ORIGINAL ARTICLE

MEDICOLEGAL IMPORTANCE OF ORGANOPHOSPHORUS POISONING IN YOUNG ADULTS

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Background: Poison is defined as any substance that 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 most of the population. Due to the easy availability and increased use of pesticides, accidental and suicidal poisoning is very common. The objective of the study is to find out the most common poison used by people in the general population and its frequency in our setup. **Methods:** Casualty Department of the Ayub Teaching Hospital in Abbottabad, served as the site of this retrospective investigation. Registrations between January 1st and December 31st, 2023, provided the data. All cases with a history of poisoning were included. Using SPSS 22, the data was analyzed. Sample was limited to those who were admitted when they were still alive. Ethical permission was taken from hospital administration. **Results:** The study revealed that poisoning was more common among females and the most common age group affected was 16-22years. 57.8% (52) cases were of suicidal intent while 40% (36) were accidental. **Conclusion:** Female and young people are more prone to Aluminium 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: Aluminium Phosphide; Poisoning; Phosphine; Wheat pill; Homicide; Suicide

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INTRODUCTION

Any material that can be injected into the body, breathed in, eaten, or absorbed through the skin and result in significant organ damage or death is considered poison. Any substance that acts chemically in the bodily tissues to disrupt an individual's physiology and biochemistry, resulting in disease and even death, is considered to be poisoning.[1] It may be accidental, suicide, or homicidal.

One popular technique used to control rodent populations is rat poisoning, however, it is perilous for both people and non-target animals. With this technique, poisonous materials like organophosphorus intended to kill rats and mice—usually by ingestion—are used. Nonetheless, these toxins can be accidentally consumed and cause potentially fatal poisoning. Other than this it is most commonly used for Suicidal purposes because of its easy availability and cheap as compared to other poisons. Rat poisoning is complex, and it is important to comprehend its toxicological consequences, clinical symptoms, and preventive measures to minimize the detrimental impacts it has on human health and the environment.

To manage rodent populations, Pakistan employs a variety of rat poisons, each with a unique mechanism of action and level of efficacy. In Pakistan, anticoagulant rodenticides, zinc phosphate, bromethalin, phosphorus-based rodenticides, and strychnine are a few of the frequently used rat-kill poisons. Chemicals known as anticoagulant rodenticides cause internal bleeding and ultimately death in rodents by interfering with their blood clotting mechanism. When zinc phosphide comes into touch with stomach acids or moisture, it releases phosphine gas, which is extremely poisonous. This gas causes metabolic failure and death in rodents by interfering with cellular respiration. A neurotoxic rodenticide called bromethalin works by upsetting rodents' central nervous systems, which causes cerebral edema and elevated intracranial pressure. This poison works especially well against populations of rodents that are resistant to anticoagulants.

If rat poisoning is not treated right away, it poses serious health risks to both humans and animals and may even be fatal. Toxic materials intended to eradicate rats and mice are used in rat poisoning, a technique used to manage rodent populations. Although these poisons are excellent at killing rodents, they can also accidentally be consumed by humans and other animals, which can be extremely dangerous.

Among all the rat poisons the incidence of Aluminium Phosphide is the highest. Acute poisoning and fatalities from phosphorus poisoning are frequent in many underdeveloped nations, particularly in Asia. Its mortality rates range from 60–90%.[2–8.] There is no known effective counteragent for this chemical, and poisoning-related deaths are becoming more commonplace. Because phosphorus releases phosphine gas when exposed to moisture in the air, water, or stomach hydrochloric acid, phosphorus is poisonous. When AlP is taken orally, the generated phosphine is swiftly absorbed through the digestive tract. Thus, there is a chance of dying if prompt treatment is not given.[9] For an adult weighing 70 kg, the lethal dose of AlP is roughly 500 mg.[10]

A respiratory hazard is phosphorus. By preventing cytochrome-c oxidase, it prevents mitochondrial oxidative phosphorylation, hinders cellular respiration, and causes damage to multiple organs and death.[11] Phosphine gas poisoning has no known cure, and even with intensive treatment, many patients do not survive.[12,13] it is Because an inexpensive and accessible poison that is used for suicide, the prevalence is rising.

In Pakistan, the bulk of the population works mostly as farmers. Pakistan is a growing nation. Unintentional and suicide poisoning are highly common because of the substances' accessibility, affordability, and growing use as insecticides. The death rate from AlP poisoning is between 60 and 90 percent in Pakistan.[14] In addition to being crucial for early diagnosis and effective treatment, a thorough understanding of the kind and volume of poisoning cases may aid in formulating regulations limiting public access to specific dangerous substances. The emergency department needs to be aware of the specific occurrence of the cases to adequately plan for future situations. Thus, the purpose of this study was to identify the most often used poison in the general population, as well as how frequently it occurred in our setting and whether it was related to any demographic information.

MATERIAL AND METHODS

The Ayub Teaching Hospital in Abbottabad's casualty department served as the site of this retrospective investigation. Registrations between January 1st and December 31st, 2023, provided the data. All cases with a history of poisoning were included. Using SPSS 22, the data was analyzed. Sample was limited to those who were admitted when they were still alive.

Ethical permission was taken from hospital administration.

RESULTS

90 poisoning incidents were documented. Organophosphorus was the most often used toxin in cases of undiagnosed, miscellaneous, and carbon monoxide poisoning. There were 57.8% (52) females and 42.2% (38) males. (Table 1) The age group of 16 to 22 was the most common (Table 2). Suicidal (57.8%) intent was the predominant kind of poisoning intent in the instances that were recorded, followed by accidental intent (40%).

Our results showed a positive correlation between age and the intent of poisoning ingestion.

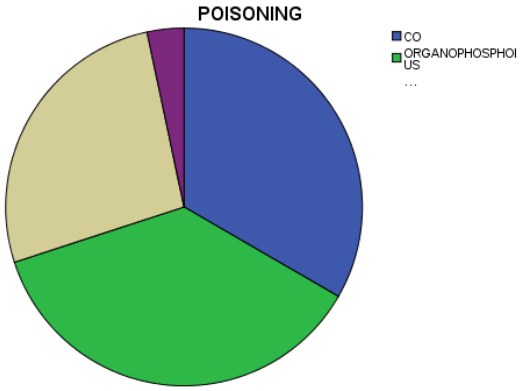

Figure-1: Poisoning

Table-1: Sex

Sex					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	38	42.2	42.2	42.2
	Female	52	57.8	57.8	100.0
	Total	90	100.0	100.0	

Table-2: Age

Age					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	5-10 years	1	1.1	1.1	1.1
	10-15 years	5	5.6	5.6	6.7
	15-20years	27	30.0	30.0	36.7
	20-25 years	24	26.7	26.7	63.3
	25-30years	6	6.7	6.7	70.0
	more than 30 years	27	30.0	30.0	100.0
	Total	90	100.0	100.0	

Table-3: Correlations

Correlations			
		Age	**Intent**
Age	Pearson Correlation	1	.342**
	Sig. (2-tailed)		.001
	N	90	90
Intent	Pearson Correlation	.342**	1
	Sig. (2-tailed)	.001	
	N	90	90
**. Correlation is significant at the 0.01 level (2-tailed).			

DISCUSSION

Over the globe, organophosphorus-containing compounds are extensively used as insecticides. These are widely available in the market due to lax rules regulating their sale, which has led to a high incidence of accidental and suicidal poisoning. These compounds inhibit the acetylcholinesterase enzyme. Which results in the accumulation of acetylcholine in the body and increased effects on its receptors. There are two types of acetylcholine receptors- nicotinic ion channels and muscarinic coupled G proteins. Activation of these receptors due to excess acetylcholine causes over stimulation of the central nervous system and death particularly due to respiratory arrest if the individual is not rapidly and safely transferred to hospital.

Excessive activation of these receptors leads to cholinergic crises which in severe cases may be fatal if not treated. Symptoms of cholinergic crisis are due to stimulation of the muscarinic and nicotinic receptors: Nicotinic manifestations include increased or decreased muscle power and skeletal muscle fasciculations. Muscarinic manifestations include excessive salivation, miosis, diarrhoea, bronchorrhea, bronchospasm, bradycardia and urination. Other signs include vomiting, respiratory distress, abdominal pain and depressed level of consciousness.

Organophosphorus poisoning most commonly affects the young age group with slight female preponderance. More than 80% of cases reported lay in the age group younger than 30 years with a few cases reported between 30-40 years. The maximum cases reported were at 22 years and then at 18 years. Both ages mark the most important transition time in individual life. Very few of 1 or 2 cases were reported above 40 years.

The reason behind such a young population's extreme decision is a complicated one. Several factors, including familial issues, educational mishaps or failures, pop culture, peer pressure, financial inequality, lack of opportunities, fear of losing out, and matters of the heart, have an impact on this decision. Integrating and assessing these factors is outside the purview of this investigation. In Pakistan, however, such knowledge about Organo Phosphorus poisoning is desperately needed.

Insecticides and rat poisons come in liquid, semi-solid, and powdered forms. The bulk of patients consumed the liquid form. Phenyl and drain cleansers are also exclusively accessible in liquid or semi-solid forms. The majority of OP consumption is suicidal. But we think that most of the time, this is a desperate attempt to get attention—a scream for help. When it comes to presentation, there are clear distinctions between sincere and false suicidal attempts. The second category comprises the majority of the patients.[15]

The suicidal purpose that is sincere has several traits often with certain specific characteristics. These Individuals have taken large dosages of medication and are frequently discovered alone, sick, and in a bad state. There is absolutely no intent message relayed. Contrarily, with false attempts, none of these qualities are present. In general, patients are cooperative during therapy, easily locate-able, disclose what they have done or consumed, take the lowest amounts feasible, and communicate their intentions to a friend or relative.

The main crops farmed in Pakistan, wheat and rice, are frequently fumigated and treated with rodenticides that mainly contain aluminium phosphate, also known as "wheat pills." It is highly hazardous, and when it comes into contact with moisture—whether by the air or ingestion—it releases phosphine gas. Despite treatment, more than 50% of patients who take aluminium phosphate tablets die.[16]

In our study we calculated the P-value which is measured to know whether our results are significant or not. So, we calculated the P value between the age of the people and the intent with which organophosphorus was ingested. The results are quite impressive and it shows that the values are highly significant, as our *p*-value is 0.001 which is less than 0.01. This means that there is a significant relation between the age and the intention of poisoning. As in our study it can be seen that most cases were reported in in people younger than 30years.

The wellbeing of patients who have been poisoned depends to a large extent on the time between the onset of poisoning and the administration of therapy. Primary care providers should be equipped to

handle these situations and provide their patients with the appropriate care.

In a study done in Bahawal Victoria Hospital Bahawalpur [17]stated that the patients who were admitted there under poisoning case before coming to their center, one-third of the patients had received some form of therapy, and only one of them had received an antidote. In contrarily to the patients, we received in our emergency department who didn't receive any treatment.

These findings suggest that community education priorities need to be shifted towards teaching first-aid treatment for poisoning patients. Medical authorities should ensure that all primary health care facilities have adequate resuscitation equipment and that medication is delivered on a regular basis. In addition, the management of poisoning by organophosphorus compounds should be emphasized in the health care workers' curriculum. The distribution, trade, and storage of these substances must be regulated with strict laws to reduce the risk of poisoning and subsequent death.

AUTHORS' CONTRIBUTION

SS: Literature review, analysis, proofreading. OK: Literature review. MZ: Data analysis. SA: Literature review, analysis. MAK, HUR: Data collection, data analysis. AA, MH: Data collection, data interpretation. AI: Literature review.

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