

Formalin, a Rare Suicidal Poison – A Case Report

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Abstract: As a general rule ideal suicidal poisons should be tasteless or pleasant in nature and capable of being easily taken in food or drink. Formalin has selective availability, strong taste and pungent odor. Formalin is an aqueous solution of formaldehyde containing 37-40% formaldehyde and 10-15% of methanol. Due to its reactive and unstable nature formaldehyde generally marketed in aqueous solution. Formalin is a protoplasmic poison and potent caustic substance; it causes coagulation necrosis, precipitation of protein, fixation of tissues and stabilizes the structural details of the cells. Ingestion of formalin and inhalation of fumes causes immediate deleterious effects on different systems of body. These properties of formalin generally serve a sufficient warning for suicidal intake in comparison to other poisons. That is why formalin is a very unusual suicidal poison to be taken. We, herewith, present a rare case of acute poisoning in a 51-year old man who committed suicide and was found dead in his office godown and brought for autopsy to the mortuary of SIMS, Shimoga. Detailed examination, investigation and circumstantial evidences revealed features suggestive of formalin poisoning. The interesting findings of the case are discussed in this article.

Keywords: Formalin, Ingestion, Suicide, Corrosive Effect on Body

I. Introduction

Formaldehyde is a gas at room temperature. Due to its reactive and unstable nature formaldehyde generally marketed in aqueous solution. Formalin is an aqueous solution of formaldehyde containing 37-40% formaldehyde and 10-15% of methanol which acts as a stabilizer and prevents oxidation and polymerization of formaldehyde. It is, however, generally referred to as 100% formalin. The commercial preparation usually contains 3.7% of formalin [1].

In daily practice it is mainly used as a preservative, disinfectant, tissue fixative, hardening and reducing agent, in embalming fluids etc. Formaldehyde is also found in cigarette smoke and can be formed in the environment during burning of household waste. Very little amount of formaldehyde is actually found in human body. Formalin is a protoplasmic poison and potent caustic substance; it causes coagulation necrosis, precipitation of protein, fixation of tissues and stabilizes the structural details of the cells. Since it is easily available in biological laboratories and medical colleges, accidental poisoning is common at these places in comparison to suicidal intake.

Acute exposure to formaldehyde can affect all the organ systems in various ways. If it is inhaled it is capable of causing burning sensation of eyes, lacrimation and other features similar to asthma like violent coughing, and constriction of chest leading to severe choking sensation etc. Ingestion of this chemical can cause quite a similar kind of effects like corrosive strong acids. Even in simple dermal contact also it can produce cracking, bleeding, and contact dermatitis. Occupational exposure is the main mode of chronic poisoning. Other than production of different respiratory complications like chronic obstructive pulmonary disease, reduction in ventilator capacity, due to presence of mutagenic and carcinogenic potential even it can cause nasopharyngeal cancer [11]. The International Agency for Research on Cancer (IARC) has classified formaldehyde as group 1 known human carcinogen in June 2004 [5].

The cumulative effects of ambient, residential, occupational, and food exposure to formaldehyde have resulted in adverse human health effects. There have been many documented cases of formaldehyde exposure from polluted air, water and contaminated food in the past two decades. Many of these have resulted in negative health outcomes, and public concern regarding the health effects of formaldehyde exposure. But there is not much noteworthy information in literature of forensic toxicology on cases of suicidal formalin poisoning. Hence, a case of suicidal ingestion of formalin by a 51-year-old male is reported due to its rarity.

II. Case Report

An elderly unmarried male aged 51 yrs was brought to the mortuary for autopsy with alleged history of consumption of unknown substance at 12:00 pm on 24-07-14 and found dead at his office godown. As per history he was suffering from deep mental agony since past few months and many time expressed his suicidal thoughts to his brother. After crime scene investigation one jar half filled with formalin solution was obtained.

On external examination body was of an adult male, moderately built and nourished measuring 166cm in length, weighs 55kg. Rigor mortis was present all over the body. Livor mortis was present over back of the body and fixed. Lips were blackened and hardened. Blackening of the buccal mucosa was present. Tongue was also hardened. Odor was emitting from body and it was irritating to eyes and nose. No demonstrable external injuries were present over the body.

On internal examination larynx and trachea showed grayish black discoloration and food particles were present. Laryngeal edema was also present. Lungs were partially fixed and hardened and cut-section emits vapors irritating to eyes and nose (fig-1). Heart was also hardened and epicardial hemorrhage was present on the inferior surface of left ventricle (fig-2). Cut open esophagus showed blackening and signs of corrosion (fig-3). Stomach was hardened and tough in texture with lather bottle appearance (fig-4). All the rugosities of the stomach were lost. Mucosal folds of the small intestine were distinctly marked and greyish black in color. There was 200 ml of brown colored fluid with some food particles, formalin smell was present. Diaphragm was partially fixed.

Routine Viscera and blood was subjected to toxicological analysis which revealed presence of formaldehyde compound. Final opinion: Death due to consumption of formaldehyde containing compounds.



Fig-1



Fig-2



Fig-3



Fig-4

III. Discussion

Exposure to formaldehyde mainly occurs via the route of inhalation and ingestion. Inhalation presents with asthma like symptoms like coughing, lacrimation, dyspnea, chest pain and wheezing. On the other hand Ingestion may show features of severe abdominal pain, vomiting, diarrhea, tachypnea, and hypotension [1]. These are due to the contact of the irritant with the mucosa and due to the corrosive nature of the formaldehyde. They result in ulceration and necrosis of the tissues resulting in complications. Clinically, it is manifested in the form of abdominal cramps, vomiting, hematemesis, malena and altered gut motility [8, 9, 10].

When the mode of exposure is ingestion, it is a definite fact that stomach being the main organ of digestion, suffers the most severe damage in these cases. As formalin comes in contact with the gastric mucosa longer than other parts of the gastrointestinal tract, the ingestion of formalin can lead to chemical peritonitis even without perforation [2]. Due to its fixative property it can precipitate proteins. The "fixing" of the stomach by formaldehyde may produce delayed absorption following formalin ingestion [3]. Formaldehyde is a corrosive material that can produce late sequel similar to the more common ingestion of acids and alkali [4]. Skin and mucous membrane may appear whitened [1].

During post mortem examination the smell of formalin might be noticed after opening the body. Odor of formalin may be present in the stomach. Cut section of lung can emit vapors irritating to eyes and nose. The mucous membrane of the stomach may be red, inflamed and eroded with the extravasation of blood, or may be leathery, fixed, and hard to touch as seen in our case [4]. The duodenum may present the same appearance as that of the stomach and histological details may be well preserved. In addition, renal failure is a frequent complication in this poisoning due to metabolic acidosis. Kidneys may also reveal microscopic evidence of acute tubular necrosis [1].

Once absorbed formaldehyde is very quickly broken down and almost every tissue is capable of breaking down the formalin. It gets converted to a chemical called formate, which is nontoxic in nature. This is usually excreted in urine and eliminated from the body. It is also converted to carbon-dioxide and removed from the body. Retention of formaldehyde vapors in the systems can be toxic, allergenic and carcinogenic [5].

The most important effect of formalin on the respiratory system is due to the unpleasant smell [6]. Acute exposure of formalin adversely affects pulmonary system. It may decrease vital capacity much more as compared to other pulmonary parameters. This may be attributed to bronchoconstriction [7].

IV. Conclusion

Formalin has selective availability, strong taste and suffocating odor. These properties of formalin generally serve a sufficient warning for suicidal intake in comparison to other poisons. That is why formalin is a very unusual suicidal poison to be taken. Hence it is reported in this article.

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