

Original Research Article

CLINICO-EPIDEMIOLOGICAL PROFILE OF ORGANOPHOSPHORUS POISONING PATIENTS REPORTING AT TERTIARY CARE HOSPITAL – A PROSPECTIVE OBSERVATIONAL STUDY

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ABSTRACT

Background: Organophosphorus poisoning (OPP) remains a significant public health concern in developing nations, particularly among agricultural communities. This study examines the clinico-epidemiological profile of OPP patients at a tertiary care hospital in Western Maharashtra.

Materials and Methods: A prospective observational study was conducted from November 2022 to October 2023, including 228 adult OPP patients. Data on demographics, clinical presentation, poisoning severity (Peradeniya scale), and outcomes were analysed using descriptive and inferential statistics. This study aims to assess the clinico-epidemiological profile, severity, outcomes, reasons, and seasonal trends of organophosphorus poisoning in adults admitted to a tertiary care hospital.

Results: 69.3% patients of OPP were adults (21-40 yrs old) predominantly male (62.72%), and from rural areas (76.32%). Suicidal intent accounted for 92.54% of cases, primarily linked to socioeconomic stressors. Chlorpyrifos (65.79%) was the most common agent, with ingestion (91.67%) as the main exposure route. Clinical features included miosis (89.91%), fasciculations (82.46%), and respiratory depression (3.51%). Moderate-to-severe poisoning (84.65%) necessitated ventilatory support in 82.89% of cases. Outcomes revealed 73.68% cases completely recovered, 16.67% residual disability, and 9.65% mortality. Early hospital arrival (<3 hours) and pre-hospital treatment significantly improved survival ($p < 0.05$).

Conclusion: OPP disproportionately affects young rural males, with high suicidal intent and severe complications. Strengthening pesticide regulations, mental health services, and rural healthcare access is critical to reducing morbidity and mortality.

Keywords: Organophosphorus poisoning, POP Scale, Pesticide, Seasonal trends, Suicidal poisoning.

INTRODUCTION

Organophosphates (OPs) are widely used as pesticides in agriculture and also in domestic, industrial, and veterinary applications.^[1] They are utilized in vector control for diseases such as malaria and dengue.^[2] Despite their benefits in agriculture, OPs pose significant toxicological risks, making them a major public health concern.^[3] Pesticide

exposure can be occupational, accidental, or suicidal, with deliberate self-harm (DSH) cases having higher mortality than accidental exposure.^[4]

Studies indicate OPs are the most commonly used agents in suicidal poisoning. Poisoning ranks as the fourth leading cause of significant mortality, especially in rural India.^[5] Pesticide self-poisoning accounts for 14–20% of global suicides.^[6] In India, OPC-related suicidal poisoning incidence ranges

from 10.3% to 43.8%, with mortality rates between 4% and 30%.^[7] Deaths from OPC poisoning are particularly common in southern and central India.^[8] According to 2017 data from the National Crime Bureau of India, pesticide-related suicides accounted for 26.6% of cases, with Maharashtra reporting the highest number (17,646), followed by Tamil Nadu (14,459) and West Bengal (12,014).^[9] This highlights the widespread use of pesticides in developing Asian nations.^[10]

The clinical presentation of OP poisoning varies based on the compound type, exposure route, and poisoning severity. Core pharmacotherapy includes Atropine, a muscarinic receptor antagonist, and Pralidoxime, a cholinesterase reactivator. Respiratory failure and lung injury are primary causes of death, with prognosis influenced by the compound type, amount consumed, severity, and the time to medical intervention.^[11]

The present study is undertaken with the objectives to assess the clinico-epidemiological profile, severity and outcome of adult patients admitted with organophosphorus poisoning in tertiary care hospital and to identify the reasons and seasonal trends of organophosphorus poisoning among them.

MATERIALS AND METHODS

The present prospective observational study was carried out in the medicine Intensive care unit (ICU) and ward, of Government Medical College, Miraj which provide advanced care for poisoning cases. The study period was from 01/11/2022 to 31/10/2023.

The study population included all patients aged 18 years and above with a provisional diagnosis of organophosphorus poisoning based on exposure history, characteristic clinical signs, symptoms, and laboratory tests. Patients willing to provide written informed consent were included. Poisoning with non-organophosphorus compounds, mixed poisoning, and critically ill or moribund patients unable to provide history were excluded from the study.

Data collection was performed daily, with stable patients assessed at the first contact and unstable patients evaluated upon stabilization. Privacy and confidentiality were maintained. Information was obtained through patient interviews or for intubated cases, from relatives, later confirmed with the patient. A pretested, predesigned structured questionnaire (case record form) was used for data collection.

The study examined three key data categories: Demographic Data: Included age, gender, education, occupation, family structure, type of house, socioeconomic class, and residence to determine risk factors for OP poisoning.

Clinical Data: Assessed symptoms (cholinergic and muscarinic), vital signs (heart rate, respiratory rate, blood pressure, temperature), poisoning severity (Peradeniya OP scale)¹², laboratory findings (serum cholinesterase, blood sugar levels), and treatment.

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Epidemiological Data: Recorded details of exposure, including date, time, mode (accidental, suicidal, homicidal), time to reach the hospital, type of OP compound, prior treatment received, and patient outcomes.

Data were entered into a Microsoft Excel sheet and analysed using Microsoft Excel and SPSS software. Descriptive statistics summarized demographic and clinical characteristics, with mean and standard deviation for continuous variables (age, serum cholinesterase levels) and frequencies/percentages for categorical variables (gender, education, mode of poisoning). Inferential analysis using chi-square tests identified associations, such as treatment outcomes relative to the Peradeniya OP scale, to determine prognosis factors.

All ethical guidelines were followed during study. Ethical clearance was obtained from the institutional ethical committee, Government Medical College & Hospital, Miraj (Vide Letter No. GMCM/IEC/C-10/2022, Dated - 06/10/2022).

RESULTS

During study period 264 patients were admitted for OP poisoning, 36 of them were excluded from study due to non-fulfilment of selection criteria. Hence 228 patients were included in study.

Among the study participants, 69.3% were between 21-40 years of age, the mean age of the cohort was 38.82 years (± 12.65). With males (62.72%) being more affected than females. A significant proportion (76.32%) resided in rural areas, while 57.46% belonged to joint families. Nearly half (49.56%) were illiterate, and most (53.51%) belonged to the lower socioeconomic class. Farmers (30.26%) and labourers (23.25%) were the most affected occupational groups. [Table 1]

Miosis (89.91%), fasciculation (82.46%), and lacrimation (78.07%) were the most common signs, while vomiting (86.40%) and nausea (73.68%) were the predominant symptoms. Most cases were of moderate (56.14%) or severe (28.51%) poisoning. Timely hospital admission was crucial, with 78.51% arriving within three hours, leading to a 73.68% full recovery rate. However, delayed treatment increased the mortality risk (9.65%). ICU admissions and ventilatory support were required in 19.74% and 82.89% severe cases respectively. Highlighting the need for rapid medical intervention. [Table 2]

[Tables 3] highlight epidemiological trends in organophosphorus poisoning cases. Most incidents were suicidal (92.54%), occurring mainly at home (49.12%) and on farms (38.16%), with family issues (30.81%) and multiple stressors (62.56%) being common reasons. Poisoning cases peaked in winter

(32.02%) and summer (29.82%). Chlorpyrifos (65.79%) was the most frequently used compound, and ingestion was the primary mode of exposure

(91.67%). While 78.51% of patients reached a hospital within 3 hours, 66.23% received no pre-hospital treatment.

Table 1: Sociodemographic Profile of Organophosphorus Poisoning Patients

Variable	Category	Frequency (%)
Age Group (Years)	< 20	09 (03.95)
	21-40	149 (65.35)
	41-60	56 (24.56)
	> 60	14 (06.14)
Gender	Male	143 (62.72)
	Female	85 (37.28)
Residency	Urban	25 (10.96)
	Rural	174 (76.32)
	Peri-urban	20 (08.77)
	Slum	09 (3.95)
Education	Illiterate	113 (49.56)
	Primary	43 (18.86)
	Middle	29 (12.72)
	High Sec./Diploma	35 (15.35)
	Graduate/Post Graduate	08 (03.51)
Occupation	Unemployed	36 (15.79)
	Housewife	28 (12.28)
	Labourer	53 (23.25)
	Student	10 (04.39)
	Farmer	69 (30.26)
	Business	13 (05.70)
	Professional/Job/Service	19 (08.33)
Socioeconomic Class	Upper Class I	02 (0.88)
	Upper Middle Class II	05 (02.19)
	Middle Class III	21 (09.21)
	Lower Middle Class IV	78 (34.21)
	Lower Class V	122 (53.51)
Type of Family	Nuclear	97 (42.54)
	Joint	131 (57.46)
Type of House	Kaccha	64 (28.07)
	Semi Pakka	116 (50.88)
	Pakka	48 (21.05)

Table 2: Clinical Characteristics, Severity, and Outcomes of Organophosphorus Poisoning Cases

Variable	Category	Frequency (%)
Clinical Signs	Miosis	205 (89.91)
	Fasciculation	188 (82.46)
	Lacrimation	178 (78.07)
	Salivation	153 (67.11)
	Bradycardia	133 (58.33)
	Hypertension	71 (31.14)
	Hypotension	36 (15.79)
	Tachycardia	21 (09.21)
	Sweating	12 (05.26)
	Respiratory Depression	08 (03.51)
Clinical Symptoms	Vomiting	197 (86.40)
	Nausea	168 (73.68)
	Diarrhoea	157 (68.86)
	Abdominal Pain	68 (29.82)
	Breathlessness	67 (29.39)
	Convulsions	59 (25.88)
	Altered Sensorium/Unconsciousness	39 (17.11)
	Irritation	18 (07.89)
	Neck Holding	09 (03.95)
Severity of Poisoning (POP Scale)	Mild	35 (15.35)
	Moderate	128 (56.14)
	Severe	65 (28.51)
Time Taken to Reach Hospital (Hr)	<3 Hr	179 (78.51)
	3-6 Hr	44 (19.30)
	>6-9 Hr	05 (02.19)
Outcome	Complete Recovery	168 (73.68)
	Recovered with Residual Disability	38 (16.67)
	Death	22 (09.65)
Admitted in	ICU	45 (19.74)
	Ward	183 (80.26)

Ventilator Requirement	Yes	189 (82.89)
	No	39 (17.11)
Complications	No Complication	82 (35.96)
	Respiratory Failure	19 (8.33)
	Intermediate Syndrome	61 (26.75)
	Aspiration Pneumonia	42 (18.42)
	Circulatory Collapse	02 (0.88)
	Septic Shock	05 (02.19)
	Atropine-Induced Psychosis	63 (27.63)

Table 3: Epidemiological Profile of Organophosphorus Poisoning Cases

Variable	Category	Frequency (%)
Site of Poisoning	Home	112 (49.12)
	Farm	87 (38.16)
	Work	22 (9.65)
	Other Place	07 (03.07)
Nature of Poisoning	Suicidal	211 (92.54)
	Accidental	16 (07.02)
	Homicidal	01 (00.44)
Reasons for Suicidal Poisoning	Financial Problems	13 (06.16)
	Family Problems	65 (30.81)
	Psychological/Mental Problems	01 (00.47)
	Multiple Reasons	132 (62.56)
Season of Poisoning	Rainy (June – August)	34 (14.91)
	Spring (September – November)	53 (23.25)
	Summer (March – May)	68 (29.82)
	Winter (December – February)	73 (32.02)
Time to Reach Hospital (Hours)	Up to 3	179 (78.51)
	3-6	44 (19.30)
	>6	05 (2.19)
Treatment Received	Yes	77 (33.77)
	No	151 (66.23)
Type of Treatment Received	No Treatment	151 (66.23)
	Gastric Lavage	32 (14.04)
	Inj. Atropine	05 (02.19)
	Combined Treatment	40 (17.54)
Type of OP Compound Used	Chlorpyrifos	150 (65.79)
	Dimethoate	28 (12.28)
	Profenphos	13 (05.70)
	Dichlorvos	10 (04.39)
	Monocrotophos	05 (02.19)
	Dicrotophos	12 (05.26)
	Temphos	01 (00.44)
	Quinalphos	09 (03.95)
Quantity of Poison Ingested (ml)	1-20	77 (33.77)
	21-40	119 (52.19)
	41-60	20 (08.77)
	61-80	05 (02.19)
	81-100	07 (03.07)
Mode of Exposure	Ingestion	209 (91.67)
	Inhalation	01 (00.44)
	Topical/Dermal	07 (03.07)
	Mixed	11 (04.82)

Table 4: Association between clinical factors and patient outcomes in OP poisoning

Variable		Outcome			Total (%)	P value
		Complete Recovery	Recovered Residual Disability	With Death		
POP scale	Mild	35	105	28	168 (73.68)	0.001***
	Mod	0	23	15	38 (16.67)	
	Severe	0	0	22	22 (9.65)	
Treatment received before reaching a tertiary care hospital	Yes	61	14	2	77 (33.77)	0.036*
	No	107	24	20	151 (66.23)	
Time taken to reach tertiary care hospital (Hr)	< 3 Hr.	136	30	13	179 (78.51)	0.00038***
	3-6 Hr.	32	6	6	44 (19.30)	
	>6-9 Hr.	0	2	3	5 (2.19)	
Comorbidity	Absent	95	2	0	97 (42.54)	0.001***
	Present	73	36	22	131 (57.46)	

* $p \leq 0.05$ Statistically significant

*** $p \leq 0.001$ Very highly significant

[Table 4] highlights significant associations between various clinical factors and patient outcomes in organophosphorus poisoning cases. Patients with mild poisoning had the highest complete recovery rate (75.49%), whereas those with severe poisoning had 100% mortality, with a highly significant association ($p < 0.001$). Pre-hospital treatment improved recovery rates, as 79.22% of those who received early intervention fully recovered, compared to 70.86% among those who did not, with a statistically significant association ($\chi^2 = 6.63$, $p = 0.036$). Time to reach the hospital also played a crucial role, with 75.98% of patients arriving within three hours achieving full recovery, whereas those arriving after six hours had no complete recoveries and a mortality rate of 60% ($\chi^2 = 20.61$, $p = 0.00038$). Additionally, comorbidities negatively impacted outcomes, as patients without comorbidities had a 97.94% recovery rate, whereas those with comorbidities had a significantly higher mortality rate of 16.79% ($\chi^2 = 51.37$, $P < 0.001$).

DISCUSSION

Adult organophosphorus poisoning (OPP) cases admitted to a tertiary care hospital provides a detailed analysis of the clinico-epidemiological profile of this significant public health concern. The findings offer crucial insights that align with global patterns while highlighting region-specific characteristics that demand targeted interventions. By examining demographic distributions, exposure patterns, clinical manifestations, and treatment outcomes, this study contributes valuable evidence to inform both clinical practice and preventive strategies in pesticide poisoning management.

The study population demonstrated a striking predominance of young adults aged 21–40 years (65.35%). This age distribution closely matches reports from Selvaraj et al.^[13] and Gabali et al.^[7] suggesting consistent vulnerability among economically active young adults across developing nations. The male preponderance (62.72%) reflects well-documented occupational exposure patterns in agrarian economies, as seen by Pensalwar et al.^[14] (58.75%) and Bhattad et al.^[15] (58.75%) in their studies.

Geographical analysis revealed 76.32% ($n=174$) rural cases, consistent with Vedpathak et al.^[16] (77.46%) and Khalid et al.^[17] (77%), but differing markedly from Timsinha et al.^[18] urban-predominant sample (61.53%). This urban-rural disparity underscores how agricultural practices shape poisoning epidemiology. Educational status showed 49.56% illiteracy, significantly higher than Datir et al.^[19] report (3.41%), highlighting regional variations in socioeconomic development and its impact on poisoning risk. Occupation distribution revealed farmers (30.26%) and labourers (23.25%) as highest risk groups, while the 12.28% housewife representation suggests important domestic exposure

routes requiring specific attention in prevention programs.

Seasonal variation analysis demonstrated winter peaks (32.02%), contrasting with monsoon peaks reported in Nepal by Timsinha et al.^[18] (43.58%) and aligning more closely with Pal et al.^[20] This likely reflects regional agricultural cycles, with winter representing post-harvest periods of increased pesticide handling in our study area. Chlorpyrifos emerged as the predominant compound (65.79%), differing from studies where dimethoate was more common in Bhattad et al.^[15] and Rajput et al.^[21] suggesting important regional variations in pesticide availability and use patterns that should inform local antidote stocking policies.

The alarming predominance of suicidal intent (92.54%) far exceeds rates reported in developed nations and matches findings from Varsha et al.^[22] (91.8%). Detailed analysis of suicidal motives revealed family problems as most common (30.79%), followed by financial issues (6.16%), with 62.56% citing multiple complex factors. This pattern differs from Timsinha et al.^[18] where financial problems dominated (37.17%), suggesting region-specific psychosocial stressors that should guide mental health interventions. The overwhelming predominance of oral ingestion (91.67%) over dermal (3.07%) or inhalational (0.44%) routes has crucial implications for first-aid protocols and community education priorities.

The clinical spectrum closely followed classic cholinergic toxidrome patterns: miosis (89.91%), vomiting (86.40%), fasciculations (82.46%), and lacrimation (78.07%) were most frequent. Severe manifestations included respiratory depression (3.51%) and seizures (25.88%), consistent with Sidiq et al.^[23] and Banday et al.^[24] The Peradeniya Organophosphorus Poisoning (POP) scale classification showed moderate (56.14%) and severe (28.51%) cases predominating, differing significantly from Timsinha et al.^[18] mild-predominant cohort (80.76%), likely reflecting referral bias to our tertiary centre and regional differences in poisoning severity.

Ventilatory support requirements (82.89%) exceeded reports from Gagarin et al.^[25] (40%) and Divekar et al.^[26] (3.36%), emphasizing both the critical need for ICU preparedness and potential regional differences in poisoning severity. The 9.65% mortality rate compares favourably with Gagarin et al.^[25] but remains concerning, while the 16.67% disability rate highlights an often-overlooked consequence requiring better rehabilitation services. Time-to-treatment emerged as a crucial prognostic factor — the 78.51% presenting within 3 hours had significantly better outcomes than delayed presentations ($p < 0.001$), matching findings from Ahmed et al.^[27] and Meena et al.^[28]

When contextualized within global literature, several key patterns emerge. Our demographic findings align closely with most Indian studies but contrast sharply with Western reports where accidental paediatric

exposures predominate. The male predominance matches Pensalwar et al,^[14] (58.75%) but differs substantially from Siddique et al,^[23] female-majority cohort (67.64%), suggesting important regional variations in gender roles in agriculture and pesticide handling. The high rural representation (76.32%) matches Vedpathak et al,^[16] (77.46%) but contrasts strikingly with Timsinha et al,^[18] urban majority (61.53%), highlighting how agricultural practices and urbanization levels shape poisoning epidemiology across regions.

Clinical outcomes showed important variations from published data. Our mortality rate (9.65%) was lower than Gagarin et al.²⁵ but higher than Timsinha et al,^[18] likely reflecting differences in case severity, healthcare access, and treatment protocols. The high ventilator requirement (82.89%) significantly exceeded most literature reports, suggesting either more severe cases in our population or differences in ventilation criteria. These variations underscore the need for context-specific treatment protocols rather than universal guidelines.

CONCLUSION

This study highlights that organophosphorus poisoning predominantly affects young rural males engaged in agricultural work, reflecting occupational pesticide exposure risks. The high rate of suicidal intent, driven by socioeconomic stressors like financial hardship and family conflicts, underscores the urgent need for mental health support in vulnerable communities. Timely medical intervention proves critical, with better outcomes for patients receiving prompt care, emphasizing the importance of improved healthcare access in rural areas.

Clinical assessment reveals moderate to severe poisoning in most cases, often requiring ventilatory support. While many patients recover fully, a significant portion experience lasting disability, particularly those with comorbidities. Common complications like intermediate syndrome and aspiration pneumonia demand comprehensive clinical management. The prevalence of chlorpyrifos poisoning calls for stricter pesticide regulations and safer handling practices.

Effective prevention requires multifaceted strategies addressing occupational safety, mental health support, and healthcare system strengthening to reduce the substantial burden of organophosphorus poisoning.

Ethical clearance: The study was approved by the Institutional Ethics Committee of GMC Miraj (IEC No. GMCM/IEC/C-10/2022)

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