

Aluminum Phosphide Intoxication

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Abstract

Phosphine gas is a gas that is frequently used as rodenticide and insecticide due to its high diffusion capacity and the absence of residues in agricultural products. Since this gas is highly toxic, it is found in our country as aluminum phosphite tablets impregnated with clay, these tablets emit phosphine gas when they meet with the moisture in the air or gastric hydrochloric acid. Mortality rates in aluminum phosphite intoxications are 40-80% depending on the exposure dose. There is no control mechanism in the supply of aluminum phosphide tablets which are so dangerous and no information is given about the serious conditions that may occur during the use of these tablets. A 2 month old baby, whose family practiced drying pepper-eggplant, was reported to have been exposed to phosphine gas by inhalation, admitted to hospital with vomiting and cyanosis and lost his life within 24 hours. We present our case, who lost his life due to erroneous usage of aluminum phosphite, with additional emphasis on early diagnosis, treatment and gathering sample for toxicologic analysis, with corresponding forensic and medical documents.

Keywords: aluminum phosphide, autopsy, toxicology, intoxication

Özet

Fosfin gazı difüzyon kapasitesinin yüksek olmasından ve tarımsal ürünlerde kalıntı bırakmamasından dolayı rodentisit ve insektisit olarak sıklıkla kullanılan bir gazdır. Bu gaz oldukça toksik olduğundan preparat olarak kile emdirilmiş alüminyum fosfit tabletleri olarak ülkemizde bulunmakta, bu tabletler havadaki nem ya da mide de hidroklorik asit ile karşılaştığında fosfin gazı ortaya çıkmaktadır. Maruz kalınan doza bağımlı olarak alüminyum fosfit intoksikasyonlarında mortalite oranları %40-80 olarak belirtilmiştir. Bu kadar tehlikeli olan alüminyum fosfit tabletlerinin temininde ülkemizde herhangi bir kontrol mekanizması olmadığı gibi bu tabletlerin kullanımını sırasında oluşabilecek ciddi durumlar hakkında herhangi bir bilgilendirme de yapılmamaktadır. Ailesi biber-patlıcan kurutuculuğu yapan 2 aylık bebeğin inhalasyon yoluyla fosfin gazına maruz kaldığı, kusma ve morarma şikayetleriyle hastaneye kaldırıldığı ve 24 saat içerisinde hayatını kaybettiği bildirilmiştir. Bilinçsiz kullanılan alüminyum fosfite bağlı gelişen intoksikasyon sonucu hayatını kaybeden olgumuzu erken tanı-tedavinin ve toksikolojik inceleme için örnek alınmasının önemi vurgulanarak adli ve tıbbi belgeler eşliğinde sunuldu

Anahtar kelimeler: alüminyum fosfit, zehirlenme, otopsi, toksikoloji

Introduction

Aluminum phosphite tablets are frequently used to protect stored agricultural products from rodents and insects¹. The most common cause of aluminum phosphite poisoning is suicide attempts and it is followed by accidental intoxications. This preparation has recently been identified as one of the most commonly used agents in suicide attempts in Iran². Likewise, in a study conducted in India; organophosphate poisonings were found to be the most common cause of poisoning cases until 1982, while aluminum phosphite poisoning became the most common factor in the period after 1982³.

As a result of a series of chemical reactions after aluminum phosphide tablets come into contact with air or encounter with gastric acid; highly toxic phosphine gas occurs. Phosphine gas in general inhibits cytochrome c enzyme, disrupts the use of oxygen at the cellular level and causes an increase in free oxygen radicals. This may result in multiple organ failure and death⁴⁻⁵. Despite good ICU follow-up, the mortality rate is high in the patients who are admitted to the hospital late and the exposure dose is high and this ratio is 40-80% in the literature⁶⁻⁷.

We will present a 2-month-old infant case who was exposed to intoxication as a result of unconsciously used aluminum phosphide tablets in the presence of autopsy reports, forensic and medical documents.

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Case Report

When the forensic and medical documents of the patient was examined; it was seen that the 2-month old baby was admitted to hospital with vomiting and bruising. It was learned that the baby's family were making dry eggplant and pepper trade. They put pesticide (aluminum phosphite) tablets just twenty four hours ago onto the dried vegetables with fumigation purposes in the room next to the room where they slept. It was learned that the baby was vomited within 5-6 hours after the tablets were placed and then he was put to sleep by his mother. It was learned that the baby's father had resistant vomiting starting in a few hours after putting the tablets and that he was admitted to hospital and received treatment for intoxication. Twelve hours after the administration of the tablets, it was reported that the baby was admitted to the hospital after the bruising. It was reported that cardiac arrest developed shortly after admission and the baby died at the second hour of admission.

In the crime scene review; it was reported that there was a smell similar to intense garlic smell at home. It was seen that there were dry vegetables next to the room where the beds were located, and it was also recorded that "Dephos" written packaging was found on the floor of the room where those vegetables were dried.

In the baby's autopsy report; no prominent pathology was detected other than single petechial hemorrhage in the scalp, on the surface of the heart and in the lungs. Blood, urine and adipose tissue samples were taken for toxicological examination and tissue samples were taken for histopathological examination. In toxicological examination; no substances in the systematics of the Chemical Specialized Department of Forensic Medicine Institute (including pesticides) were found. Histopathological examination revealed no special features other than intraalveolar fresh hemorrhage. As the exact cause of death could not be determined; it was reported that the Council of Forensic Medicine should be consulted by the First Specialized Board of Council of Forensic Medicine.

In the case of the the First Specialized Board of Council of Forensic Medicine; the death of the infant was recorded to be as a result of exposure to an unpredictable toxic substance (insecticide) when macroscopic and histopathological findings in the autopsy of the baby, crime scene investigation and baby's father to be treated with the diagnosis of poisoning were taken all together.

Discussion

Deaths due to aluminum phosphide poisoning are frequently reported in Iran and India²⁻⁴. These deaths in the US and Europe are very rare due to the limitation of the use of this preparation and the conscious about its use. In our

country, although not as frequent as Iran and India, aluminum phosphide poisoning cases are reported¹³.

Phosphine gas, which is quite toxic, is frequently used as an effective insecticide because it disrupts the developmental stages of all living things in the environment at various levels⁸. It is found in our country as aluminum phosphite tablets impregnated with clay as a gas preparation. When these tablets encounter atmospheric or gastric acid, phosphine gas is produced by a series of chemical reactions^{5,9}.

Phosphine gas is colorless and odorless in its natural form. In commercial forms, it has the smell of rotten fish or garlic with some additives¹⁰. In our case, it was reported that there was intense garlic smell at home.

The most important factors affecting mortality and morbidity in aluminum phosphite poisoning are the amount of intake, the mode of administration (inhalation-oral) and time of hospital admission¹¹. Symptoms of poisoning include nausea, vomiting, restlessness, abdominal pain, palpitations, refractory shock, cardiac arrhythmias, pulmonary edema, shortness of breath, cyanosis and sensory changes⁷⁻⁹. Cardiovascular collapse, ARDS (acute respiratory distress syndrome) and neurological complications are expected in the early period. Rarely, DIC (Disseminated Intravascular Coagulopathy), pancreatitis, hypoglycemia and multiple organ failure findings are observed. The main step of treatment is the early application to the health institution and the intensive care support¹¹. In our case; Cardiovascular collapse and cardiac arrest were developed in a short time after the baby was brought to the hospital with cyanosis, vomiting and poor general condition. We think that high exposure as inhaler and late detection of poisoning by family had strongly contributed to the death of baby.

In our country, aluminum phosphite exposure is generally caused by suicide, but rarely by accident. Because clinical findings are non-specific, anamnesis is important in diagnosis¹¹. In a case report of Demir et al.¹², 20-year-old patient who drunk aluminum phosphate with suicide purpose; no significant features were found in the autopsy. The toxicological analysis revealed high levels of aluminium in gastric fluid and sulfonic acid in muscle samples. In the autopsy of our case; no obvious pathology was found except single petechial hemorrhage in the scalp, heart surface and lungs, and toxicological examination revealed no insecticides in blood, urine and adipose tissue. The fact that the age of our case was very small (2 months), the exposure was through inhalation and not taking sample for toxicological examination from lung tissue prevented the determination of the factor. When the findings in the investigation of the crime scene, the baby's autopsy findings, the application of father a few hours before the baby to the hospital with signs of intoxication and the anamnesis given by the family were evaluated together; we believe the death of the baby was due to aluminum phosphite poisoning.

Conclusion

The investigation of the crime scene, taking the appropriate samples and specifying these examples in detail are very important. In this case, it will be possible to perform a specific study and be able to diagnose the exact diagnosis. In addition, it is important to know the systematics of the toxicology laboratory, the factors which have been studied, and to ensure the specific study of the agent if necessary. If the appropriate sample was taken from the scene and work could be done for the suspected agent, the exact cause of death could be mentioned.

As a result of the unconscious and carelessly use of aluminum phosphite in the living area and late application to the health institution caused the death of a 2-month-old baby in our case report.

Restriction of aluminum phosphite procurement, strict control of its use and making necessary warnings when given to the user will reduce aluminum phosphite intoxications and related mortality and morbidity.

Intoxication should be kept in mind in the presence of similar symptoms that occur suddenly in more than one person living in the same household. Health institutions should be consulted as soon as possible and health workers should be informed.

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