ORIGINAL ARTICLE

THREE YEARS ANALYSIS OF POISONING CASES OF FORENSIC MEDICINE TOXICOLOGICAL LABORATORY, KHYBER MEDICAL COLLEGE, PESHAWAR

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Background: Poison is defined as any substance which harms, endangers or even kills a person irrespective of the quality or quantity. Pakistan is a developing country and farming is the major occupation of the majority of the population. Due to the easy availability and increased use of pesticides, the accidental and suicidal poisoning is very common. The objective of the study is to find out the most common poison used by the people in the general population and its frequency in our setup. **Methods:** The present cross-sectional study with retrospective data collection was undertaken in the Department of Forensic Medicine, Khyber Medical College (KMC) Peshawar to determine the frequency of different poisons detected in various samples brought to the toxicological laboratory. A three-year data (1stJanuary 2014 to 31 December 2016) was retrieved from Forensic Laboratory of KMC, Peshawar. Different methods were used for the detection of poisons. All the cases coming from Khyber Pakhtunkhwa province were included whereas; cases from other provinces were excluded. **Results:** The study revealed that poisoning was more common among females and the most common age group affected was 21–25 years. The incidence of positive cases was more in Peshawar district followed by Swat district. The common poison detected was phosphine (wheat pill). Conclusion: Female and young people from Peshawar and Swat are more prone to Aluminum Phosphide (wheat pill) poison. It is a dangerous and lethal poison, so healthcare workers at emergency department ought to be prepared for such cases. Furthermore, its routine use as a domestic pesticide has to be strictly prohibited by creating awareness among the public.

Keywords: Aluminum Phosphate; Poisoning; Phosphine; Wheat pill; Homicide; Suicide

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INTRODUCTION

Poison is defined as any substance that can cause severe organ damage or death if ingested, breathed in, injected into the body or absorbed through the skin. Poisoning is a concept of any substance acting chemically in the body tissues to cause disturbance of both physiology and biochemistry of an individual leading to illness and even death.[1] It can be homicidal, accidental or suicidal.

Wheat pill or Aluminum Phosphide (AlP) poisoning is widespread in many parts of Asia like Afghanistan, India, Pakistan, Bangladesh, Sri Lanka, Nepal, Bhutan and Maldives. It is also known as "rice pill" in some parts of the world. It is widely used as a rodenticide to prevent the wheat and rice infestation in developing agricultural countries like Pakistan, India, Iran, Morocco and Nepal.[2] Aluminum Phosphide is an effective grain fumigant. It is well known for its easy availability and high potency against many insect species and leaves little residue on rice and other food grains.[3,4] Aluminum Phosphide is a common cause of acute poisoning and deaths in many developing countries, especially in Asia. It has high fatality rates (60–90%).[5–11]This substance has no effective antidote and the incidence of deaths due to its poisoning is increasing day by day. Phosphide is toxic because it produces phosphine gas in the presence of moisture in the air or water and in the presence of hydrochloric acid in the stomach. The produced phosphine is quickly absorbed through the digestive system when AlP is consumed orally. Therefore, if timely treatment measures are not applied, there is a risk of death.[12] The lethal dose of AlP for an adult weighing 70 kg is approximately 500 mg.[13] Phosphine is a respiratory poison. It inhibits mitochondrial oxidative phosphorylation by blocking cytochrome-*c* oxidase, inhibits cellular respiration, and results in multi-organ damage and death.[14] There is no specific antidote for phosphine gas poisoning and many patients do not survive despite intensive care.[15,16] The incidence is increasing as it is a cheap and readily available poison used for suicide.[2] Pakistan is a developing country and farming is the major occupation of the majority of the population. Due to the easy availability, low cost and increased use as pesticides, accidental and suicidal poisoning are very common. In Pakistan, the mortality rate from AlP poisoning is around 60–90%.[17] A detailed knowledge about the nature and magnitude of the poisoning cases is not only important for early diagnosis and prompt treatment but also it may

help to form policies to restrain the access of the population to certain toxic substances. The detail incidence of the cases must be known to the emergency department so that they should be well prepared for the coming cases. Therefore, this study aimed to find out the most common poison used by the people in the general population and its frequency in our setup as well as to find its association with demographic data.

MATERIAL AND METHODS

In this cross-sectional study, in which data was retrospectively collected, study. Three years data was retrieved from forensic Laboratory of Khyber Medical College (KMC), Peshawar (from 1st January 2014 to 31 December 2016). A *pro forma* was developed. Data, consisting of demography, type of samples/material, tests required/conducted and laboratory results were noted on the *pro forma*. All the cases coming from Khyber Pakhtunkhwa province were included in the study. Whereas cases from other provinces were excluded. The procedures used for detecting the poison were: Liquid poisons were analysed by High Performance/ Pressure liquid chromatography (HPLC) and gaseous poisons by Gas chromatography/ Mass spectrometry (GC/MS) and (GC-MS/MS). Atomic absorption spectroscopy was used for detecting metallic poisons. Liquid chromatography/ time-of-flight/mass spectrometry (LC/TOF/MS) was used for all the poisons generally. Fourier Transform Infrared Spectrometer (FTIR) was used for unknown poisons collected from the crime scene. The data was obtained after written permission of the head of the department. Confidentiality was ensured. The results were analysed on Microsoft office excel (VR 2016). Continuous variables were described as mean±standard deviation. Categorical data was presented as frequency, percentages in tables and figures.

RESULTS

A total of 796 suspected poison cases were received in the KMC Forensic laboratory during the period. Among them, 249 (31.28%) cases were positive for different types of poisons (Table-1). Their mean age was 23±2.54years. In positive cases, males were 123(49.39%) and females were 126(51.85%) (Figure-1 and Table-2). District wise study showed that maximum numbers of positive cases were detected from Peshawar District 104(31.3%), followed by Swat District 49 (14.8%) (Table-3). Among the type of poising, phosphine (wheat pill) was detected in 108 (43.37%) cases. Morphine and Benzodiazepine were found in combination in 16 (6.43%) cases. Benzodiazepine was found in 15 6.02%) (Table-4).

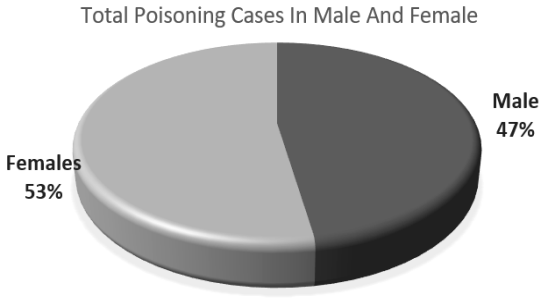

Figure-1: Percent distribution of cases of poising among male and female

Table-1: Total number of positive cases in three years, at KMC Forensic Laboratory, Peshawar

Year	Positive	Negative	Total
2014	76	171	247
2015	79	165	244
2016	94	211	305
Total	249	547	796

Table-2: Positive cases of poisoning in different age groups and gender (n=249).

Demographic variables	Year		
Gender	**2014**	**2015**	**2016**
Male	40	43	40
Female	36	36	54
Age groups (years)			
≤15	1	1	8
16–20	19	17	22
21–25	15	22	27
26–30	17	14	15
31–35	7	9	8
36–40	9	5	4
41–45	3	2	5
46–50	2	1	1
51–55	0	3	1
56–60	2	2	3
≥61	1	3	2
Total	76	79	94

Table-3: District wise distribution of cases of poisoning

District	No	%
Abbottabad	14	4.2
Bannu	13	3.9
Batagram	3	0.9
Bunner	8	2.4
Charsada	7	2.1
D.I. Khan	14	4.2
Dir Lower	11	3.3
Dir Upper	2	0.6
GhizarGilgit	3	0.9
Haripur	18	5.4
Karak	4	1.2
Kohat	19	5.7
Malakand	3	0.9
Mansehra	4	1.2
Mardan	6	1.8
Nowshera	10	3
Peshawar	104	31.3
Shangla	7	2.1
Swabi	23	6.9
Swat	49	14.8
Other	9	2.7

Table-3: Showing overall frequencies of different types of poising used by 249 subjects

Poison	Year			total	%
	2014	2015	2016		
Alcohol	2	1	4	7	2.81
Amphetamine	4	3	2	9	3.61
Amphetamine, Methamphetamine	1	3	3	7	2.81
Arsenic	3	0	1	4	1.61
Benzodiazephine	4	4	7	15	6.02
Benzodiazephine, Morphine, tricyclic anti-depressant	1	1	0	2	0.80
CO poisoning	1	5	5	11	4.42
Methamphetamine	0	2	5	7	2.81
Morphine	5	4	5	14	5.62
Morphine, Benzodiazephine	4	7	5	16	6.43
Morphine, Benzodiazephine, Barbiturate	0	2	0	2	0.80
Morphine, Benzodiazephine, THC	4	1	0	5	2.01
Morphine, THC	2	0	0	2	0.80
Organophosphate	3	4	4	11	4.42
Organophosphspho-organochlorine Antilice Compound	0	1	1	2	0.80
Phosphine (Wheat Pills)	32	35	41	108	43.37
THC	3	2	3	8	3.21
Tricyclic Antidepresant	1	1	0	2	0.80
Others	5	4	8	17	6.80
Total	75	80	94	249	100 %

DISCUSSION

A common method of suicide attempt in developing countries is pesticide poisoning.[4] Poisoning has been reported to account for 1.0–2.0% and 1.3% of deaths in developed countries and Iran, respectively. Aluminum Phosphide is a highly dangerous pesticide that is popularly referred to as rice tablets in Iran and wheat pill in other Asian countries.18 In this study, among 796 cases, 249 (31.28%) cases were positive for different poisons, while 547 (71.13%) samples didn't show any poison. Likely, mortalities due to hydrocarbons come among the leading causes in most of the developing countries. Poisoning in Pakistan was the second commonest cause of unintentional injuries in people aged five years and above is given by a national health survey. Forty percent of cases were related to poisoning in a hospital-based case series in Karachi, Pakistan. Among 5.6% overall mortality, the most common poison used was organophosphates.19 This is consistent with our study which concluded with 43.37% cases of white pill poisoning.

This study revealed that cases of phosphine were most prevalent, followed by benzodiazepines and morphine alone or in combination. This finding is consistent with a 7-year study done in Iran.[18] Muhammad R found organophosphorus as commonest poison (31.1%), followed by benzodiazepines (12.6%) and Aluminum Phosphide poisoning (8.7%) in acute cases of poisoning in the same city, Peshawar.[20] Besides AlP, benzodiazepine seems the 2nd most common causes of poisoning in this setup. The possible reason behind this is easy access to such chemicals. Similarly, cheap prices make them affordable too. According to research done in America, the use of opioids in combination with Benzodiazepine constituted the majority of Emergency Department visits involving non-medical use of psychotherapeutics. [21] This statement is further strengthened by Bachhuber MA *et al*.[22] In developed countries, the trend of substance abuse varies from developing regions. That is why, the causes of poisoning differ.

Our research showed the frequency of poisoning among females was more than males. This is at variance with a study done at the Hospital General de Tejupilco during the period 2009–2011[23] and in Rawalpindi[24]. However, it differs from another research done in Iran.[18] In male dominant society, like few countries of the Middle East and Asia, females are prone to more domestic violence and are cared less. Additionally, due to illiteracy, less self-esteem, emotionally unstable behaviour and easy availability of such poisons, there is an increased frequency of aforementioned poisoning cases.

In this study, the age group of 21—25 years was maximally affected, followed by 16–20 years. It is the same age group found in Iran.[23,25] However it doesn't match with the studies done by Chaudhary SK *etal*.[26] Most of the patients with wheat pill poisoning were young, with mean age reported being 25±5 years in other studies done in Pakistan.[27,24] This finding is almost the same as our research showed. The problems of young aged females are overlooked in low to middle-class families. This is why the cases of adolescent females are common in this setup. This is an alarming situation and ought to be addressed.

The influence of psychoactive drugs such as antidepressants, benzodiazepines and opioids in suicidal poisoning was discussed in a 10-year

retrospective study. The study showed that drug toxicity is the third leading cause of suicide after firearm injury and hanging.[28] This is somehow, inconsistent with the current study. Maximum numbers of cases of poisoning were received from Peshawar district followed by Swat, Kohat and Haripur district. Another study, conducted on 103 acute poisoning cases in Peshawar revealed that cases of Peshawar district were maximum, preceded by Nowshera and Kohat.[20] This indicates that the majority of cases are registered from a nearby district. Those which could not access the health care facility of Peshawar district might have escaped the data.

CONCLUSION

Female and young people from Peshawar and Swat are more prone to Aluminum Phosphide (wheat pill) poison. It is a dangerous and lethal poison, so its routine use as a domestic pesticide has to be strictly prohibited by creating awareness among the public. Moreover, healthcare workers at emergency department ought to be prepared for such cases.

RECOMMENDATIONS

Easy and cheap availability of AlP should be banned at the gross root level by the government.

The government should take preventive measures for easy availability and should make policies for poison control.

AlP should be included in the medical and pharmaceutical curriculum in detail and research studies should be conducted to discover new treatment guidelines, hence decreasing the mortality rate.

There is a strong need for poison control centre in each district of KPK.

AUTHORS' CONTRIBUTION

SS: Literature search, study design, results interpretation, discussion. AHW. Literature review and discussion. HUR. Data collection, data analysis and data interpretation. ZHK. Proof reading, final approval.

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