



Original Article

Clinical Spectrum, Severity, and Outcomes of Organophosphorus Compound Poisoning: A Prospective Observational Study at a Tertiary Care Center, HIMS Hassan.

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ABSTRACT

Background: Organophosphorus (OP) compound poisoning is a major cause of morbidity and mortality in agricultural regions. Early assessment of severity is critical for management and outcome prediction.

Objectives: To evaluate the clinical spectrum, severity, and outcomes of OP poisoning and identify predictors of adverse outcomes.

Methods: A prospective observational study was conducted over 18 months at HIMS Hassan, enrolling 276 adult patients with confirmed OP poisoning. Severity at admission was graded using the Peradeniya Organophosphorus Poisoning (POP) scale. Sample size was calculated based on mortality reported in Kamath SD et al., 2021 (22%). Data included demographics, clinical features, lab findings, POP scores, ventilatory support, complications, hospital stay, and mortality. Statistical analysis included descriptive statistics, χ^2 , t-tests, and logistic regression.

Results: Of 276 patients, 160 (58%) were male; mean age was 32 ± 11 years. Suicidal ingestion accounted for 88%. Common agents were monocrotophos (30%) and chlorpyrifos (25%). Vomiting (88%) and profuse secretions (72%) were frequent. POP grading: mild 38% (105), moderate 43% (119), severe 19% (52). Ventilatory support was required in 45% overall, increasing with severity (mild 12%, moderate 46%, severe 92%; $p < 0.001$). Overall mortality was 21% (58/276), rising from 4% in mild to 67% in severe cases. Logistic regression identified severe POP score, ventilatory support, and delayed hospital arrival (>6 hrs) as independent predictors of mortality.

Conclusion: POP scale severity at admission strongly correlates with outcomes in OP poisoning. Early recognition and timely intervention can reduce morbidity and mortality.

Keywords: Organophosphorus poisoning; POP scale; Ventilatory support; Ingestion.

INTRODUCTION

Organophosphorus (OP) compounds are among the most widely used pesticides globally, particularly in developing countries, due to their high efficacy and low cost. These compounds are a major cause of acute poisoning, with an estimated 3 million cases worldwide each year, leading to substantial morbidity and mortality, particularly in rural areas with limited healthcare access.¹

OP compounds act primarily through irreversible inhibition of acetylcholinesterase, resulting in accumulation of acetylcholine at synapses and neuromuscular junctions. This causes overstimulation of muscarinic, nicotinic, and central nervous system receptors, leading to classical manifestations such as vomiting, salivation, miosis, fasciculations, seizures, respiratory failure, and death in severe cases.²⁻³

In India, OP poisoning is frequently encountered in emergency departments, often due to **suicidal ingestion** rather than accidental exposure.⁴ Mortality rates reported in various Indian studies range from 4% to over 30%, influenced by the type and quantity of OP ingested, time to hospital presentation, and availability of intensive care facilities.⁵⁻⁶

Early assessment of poisoning severity is crucial for prognostication and management. The **Peradeniya Organophosphorus Poisoning (POP) scale**, developed in Sri Lanka, uses seven clinical parameters (pulse rate, pupil size, fasciculations, respiratory rate, level of consciousness, seizures, and presence of vomiting or secretions) to classify poisoning as mild, moderate, or severe.⁷ Several studies have demonstrated that POP scores strongly correlate with the need for mechanical ventilation, complications, and mortality.⁸⁻⁹

Despite extensive research, there remains **regional variation in clinical presentation, agent type, and outcomes**, emphasizing the need for local data to guide management strategies. Kamath SD et al., in a prospective study at Tata Main Hospital, reported a **22% mortality rate** among 100 patients with OP poisoning and highlighted the predictive value of the POP scale for ventilatory requirement and outcomes.¹⁰

This study was conducted at **Hassan Institute of Medical Sciences (HIMS), Hassan**, to evaluate the **clinical spectrum, severity, and outcomes** of OP poisoning in adults, using the POP scale to predict adverse outcomes and identify factors associated with increased mortality. This information is intended to inform clinical decision-making and improve patient care in tertiary care settings.

Methods

Study Design and Setting

Prospective observational study at **HIMS Hassan**, a tertiary care teaching hospital, over 18 months (Jan 2024–June 2025). Ethics approval obtained; informed consent from patients/guardians.

Study Population

Inclusion:

- Adults ≥ 18 yrs,
- acute OP poisoning within 24 hrs,
- clinical features consistent with OP poisoning.

Exclusion:

- Chronic exposure,
- co-ingestion of other toxins,
- terminal illness,
- refusal of consent.

Sample Size Calculation

Based on previous study Kamath SD et al reporting **22% mortality**, the minimum required sample size was calculated using formula : 263

A total of **276 patients** were enrolled to account for 5% dropouts.¹

Data Collection

Demographics, mode and type of poisoning, clinical features, laboratory parameters, POP score at admission, interventions, complications, and outcomes were recorded using a structured proforma.

Management Protocol

Patients received standard treatment:

- Gastric lavage and decontamination when appropriate
- Atropine titrated to symptom resolution
- Pralidoxime infusion when indicated
- Supportive care including oxygen therapy and mechanical ventilation if needed

Statistical Analysis

- Data analyzed in **SPSS v25**. Continuous variables: mean \pm SD; categorical: n (%). χ^2 , t-test, ANOVA, logistic regression used; p < 0.05 significant.

Results

Demographics and Clinical Features

Table 1. Demographics and Clinical Characteristics (n=276)

Characteristic	n (%) or mean \pm SD
Age (years)	32 \pm 11
Male	102(58)
Female	116(42)
Suicidal ingestion	242(88)
Accidental ingestion	32(12)
Vomiting	243(88)
Profuse sweating	199(72)
Miosis	177(64)
Fasciculations	155(56)
Altered sensirium	105(38)

POP Severity and Ventilatory Support

Table 2. POP Severity and Ventilation Requirement

POP Severity	n (%)	Ventilatory Support n (%)
Mild (0–3)	105 (38)	13 (12)
Moderate (4–7)	119 (43)	55 (46)
Severe (8–11)	52 (19)	48 (92)

Treatment and Outcome

Table 3. Treatment and Outcomes

Parameter	n (%) or mean \pm SD
Atropine use	276 (100)
Pralidoxime use	220 (80)
Mechanical ventilation	116 (42)
ICU admission	128 (46)
Mean hospital stay (days)	7.2 \pm 4.3
Complications	86 (31)
Mortality	58 (21)

Table 4. Mortality According to POP Severity

POP Severity	Mortality n (%)
Mild	4 (4)
Moderate	19 (16)
Severe	35 (67)

Table 5. Logistic Regression for Mortality Predictors

Variable	OR (95% CI)	p-value
Severe POP score	8.5 (4.3–17.0)	<0.001
Mechanical ventilation	5.8 (2.8–12.0)	<0.001
Delay >6 hrs	4.0 (1.9–8.8)	0.002

Discussion

Organophosphorus (OP) compound poisoning remains a significant public health concern in developing countries, especially in rural agricultural regions, due to widespread availability and easy accessibility of these pesticides. In this study of **276 patients** at HIMS Hassan, we observed a **male predominance (58%)** with a mean age of 32 \pm 11 years. These findings are consistent with previous Indian studies such as Acharya et al.,¹¹ and Mevada et al.,³ which reported that young adults, particularly males, are at higher risk due to occupational exposure and intentional self-harm.

Suicidal ingestion accounted for **88% of cases**, reflecting a socio-psychological pattern similar to that reported by Sah et al.,⁴ where most OP poisoning cases in rural India were intentional rather than accidental. This contrasts with studies from Iran and Sri Lanka, where accidental exposures constitute a larger proportion of cases.^{8,9}

Clinical presentation in our cohort was dominated by **vomiting (88%), profuse secretions (72%), miosis (64%), and fasciculations (56%)**. These findings align with the classical muscarinic and nicotinic manifestations described by Gupta et al.² and Mevada et al.³ Interestingly, 38% of our patients presented with altered sensorium, indicating central nervous system involvement, which is consistent with findings reported by Shadnia et al.⁸

The **POP scale** proved to be an effective predictor of severity and outcome. In our study, mild cases had a mortality of 4%, moderate cases 16%, and severe cases 67%. This is comparable to Kamath SD et al.,¹⁰ who reported overall mortality of 22% and demonstrated a significant correlation between POP scores and need for ventilatory support. Similarly, Chaudhary et al.,⁶ in a prospective study, emphasized that patients with higher POP scores were significantly more likely to require ICU care and mechanical ventilation.

Time to hospital presentation emerged as an independent predictor of mortality. Patients presenting **more than 6 hours after ingestion** had a fourfold increased risk of death, corroborating findings by Eddleston et al.,¹² who showed that early medical intervention significantly improves survival. This emphasizes the critical role of rapid transport and early resuscitation in OP poisoning management.

Type of OP compound ingested also influenced clinical severity. Monocrotophos and chlorpyrifos were the most common agents and were associated with higher rates of severe poisoning and ventilatory support, consistent with the findings of Regmi et al.⁷ and Shadnia et al.⁸ These organophosphates are highly toxic and associated with intermediate syndrome, respiratory failure, and cardiac complications. Intermediate syndrome occurred in 31% of patients in our study, similar to reports from other Indian centers.⁶

The need for **mechanical ventilation** in 42% of patients was comparable with prior studies, including Kamath SD et al.¹⁰ and Mevada et al.,³ highlighting the critical nature of respiratory involvement. Ventilatory support remains the cornerstone in severe OP poisoning and is directly associated with improved survival when provided promptly.

Our study also observed that **delayed initiation of antidotes** and supportive care contributed to poorer outcomes, echoing findings by Eddleston et al.¹² and Shadnia et al.⁸ Although biochemical markers such as serum cholinesterase were inconsistently available, clinical scoring systems like the POP scale provided practical and reliable prognostic information in resource-limited settings.^{7,9}

When comparing with other international data, mortality rates vary widely. Studies from Sri Lanka reported mortality between 10–20%,⁷ while Iranian data reported rates up to 28% depending on the compound and supportive care availability.⁸ Our observed mortality of 21% aligns with these regional trends, reinforcing the importance of local epidemiological data to guide management strategies.

This study underscores several **key clinical implications**:

1. Early identification of high-risk patients using the POP scale can guide ICU admission and mechanical ventilation decisions.
2. Public health interventions to reduce pesticide availability and improve mental health support could reduce the burden of suicidal ingestion.
3. Prompt hospital transfer and early antidote administration are critical for survival.

Limitations include the single-center design, lack of consistent biochemical monitoring, and absence of long-term follow-up to assess neurological or cognitive outcomes. Despite these limitations, our findings provide robust local data that can inform clinical protocols and regional health policies.

In summary, the **POP score, time to hospital, and ventilatory requirement** are strong predictors of mortality in OP poisoning. Comparison with prior studies including Kamath SD et al.,¹⁰ Mevada et al.,³ Chaudhary et al.,⁶ and Eddleston et al.¹² demonstrates consistency in trends and validates the use of clinical scoring in resource-limited settings.

Conclusion

POP scale severity at admission is a **strong predictor of clinical outcome** in OP poisoning. Early identification, timely antidote administration, and supportive care significantly reduce morbidity and mortality in tertiary care centers like **HIMS Hassan**.

Limitations

1. Single-center study limits generalizability.
2. Biochemical markers inconsistently available.
3. Long-term neurological outcomes not assessed.
4. Exact ingested quantity/type uncertain in some patients.

Future Directions

- Multicenter studies with long-term follow-up.
- Integration of biomarkers and electrophysiology for prognosis.
- Community interventions on pesticide safety and mental health awareness.

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