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ASSESSMENT OF SEVERITY OF ORGANOPHOSPHORUS POISONING AND PREDICTING THE NEED FOR VENTILATORY SUPPORT.

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ABSTRACT **INTRODUCTION:** Respiratory failure is the one of the major complication leading to death in organophosphorus compound poisoning. Early recognition of respiratory failure and prompt ventilatory support may improve survival in these patients.

Aim of study: This study was undertaken to assess the severity of organophosphorus(OP) compound poisoning both clinically by using Peradeniya scoring, estimating seum cholinesterase levels and to correlate serum cholinesterase levels and Peradeniya OP poisoning scale to predict the need for ventilatory support.

Materials and methods: prospective descriptive and intention to treat study conducted at Narayana medical college for one year period. 149 patients were included in study after applying inclusion and exclusion criteria. Serum cholinesterase levels and Peradeniya organophosphorus compound poisoning (POP)score were studied in all cases.

Result: Most of patients with moderate (65%) and severe poisoning (100%) according to POP scale required ventilatory support. Most of patients with moderate (40%) and severe poisoning (100%) according to POP scale expired. P value <0.005. 85% of patients with PChe levels <50% required ventilatory support. Patients with PChe levels <50% had more mortality compared to patients with PChe levels >50%.

Conclusion: POP score of more than 5 correlated in predicting the need for ventilatory support and mortality. Pseudo cholinesterase levels in conjuction with Peradeniya OP poisoning score is a useful parameter for grading severity of OP poisoning and in predicting the need for ventilatory support and mortality.

KEYWORDS : OP compound poisoning, seum cholinesterase levels, Peradeniya OP score, ventilatory support.

INTRODUCTION

Organophosphorus compound (OPC) poisoning is the most common cause of admission to emergency wards in India, accounting to around 80% of all pesticide related poisonings.(1).

The deleterious effects of OPC were recognized in 1932 by Lange and von Kruger. During the Second World War Schrader developed around 2000 organophosphorus compounds including sarin, parathion and paraxon. They were used as potential chemical warfare agents (2, 3). Organophosphorus (OP) compounds are used as pesticides, herbicides, and chemical warfare agents in the form of nerve gases[4]. Organophosphates irreversibly inhibit the enzyme acetyl cholinesterase, leading to accumulation of acetylcholine at synapses and myoneural junctions. Prolonged action and excess of acetylcholine at the autonomic, neuromuscular, and the CNS synapses leads to cholinergic over activity. The clinical manifestations of poisoning are the result of dysfunction of these synapses[5].

Although poisoning can be the result of occupational exposure or accidental ingestion, in majority of cases the intent is suicidal. Their ease of availability renders OP insecticide poisoning a worldwide phenomenon. The WHO estimates that approximately 3 million pesticide poisonings admissions occurring annually worldwide causing more than 200000 deaths. Organophosphorus compounds are among the most common agents used for suicidal poisoning in India[6] Developing countries like India and Srilanka report alarming rates of toxicity and death [7,8].

In Indian studies the mortality ranges from 4-30%. Respiratory failure is the one of the major complication leading to death. Early recognition of respiratory failure and prompt ventilatory support may improve survival in these patients. Due to lack of infrastructure and intensive care units(ICU) beds, all patients with OPC poisoning are not managed in ICUs in Indian setup. It is therefore essential to identify clinical features and criteria to predict need for ventilatory support at initial examination.

Serum cholinesterase levels or pseudocholinesterase (Pche) levels are very specific for OPC poisoning, easier to estimate and usually depressed after OP poisoning. Peradeniya OP poisoning score (POP score) was devised by Senanyake et al[9] in 1993. This scale uses clinical parameters to assess the severity of poisoning and to prognosticate patient's condition. POP scale can be a simple and effective system to determine the need for ventilator support early on in the course. Hence this study was undertaken to assess the severity of organophosphorus compound poisoning both clinically by using Peradeniya scoring, estimating seum cholinesterase levels and to correlate serum cholinesterase levels and Peradeniya OP poisoning scale to predict the need for ventilatory support.

Materials and methods:

This study was a prospective descriptive and intention to treat study conducted at Narayana medical college, Nellore during January 2016 to December 2016. There were 149 patients of OP compound poisoning admitted to the Department of Medicine during the study period. After applying inclusion and exclusion criteria, 60 patients who fulfilled all the criteria were chosen as study subjects. (n=60). The study was approved by institutional ethical committee.

Inclusion Criteria:

Patients with history of exposure or consumption of organophosphorus compound, as indicated by patients or relatives within previous 24 hours with characteristic clinical manifestations of organophosphorus compound poisoning were included in the study.

Exclusion Criteria:

Patients treated elsewhere with atropine before admission.
Patients with a doubtful diagnosis.
Patients who consumed a combination of poisons.
Patients with serious systemic illness.

Method of collection of data:

All patients who presented to emergency department with history of organophosphorus compound poisoning were taken as study subjects. Information was collected from patients or their relatives regarding the type of compound, time of consumption, cause for consumption. A detailed clinical examination was carried out with particular reference to vital parameters, pupil size, assessment of central nervous system, respiratory system, cardiovascular system as per prescribed proforma. All relevant biochemical investigations were performed. This examination took place during initial resuscitation and treatment of the patient.

Peradeniya OP poisoning scale (table 1) was applied to all study subjects and the severity of OP poisoning was graded as mild, moderate, severe (table 2).

Table 1: Peradeniya organophosphorus poisoning (POP) scale

Sl. No.	Parameter	Score
1	Miosis - Pupil size >2mm - Pupil size ≤2mm - Pupils pin point	 0 1 2
2	Fasciculations - None - Present but not generalized or continuous - Generalized and continuous with central cyanosis	 0 1 2
3	Respiration - Respiratory rate ≤20/min - Respiratory rate >20/min - Respiratory rate >20/min with central cyanosis	 0 1 2
4	Bradycardia - Pulse rate >60/min - Pulse rate 41-60/min - Pulse rate ≤40/min	 0 1 2
5	Level of consciousness - Conscious and rational - Impaired, responds to verbal commands - Impaired, no response to verbal commands (if convulsion present add 1)	 0 1 2
	Total	11

Table 2: severity of poisoning based on Peradeniya organophosphorus poisoning (POP) scale

POP Score	Grade
<4	Mild
4-7	Moderate
>7	Severe

In all study subjects, 3 ml of plain blood was collected on admission before administration of atropine and seum cholinesterase was estimated. Patients were classified as mild (20-50%) , moderate(10-20%) and severe(10%) poisoning based on PChe levels.[9] Patients were kept under strict observation during their stay in hospital. All patients were managed as per standard protocol. Every patient underwent decontamination including gastric lavage. Intravenous atropine, pralidoxime chloride were given to patients. All patients were followed till discharge or death. Assessment of patient's airway and need for endotracheal intubation was assessed. Patients with respiratory failure were intubated and mechanical ventilator support was given. Psychiatric counseling was done for the patients who survived.

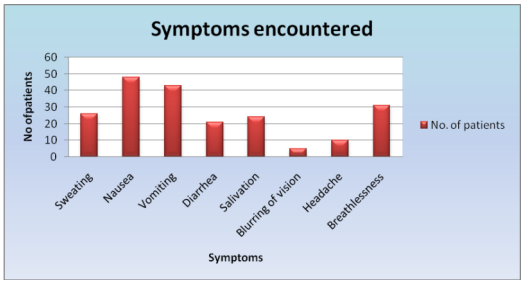
Statistical tests:
Data collected from profoma was entered into Microsoft excel sheet 2007. Data was described as actual numbers and percentages. Pearsons Chi square test was used to calculate test of significance. All statistical analysis was done using SPSS 16. A two tailed 'p' value of less than 0.05 was considered statistically significant.

RESULTS

A total of sixty patients who fulfilled the inclusion and exclusion criteria were studied. Age group ranged from 17 years to 60 years. Majority of the patients were in the age group of 21-30 years which comprised 50% of the study patients. 60% of patients were males and 40% of the cases were females. Males were more than females in age group above 20 years. More than half of our study subjects were from rural area. 63 % of patients were from lower socioeconomic group in contrast to 2 % from upper class. 39% of patients in our study were agriculturists. Next major group was constituted by housewives. More than 50% of patients had consumed less than 30 ml of poison. Only 13% had consumed more than 50 ml**.** 6 patients with moderate and severe grade of poison had consumed more than 50 ml of poison. More the amount of poison, higher was the grade of severity. This was statistically significant. Almost all patients (98.3%) had consumed poison with a suicidal intent.

The most common symptom reported by patients in our study was nausea (80%), vomiting (71.7%). Other symptoms noted are depicted in figure 1.. The most commonly found clinical sign was tachypnoea in 70% of patients followed by fasciculations which was seen in 62% of patients.

Figure 1: Graph showing symptoms at presentation



65% of patients in our study belonged to mild grade of poisoning with a POP score less than 4. Only 1 patient had a score more than 7 and had severe poisoning. In this study 65% of patients had pseudocholinesterase (PChe) levels more than 50%, normal range. Only 5% of patients had severe poisoning with PChe levels less than 10%. In the present study mortality was 17%. 83% of patients survived. 94% of patients who presented to hospital within 2 hours survived. Mortality was highest among patients who reached hospital after 4 hours of consumption (33.3%).

Only 15% of patients with mild grade of poisoning according to POP scale required ventilatory support. Most of patients with moderate (65%) and severe poisoning (100%) according to POP scale required ventilatory support. This was statistically significant. P value <0.005.

Most of patients with moderate (40%) and severe poisoning (100%) according to POP scale expired. P value <0.005.

92% of patients with normal levels of Pseudocholinesterase did not require ventilatory support. 85% of patients with PChe levels <50% required ventilatory support. Our study showed a highly significant correlation between PChe levels and the need for ventilatory support. Patients with PChe levels <50% had more mortality compared to patients with PChe levels >50%. P value - <0.001.

In our study, 31 of 39 patients with mild grade of poisoning according to POP scale had PChe levels more than 50% indicating mild grade even according to PChe scoring severity. 12 out of 20 patients with moderate poisoning according to POP scale had PChe levels less than 50%.(P value - <0.001)

We correlated individual parameters of Peradeniya op poisoning scale with need for ventilatory support as shown in table 3. Miosis, higher respiratory rate, bradycardia, altered sensorium, convulsions at admission correlated significantly in predicting need for ventilatory support. p<0.05

Table 3: Correlation between individual parameters of Peradeniya op poisoning scale with need for ventilatory support

Parameter	POP Score	Ventilatory support		Total n	Significance	
		Yes n(%)	No n(%)		X^2	P value
Miosis	0	4(100)	0	4	5.66	0.05
	1	31(70.5)	13(29.5)	44		
	2	5(41.7)	7(58.3)	12		
Fasciculations	0	18(78.3)	5(21.7)	23	3.89	0.14
	1	22(61.6)	14(38.9)	36		
	2	0	1(100)	1		
Respiratory rate	0	14(82.40	3(17.6)	17	24.06	0.001
	1	26(28.8)	7(21.2)	33		
	2	0	10(100)	10		
Bradycardia	0	35(79.5)	9(20.5)	44	13.32	0.01
	1	5(35.7)	9(64.3)	14		
	2	0	2(100)	4		
Consciousness	0	35(79.5)	9(20.5)	44	14.66	0.01
	1	5(41.7)	7(58.3)	12		
	2	0	4(100)	4		
Convulsions	0	40(72.7)	15(27.3)	55	10.91	0.01
	1	0	5(100)	5		

P<0.05, P<0.01 – Significant
P<0.001- Highly significant.
P>0.05 – Not significant.

DISCUSSION

In our study, majority of patients were in the age group of 20-30 years (50%). 85% of patients were within 40 years of age. This is in comparison to studies done by Reihman et al[10], Goel et al[11], Doshi et al[12], and Noiura et al[13] The male to female ratio in this study is 1.5:1. This corresponds to gender distribution reported by Shankar et al[14] (1.48:1), A Goel et al[11] (2.5:1), Gupta et al[15].

63% of patients in this study were from a lower socio economic group and majority of patients were agriculturists (38.3%). Farmers had maximum incidence in our study as agriculture is the main source of income in this region and easy accessibility of OP compounds to farmers. Similar findings have been reported in other studies also[10,11]. Almost all cases in our study (98%) had consumed poison with a suicidal intent. As OP compounds are generally available ready hand as pesticides and open access to these compounds at pesticide shops may be the reason for OP compounds to be used as a common mode of suicidal attempt. This is in comparison to values reported by Reihman et al[10], Noiura et al[13] (90%), Goel et al[11] (96.1%), and Gupta et al[15] (91%).

We observed that both the severity and mortality were significantly higher in those patients who were hospitalized more than 2 hours after exposure, compared to the mortality of 5.9% in patients who were hospitalized within 2 hours of exposure. These findings are in correlation with findings by Gupta et al[10], Arup kumar kundu et al.[16]

Nausea was the commonest symptom seen in 80%, followed by vomiting (72%) and sweating in 43%. All patients included in this study had a characteristic smell of organophosphorus compound. The common clinical signs were miosis (76%), tachypnoea (70%), Fasciculations (61%). These are due to excessive stimulation of the muscarnic receptor in the acute period. These findings were seen in studies done by Reihman et al[10], A Goel et al[11].

In our study, about 31 patients had consumed less than 30 ml of poison. Most patients in this group had mild (59%) and moderate grade (40%) of poisoning according to Peradeniya OP Poisoning (POP) scale. Pseudo cholinesterase (PChe) levels were in the normal range in about 67% of patients who had consumed less than 30ml and none had severe poisoning according to PChe levels. As the amount of poison increased to more than 50 ml, severity of poisoning did not correlate with either PChe levels or POP scale.

Our study had a mortality of 16.7% which is in comparison with other studies[10,13,16]. Most deaths in our study occurred within 24 hours of admission to hospital. Delay in hospitalization, type of poison and higher clinical score at presentation accounted for mortality.

97.4% of patients with mild grade of poison according to POP scale survived. 9 out of 10 patients who had expired had moderate grade (8) and severe grade (1patient) according to POP scale.POP scale had a statistically significant correlation with mortality.(p value<0.001)

Majority of patients (65%) had subclinical poisoning with their pseudo cholinesterase levels being >50%, out of which only 1 patient expired. Patients with PChe levels <50% had more mortality compared to patients with PChe levels >50%. P value - <0.001.

This in accordance with findings from Namba et al[17] who found definitive correlation between PChe levels and severity of poisoning and considered it a valid marker of severity and to prognosticate patients with OP poisoning.

Respiratory failure requiring ventilatory support was observed in 33.3% of patients in our study. This is in comparison to values obtained by Noiura et al[13] (40%), A Goel et al[11] (34.95%), Thomas chang et al [13](40.2%).

Our study showed a highly significant correlation between PChe levels and the need for ventilatory support. Weissmann- Brenner et al[14] found a direct correlation between the degree of inhibition of PChe levels and the severity of poisoning. Similar findings were documented by S.D.Zawar et al[15].

In this study, PChe levels had a sensitivity of 85% and specificity of 90% in predicting the need for ventilatory support. The positive predictive value is 85% and negative predictive value of 92%. Over all accuracy is 88%. So it can be said that, PChe levels can be a better predictor to categorize patients who might not require ventilatory support at admission. However studies with a large sample size and a heterogeneous population have to be conducted to confirm the results.

POP scale was calculated for all patients on admission. 65% of patients had mild grade of poisoning and 33% had moderate grade of poisoning. 1 patient in our study belonged to severe grade of poisoning and required ventilatory support and expired. Miosis and presence of fasciculations did not have a significant correlation in predicting need for ventilatory support in our study. However studies done by A Goel et al[11] showed patients with extensive fasciculations and miosis required ventilatory support. All patients who had presented with respiratory rate more than 20 with central cyanosis required ventilatory support. This had a highly significant correlation in predicting the need for ventilatory support. A Goel et al[11] and Bardin et al[21] has found a significant correlation between respiratory failure and need for ventilatory support. The presence of bradycardia(61.1%) correlated significantly as a predictor of mechanical ventilation. Patients who presented with altered sensorium and seizures (69%) required a mechanical ventilator. This is in corroboration with many Indian studies[11,12].

POP score ranges from 0 to 11. Majority (70%) of our patients with a score more than 4 required ventilatory support. This finding was in correlation with study by Reihman et al[10]. The higher the score of POP scale, higher was the suppression of PChe levels. Comparison of individual components of POP scale was done by Goel et al[11] and found that that they can be used in predicting the need for ventilatory support. In this study, POP scoring had a sensitivity of 70% and specificity of 83% in predicting the need for ventilatory support. The positive predictive value is 67% and negative predictive value of 85%. Over all accuracy is 78%. So it can be said that, POP score can be a better predictor to categorize patients who might not require ventilatory support at admission. However as stated earlier, studies with a larger sample size and a heterogeneous population have to performed to confirm these findings.

Conclusions :

In our study pseudo cholinesterase levels were significantly depressed in patients who required ventilatory support and correlated with mortality. POP score of more than 5 correlated in predicting the need for ventilatory support and mortality. Pseudo cholinesterase levels in conjuction with Peradeniya OP poisoning score is a useful parameter for grading severity of OP poisoning and in predicting the need for ventilatory support and mortality.

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