, 24 years old, presenting extended dark violaceous livor mortis. Internal examination revealed generalized stasis, upper respiratory airways with erosive areas that tended to merge. In the main bronchial lumen, we found a pinkish air foam. At lungs level, edema could be noticed, together with confluent hemorrhagic areas and emphysematous areas.

Histopathologic analysis

Histopathologic examination of the epiglottis revealed areas of necrosis and epithelial mucosal desquamation and areas with epithelium absence, corium with edema and small inflammatory focal infiltration with mixed cellularity (Fig. 2). Histopathologic examination of the lung revealed marked congestion of the septal capillaries, aerated eosinophilic material intraalveolarly, hematic infiltration areas, areas with dilated and broken septa, alveolar epithelium desquamation into the alveolar and bronchial lumen (Fig. 3).

Toxicological analysis

The toxicology test of fluids revealed: blood alcohol concentration ‰ 0 g; urine (GS-MS technique): negative; positive reactions to paper-indicator for the presence of H_2S (iodide starch paper + lead acetate for the urine sample). Toxicological analysis of the substance in the containers found in the car revealed sodium ions and chloride ions.

DISCUSSIONS

Based on autopsy, toxicological and histopathologic findings, we concluded that the victim's death was violent and was due to acute intoxication from the inhalation of H_2S.

Similar to H_2S intentional poisonings cases cited on websites, the victim combined two commercial chemical products: chlorhydric acid (33%) and sodium

Figure 1. Warning note on the car window - regarding the lethal potential of the gas.

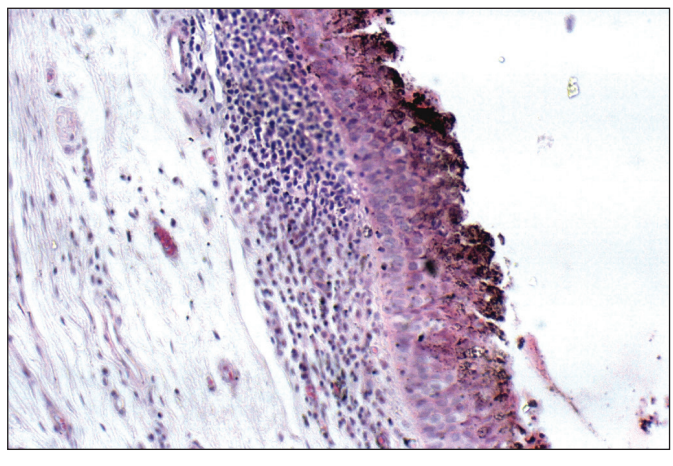

Figure 2. Histopathologic examination of the epiglottis - showing areas of necrosis and epithelial mucosal desquamation (10X).

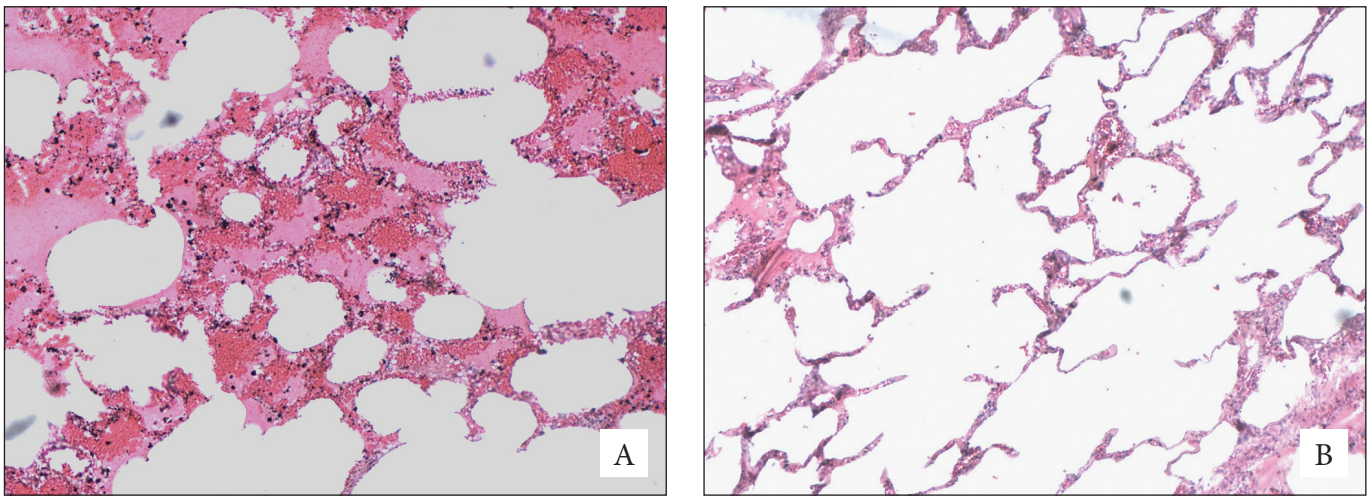

Figure 3. Lungs examination - showing confluent hemorrhagic areas and emphysematous areas (A, B, 20x).

sulfide (revealed by toxicological tests). Both substances are common industrial reagents. Unlike similar cases of chemical suicide, that used household substances, in this case industrial substances were used, but which can be found on the market. This raises the question of access of domestic buyers to products not intended for home use, which may have high toxic potential and are not subject to the regulations on the marketing of products intended for general consumption.

On the other hand, internet shows alternative acid sources (sulfuric acid, lysol disinfectant, lysol toilet bowl cleaner, The Works toilet bowl cleaner, blu-lite germicidal acid bowl cleaner, Kaboom shower, Tub and Tile cleaner, Tile and Stone cleaners) or sulfur sources (artist oil paints, dandruff shampoos, pesticides, spackling paste, latex paints, garden fungicides, lime sulfur, bonide) [11], largely available on the market.

The method of suicide was copied step by step according to the instructions available on websites, including those regarding the warning posted on car windows regarding the chemical hazard. Warnings were vital for the research team and directed the criminal and forensic investigators to wear protective equipment.

The intervention of governmental bodies in limiting the access to chemicals and the information with harmful potential are issues that must concern us. Following the Japanese crisis of domestic suicide, the Japanese National Police Agency response was to immediately ask internet providers to remove information that could be harmful and the manufacturing company to stop the production of bath additive most frequently mentioned in recipes [2]. In the USA, the Chemical Safety Improvement Act of 2013 (IAASB) requires producers of industrial chemicals to better assess the potential toxic hazards before the substances reach the market [12].

The role of state institutions in limiting the phenomenon is even more important as the incidence is likely to be under reported [13].

CONCLUSIONS

We believe that suicide by H_2S has become a public health problem due to extensive propagation through the media of gas production methods, the availability of substances and the possibility of replacing the main ingredients with substances having the same properties, depending on their availability on the local market.

Suicide by inhalation of H_2S is of extreme gravity because of the fatal toxic potential of inhaling the gas, not only for the victim, but also for the entourage, neighbours, members of the intervention teams.

The management of such a suicide case involves the existence, knowledge and observance by professionals, of the intervention protocols for risk situations and emphasizes the importance of sharing these experiences to improve such protocols and to better protect communities from chemical hazards.

The appearance of this kind of chemical suicide in Romania could mean the beginning of an upward trend of the "imported" autolytic methods, favoured by the uncontrolled access of information through the internet and can endanger the lives of rescuers, entourage and members of research teams.

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