

Original Paper

Fatal Nitrobenzene Poisoning: Some Case Reports and Medicolegal Aspects

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ABSTRACT

Nitrobenzene is a synthetic organic compound, pale yellow in colour, freely soluble in alcohol, with a pleasant odour like that of bitter almonds or shoe polish. It is widely used in chemical industry, and is present in commercial products such as shoe and metal polish, ink, paint remover and soap.

Poisoning due to nitrobenzene is usually chronic in nature, mainly due to occupational exposure, except for a few acute cases of industrial accidents or suicides.

We report three cases of fatal nitrobenzene poisoning through oral ingestion. All persons consumed alcohol prior to, or along with nitrobenzene. The alleged manner of poisoning was different in every case (one case each of homicide, suicide and accident).

Clinical features, autopsy findings and medicolegal aspects of nitrobenzene poisoning are discussed.

Key Words: Nitrobenzene; Alcohol

Introduction

Nitrobenzene is a volatile, pale yellow oily liquid (**Fig 1**), partially soluble in water, but freely soluble in alcohol, with a pleasant odour like that of bitter almonds or shoe polish. Synonyms for nitrobenzene include oil of mirbane, essence of mirbane, nitrobenzol, and solvent black 6.¹ It does not occur naturally, but can be manufactured by nitration of benzene with nitric acid, using sulfuric acid as a catalyst and dehydrating agent. The purified prod-

uct is used extensively in chemical manufacturing, especially in the synthesis of aniline, which is predominantly used in the manufacture of polyurethane. Nitrobenzene has been used as a solvent for cellulose esters and acetates, and in petroleum refining. Up to early 20th century, nitrobenzene had some use as a food additive (substitute for almond essence). Today it is present in a number of commercial products, such as shoe and metal polishes, inks, paint remover and soaps.^{2,3} Human exposure to nitrobenzene is on the rise worldwide, due to easy accessibility to commercial products containing nitrobenzene.

Case Report 1: A 44 year-old male was admitted to Lok Nayak Hospital, Delhi with alleged history of consumption of unknown poison in his shop under the intoxication of alcohol one hour ago. He was a cobbler by profession. There was history of vomiting. On examination, the patient was in a state of unconsciousness, vitals stable, and systemic examination was unremarkable. Gastric lavage was done and 100% oxygen was begun.

Relatives of the patient brought the remnants of the compound ingested (shoe polish). The manufacturer was called on telephone, who identified the compound as nitrobenzene. The patient was started on ceftriaxone, metronidazole, pantoprazole, metoclopramide, methylene blue, ascorbic acid and amikacin. Later the patient experienced sudden fall of blood pressure and respiratory distress. ABG showed severe metabolic acidosis, and he was started on IV sodium bicarbonate. He was intubated, and supported with ventilator and inotropic agents. Two

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days later, the patient developed bradycardia followed by cardiac arrest. CPR was started, but he could not be revived. The body was sent for autopsy examination.



Fig 1: Nitrobenzene

At autopsy, the following observations were made. The body was that of a middle aged male, moderately built and nourished. Bluish discoloration was present over the nail beds and lips. Petechial haemorrhages were present in the left conjunctiva. No external injury was present over the body. About 100ml of yellowish coloured fluid was present in the stomach. The mucosa was congested and haemorrhagic (**Fig 2**). Other organs were also congested. Selected viscera and body fluids were sent for toxicological examination.



Fig 2: Congested Gastric Mucosa

Liver, kidney, spleen, lung, brain and heart were subjected to histopathological examination. Liver showed swelling of hepatocytes suggesting fatty changes consequent to chronic alcohol consumption (**Fig 3**). Spleen showed red-pulp congestion. Kidney was normal in the cortical

region, but was congested in the medullary region (**Fig 4**). Mononuclear and polymorphic infiltrates were seen in the interstitium of the lung, suggestive of pneumonitis (**Fig 5**). Heart and brain were normal.

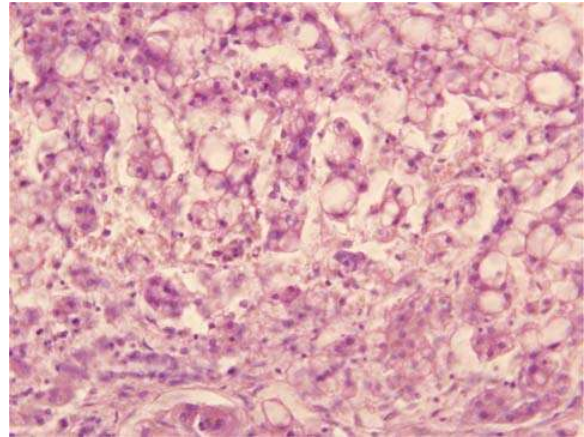


Fig 3: Microscopy of Liver - Swelling of Hepatocytes

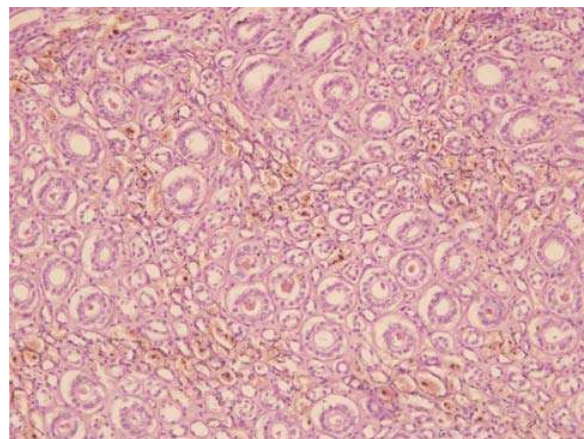


Fig 4: Microscopy of Kidney – Medullary Congestion

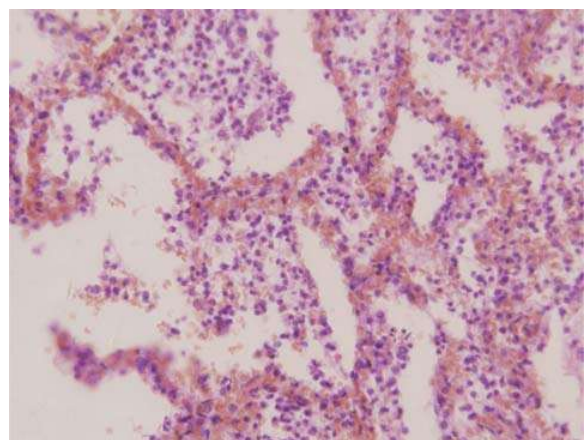


Fig 5: Microscopy of Lung – Inflammatory Infiltrates

Case Report 2: An adult male ingested some nitrobenzene along with alcohol in his shop. He was brought to LN Hospital, Delhi in an unconscious state. There was no history of vomiting. On examination, cyanosis was present. The patient was immediately intubated and placed on ventilatory support. Inotropic support with dopamine, dobutamine, and adrenaline were given. However he survived for 7 hours only.

At autopsy it was found that the deceased was a young male, 45 kg in weight, emaciated, and of average stature. A poorly defined mass (7 x 5 x 4.5 cm) involving the right half of the tongue, base and floor of the mouth was present. Stomach was found containing 70 ml of brownish fluid. The mucosa was congested and haemorrhagic at places. All the other organs were found congested. The chemical analysis report suggested that common poisons including nitrobenzene could not be detected. He was working in a printing press. The relatives stated that he was in depression due to carcinoma of the oral cavity. He had taken alcohol first and then ingested the compound containing nitrobenzene used in the printing press which was available in his shop.

Case Report 3: A 27-year old male was brought to a charitable hospital in Delhi with alleged ingestion of some unknown chemical substance. On admission, he was in an unconscious state, not responding to verbal commands and pain. There was history of an episode of vomiting. On examination, the pupils were found dilated, reacting sluggishly to light. Heart rate was 63/minute, BP-83/34 mm Hg, SPO₂-70%. Respiratory and cardiovascular findings were normal. Abdomen was found soft to palpation. The patient was immediately intubated and placed on ventilatory support. Inotropics dopamine, dobutamine, and adrenaline were given. He was given injection atropine, antibiotics, pantoprazole, and ondansetron. Gastric lavage was done. Blood sample and gastric lavage fluid were collected. However, the patient went into bradycardia followed by cardiac arrest. Despite resuscitative efforts, he died after 4hrs.

The deceased person's brother, in his written statement to the police said that the victim (along with two other persons) used to work at a photostat shop. He alleged that the other two persons had killed his brother by administering poison. Autopsy was conducted in the Department of Forensic Medicine, Maulana Azad Medical College, and revealed the following findings. The deceased was a young male, of average build and stature.

There was no external injury present over the body. About 500 ml of brownish coloured fluid was present in the stomach, and the mucosa was congested. Other organs were found congested. Selected viscera and body fluids were sent for toxicological examination, and revealed the presence of nitrobenzene and ethyl alcohol. Blood sample was found to contain 50.4 mg per 100 ml of ethyl alcohol. Cause of death was given as due to ethyl alcohol and nitrobenzene poisoning.

The investigation was then transferred to the DIU/Central District. During investigations, the sample of the chemical allegedly consumed by the deceased was taken from the shop and sent for analysis, which revealed the presence of nitrobenzene. A request was made to the autopsy surgeon by the crime branch to opine as to the manner of ingestion of the chemical. The autopsy surgeon opined that as there was nothing suggestive of forceful feeding or struggle marks over the body, nitrobenzene could have been given along with drinks when the person was already under the influence of alcohol.

Discussion

There are no reports of epidemiological studies of the human health impacts of nitrobenzene exposure in the workplace or environment. However, a number of case reports of nitrobenzene poisoning have been published in the biomedical literature.¹ A study of poisoning cases reported to the National Poisons Information Centre, AIIMS, New Delhi, revealed that nitrobenzene is a common industrial poison in India, but the exact incidence is not known.⁴

Nitrobenzene exposure is predominantly occupational via the inhalation or dermal routes. It is a volatile liquid that can readily gain access to the body by inhalation and skin penetration by the vapour. Other possible modes of exposure include consumption of drinking water and consumer products containing nitrobenzene.¹ High quantities of nitrobenzene can be lethal via any route of exposure, but usually the level of exposure is not enough to cause death. Hence only a few cases of fatal nitrobenzene poisoning have so far been reported.⁵

In our report, all cases of poisoning were due to ingestion of nitrobenzene with alcohol, though the alleged manner was different. As nitrobenzene is freely soluble in alcohol, it gets rapidly absorbed when taken along with alcohol leading to enhanced harmful effects. In the first case, the victim was a cobbler working in his own shop.

He had first taken alcohol, and under intoxicated state, accidentally ingested the liquid shoe polish lying around in the shop. Acute poisonings due to ingestion of nitrobenzene present in consumer products have occurred frequently in the past and are mostly accidental. Poisoning via skin absorption has occurred with the use of nitrobenzene scented soap, spilling of compound on the clothes, application of dye to the hair, wearing of dyed shoes before they are properly dry, etc.¹ Accidental ingestion of substances such as furniture cream, screen printing material containing nitrobenzene, etc., are reported in literature.⁶⁻⁸ Accidental nitrobenzene poisoning can also occur when it is mistakenly swallowed as spirit or some other medicine.² Nitrobenzene poisoning cases have been reported from taking alcoholic drinks which have been contaminated with nitrobenzene and related substances,^{9,10} or from drinking a nitrobenzene preparation when intoxicated.^{11,12} As nitrobenzene is freely soluble in alcohol and has a yellowish tinge similar to some alcoholic beverages, accidental intake of mixed solutions is quite possible.

In the second case, the deceased was working in a photostat shop. The ink of the photostat machine contains nitrobenzene compound. The deceased was in a state of depression as he was suffering from carcinoma of tongue. On the fateful day, he consumed alcohol first, and then consumed the ink to suicide. Suicidal poisonings have occurred in the past from the ingestion of compounds containing nitrobenzene.^{13,14} A case of suicidal poisoning by flowering stimulant containing nitrobenzene has been reported.¹⁵ Another rare case has been reported in which nitrobenzene containing India ink was injected into the medial cubital vein with suicidal intent.¹⁶

In the third case, there was allegation by the deceased person's brother that two other persons had killed the victim by administering poison. There was nothing suggestive of forceful feeding or struggle marks over the body, at autopsy. Hence it is possible that nitrobenzene was given along with drinks when the person was already under the influence of alcohol. It is unlikely that a person who is fully conscious and alert can be administered the compound containing nitrobenzene surreptitiously, because of its pungent odour and pale yellow colour. There are no other reports of nitrobenzene having been used for homicidal purposes, although it has been used as an abortifacient.²

Symptoms of nitrobenzene ingestion include burning taste in the mouth, numbness of the tongue, salivation, nausea, vomiting, diarrhoea, giddiness, throbbing headache, marked cyanosis, cold and moist skin, weak and rapid pulse, hurried breathing, drowsiness and coma. The pupils get constricted at first, and then dilated. Urine becomes dark coloured. Convulsions may occur before death. Gastrointestinal toxicity may result in hepatosplenomegaly, jaundice and altered liver functions. Haematological toxicity may show methaemoglobinaemia, haemolytic anaemia, and Heinz bodies.

Symptoms resulting from inhalation of nitrobenzene vapour are almost precisely the same as those produced when swallowed. There is also intense cyanosis and a smell of bitter almonds on the breath.^{1,2,17}

In this report, all the three cases detailed were brought to the casualty in an unconscious state. Case numbers 1 and 3 had episodes of vomiting. Case 3 had dilated pupils. Case 2 had cyanosis. Case 3 had bradycardia and cardiac arrest. Case 1 had metabolic acidosis and respiratory distress. The symptoms which were present were non-specific except for cyanosis which is a typical finding in cases of nitrobenzene poisoning, as methaemoglobinaemia commonly occurs. This happens when nitrobenzene oxidizes ferrous ion of haemoglobin to ferric state (Fe³⁺), resulting in decreased binding and delivery of oxygen by red blood cells.¹⁷ It is a potentially fatal condition.

The fatal dose of nitrobenzene is said to be about fifteen drops, and the MAC in air is about 1 ppm. Death usually occurs within six to seven hours of ingestion.² In the first case, death occurred after 2 days of ingestion. However, the quantity consumed was not known. In the other two cases, death occurred within 7 hours and 4 hours after ingestion respectively.

At autopsy, the following findings are suggestive of nitrobenzene poisoning. The smell of nitrobenzene is discernible on opening the cavities, but in our reports we were unable to clearly detect the characteristic smell. All the organs are expected to be congested. The mucous membrane of the stomach and duodenum will be diffusely reddened, and occasionally show patches of ecchymosis. The blood is likely to be chocolate-coloured due to the presence of methaemoglobin. Liver and kidneys may show degenerative changes.²

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