Gas Poisonings—An Overview

Dag Jacobsen, MD, PhD
Director and Professor, Department of Acute Medicine, Ullevaal University Hospital, Oslo, Norway

In the war against international terrorism, civilian preparedness for toxic terrorism and gas attacks must have high priority. This preparedness consists of theoretical knowledge within clinical toxicology and experience from work with chemical accidents. Here, the role of proper out-of-hospital decontamination of the victims cannot be overestimated—and in Norway, this has resulted in the introduction of several mobile decontamination units/wagons distributed throughout the country.

Healthcare professionals working in gas/chemical-contaminated areas also illustrate another important problem: The safety of the rescuer. This is best illustrated by the phrase "use your head and not your heart" during fieldwork, while trying to help gas-poisoned victims. The typical (and potentially fatal) error by untrained personnel is to run into a gas exposed area with a filter gas mask only—forgetting the fact that oxygen may not be present—and that some gases are easily absorbed through the skin (e.g., the nerve gases).

Toxic gases may be classified in many ways according to their chemistry, toxicity, or clinical features of the exposed victims. From a pedagogic point of view, the original classification of gases according to their mechanisms of action originally proposed by the Joint Military Service of our armed forces still is attractive. Based on this classification, an overview of gas poisoning is presented. Special focus is given to nerve gas agents because a minimum of pathophysiology is necessary to understand the rationale for the antidotal treatment, especially the amount of atropine that may be needed for the individual victim. This amount also has implications for the amount of antidotes that must be stocked. Because many antidotes are rarely used, expensive, and have limited shelf lives, regional cooperation often is the best choice in the Nordic region, where rural areas dominate.

Keywords: antidote; chemicals; civilian; decontamination; gas; mobile; nerve gas; poisoning; preparedness; regional cooperation; safety; terrorism; toxicology; toxins; war

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Disastrous Fire in a Clubhouse in Gothenburg in 1998

Kai Knudsen, MD, PhD
Department of Anaesthesia and Intensive Care, Sahlgrenska University Hospital, Göteborg, Sweden

Introduction: In 1998, about 400 teenagers gathered in a clubhouse for a private party. Around 23:00 hours, four teenagers who had been rejected to the party some hours before set fire to some furnishings behind the stage exit door. Within approximately 10 minutes, the fire accelerated aggressively and the main dance floor was in flames. There was only one narrow door for emergency exit (120 cm wide) and about 200 people were stuck inside. The rescue action was cleared within two hours.

Results: Two-hundred thirteen injured people were brought to four different hospitals within two hours. Sixty-three people died in the accident, of these, 61 had died at the scene of the accident. Of the two who died in the hospital, one had developed cardiac arrest at the scene, while the other developed irreversible brain damage. Of the 213 brought to the hospital, 150 remained and 74 were admitted into intensive care.

Cyanide levels in venous blood and carboxyhemoglobin (CO-Hb) levels were determined in the 61 victims who died at the scene. Mean levels of cyanide were 0.76 microgram/g (0-2.1) and CO-Hb was 57% (17-80%).

Discussion: The level of cyanide increased with the level of CO-Hb indicating a longer duration of exposure to toxic gases for those with high levels. Thus, a longer duration of exposure increases the risk of cyanide and carbon monoxide toxicity.

The levels of cyanide were fairly low in most cases. Several cases had such low levels of CO-Hb and cyanide that other factors must have contributed to the death. Such factors could have been asphyxia with hypoxemia and hypercapnia. Also body-packing and hyperthermia may have contributed to the deaths.

Keywords: carbon monoxide; cyanide; escape; exposure; fire; mortality

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Gas Poisoning in Historical Perspective

Per Kulling, MD
Director, Unit for Emergency Preparedness, Swedish National Board of Health and Welfare, Sweden

Gas poisoning that affects a great number of people has occurred throughout the years. In 1944, a chlorine bottle leaked close to the fresh air inlet of an underground station in New York, resulting in the hospitalization of more than 200 persons. At an uncontrolled release of dioxines (an impurity) from a plant in northern Italy in 1976, a large number of people were exposed in an area of 4–5 km^2. No immediate effects were noted, but after several days, acute symptoms appeared, and much later, general symptoms such as chloracne and liver impairment developed. In 1979, a train carrying chlorine derailed in Canada leading to the evacuation of one hospital with 1,250 patients and 250,000 persons from their homes for two to five days. In 1984, a release of methylisocyanate from a plant in Bhopal, India exposed 150,000–200,000 persons. More than 2,500 persons died during the first week mainly due to lung damage, and thousands of people developed chronic pulmonary damage. The fire in King's Cross underground station in 1987, the fire on the passenger ship, Scandinavian Star, in 1990, and the discotheque fire in Gothenburg in 1998, all revealed a number of deaths from inhalation of hydrogen cyanide (and carbon monoxide). The terrorist attack in the Tokyo subway in 1995, where the nerve agent, sarin, was spread, forced more than 3,000 persons to seek medical attention and about 500 persons were admitted to hospitals with symptoms typical of cholinergic poisoning. In 1998, more than 100 persons in Sweden were exposed to nitrogen oxides in an ice hockey arena and 62 were treated in hospitals. The examples presented here illustrate that these events have different dimensions and characteristics.

Keywords: chlorine; cyanide; dioxines; gas; history; methylisocyanate; nitrogen oxides; poisoning; sarin

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