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Clinical Profile and Outcome of Organophosphorus Poisoning in ICU

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Abstract

Background: Organophosphorus compounds are associated with significant morbidity and mortality in developing countries, predominantly affecting age group 21-30 years. Present study was planned to study clinical profile and outcome of organophosphorus poisoning in intensive care unit (ICU) patients.

Methods: Patients admitted to Indira Gandhi Government Medical College, Nagpur during April 2018 to March 2019 with history of organophosphorus poisoning were studied.

Results: During the study period, total admission in ICU was 2751, of them organophosphorus poisoning cases were 474 (17.23%). Most common cause was suicidal and affecting people was farmer and age group 21-30 years. Most commonly seen in male 81.01% (384 cases) as compare to female 18.98% (90 cases). Number of admission above 60 years patients was 15 cases (3.16%) and mortality in op poisoning was found to be 16.6%. Severity of OP poisoning cases decides by pop scale was moderate grading found maximum on admission.

Conclusion: Organophosphorus poisoning has common mode of suicide in rural area. The easy availability of the poison and poor health care facility has cause highest mortality rate. Selective ban on oragnophophorus compounds those having high mortality rate and patients who reached hospital earlier and received immediate treatment in ICU have chances of high survival rate.

Keywords: Organophosphorus; Poisoning; Intensive care unit; Mortality; Pop scale

Introduction

Organophosphate (OP) compounds are used as commercial insecticides and its widespread use and easy availability has increased the likelihood of poisoning with these compounds in developing countries like India [1]. During past four decades more than 50,000 organophosphorous compounds have been synthesized and tested for insecticidal activity, but the number actually used for this purpose today probably does not exceed three dozen [2]. However, organophosphorus compounds are used as pesticides, herbicides, and chemical warfare agents in the form of nerve gases. The importance of pesticides in India can

be understood from fact that agriculture is major component of Indian economy [3].

Accidental and occupational exposures were estimated to cause 1 million cases with 200,000 deaths [4]. Recent data from the National crime bureau of India shows a mortality rate of 26.6% (34,869) in the year 2017 by the consumption of pesticides [5]. Poisoning is the fourth most common cause of mortality in rural India. In North India aluminum phosphide and organophosphate, poison is common. Overexposure to pesticides can occur before spraying because of easy availability for children, lack of adequate labeling and not taking any protective measure during mixing and spraying. Moreover, easy availability in shop and cheap in cost, organophosphorus poison is used as suicidal poison [6].

OP compounds lead to acute and chronic complications. Acute complications include acute respiratory failure, acute respiratory distress syndrome (ARDS), types I and II paralysis, intermediate syndrome (IMS), sudden cardiac death, aspiration pneumonitis, and resecretions while chronic complications include anxiety, depression, polyneuropathy, paralysis, and coma [7]. Poisoning with these compounds is very serious and requires treatment in intensive care unit as they present with life-threatening complications and may result in mortality. It also affects respiration, which may endanger the individual's life. Hence the present study was undertaken to assess the clinical profile, severity and outcome of OP poisoning cases admitted in ICU at Tertiary health care institute.

Materials and Methods

Patients on admission presented with unknown poisoning but after clinical examination and investigation diagnose as OP poisoning patient or any poisoning mix with OP compound and accidental exposure or ingestion of contaminated water with OP and not taking any protective measure while mixing & spraying OP poisoning cases admitted in ICU at Indira Gandhi Medical College Nagpur during period of 1st April 2018 to 31st March 2019 were included in the study. In this retrospective observational study a total of 474 cases with OP were admitted to the hospital during the study period. Exclusion criteria were cases of poisoning other than oranophosphorus poisoning and cases of OP poisoning with other traumatic condition like hanging.

Initial decontamination procedures were carried out including skin decontamination by removal of all clothing, washing skin and hair with soap and water and gastrointestinal lavage with activated charcoal. A detail history, demographic and clinical profiles were noted. Patient admitted in ICU through casualty with history and clinical features of oraganophosphorus poison. Information regarding general and systemic examinations as well as details of routine laboratory investigations/results was recorded for the duration of the patients' stay in the ICU. All cases were treated with inj pralidoxime 2 gm iv loading dose within 4 hour and followed by 500 mg every 1 hour diluted with normal saline completed dose 12 gm. and inj atropine every 5 min interval up to fully atropinised followed by titrate dose according to pupil size, heart rate and temperature and mental status [8, 9].

Cases of organophosphate poisoning satisfying eligibility criteria were investigated. POP (Peradenya Organophosphorus Poisoning) scale was determined (Table 1). Adequate airway was maintained in unconscious patients and if necessary endotracheal

intubation was done and ventilatory support was given. All patients were managed according to standard line of management of organophosphorus poisoning. Specific antidotes were used whenever necessary. Other necessary treatment was given according to clinical condition of the patient whenever needed. Data collection was started after institutional ethical committee approval. The data was presented in tabular form and expressed in frequency and percentages.

Table 1: Peradenya organophosphorus poisoning scale

Sn.	Parameter	Criteria	Score
1	Pupil size	>2mm	0
		< 2mm	1
		pinpoint	2
2	Respiratory rate	<20/min	0
		>20/min	1
		>20/min with central cyanosis	2
3	Heart rate	>60/min	0
		41-60/min	1
		<40/min	2
4	Fasciculation	None	0
		Present, generalised / continuous	1
		Both generalized & continuous	2
5	Level of consciousness	Conscious and rationale	0
		Impaired response to verbal command	1
		No response to verbal command	2
6	Seizures	Absent	0
		present	1
0-3 - Mild poisoning 4-7 - Moderate poisoning 8-11 - Severe poisoning			

Observations and Results

Total admissions in ICU from 1st April 2018 to 31st March 2019 were 2751 cases, of them 474 cases of organophosphorus poisoning. Thus, the incidence of organophosphorus poisoning in present study was 17.23%. The maximum cases of OP poisoning were found in January 2019 month as shown in table 2.

Table 2: Number of OP admissions in ICU from April 2018 to March 2019

Name of months	Admitted cases OP in ICU	Total admissions in ICU for month	Percentage of op admissions in ICU
April 2018	41	197	20.81
May 2018	41	208	19.71
June 2018	38	210	18.09
July 2018	38	251	15.13
Aug 2018	44	252	17.46
Sept 2018	38	235	16.17
Oct 2018	37	212	17.45
Nov 2018	39	219	17.80
Dec 2018	33	239	13.80
Jan 2019	48	259	18.53
Feb 2019	36	222	16.21
Mar 2019	41	247	16.59
Total	474	2751	17.23%

The age group most commonly affected was between 21-30 years (39.2%) in both sexes and detailed age distributions are shown in table 3.

Table 3: Age distribution of oraganophosphorus cases

Month	<20 yrs	21-30 yr	31-40 yr	41-50 yr	51-60yr	>60 yrs
April 2018	5	14	8	7	6	1
May 2018	5	17	9	8	1	1
June 2018	4	16	11	3	4	0
July 2018	6	11	10	7	2	2
Aug 2018	7	17	11	4	3	2
Sept 2018	5	19	7	2	4	1

Oct 2018	6	17	8	3	2	1
Nov 2018	7	11	8	7	5	1
Dec 2018	6	17	3	4	3	0
Jan 2019	9	18	8	10	1	2
Feb 2019	6	13	9	5	2	1
Mar 2019	2	16	12	5	3	3
Total	68 (14.3 %)	186(39. 2%)	104(21. 9%)	65(13. 7%)	36(7.5 9%)	15(3.1 6%)

Incidence of organophosphorus poisoning was more in males (81.01%) when compared with female (18.98%) as shown in table 4.

Table 4: Sex distribution of organophosphorus cases

Month	Male	Female	Total
April 2018	31	10	41
May 2018	32	09	41
June 2018	27	11	38
July 2018	29	09	38
Aug 2018	39	05	44
Sept 2018	34	04	38
Oct 2018	32	05	37
Nov 2018	31	08	39
Dec 2018	25	08	33
Jan 2019	41	07	48
Feb 2019	30	06	36
Mar 2019	33	08	41
Total	384(81.01%)	90(18.98%)	474

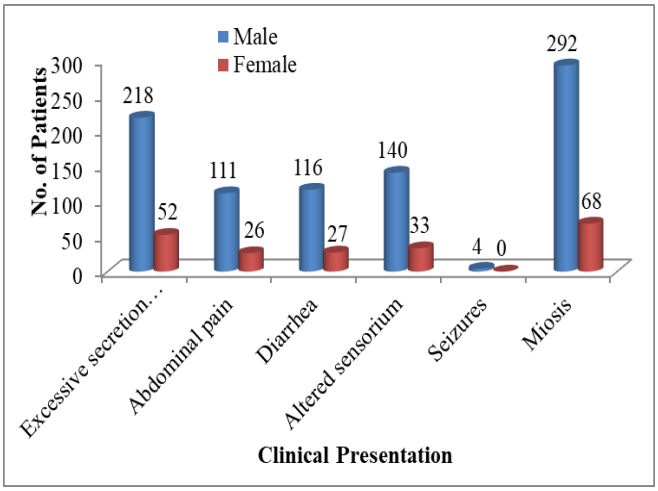
The main reason for poison consumption was suicidal followed by intentional and accidental exposure (Table 5). Majority of cases were seen in farmer and field worker with rural region. Oral consumption was most common route of poisoning as compare to cutaneous exposure.

Table 5: Some data with admission mortality and exposure

Month	Mortality	Op+ alcohol	Accidental
April 2018	7	0	1
May 2018	10	4	0
June 2018	8	6	0
July 2018	14	3	0
Aug 2018	4	6	0
Sept 2018	4	1	2
Oct 2018	6	1	1
Nov 2018	5	1	0
Dec 2018	5	2	0
Jan 2019	3	2	0
Feb 2019	8	1	0
Mar 2019	5	2	0
total	79(16.6%)	29(6%)	4(0.84%)

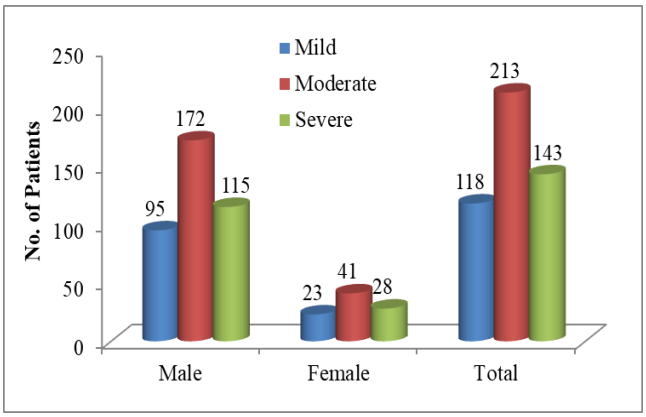
The most common clinical presentation was miosis (Total= 360; 76%) followed excessive secretions and respiratory distress (270; 56.9%). The details of clinical presentations are depicted in figure 1.

Figure 1: Comparison of clinical presentations among male and female patients



The majority of cases were found moderate (44.9%) severity as per POP scale and mostly in males as shown in figure 2.

Figure 2: Distribution of cases according to severity of OP by POP scale



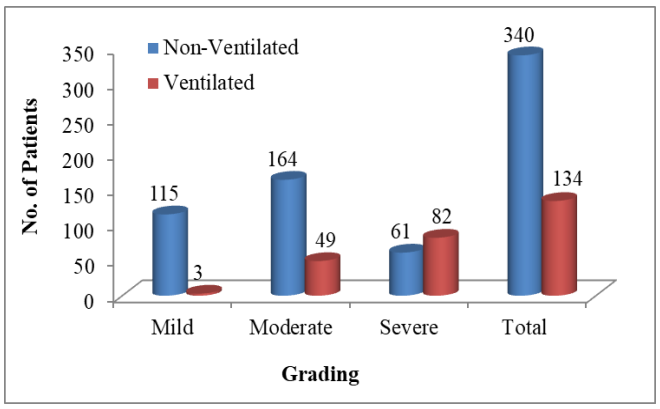
Hospital stay and mortality was depending on severity of poisoning on admission. The level of serum cholinesterase on admission showed that maximum patients (437; 92.19%) had decline serum cholinesterase level <5000 IU i.e. below normal range (Table 6).

Table 6: Serum cholinesterase level of organophosphorus cases

Sr cholinestarase	Severity	Frequency
<1000	Severe	61(12.8%)
1001-2000	Moderate	80(16.8%)
2001-3000	Mild	175(36.9%)
3001-4000	Mild	104(21.9%)
4001-5000	Mild	17(3.6%)
>5000	Mild	37(7.8%)

Ventilator support was needed in 28.2% cases depend on grading of severity of OP poisoning, patients with severe grade of poisoning had more ventilator support as depicted in figure 3.

Figure 3: Ventilator support with severity of Organophosphorus poisoning



Most of the organophosphorus poisoning patients was expired in July 2018 (36.8%), followed by in May 2018 (24.3%), & February 2019 (22.2%). Overall mortality of organophosphorus poisoning in ICU was 16.6%, among them most common in males (78%) as shown in table 7.

Table 7: Mortality distribution

Month	Male	Female	Total	Percentage
Apr 2018	6	1	7	17.0
May 2018	6	4	10	24.3
Jun 2018	5	3	8	21.0
July 2018	10	4	14	36.8
Aug 2018	4	0	4	09.0
Sep 2018	4	0	4	10.5
Oct 2018	5	1	6	16.2
Nov 2018	4	1	5	12.8
Dec 2018	4	1	5	15.1
Jan 2019	3	0	3	06.25
Feb 2019	7	1	8	22.2
Mar 2019	4	1	5	12.1
Total	62(78%)	17(21.5%)	79(16.6%)	16.6%

Discussion

Organophosphorus poisoning often presents as a medical emergency requiring monitoring and management in intensive care unit. Management of poisoning depends on clinical severity and is assessed by clinical signs and symptoms as well as laboratory evaluation. In mild cases, the management of poisoning done by removing the patient from the area of exposure

and a low dose of atropine may suffice. However, in severe cases, mechanical ventilation, high doses of antidotes and resuscitation become necessary. Present study reported cases of OP poisoning were distributed throughout the year and was more common in the month of January 2019. Kar et al demonstrated that incidences were very large in the month during May to august (56.92%) and the reason may be that this was main harvesting season in Nepal [10]. Muhammad et al showed that most of poisoning occurred in July, August and September [11].

In the present study OP poisoning was prevalent in age group of 21-30 years (39.2%) which is consistent with other studies [12, 13]. The possible reasons for this in our country might be unemployment and the people in this age group are described to be most stressful, emotionally weak, and vulnerable to minor conflicts, failures, or disappointments during this phase of life. Also this was the main working age group and has whole responsibility of their family and exposed to OP compounds while working in farm. The incidence of OP poisoning was more common in males than in females which are similar to previous studies [13, 14]. This may be due to males are main working group in outdoor field, i.e. they are more involved in spraying crops in the farms. The main reason for poison consumption was suicidal followed by intentional and accidental exposure. This finding is comparable with the other studies [14, 15] while Khan et al [16] reported much higher incidence of accidental OP (87.3%) as compared to our study (0.84%). The most common way of OP poisoning was found to be oral intake which is in accordance to other studies [17, 18]. This might be explained by its easy availability and relatively cheap and having rapidly lethal action even in smaller doses, they are widely used as suicidal poisons. The most common clinical presentation was pupillary constriction (76%), followed by excessive secretion and respiratory failure (56.9%), altered sensorium (36.4%), diarrhea (30.2%), abdominal pain (28.75%), seizures (1%), and fasciculations. These findings are comparable with the study done by Salame et al [12] and Noshad et al [19].

The POP scale and serum cholinesterase at presentation appeared useful to assess the severity of poisoning. The majority of patients had a moderate grade (44.9%) of poisoning as per POP scale and mostly in males which is comparable with the study done by Gagarin et al [13] and Bhattacharya et al [20]. The maximum patients (437; 92.19%) had decline serum cholinesterase level <5000 IU i.e. below normal range, this was consistent with results of Chintale et al study [14]. The patients with severe grade of poisoning had more decrease serum cholinestarase level i.e. <1000 followed by moderate and mile grade of poisoning, Timely administration of an antidote insufficient dose and duration are much more important in the patients with evidence of a moderate and severe degree of OP poisoning. Such patients need to be monitored and observed closely with good supportive care. Similarly, strict implementation of the pesticide act and involving a new policy by the government to educate the public and youth in large about the dangerous life-threatening effects of OP compounds could help ameliorate the harmful effects of such poisoning.

Respiratory failure is the most common dreaded complication in OP poisoning leading to mechanical ventilation and death. The higher the clinical grade on admission more is incidence of respiratory failure and need ventilator support [21, 22]. In the current study,

28.2% of the subjects were on mechanical ventilation which similar to previous studies [12, 13]. Patients with severe grade of poisoning had more ventilator support followed by moderate and mild grade of OP poisoning.

The toxic effects of OPs are associated with significant morbidity and mortality and are a major global clinical problem. Mortality ranges from 4-30% in Indian studies [23]. Among the 474 patients, death was reported in 79 (16.6%) patients and 395 (83.33%) patients survived after mechanical ventilation. Thus the overall mortality was 16.6% and this was compared with other studies [12, 24]. We assume that death due to OP poisoning is rather due to the more severe poisoning and the duration of the mechanical ventilation. The mortality can also be very high in case the victims are from rural areas. Mortality rates depend upon amount and type of compound, condition of patient on arrival at hospital, delay in diagnosis and treatment, and respiratory management.

One third of admission in ICU was of OP poisoning so this study is very helpful to shows the incidence of OP poisoning case in ICU. OP compounds are easily available at small shop and shop keeper sales to anybody without any personal identity proof. Government should take initiation regarding easy availability of OP compounds and make some restriction just like

1) Without identification card should not purchased at small shop and keep records

2) Company of manufacture of OP compounds give protective equipment which are used while handling and spraying the OP compound

3) Company of manufacture of OP compounds educate and give training to farmers about toxicity of op compounds, precaution and use of protective equipment while handling OP compounds.

Conclusion

It can be concluded that organophosphorous is the leading cause of poisoning and has common mode of suicide requiring admission to the ICU in the central rural part of India. OP poisoning is more common among the younger population, below 40 years with male preponderance. The majority had a moderate grade of poisoning, easy availability of the poison and poor health care facility has cause highest mortality rate. Selective ban on oragnophophorus compounds those having high mortality rate and patients who reached hospital earlier and received immediate treatment in ICU have chances of high survival rate.

The overall aim of agricultural policies must be to reduce the use of pesticides to the lowest feasible level. This will reduce number of agricultural pesticide poisoning and minimize the overall exposure to pesticides at the community level. There is a need for prospective studies to understand the underlying socioeconomic factors responsible for OP poisoning in our population, and, accordingly, address the problems to reduce the incidence of OP poisoning cases.

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