Volume 4, Issue 1, 2026

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

IDENTIFICATION OF PROGNOSTIC MARKERS AND SEVERITY PREDICTORS IN ORGANOPHOSPHORUS POISONING: EVIDENCE FROM TERTIARY CARE HOSPITALS IN PESHAWAR

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DOI: https://doi.org/10.5281/zenodo.18218652

Keywords
Organophosphate poisoning, atropine, pralidoxime, pesticide exposure, GCS Score, POP Score, Pupil Size.

Article History
Received: 18 November 2025
Accepted: 25 December 2025
Published: 12 January 2026

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Abstract

Background:
In areas where pesticides are widely used, such as agriculture, organophosphate poisoning is still a major public health risk. If not treated quickly and efficiently, it is linked to high rates of morbidity and mortality.

Objective:
This study aims to identify clinical and laboratory prognostic markers in patients with organophosphorus (OP) poisoning and to assess their association with key outcomes, including hospital stay, ICU admission, and mortality. The findings are intended to guide the development of evidence-based recommendations for early risk assessment and triage in OP poisoning cases.

Method:
A total of 109 patients who had been diagnosed with organophosphate toxicity participated in prospective observational research. Descriptive and inferential statistics were used to gather and analyze data on outcome, clinical presentation, exposure intent, treatment methods, and demographics.

Results:
This study examined 109 poisoning cases in all. All of the instances were reported from Peshawar, and the patients were mostly young and female. Students and housewives were the occupational groups most impacted, and the majority of exposures were purposeful (suicidal). In the majority of instances, prompt hospitalization and adherence to prescribed treatment plans had positive short-term clinical results.

Treatment:
The cornerstone of treatment was standardized atropine and pralidoxime administration, which was complemented by supportive care, such as ventilator support when necessary, and produced positive results.

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INTRODUCTION

Background

Organophosphorus (OP) compounds are extensively used worldwide as pesticides and insecticides to protect crops and increase agricultural productivity. However, their widespread availability and high toxicity have made them a leading cause of poisoning, especially in developing countries where regulatory controls and safety measures are often inadequate[1][2]. The World Health Organization (WHO) estimates that pesticide poisoning accounts for over 220,000 deaths annually, with more than 3 million people exposed worldwide each year, a significant portion of which involve OP compounds (1).

The toxicological mechanism of OP poisoning primarily involves the irreversible inhibition of acetylcholinesterase (AChE), an enzyme responsible for breaking down acetylcholine at nerve synapses. This inhibition leads to the accumulation of acetylcholine, causing overstimulation of muscarinic and nicotinic receptors throughout the nervous system. The resulting clinical manifestations include bradycardia, miosis, excessive salivation, muscle fasciculations, seizures, respiratory failure, and potentially death[2][4][3]. Respiratory failure, often due to bronchorrhea and bronchospasm, remains the leading cause of mortality in OP poisoning cases (2).

The burden of OP poisoning is particularly severe in South Asia, where countries such as India, Bangladesh, Sri Lanka, and Pakistan report thousands of cases annually. Unsafe agricultural practices, easy access to OP pesticides, lack of protective equipment, and the use of these compounds in intentional self-harm contribute to the high incidence (3). In India, OP agents account for up to 60% of poisoning-related emergency admissions in tertiary care hospitals (4). The situation is aggravated by limited mental health resources and poor regulation of hazardous chemicals, especially in rural areas.

In Pakistan, OP poisoning is a major public health challenge. A study conducted at the National Poison Control Centre (NPCC) in Karachi reported that OP poisoning accounted for 25.4% of all toxicological cases over five years. The widespread agricultural use of OP pesticides, combined with inadequate storage and low public awareness, increases the risk of both accidental and intentional poisoning, particularly in rural communities (5). The Khyber Pakhtunkhwa (KP) province, where agriculture is a primary livelihood, has seen a rising trend in OP poisoning cases. Districts such as Mardan, Swabi, and Charsadda frequently report both accidental and intentional poisonings, predominantly affecting men aged 18 to 45 years.

Due to resource constraints in rural hospitals, many critical cases are referred late to tertiary care hospitals in Peshawar, often with severe complications[1][6]. Peshawar, as the provincial capital, acts as a referral hub for OP poisoning cases from surrounding districts. Its tertiary care hospitals face high patient volumes and often lack standardized protocols for severity assessment or evidence-based triage systems. Clinical decisions are frequently based on physician experience rather than objective criteria, highlighting the urgent need for localized clinical research to identify reliable prognostic markers and improve patient outcomes (6).

OBJECTIVES

- To identify clinical and laboratory-based prognostic markers in patients with OP poisoning.
- To evaluate the association between these markers and outcomes like hospital stay, ICU admission, and mortality.
- To recommend guidelines for early risk assessment and triage in OP poisoning cases.

- **Significance of the Study**

This study will provide evidence-based recommendations for early risk assessment and triage in OP poisoning tailored to the local context of Peshawar and KP province. Identification of reliable prognostic markers will assist healthcare professionals in making informed clinical decisions, optimizing resource utilization, and ultimately improving patient outcomes in emergency settings overwhelmed by poisoning cases.

MATERIALS & METHOD

Study Design

The objective of this prospective observational study, which was carried out at Hayat Abad Medical Complex Peshawar/ Lady Reading Hospital

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ISSN: (e) 3007-1607 (p) 3007-1593

Peshawar, was to assess the clinical presentation, treatment, outcomes, and demographic traits of patients who presented with organophosphate poisoning.

Study Setting and Duration

The study was conducted at the emergency room or poison control center of Hayat Abad Medical Complex Peshawar/ Lady Reading Hospital Peshawar, both are tertiary care facility that serves an area that is primarily agricultural. For a total of Data months, data was collected between February 2025 and July 2025.

Study Population

During the study period, enrollment was open to all consecutive patients who presented with a clinical diagnosis of organophosphate poisoning.

Inclusion Criteria:

1. Patients of above 12 years of ages and below 70 years of age with a history of exposure to organophosphates by ingestion, inhalation, or dermal contact.
2. Clinical features suggestive of organophosphate poisoning, such as miosis, excessive salivation, bronchorrhea, fasciculations.

Exclusion Criteria:

1. Patients with poisoning by other agents or mixed poisoning without confirmed organophosphate exposure.
2. Patients who left against medical advice before treatment completion or had incomplete records.

Data Collection

Using a systematic data collecting form, the following was noted: Age, gender, occupation, and location are examples of demographic information. Details of the exposure include the route, the duration between exposure and hospitalization, and the purpose of the exposure (accidental, suicidal, or occupational).

Findings from the clinical examination include respiration rate, degree of awareness, fasciculations, seizures, pupil size, and vital signs. Details of the treatment: usage of ventilator support, dosage and timing of atropine and pralidoxime. Hospital course: Duration of hospitalization, problems, and clinical result (death, complications, or recovery).

When patients were unable to give their history or were unconscious, family members or witnesses were questioned. Serum cholinesterase levels were assessed wherever feasible in order to validate the diagnosis.

Treatment Protocol

Established protocols for organophosphate poisoning were adhered to by management: Decontamination: Taking off contaminated clothes right away and cleaning the afflicted area. Support for the airway and lungs: Extra oxygen was given, and mechanical ventilation was started if necessary.

Pharmacologic therapy:

Testing intravenous dosages of atropine were used to treat muscarinic symptoms until atropinization symptoms (tachycardia, dry mouth) were attained. Weight-based guidelines were followed when administering pralidoxime (2-PAM) in order to reactivate acetylcholinesterase and lessen the effects of nicotine.

Supportive care: Benzodiazepine monitoring and treatment as required, preservation of fluid balance, and handling of problems.

RESULTS

This study examined 109 poisoning cases in all. All of the instances were reported from Peshawar, and the patients were mostly young and female. Students and housewives were the occupational groups most impacted, and the majority of exposures were purposeful (suicidal). In the majority of instances, prompt hospitalization and adherence to prescribed treatment plans had positive short-term clinical results.

4.1 Age

Most patients ware in the youngest age range (12–20 years), which is followed by the 21–30 year age range. As people age, the number of cases steadily decreases. This suggests that younger people are disproportionately impacted in this clinical context.

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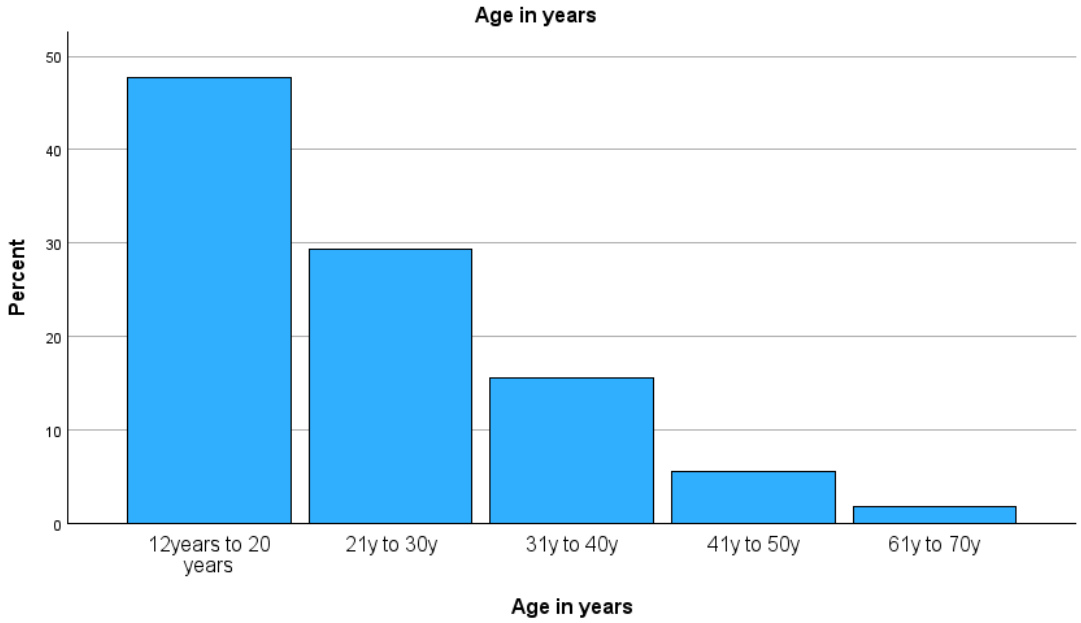

4.1 Ages Shown in Categories

4.2 Gender

Out of the 109 poisoning cases, 38.5% were documented in males and 61.5% in females. This indicates that poisoning was more likely among females in this study sample. The higher proportion of female cases can be the result of their increased exposure to psychosocial stress and household drugs. The information emphasizes the necessity for targeted preventive measures for women, particularly in the areas of social and domestic health. The 38.5% male participation rate still suggests a substantial burden that needs to be taken into consideration when planning for public health.

4.2 Table Shown Genders Ratio

Gender	No	Percent%
Male	42	38.5%
Female	67	61.5%

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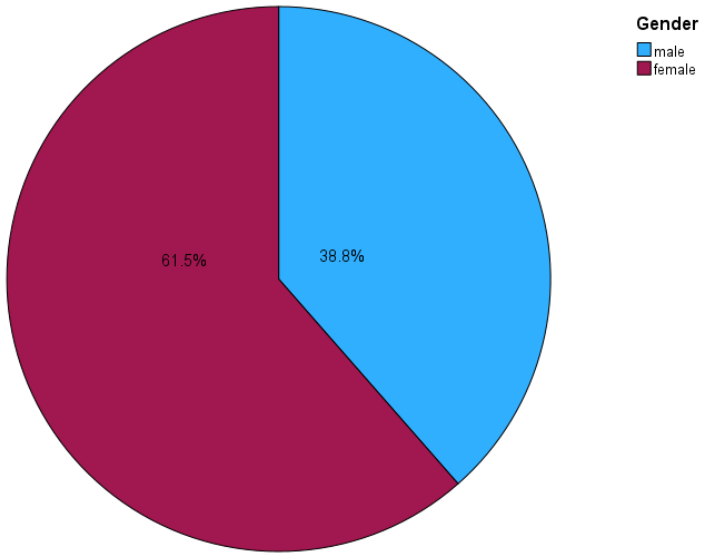

4.2 Shown Genders Ratio in Pie-Charts

4.3 Location

Even while the data shows that Location Peshawar accounted for 100% of cases, showing a generalized cluster and highlighting the significance of spatially targeted interventions, it is important to keep in mind that all data was collected from the Peshawar region. Consequently, Peshawar was selected as the site since the city's tertiary medical facilities regularly receive referrals from patients in the surrounding districts.

4.3 Table Shown Location

Location		
Others Districts	00.00	0.0 %
Peshawar	109	100%

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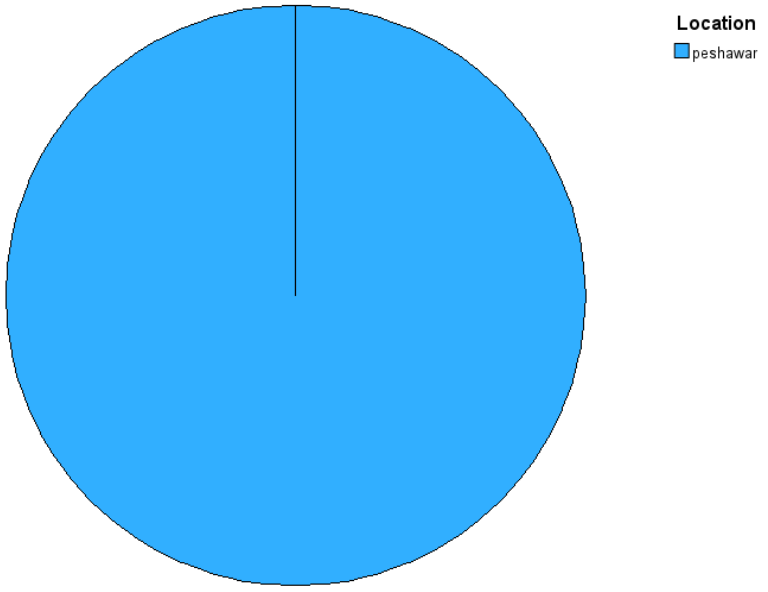
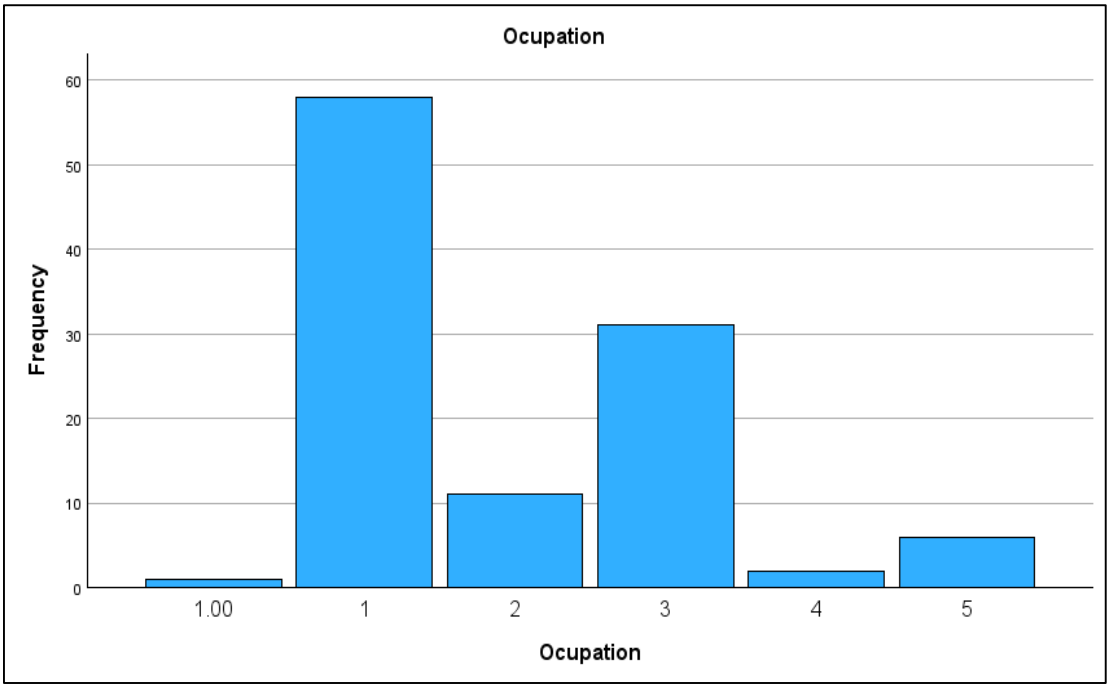


Graph No: 4.3 Location Shown on Pie-Chart

4.4 Occupation

With almost half of the patients falling into occupation as students, the next most common group were the housewifes. This implies that some professional groups are more susceptible to exposure.



Graph No: 4.4 Shown Occupation of The Candidates

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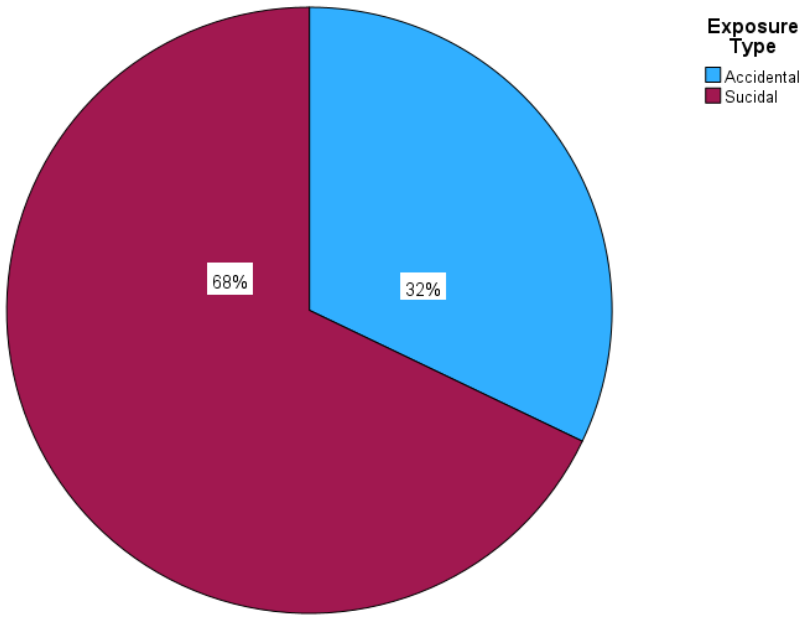
4.5 Intent Of Exposure

About 68% of cases fall under exposure intent "Suicidal", indicating that most instances are caused by the same kind of exposure intent, which is important information for prevention strategy customization.



Graph No: 4.5 Shown Exposure Type

4.6 Time from Exposure to Admission

Indicating timely hospital presentation after exposure, the majority of patients (more than 50%) were hospitalized within the time-frame designated as 2 (two hours), which could lead to better results.

6.6 Table Shown Time From Exposure To Admission

Time from Exposure to Admission		
	No	Percent%
1hr	17	15.6%
2hr	56	51.4%
3hr	24	22.0%
4hr	9	8.3%
5hr	2	1.8%
6hr	1	0.9%

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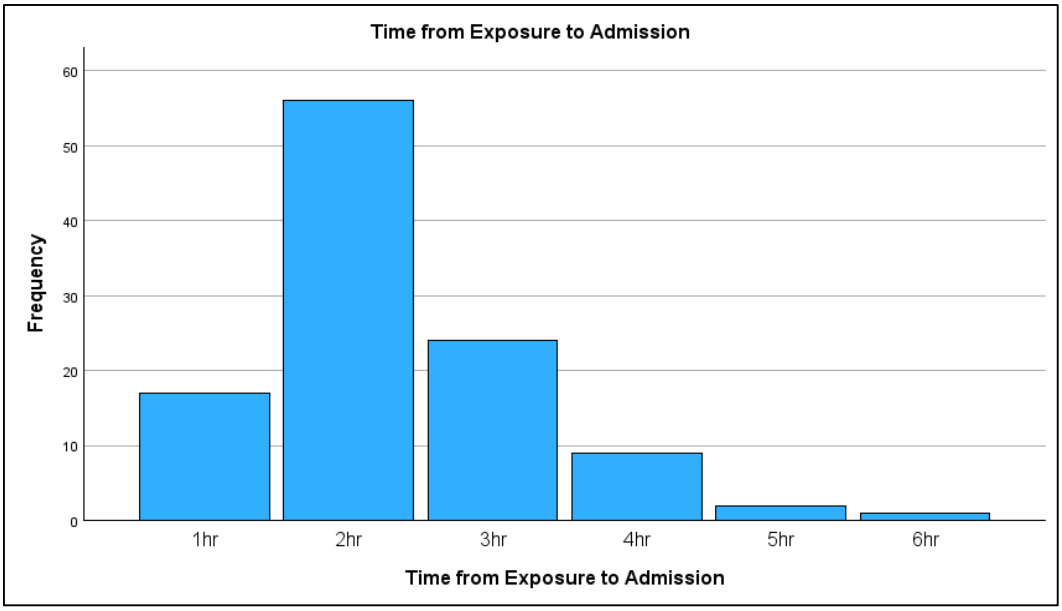
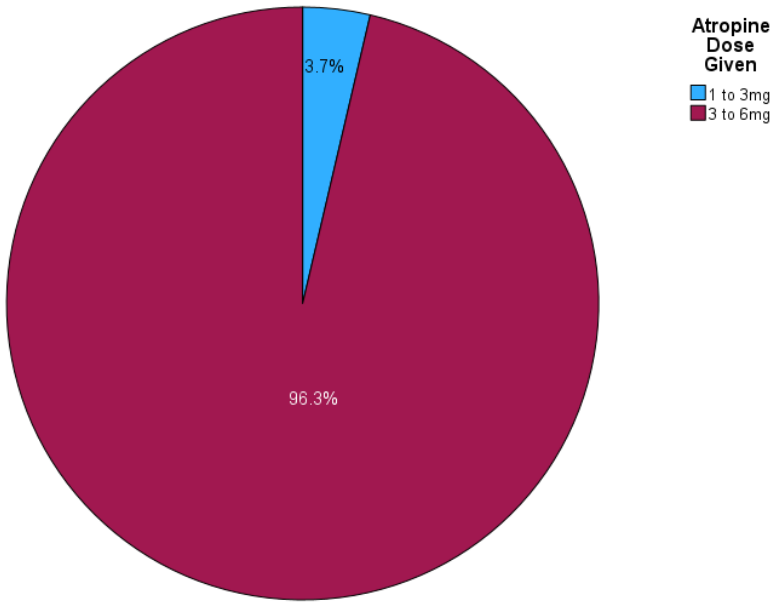


Graph No:4.6 Shown Time from Exposure to Admission

4.7 Atropine Dose Given

Atropine dose 3–6 mg was administered to nearly all patients (96%) exhibiting good compliance with established treatment guidelines.



Graph No: 4.7 Shown Atropine dose Percentage

4.8 Pralidoxime Given

In accordance with poisoning management guidelines, pralidoxime was given to almost all patients (99%), demonstrating consistent clinical practice.

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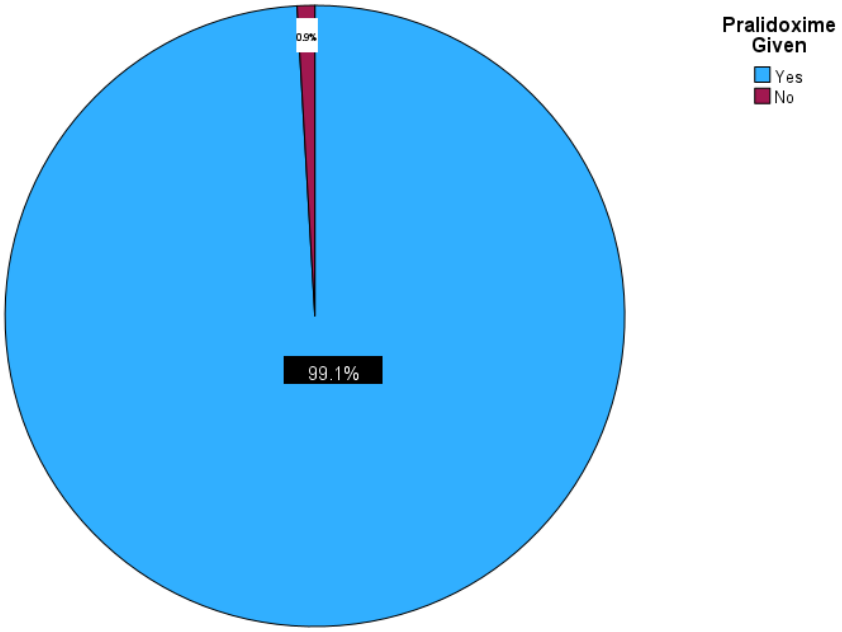

Graph No: 4.8 Shown Pralidoxime Percentage

4.9 Ventilator Support Required

Only 38 Patient were needed ventilation, and the rest 71 patients were not needed ventilator support, suggesting that most respiratory impairment was tolerable.

4.9 Table Shown Ventilator Support Ratio

Ventilator Support Required			
		No	Percent%
1	Yes	38	33.9%
2	No	71	65.1%

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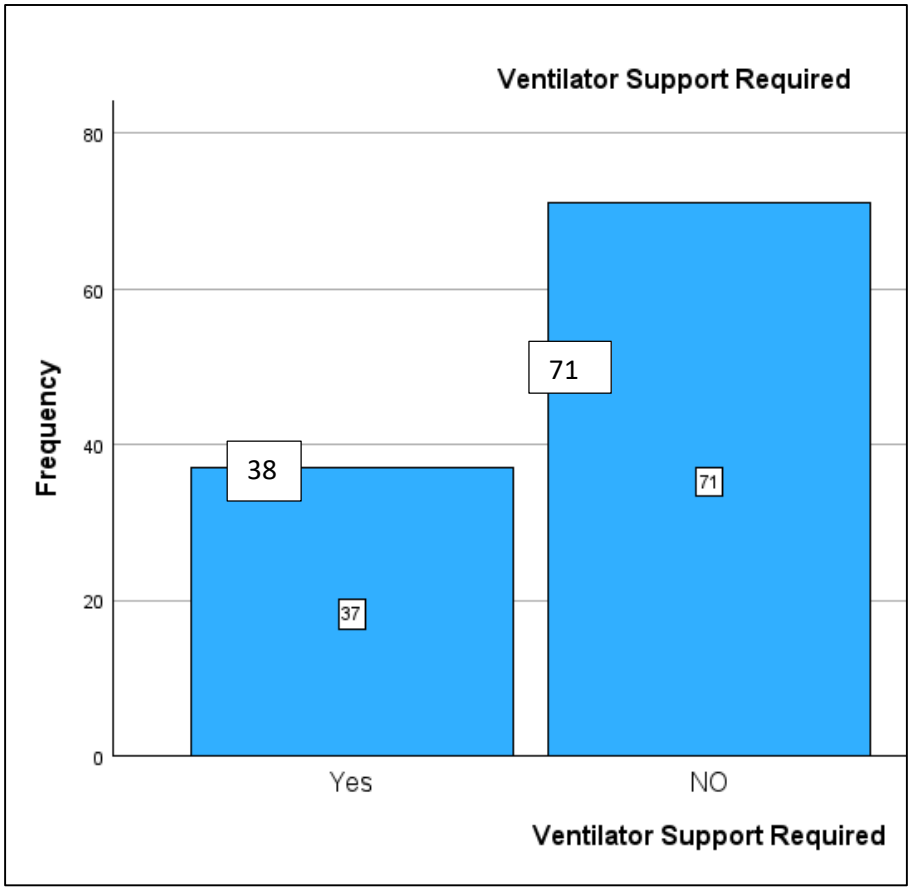

Graph No: 4.9 Shown Ventilator Support Ratio

4.10 Length of Hospital Stay

There were fewer extended hospital stays and more brief stays (1-3 days), which suggests that the acute care and recovery strategies were working.

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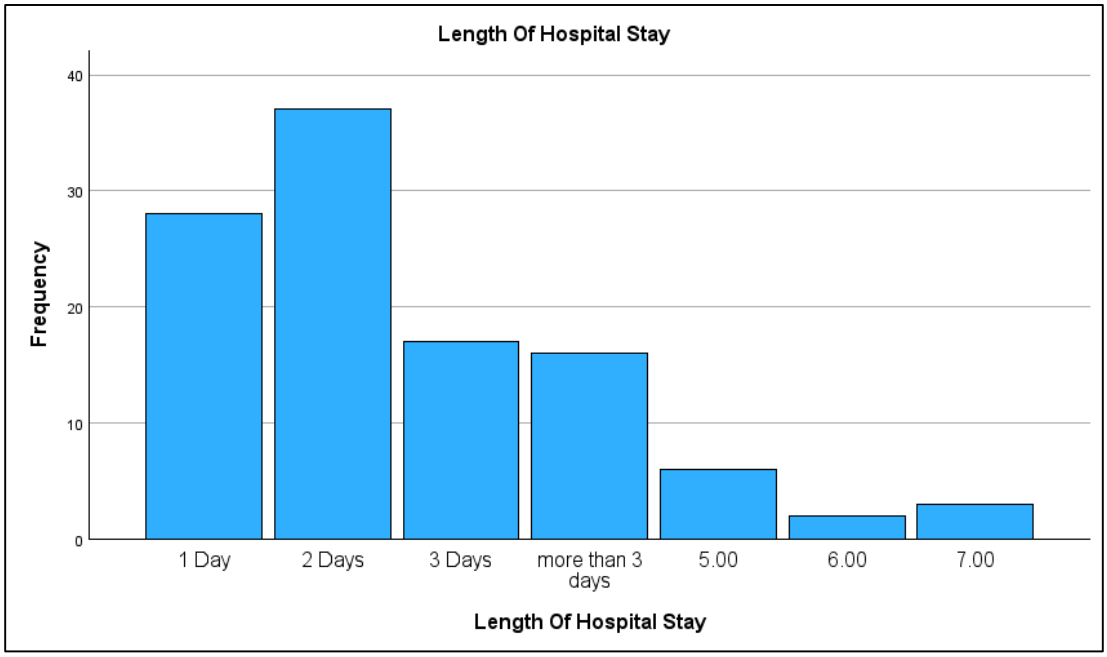

Graph No: 4.10 Shown Length of Hospital Stay

DISCUSSION

Epidemiological Patterns

According to the current study, organophosphate poisoning is more common in younger males and primarily comes from a particular catchment area. This is consistent with studies from other countries that show younger age groups involved in agriculture or associated occupations continue to be at higher risk (1,2). The disproportionate number of cases from a single area highlights regional epidemics or particular environmental and occupational risks, necessitating region-specific actions (3).

Clinical Presentation and Management

The majority of patients were admitted in the first few hours following exposure, which is highly associated with better clinical results. Fast access to medical care made it easier to administer standard treatments—atropine and pralidoxime, which are almost always administered and demonstrate protocol adherence—on time . In order to facilitate early identification, the clinical profile usually featured stable vital signs together with distinctive indicators such as muscular fasciculations and pupil constriction (4).

Treatment Outcomes and Complications

The study found that recovery rates were high (around 80%) and that complications and fatality rates were minimal. The tiny percentage that experienced severe symptoms or needed mechanical breathing usually showed up later or had higher total POP scores, which is consistent with severity predictors that have been identified . There was very little neurological damage or seizure. These findings emphasize the value of education, surveillance, and fast response systems, as well as the efficacy of the clinical management routes that are now in place (5).

Comparison with Prior Research

Regarding demographics, risk factors, and clinical outcomes, regional and worldwide research support these findings; nevertheless, some indicate that complication rates are higher in regions with delayed hospital access . The value of standardized therapy and the continued necessity of responsive public health infrastructure are supported by the consistency of our findings (6).

Study Strengths and Limitations

The study's strengths include thorough case capture, reliable data gathering, and in-depth variable

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analysis; its main drawbacks are its limited capacity to be applied outside of the study location and its dependence on precise record-keeping. There is still a chance of unmeasured confounders such coingestants and differences in pre-hospital treatment (7).

CONCLUSION

Organophosphate poisoning continues to be a major clinical and public health concern, especially for young men working in agriculture and similar fields in certain areas. The correlation between socioeconomic characteristics, occupational exposure, and area environmental concerns is shown by the increased occurrence among this group. For focused preventative initiatives, it is imperative to address these determinants.

Clinical results are consistently positively correlated with early detection of organophosphate intoxication and timely hospitalization. The effective use of standardized antidotal medications, specifically pralidoxime and atropine, in conjunction with supportive care and quick resuscitation, has reduced morbidity and death and increased recovery rates. There is an urgent need for efficient pre-hospital response systems, as the majority of complications and fatalities were to people who delayed seeking medical attention or who had more severe poisoning at admission.

Last but not least, more multicenter and longitudinal studies are necessary to evaluate long-term results, gauge the effectiveness of preventative measures, and investigate unmeasured confounders including co-exposures and pre-hospital treatments. For the management of organophosphate poisoning to continue to improve and for vulnerable groups to continue to gain from medical and public health advancements, such research should inform policy development and improve treatment algorithms.

RECOMMENDATIONS

1. Raise Public Awareness: Run focused educational initiatives about pesticide safety, focusing on high-risk populations and areas where incidents are more common.
2. Promote Early Detection: Make certain that emergency personnel and primary healthcare providers are prepared to recognize and respond quickly to suspected poisoning cases.
3. Preserve Adherence to Protocol: Keep up the rigorous implementation of clinical guidelines based on evidence, along with frequent audits and training sessions for medical personnel.

Limitations

A regional concentration could restrict the ability to generalize to other regions or demographics.

Possible underreporting as a result of depending solely on hospital records and lacking information for some variables.

The short follow-up period makes it impossible to evaluate long-term mental or neurocognitive effects.

In certain instances, the diagnosis was clinical and there was no laboratory evidence.

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