ORIGINAL ARTICLE

PREVALENCE OF ALUMINUM PHOSPHIDE INTOXICATION AMONGST VICTIMS OF POISONING – FORENSIC MEDICINE AND TOXICOLOGY REGISTRY DATA

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ABSTRACT

Objectives: To study the prevalence of aluminum phosphide intoxication reported to Forensic Medicine and Toxicology Department.

Material and Methods: Retrospective chart review was conducted on the victims of aluminum phosphide poisoning out of the total autopsies conducted at the Department of Forensic Medicine and Toxicology, Khyber Medical College, Peshawar, from January 2019 to December 2019. The cases were identified on the basis of postmortem findings, laboratory results and the police inquest report. SPSS 20.0 was used as a statistical tool for the study.

Results: A total of 940 cases of poisoning were received, out of which 99 were of aluminum phosphide intoxication making a percentage of 10.5%. Amongst these 70 were females and 29 were males. The most commonly affected age group is 11-20 years among females and 21-30 years among males and intoxication was more common in rural than in urban areas.

Conclusion: Aluminum phosphide (wheat pills) is one of the most commonly used substance for poisoning among young people. More prevalent in rural areas, due to easy availability with a maximum number of cases received in the month of December.

Keywords: Postmortem, Toxicology, Intoxication, Aluminum Phosphide

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INTRODUCTION

Metal phosphides such as aluminum phosphide is a potent insecticide. Aluminum phosphide (ALP) and zinc phosphide are highly effective fumigant pesticides which are used throughout the world to protect grains and rice from rodents and pests [1,2]. ALP exists as yellow to gray granules or powdered solid, formulated as tablets or powder sachets, the lethal dose of ALP is 1-1.5gm. It is cheaper and easily available in market with the brand name of Celphos, Alphos, Quickphos, Phostoxin, Phosphotex. Due to its properties it is being used in the developing countries as an effective grain fumigant [2].

When it comes in contact with moisture, Phosphine gas is liberated which is very toxic and lethal for the insects, pests and rodents. Pure phosphine gas is colorless and odorless but technical grade phosphine has odor similar to decaying fish or garlic since impurities are added to it during the manufacturing [2,3-5]. It is very harmful for human beings due to lethal effects, after oral ingestion of aluminum phosphide it enters into the circulation. Phosphine produces unrestricted organ damage due to cellular hypoxia resulting from its binding to Cytochrome oxidase[6]. The interference with trans-membrane exchange of electrolytes causes acute cardio toxicity and may lead to focal myocardial necrosis. No antidote is available for phosphine gas poisoning and majority of the patients do not survive [7,8].

Phosphides do not possess any danger to the population if used properly. Accidental and intentional poisoning due to phosphides is dangerous [9]. Many countries use the legal regulation of pesticide trading and utilization in order to prevent deaths associated with the toxic compounds. ALP containing tablets are banned in Iran by the authorities since 2007 [10].

In 2008, the number of deaths due to poisoning exceeded the deaths resulting from road traffic accidents and was considered the main cause of death for the first time since 1980. In the past three decades, the death rates due to poisoning increased to almost three folds [11]. The easy availability and toxicity of poisons and the poor health care services in the developing countries shows a high mortality rate of suicidal poisoning 10-20% even in industrialized countries [12]. In the rural areas of Sri Lanka, pes-

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ticides poisoning is the most common method of suicide [13], which is highly lethal [14] and stands fifth leading cause of death. In Pakistan very little data is available regarding aluminum phosphide poisoning but still it is labelled as the second commonest cause among unintentional injuries in a national health survey of Pakistan [15-18].

Low survival rate after ALP poisoning and the scale of deaths related to poisoning is on rise in Pakistan [4,7-19], this was the reason to conduct the present study in Forensic Medicine department, KMC, Peshawar, Pakistan. The drive to conduct this study was to define phosphine related deaths in KPK, Pakistan. Our aim to perform the present study was to include the results of toxicological analysis, demography, age group, gender, seasonal variation and trends of ALP poisoning and its prevalence.

MATERIAL AND METHODS

A Retrospective chart review was conducted at the Department of Forensic Medicine, Khyber Medical College Peshawar, Pakistan, after approval from Institutional research and ethical board, from 1st January 2019 to 31st December 2019. All cases of aluminum phosphide poisoning, including both genders and covering all age groups brought to the department and whose record was available were included in the study. Intoxication due to other poisons and reasons was excluded. External and internal examination of the body was conducted. The internal examination included systematic toxicological analysis performed on liver, stomach contents and blood collected during autopsy. The final opinion of phosphine poisoning was based on history given by relatives, autopsy findings, hospital records and the toxicology reports. The collected data was entered on a pre-designed proforma and the results were summarized as tables and figures after entering the data in SPSS 20.0.

RESULTS

A total of 940 cases of poisoning were reported to the department for toxicology during 2019, out of which 99 cases were of aluminum phosphide poisoning. Out of the total of 99 cases of aluminum phosphide poisoning 29 (29.29%) were males and 70 (70.7%) were females. Shown in figure-1. The commonly affected age group of victims was between 11-20 years among females and 21-30 years among males, making a highest percentage of 36% and 12% respectively. Followed by 21-30 years in females (30%) and 11-20 years in males (8%) given in Table-1.

Majority of the postmortems were conducted during December 13 (13.1%) followed by October 11 (11.1%) shown in Figure-2. Highest number of cases were received from Swat that is 33 (33.3%) followed by Kohat 12 (12.1%), detail of other districts is shown in Figure: 3.

Table 1: Age and gender distribution of victims of Aluminum phosphide intoxication

Gender	Age Group (years)				
Years	11-20	21-30	31-40	Above 40	Total
Male	8 (8.08%)	12 (12.12%)	7 (7.07%)	2 (2.02%)	29
Female	36 (36.36%)	30 (30.30%)	4 (4.04%)	0	70
Total	44	42	11	2	99

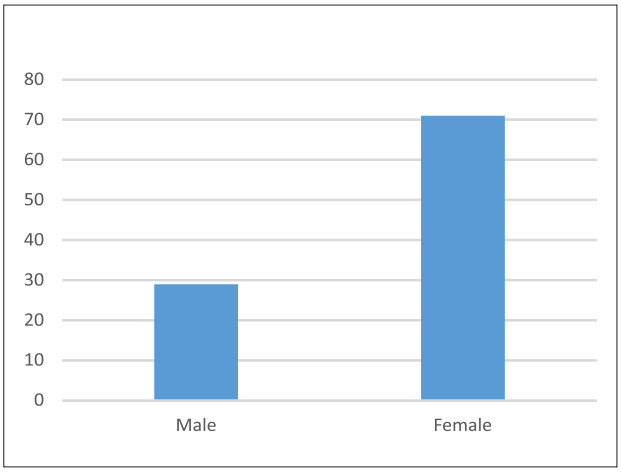

Fig 1: Gender distribution of victims of Aluminum phosphide intoxication

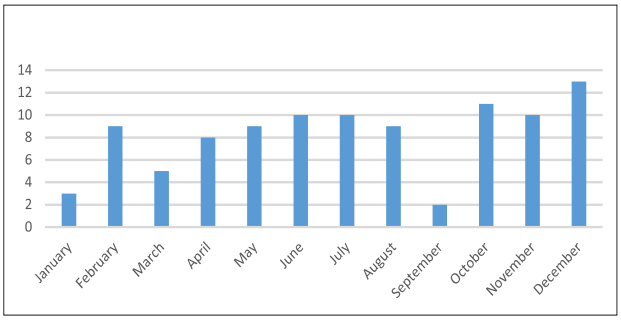

Fig 2: Monthly distribution of victims of Aluminum phosphide intoxication

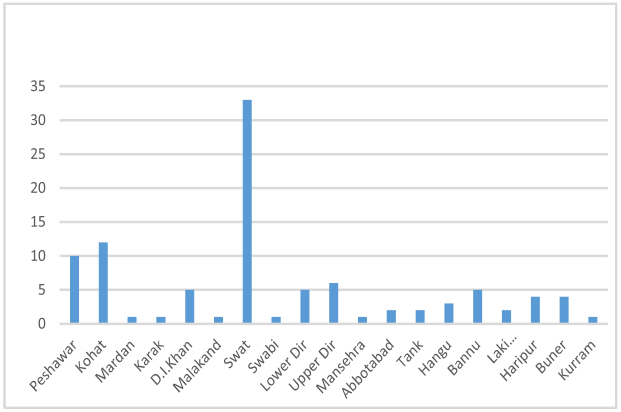

Fig 3: District wise distribution of victims of Aluminum phosphide intoxication

DISCUSSION

Poisoning is a common public health problem all over the world since a long time, occurring all over the world and affecting people of all walk of life. It is reported that almost 700 people die from poisoning everyday all over the world [20]. The incidence of pesticides poisoning in developing countries is reported to be 13-fold higher as compared to the developed countries [21,22].

The purpose of this study was to inspect phosphine related deaths in KPK. Poisoning as a result of accidental or intentional ingestion of ALP is a common medico-legal issue in Pakistan. In European countries ALP is available only to qualified users, hence suicide by ALP is rare [23]. In the current study phosphine was detected in biological samples with other drugs in Forensic Medicine and Toxicology Department KMC, Peshawar. Phosphine is very volatile and can evaporate from the body during autopsy and due to decontamination, which can give negative results, death due to other poisons can also give negative reports.

The study included 940 victims of poisoning, aluminum phosphide was detected in 99 cases, with 70 female and 29 male. Risk factors maybe underreported, several studies have described a strong association between suicide and mental or physical illness [24-27]. Deaths due to poisoning being more common in females due to the psychological stress, pressure from in-laws and lack of education, which coincides with the studies conducted at China, Japan and Austria. Majority of the victims comprised of younger age groups 21-30 years in males and 11-20 years in females which is in accordance with studies conducted in six major cities of Pakistan [28]. Loss and personal conflicts being the common identifiable life events precipitating suicidal nature. The prevalence of majority of the cases of poisoning was in December in our study, however many cases were received during the hot months of summer, which was also reported in a study conducted in Faisalabad, a major agricultural city of Pakistan [28].

Adequate law enforcement in the sale and distribution of dangerous drugs and addictive medicines and creating awareness amongst the society especially the young generation through mass media, are one of the few goals to be set on a serious note, which will help reduce the number of deaths due to ALP poisoning. The time interval between poisoning, the dosage and time taken to come to hospital has a significant influence on the outcome of ALP poisoning. The formulation of 3gm tablets to 10gm powder in sachets has resulted in a decline in mortality rate in India [29]. The mortality rate depends on the number of survivors reported in the hospital. Negligible legislation for undue propagation of media with minimal implementation results in negative solutions such as suicide or homicide to even minor problems faced by emotionally immature minds.

CONCLUSION

Aluminum phosphide (wheat pill) is a dangerous and lethal poison and the symptoms progresses quickly to death and there is no antidote for this poison. Pakistan being an agricultural country, with low income and easy availability of wheat pills is the leading cause of ALP. There is a need to substitute safe agents instead of phosphides for preserving grains. Emphasis should be made on the fact that ALP is a lethal poison with low safety and high mortality rate. In our study concluded that intentional poisoning was common amongst young adults. There is insufficient data regarding the exact frequency and therapeutic measures of wheat pill poisoning, therefore large-scale studies are required to improve survival from exposure to this dangerous poison. Proper legislation is also required for strict control on the purchase of this lethal drug.

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AUTHOR'S CONTRIBUTION

Following authors have made substantial contributions to the manuscript as under

Malik B: Concept and critical review.

Saleem K: Acquisition and proof reading.

Afridi HK: Analysis and interpretation of data.

Khan R: Final approval.

Zaman MU: Data collection.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.