Aluminum Phosphide Poisoning and Blast in Gastric Tube: A Rare Phenomenon - A Case Report

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Abstract
Aluminum Phosphide (ALP) is a highly toxic fumigant which is used commonly as an indoor pesticide in agriculture based industry for storage of grains. ALP on ingestion reacts with a gastric water and release phosphine gas, which is highly flammable, and very toxic in nature. Over the last few decades ALP has emerged as an agent of choice being used as suicidal poisoning in a country where it is readily available. The high mortality rate is due to severe mitochondrial dysfunction leading to disruption of cellular respiration, causing tissue hypoxia and organ dysfunction. Despite long research no specific antidote could be developed and the treatment remained supportive. Spontaneous ignition of phosphine (PH3) is a rare but very peculiar phenomenon reported in the case of aluminum phosphide poisoning. Here we share our experience in a case of phosphine (PH3) poisoning, which presented with spontaneous ignition and blast during treatment which caught the attention of local and national media in India.

Keywords: Aluminum phosphide; Pesticide; Spontaneous ignition; Phosphine; Antidote

Introduction
Suicide by poisoning is the second most common cause of death by suicide (27.9%) as per The National Crime Records Bureau (NCRB) India in 2015 [1]. Aluminum Phosphide (ALP) is the leading agricultural poison used to commit suicide as where its availability is not properly regulated [2]. Aluminum Phosphate (ALP) is a highly toxic solid fumigant pesticide, rodenticide and insecticide. It is commonly used as outdoor and indoor pesticide in developing countries like India, Pakistan, Sri Lanka and Iran because it is a cheap, effective, free from toxic residue and do not alter the viability of seeds [3-7]. In India it is marketed as a tablet in the name of Alphos, Celphos, Quickphos, Phosphotek, Phosphume etc., and available as dark brown or grayish green tablet of 3 g each and also available as pellets, granules and as powder, sealed in tens and twenties in airtight aluminum containers [8].

Each tablet is composed of pure ALP (active ingredient 56%) and ammonium carbamate/carbonate/urea (inert ingredient 44%) which release CO2 and NH3 gases which prevents the self-ignition of phosphine gas. On coming in contact with moisture each (3g) tablet of aluminum phosphide liberates 1g of phosphine gas, which is the toxic principle of ALP poisoning [7]. The fatal dose of ALP is around 0.5 g and acute poisoning with ALP occurs either due to intentional ingestion of an ALP tablet for committing suicide or accidental inhalation of PH3 gas. Death has been reported when people were travelling in fumigated boxcars containing grains fumigated with aluminum phosphide [7].

Phosphine gas is highly flammable and very toxic in nature [9,10]. Phosphine on coming in contact with atmospheric air may ignite spontaneously and burn with white fumes causing health hazards such as burns in poisoned patient as well as in health care professionals [11,12]. The purpose of present this case study is to spread awareness among emergency physicians and staff regarding rare but dangerous complication of ALP intoxication which liberates phosphine.

Case Presentation
A 40 year old woman was brought by police to the emergency section of the J. N. Medical College Hospital Aligarh from a town about 20 Km away from the city Aligarh with alleged history of ingestion of some unknown poisonous substance. On arrival she was very drowsy and was not responding to verbal stimuli (EMV-8). Her extremities were cold and hypotonic, and her
such as the diphosphine (P₂H₄) [11,13]. It is generally believed to be the presence of traces of diphosphine which increases the risk of 'garlic' or 'rotten fish' because of the presence of trace impurities available preparation of ALP tablets has a noticeable odor similar to the cells [14]. PH₃ further inhibits myocardial cellular metabolism by protein denaturation of cell membrane, finally causing hypoxic injury of the cardiac tissue, resulting in the release of reactive oxygen intermediates, which leads to refractory cardiac muscle necrosis and this cause's high mortality rate [16,17].

The pure phosphine gas itself is odorless, but a commercially available preparation of ALP tablets has a noticeable odor similar to 'garlic' or 'rotten fish' because of the presence of trace impurities such as the diphosphine (P₂H₄) [11,13]. It is generally believed to be the presence of traces of diphosphine which increases the risk of spontaneous ignition of phosphine/air mixtures at room temperature.

Phosphine and diphosphine are highly flammable gas, which may ignite spontaneously when its concentration exceeds its lower explosive limit of 1.8% volume by volume (v/v) in air [20-25]. If an air/phosphine mixture, in which the phosphine concentration exceeds this level, is ignited in an enclosed space, then an explosion like situation develops. The self-ignition temperature of phosphine gas is reported by some sources to be as low as 38°C [11,20].

When phosphine burns, it produces a dense white cloud of 'phosphorus pentoxide', a severe respiratory tract irritant. ALP is incompatible with oxidizing agents, which means it induces adverse reactions [22]. Potassium permanganate is recommended in ALP poisoning to convert phosphine to phosphate [26], but it is an oxidizing agent and when in contact with organic matter, it is reduced to manganese dioxide and the very corrosive potassium hydroxide [20,26,27]. This reaction is also exothermic and may have contributed in increasing injury as well as the occurrence of ignition events. Even though it is suggested that negative pressure during gastric suctioning may contribute to the ignition [27,28].

Conclusion

The present case report stresses on the need that the emergency physicians need to be highly alert and adequately prepared while handling such patients. Spontaneous ignition with the release of phosphine from ALP poisoned patients can affect not just the patient, but also pose a health hazard to emergency physicians and medical staff.

Forensic pathologist should take into the consideration that the signs of burn in the face and neck of the deceased may not mislead at autopsy.

References