PREVALENCE AND PATTERN OF ACUTE ORGANOPHOSPHATE POISONING AT A TERTIARY CARE CENTER IN WESTERN NEPAL

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ABSTRACT

INTRODUCTION

Organophosphate (OP) poisoning remains a public health problem in developing countries, including Nepal. However, data on its prevalence and clinical profiles in Western Nepal are limited.

MATERIAL AND METHODS

A retrospective hospital-based study was conducted at a tertiary care center in Western Nepal. After ethical approval (UCMS/IRC/116/22), medical records were reviewed for the period from June 2020, to August 2022. Among 317 poisoning cases, 131 involved OP compounds. Fourteen cases with inadequate or missing reports were excluded from further analysis. Socio-demographic and clinical details were noted. SPSS version 20 was used for analysis.

RESULTS

The prevalence of OP poisoning was 41.3% (95% CI: 35.8% - 46.9%). The median age of the patients was 27 years, with most cases occurring during the summer season (38.5%). Oral ingestion was the route of exposure in all cases, and suicidal intent was the major reason (90.6%). Chlorpyriphos was the most common OP compound (57.3%) used. The median time of hospital presentation was 6 hours. Vomiting was the most common presenting symptom (86.3%). Intermediate syndrome occurred in four patients. The mortality rate was 11.96%.

CONCLUSION

Married individuals in their late twenties had a higher prevalence of OP poisoning, predominantly associated with suicidal intentions. Strengthening regulations on the distribution and availability of pesticides could play a significant role in reducing the burden of OP poisoning.

KEYWORDS

Organophosphate, Pesticide, Prevalence

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INTRODUCTION

Organophosphate (OP) poisoning is a common public health problem in developing countries, including Nepal.[1] Due to widespread agricultural use, these compounds are readily accessible.[2] Both intentional and accidental exposures contribute to the burden of poisoning, with self-harm being the predominant cause.[2] Rising suicide rates are alarming and may be directly associated with the prevalence of OP poisoning.[3]

Despite extensive use of OP compounds in Western Nepal, the data describing their prevalence and clinical patterns are limited.[4] Understanding the regional trends is essential for improving clinical management and may also support the development and enforcement of regulatory measures to reduce pesticide misuse. This study aimed to determine the prevalence of OP poisoning, describe the presenting features and complications among patients attending a tertiary care center in Western Nepal.

MATERIAL AND METHODS

This retrospective hospital-based study was conducted at the Universal College of Medical Sciences and Teaching Hospital (UCMS-TH), Bhairahawa, Lumbini Province, Nepal, between June 1, 2020 and August 15, 2022. Ethical approval was obtained from the Institutional Review Committee (IRC) of UCMSTH (UCMS/IRC/116/22). All available medical records of poisoning cases during this period were thoroughly reviewed. A total of 317 poisoning cases were registered, of which, 131 individuals with documented cases of organophosphate (OP) poisoning were included. Patients with inadequate records or missing data were excluded. Ultimately, 117 cases of OP poisoning were included in the analysis. The flow diagram of the study is shown in figure 1.

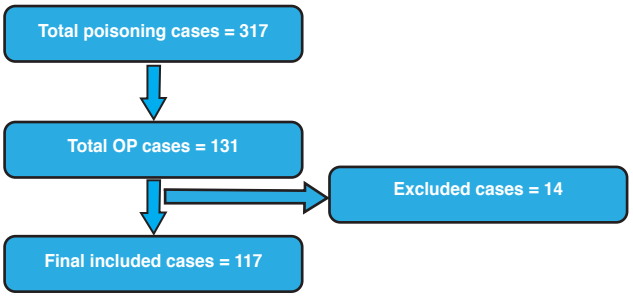

Figure 1. Flow diagram of the study

A study proforma was used to collect socio-demographic data and clinical details, including the type of OP compound, route of exposure, time to hospital presentation, immediate symptoms, comorbidities, duration of hospital stay, treatment administered, addiction history, complications (including intermediate syndrome), and mortality rate. Intermediate Syndrome was defined as the development of proximal muscle weakness, neck flexor weakness, cranial nerve involvement, or respiratory muscle weakness occurring 24–96 hours after OP exposure, as recorded.

We entered the data into Microsoft Excel 2010 and analysed them using Statistical Package for the Social Sciences (SPSS v. 20). The prevalence of organophosphate poisoning, with corresponding 95% confidence intervals, was determined. Continuous variables were reported as their medians and interquartile ranges due to non-normal distribution. Categorical variables were reported as frequencies and percentages and illustrated through tables or diagrams.

RESULTS

Of the 317 poisoning cases registered, 131 involved organophosphate (OP) compounds. The prevalence of OP poisoning was 41.3% (95% CI: 35.8%–46.9%). For a detailed analysis of demographics and clinical features, 14 cases with incomplete or missing records were excluded, resulting in 117 cases.

Of the 117 patients, a slightly higher proportion were female, accounting for 60 cases (51.3%) of OP poisoning. The median patient age was 27 years (IQR: 20–37), with the 21–40 age group accounting for the largest proportion (68; 58.1%), followed by patients younger than 20 years (29; 24.8%). Most patients were married (81; 69.2%). A summary of the socio-demographic profiles of the study population is provided in Table 1. The seasonal distribution showed that most cases occurred during summer (45; 38.5%), followed by autumn (31; 26.5%), and spring (27; 23.1%). Figure 2 depicts the regional distribution of the patients.

Table 1. Socio-demographic characteristics (n = 117)

Variables		Frequency (n)	Percentage (%)
Gender	Male	57	48.7
	Female	60	51.3
Age-group (Years)	≤ 20	29	24.8
	21-40	68	58.1
	> 40	20	17.1
Marital status	Married	81	69.2
	Single	36	30.8
Religion	Hindu	111	94.9
	Muslim	4	3.4
	Buddhist	2	1.7

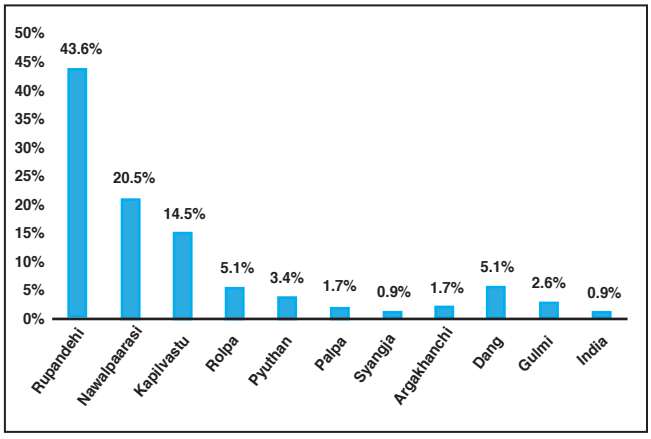

Figure 2. District-wise distribution of the patients

Suicidal ingestion was the cause in 106 patients (90.6%), of which eight (6.8%) occurred under alcohol influence, and three (2.6%) were accidental exposures. Oral ingestion was the route in all cases. Chlorpyrifos was the most frequently used OP compound (67; 57.3%). Among all cases, 43 (36.8%) involved compounds of unknown origin. The median time from poisoning to hospital presentation was 6 hrs (IQR: 3-11 hours). Patient presentations were most frequent between 6 PM and 2 AM (38; 32.5%), followed by the periods 12 PM–6 PM (31; 26.5%) and 6 AM–12 PM (30; 25.6%). The median hospital stay was seven days (IQR: 5-12 days). The circumstances of OP poisoning and the specific OP compounds used are summarized in table 2.

Table 2. Circumstances of OP poisoning and types of OP compounds (n = 117)

Variables		Frequency (n)	Percentage (%)
Time of poisoning	6 am -12 pm	30	25.6
	12 pm -6 pm	31	26.5
	6 pm -12 am	38	32.5
	12 am - 6 am	18	15.4
OP compound used	Chlorpyriphos	67	57.3
	Metacid	2	1.7
	Dichlorvos	3	2.6
	Carbofuran	1	0.9
	Dimethoate	1	0.9
	Unknown	43	36.8
Suicidal/Accidental	Suicidal	106	90.6
	Accidental	3	2.6
	Suicidal under alcohol influence	8	6.8
Hours after poisoning	< 2	19	16.2
	2 - 4	28	23.9
	4 -6	17	14.5
	6- 8	12	10.3
	8-10	11	9.4
	>10	30	25.6
Duration of Hospital stay (Days)	1	3	2.6
	2- 3	11	9.4
	4-5	26	22.2
	6-7	19	16.2
	8- 9	16	13.7
	≥10	42	35.9

Most patients (n = 103; 88%) were managed in CCU after ER admission, while seven (5.9%) were admitted to the ICU and four (3.4%) to the medicine ward. In the ER, three patients (2.6%) were already deceased upon arrival. Most patients (93; 79.5%) had no history of underlying comorbidities, with Alcohol Dependence Syndrome (ADS) and depression observed in nine (7.7%) and four (3.4%) cases, respectively. The comorbidities and addiction history are summarized in table 3.

Table 3. Co-morbidities and Addiction History (n = 117)

	Variables	Frequency (n)	Percentage (%)
Comorbidities	None	93	79.5
	ADS*	9	7.7
	Depression	4	3.4
	Diabetes Mellitus	6	5.1
	Hypertension	4	3.4
	Others#	6	5.1
Addiction History	None	77	65.8
	Only Alcohol	31	26.5
	Alcohol + PMT	6	5.1
	PMT consumption**	3	2.6

*ADS = Alcohol Dependent Syndrome; **PMT = Pan Masala Tobacco. # included Seizures, Rheumatic heart disease, Asthma, Thyroid disorders, and Tuberculosis.

NOTE: The frequencies and percentages of comorbidities do not add up to 117 and 100% because many patients had a combination of comorbidities (e.g., Diabetes Mellitus and Hypertension)

Vomiting was the predominant immediate symptom (n = 101; 86.3%), with frothing and hypersalivation reported in 22 cases (18.8%). Atropine and pralidoxime were administered to all patients. Medications targeting specific complications and underlying comorbidities were given as clinically indicated. Seventeen patients (14.5%) developed aspiration pneumonia and atropine-induced psychosis. Four (3.4%) patients developed intermediate syndrome. Overall, 14 (11.96%) patients died due to cardiopulmonary arrest. Table 4 summarizes the immediate symptoms, post-treatment complications, and mortality of the patients.

Table 4. Immediate symptoms, complications, and mortality (n = 117)

	Variables	Frequency	Percentage
Immediate Symptoms	None	6	5.1
	Vomiting	101	86.3
	Neurological symptoms*	21	17.9
	Epigastric Pain	12	10.2
	Frothing/Hypersalivation	22	18.8
	Lacrimation	5	4.3
	Urine and Stool Incontinence	8	6.8
	Diarrhea	4	3.4
	Shortness of breath (SOB)	3	2.6
	Weakness	1	0.8
	Chest pain	1	0.8
	Burning Sensation in throat	1	0.8
Complications	None	56	47.8
	Aspiration Pneumonia	17	14.5
	Intermediate Syndrome	4	3.4
	Acute Pancreatitis	5	4.2
	Hematological**	7	6
	Renal ***	6	5.1
	Acute Hepatitis	1	0.8
	Atropine induced psychosis	17	14.5
	Seizure	2	1.7
	Hypokalemia	3	2.6
	Sepsis	1	0.8
	DKA	1	0.8
	Death (CPA)	14	11.9
Mortality	Live	103	88
	Death	14	12

*Neurological symptoms included Loss of consciousness; Psychosis; Abnormal body movements, slurring of speech, headache, dizziness, & blurring of vision. ** Hematological complications included anemia, leucopenia, & thrombocytopenia, *** Renal complications included AKI & UTI.

NOTE: The frequencies and percentages of immediate symptoms and complications do not add up to 117 and 100% because many patients had a combination of symptoms and complications (e.g., vomiting + neurological symptoms; aspiration pneumonia + atropine induced psychosis)

DISCUSSION

In this study, the prevalence of OP poisoning was 41.3%. This proportion is higher than some reported rates from Central Nepal (< 20%).[5,6] Another study from Nepal reported a much lower prevalence of 4.51%.[7] It is important to account for variations in study populations, as their investigation was limited to patients admitted to the Intensive Care Unit (ICU), with prevalence estimates derived exclusively for that sub-group.[7] Furthermore, regional studies across Nepal have consistently reported higher prevalence rates, with estimates spanning from 37.3% to 66.3%.[8-10] These discrepancies primarily reflect differences in study settings and variations in denominator definitions, specifically whether total poisoning cases or only pesticide-related cases were included.[9,10] Hence, reported prevalence rates should be interpreted with caution, as reliance on these figures alone may lead to misinterpretation.

The gender-wise distribution in the current study showed a slight female preponderance (51.3%). The study population had a median age of 27 years, with 58.1% aged 21- 40 years and 24.8% aged ≤ 20 years. Nearly two-thirds of the patients were married (69.2%). Similar gender and age-group distributions have been documented in earlier studies from Nepal, consistent with our findings.[5,7,11] In contrast, a marginally higher male-to-female ratio (1.05:1) was reported in one study.[6] OP poisoning occurred most frequently during the summer (45%), followed by autumn (31%) and spring (27%). Seasonal trends have not been uniformly described in studies from Nepal. Nevertheless, a Nepalese study reported a similar summer predominance.[11] The high incidence of OP poisoning during the agricultural season is likely linked to the extensive application of OP pesticides in crops. Agriculture is a major occupation in Nepal and regulatory measures are needed to ensure safe pesticide use.[2] The success of such oversight is reflected by the substantial reduction in OP poisoning rates in the U.S., following the Environmental Protection Agency's efforts to implement a phased elimination of OP pesticides from residential settings.[12,13] Nepal ranks third worldwide for female suicides and seventeenth for male suicides, a reversal of the global norm of male predominance.[14] Although national-level data are limited, these trends highlight rising suicide concerns and are consistent with the observed higher rates of OP poisoning among females.[14] Other studies have also identified female sex, younger age, and the spring/summer seasons as common factors associated with OP poisoning.[15-17] Young adults encounter various life challenges and stressors such as career pressures, relationship difficulties, family obligations, and financial stress, that may increase susceptibility.[2] Rigorous and systematic analyses are needed to establish these associations definitively.

The vast majority of poisoning cases in our study were intentional, with 90.6% representing suicidal acts and 6.8% occurring under the influence of alcohol. All incidents involved oral ingestion, consistent with findings from studies in Central and Mid-western Nepal.[5,8,9,11,18] In our study, Chlorpyriphos accounted for 57.3% of OP poisoning cases, although the actual proportion may be higher, given that 43 cases (36.8%) involved unidentified compounds. This pattern differs from reports in Mid-Western and Central Nepal, where dichlorvos and methyl parathion were more common.[18,19] The limited use of dichlorvos in our study likely reflects the 2019 ban on its import and production for suicide prevention.[20] Nevertheless, surveys indicate that nearly 44,000 liters of dichlorvos stockpiles remained available to farmers in Mid-Western Nepal until 2021, highlighting the continued availability of older stock.[20] This could have led to higher dichlorvos in previous studies.[18,19] Particularly troubling are the findings from Central Nepal (2012–2014), which showed that methyl parathion accounted for 52 of 62 poisoning cases.[19] Despite its ban in 2006 owing to extreme toxicity and environmental hazards, its persistent use reflects deficiencies in regulatory enforcement.[20] This calls for comprehensive monitoring and intervention.

Most poisonings in our study occurred between 6 PM - 12 PM (32.5%), followed by 12 PM - 6 PM (26.5%) and 6 AM - 12 PM (25.6%). The median interval between poisoning and hospital presentation was six hours, substantially longer than the three-hour median reported from Central Nepal.[7, 21] The median hospital-stay duration in our study was seven days. Other studies indicated varying average hospital stay durations, ranging from 3.9 to 13.2 days.[7,18,21] Such variability likely reflects differences in study design, with some analyses assessing overall trends rather than targeting OP poisonings exclusively.

At presentation, vomiting was observed in 86.3% of patients. The most commonly reported complications were aspiration pneumonia and atropine-induced psychosis, each affecting 14.5% of cases. Intermediate syndrome was observed in four (3.4%) cases. Nearly half (47.8%) did not experience any complications. Bhusal et al., in their study from Central Nepal, identified vomiting and tachycardia as the predominant symptoms.7 While Agrawal et al. reported a higher incidence (5%) of intermediate syndrome compared to our findings, their study focused on pesticide poisoning cases in Eastern Nepal rather than exclusively on OP poisoning cases.10 Most patients (88%) in our study were managed in the Coronary Care Unit (CCU) following Emergency Department admission, while a small subset (5.9%) received care in the Intensive Care Unit (ICU). The mortality rate was 11.96%, primarily from cardio-pulmonary arrest. Prior studies reported fatality rates ranging from 1.5% to 16%.[5,8,10] These discrepancies may be attributed to differences in hospital presentation time, geographic factors, and study populations, such as ICU-focused cohorts.

This study has several limitations, notably its retrospective design and single-center setting. Use of medical records may have impacted the accuracy and broader applicability. Prospective, multi-center studies are warranted to overcome these limitations, incorporating insights for public health implications, pesticide regulation, and clinical management strategies.

CONCLUSION

The prevalence of OP poisoning was 41.3% with a mortality of 11.96%. The highest burden was on females, married individuals, and those in their late twenties, largely driven by suicidal behaviour. Addressing these issues may require stricter regulations on OP pesticide distribution alongside focused mental health support for vulnerable populations.

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CONFLICT OF INTERESTS

None

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