

STUDY OF CLINICAL PROFILE OF ORGANOPHOSPHORUS COMPOUND POISONING AND ITS CORRELATION WITH SERUM PSEUDOCHOLINESTERASE LEVELS AND TO ASSESS THE OUTCOME WITH CLINICAL SEVERITY

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Abstract

Background: To find the correlation of serum Pseudocholinesterase levels and Peradeniya Organophosphorus Poisoning scale with the severity and outcome in the hospital, of acute organophosphorus poisoning. **Materials and Methods:** A cross sectional study was conducted on 100 patients admitted under department of general medicine Adichunchanagiri hospital and research centre, B.G. Nagar, with OPC intoxication. Detailed history and clinical examination were done. Patients were evaluated for POP poisoning scale and serum pseudocholinesterase levels and the clinical outcome. **Result:** Male to Female ratio is 2.57: 1. Mortality is 24%. Low levels of enzymes in early stages of poisoning indicates increased mortality. There was good correlation between POP Scale and serum cholinesterase levels and severity of poisoning. Peradeniya scores of ≥ 5 correlated with an increased requirement of ventilator support. Mean cholinesterase activity in patients who survived was above 2176.53 U/L In the patients who expired the cholinesterase activity was around 698.42 U/L. This point out that enzyme levels are directly proportional to better prognosis. **Conclusion:** Patients with higher PChE activity on day of admission has a better prognosis than with lower enzyme values. Initial estimation of PChE activity can be used to predict the prognosis of patients. Lower the levels of enzyme at admission the more is the mortality.

INTRODUCTION

Organophosphorus (OP) compounds are commonly used for suicide in rural India. The rate of OP poisoning as a suicidal agent range from 10.3% to 43.8% in various studies in India.^[1] Organophosphorus Compounds Inhibit both Acetylcholinesterase (AChE) and pseudocholesterase (PChE) enzymes, resulting in over stimulation of muscarinic and nicotinic receptors. Serum pseudocholesterase enzymes levels are routinely measured in OP compound poisoning.

Organophosphorus Poisoning (POP) scale assesses the severity of the poisoning based on the symptoms at presentation and it is simple to use. Patients with a high score on the POP scale had a high rate of morbidity and mortality.

Aim & Objectives

To assess the severity of organophosphorus poisoning cases clinically, on admission by

Peradeniya Organophosphorus Poisoning scale and to estimate the serum levels of pseudocholesterase in acute Organophosphorus poisoning and to correlate the same with clinical severity scoring at admission and in hospital outcome.

MATERIALS AND METHODS

A Cross sectional study was conducted at Adichunchanagiri Hospital and Research Centre. B.G. Nagar, over the period of one and half years from October 2018 to April 2020. 100 patients who fulfilled criteria's were chosen as study subjects.

Inclusion criteria

All cases of acute Organophosphorus compound poisoning admitted to our hospital & of age 18 years and above.

Exclusion criteria

1. Patients who consumed other poisons along with Organophosphorus compound.
2. Patients with chronic neurological illness.

Method of Collection of Data

After obtaining the informed consent details of history and clinical examination were recorded. POP poisoning scale was applied to all study subjects and the severity of OP poisoning was graded as mild, moderate, severe. In all study subjects' blood was collected on admission for estimation of serum pseudocholinesterase. Other routine investigations Complete haemogram, Renal function test, Serum electrolytes, LFT, ECG, RBS, Urine routines were done.

Statistical Analysis

The Statistical software namely SPSS 11.0 was used for the analysis of the data.

RESULTS

The following observations were made after studying 100 cases of OP compound poisoning.

Age group ranged from 20-70 years. Age group of 20-29 years comprised 39% of the study patients. 72% of patients were male and 28% were females. Males were more than females. 48% of patients are farmers. In 60% of the patients had Muscarinic symptoms and 40% had both Muscarinic and Nicotinic symptoms. 47% cases presented with mild poisoning, 48% cases presented with moderate poisoning and 5% of cases in severe poisoning. 34% of the cases presented with pseudocholinesterase levels less than 1000 and 15% of the cases pseudocholinesterase levels more than 3000. 28% patients required ventilator support. Mortality is 24%. 70% of the cases had nil complications. 24% had respiratory paralysis leading to death and 6% cases went into intermediate syndrome.

Serum Pseudocholinesterase Level was directly related to the severity of the Peradeniya OP Poisoning Scale. [Table 1]

Table 1: Descriptive Statistics

	N	Mean	Std. Deviation	Median	Minimum	Maximum
Age	100	35.69	14.135	32	20	70
POP Score	100	3.97	2.027	4	1	8
Pseudocholinesterase Level	100	1821.78	1044.911	1764	187	4007

Table 2: Association between Symptoms and POP Score

POP Score	Symptoms		
	Muscarinic	Muscarinic and Nicotinic	Total
Mild Poisoning	39 (65%)	8 (20%)	47 (47%)
Moderate Poisoning	21 (35%)	27 (67.5%)	48 (48%)
Severe Poisoning	0 (0%)	5 (12.5%)	5 (5%)
Total	60	40	100
P-value(Fisher Exact Test)	<0.001 (Significant)		

Table 3a: Association between Symptoms and Pseudocholinesterase Level

Pseudocholinesterase Level	Symptoms		
	Muscarinic	Muscarinic and Nicotinic	Total
<=1000	7 (11.67%)	27 (67.5%)	34 (34%)
1001 - 2000	25 (41.67%)	2 (5%)	27 (27%)
2001 - 3000	15 (25%)	9 (22.5%)	24 (24%)
>3000	13 (21.67%)	2 (5%)	15 (15%)
Total	60	40	100
P-value(Chi-Square Test)	<0.001 (Significant)		

Table 3b: Mean Pseudocholinesterase Level Comparison between Symptoms

Symptoms	N	Mean	Std. Deviation	Range	Mean difference	P-value	Result
Muscarinic	60	2187.42	956.097	652 - 4007	914.092	<0.001	Significant
Muscarinic and Nicotinic	40	1273.33	935.144	187 - 3124			

Table 4a: Association between Pseudocholinesterase Level and Outcome

Pseudocholinesterase Level	Outcome		
	Death	Recovered	Total
<=1000	23 (95.83%)	11 (14.47%)	34 (34%)
1001 - 2000	1 (4.17%)	26 (34.21%)	27 (27%)
2001 - 3000	0 (0%)	24 (31.58%)	24 (24%)
>3000	0 (0%)	15 (19.74%)	15 (15%)
Total	24	76	100
P-value(Fisher Exact Test)	<0.001 (Significant)		

Table 4b: Mean Pseudocholinesterase Level Comparison between Outcome

Outcome	N	Mean	Std. Deviation	Range	Meandifference	P-value	Result
Death	24	698.42	255.749	187 - 1438	-1478.110	<0.001	Significant
Recovered	76	2176.53	943.304	567 - 4007			

Table 5: Association between Ventilator and Outcome

Ventilator	Outcome		
	Death	Recovered	Total
Yes	22 (91.67%)	6 (7.89%)	28 (28%)
No	2 (8.33%)	70 (92.11%)	72 (72%)
Total	24	76	100
P-value(Chi-Square Test)	<0.001 (Significant)		

Table 6: Association between POP Score and Pseudocholinesterase Level

Pseudocholinesterase Level	POP Score			
	Mild Poisoning	Moderate Poisoning	Severe Poisoning	Total
<=1000	5 (10.64%)	24 (50%)	5 (100%)	34 (34%)
1001 - 2000	16 (34.04%)	11 (22.92%)	0 (0%)	27 (27%)
2001 - 3000	15 (31.91%)	9 (18.75%)	0 (0%)	24 (24%)
>3000	11 (23.4%)	4 (8.33%)	0 (0%)	15 (15%)
Total	47	48	5	100
P-value(Fisher Exact Test)	<0.001 (Significant)			

Table 7: Association between POP Score and Ventilator

Ventilator	POP Score			
	Mild Poisoning	Moderate Poisoning	Severe Poisoning	Total
Yes	0 (0%)	23 (47.92%)	5 (100%)	28 (28%)
No	47 (100%)	25 (52.08%)	0 (0%)	72 (72%)
Total	47	48	5	100
P-value(Fisher Exact Test)	<0.001 (Significant)			

Table 8: Association between POP Score and Complications

Complications	POP Score			
	Mild Poisoning	Moderate Poisoning	Severe Poisoning	Total
Respiratory Paralysis	1 (2.13%)	18 (37.5%)	5 (100%)	24 (24%)
Inter-mediate Syndrome	0 (0%)	6 (12.5%)	0 (0%)	6 (6%)
NIL	46 (97.87%)	24 (50%)	0 (0%)	70 (70%)
Total	47	48	5	100
P-value(Fisher Exact Test)	<0.001 (Significant)			

DISCUSSION

The findings of this study and the other studies are compared here.

Age of Patients

Among the 100 cases studied, incidence was highest among the age group of 20 – 29 years (39%) followed by 30 – 39 years. This correlates with the study done by S. Singh et al.^[2] This age group corresponds to the maximum period of stressor events may be because of unemployment, poverty, depression due to various causes.

Gender of the Patients

In the present study 72% of the patients were males. This correlates with the findings of the previous studies. However, in a study done by M. Vishwanathan et al.^[3] 66% of the patients who consumed organophosphorus compounds were males.

Severity of Poisoning

On POP scale in this study, mild cases were 47%, moderate cases were 48% and severe cases were 5%, which were comparable to Ganesan E et al.^[1] where mild cases were 46%, moderate cases were 43%, severe cases were 11% and Arup kumarkundu et al.^[4] where mild was 19.5%, moderate was 50.9%, severe was 29.6% respectively.

Ventilator Support

Respiratory failure requiring ventilator support was observed in 28% of patients in present study. This is in comparison to values obtained by Noura et al.^[5] (40%), A Goel et al.^[6] (34.95%), Thomas chang et al.^[7] (40.2%). 47.92 % of the patients with moderate poisoning required ventilator support. In contrast 100 % of the patients with severe poisoning required ventilation. Studies done by Subhash et al.^[8] showed need for ventilator support in 62.5% of patients with moderate poisoning and 100% of patients with severe poisoning according to POP scale. A Goel et al.^[6] have shown that about 4% of the patients with mild and 6% of patients with moderate poisoning required ventilator support whereas 62% of the patients with severe poisoning required ventilator support.

Peradeniya Organophosphorus Scale and Ventilatory Support

The individual components of the Peradeniya organophosphorus scale namely miosis, fasciculations, respiratory rate, bradycardia, level of consciousness, seizures were compared with the need for ventilator support. Peradeniya score was calculated for all 100 patients. Among those who scored 5 and above, 52% of cases required ventilator support. Hence Peradeniya scoring system can be used to predict early need for ventilator support if a

score of 5 or more than 5 is observed. The mortality was 24 cases in this study, their scores were from 5 to 8 respectively. Lesser score was associated with less requirement of ventilator support. Individual components of Peradeniya score namely miosis, fasciculations, level of consciousness was studied by Goswamy et al,^[9] (1994) and A Goel et al,^[6] concluded that they can be used in predicting the early need for ventilator support. This was statistically significant in predicting the need for ventilatory support. Rehiman et al,^[10] found out a significant association between POP score and PChE levels, POP score and hospital stay, total dose of atropine required, mechanical ventilation.

Pseudocholinesterase Levels

PChE levels were assessed in all patients at admission to hospital. In the present study, 34% of the cases presented with pseudocholinesterase levels less than 1000, among them 79.4% cases needed ventilator support, and 66% of the cases pseudocholinesterase levels more than 1000 of which only 1% needed ventilator support.

Weissmann- Brenner et al,^[11] found a direct correlation between the degree of inhibition of PChE levels and the severity of poisoning. Similar findings were observed by S.D.Zawaret al.^[12]

Overall Mortality

Mortality rate in present study was 24% this is comparable to Sundaram et al,^[13] (23.5%) and Chuang et al,^[14] (24%). In a reported literature the mortality rate ranges were 4 to 38%.

Age and Mortality

In the present study, the overall mortality was 24%, where 45.83% mortality was seen patients belonging to age group 20-29 years, then 16.67% in 30-39 years age group, 16.67% in 40-49 years age group, 4.17% in 50-59 years age group and 16.67% in above 60 years age group. The mortality is higher in age groups 20-29 years. Shankar et al,^[15] reported maximum mortality in age group of 21-30 years (61.11%). Generally younger age group are more susceptible than older group because the enzymes like mixed functions oxidases which metabolize organophosphorus compounds are less mature; but the older age group are more susceptible to complications like acute renal failure, sepsis, and multi-organ failure.

Sex and Mortality

In this study total number of deaths was 24 (24%). Among the expired, 16 patients were male and 8 patients were female. 16 out of 72 male patients expired (22% mortality). 8 out of 28 female patients expired (28.5% mortality). However Shankar et al,^[15] reported more mortality in male patients (11.6%) when compared to female patients (7.93%).

Plasma Cholinesterase and Mortality

The maximum serum cholinesterase (PChE) level at admission was 4007U/L while minimum level was 187U/L. The overall mean PChE level at admission was 1437 U/L. Mean plasma cholinesterase level in survivors at admission was 2176.53 U/L whereas it was 698.42 in non- survivors. P value is &0.001 which is considered as statistically significant. In majority of patients on admission it was observed that the enzyme activity was very low. Hence it can be inferred that low PChE activity can be taken as good diagnostic test for OP poisoning. Studies by Namba T et al,^[16] and Wadia R.S et al,^[17] has also shown that PChE activity estimation is a reliable diagnostic test in OPC poisoning. Initial estimation of PChE activity can be used to predict the prognosis of patients. Recent studies by Kuppuswamy G et al,^[18] showed that PChE activity below 10% of normal was associated with poor prognosis. He also observed that PChE in plasma is more sensitive than AChE to inhibition by a number of compounds and is depressed well below the normal range of 60% before any symptoms due to systemic anticholinesterase intoxication is evident. Data from patients who died showed that out of 19 patients who expired majority had enzyme value around 4000 U/L, which is lower limit of normal value.

CONCLUSION

Estimation of pseudocholinesterase level in clinically suspected organophosphorus compound poisoning cases will assist in diagnosis of unidentified or organophosphorus compound poisoning & also it is very useful parameter along with Peradeniya organophosphorus poisoning (POP) scale in predicting the need for early requirement of ventilator support.

REFERENCES

1. Ganesan E, Moorthy KG. Clinical and Biochemical Profile of Acute Organophosphorus Poisoning. GLOBAL JOURNAL FOR RESEARCH ANALYSIS. 2018 Feb 16;5(11).
2. Singh S, Sharma BK, Chug KS. Spectrum of acute poisoning in adults(20years experience). JAPI 1984; 32(7): 561-563
3. M.Vishwanathan, K srinivasan. Poisoning by bug poison. A preliminary study. Journal of Indian Medical Association 1962, vol.39; No. 7: 345-349
4. Kundu AK, Mukhopadyaya JD, Saha AK, Das S. predictors of mortality in OPC poisoning – Hospital Based Study from sub urban west Bengal. JAPI 2001; 49-59.
5. Nouira S, Abroug F, Elatrous S, Boujdaria R, Bouchoucha S. Prognostic value of serum cholinesterase in organophosphate poisoning. Chest. 1994;106(6):1811-4.
6. Goel A, S Joseph, Dutta TK. Organophosphate Poisoning: Predicting the need for ventilatory support. JAPI 1998; 46: 786-90
7. Tsao TC, Jwang Y, Lan R, Sheieh W, Lee C. Respiratory failure in acute organophosphorus and carbamate poisoning. Chest 1990; 98 : 631-636.
8. Subhash L.Patil, Dr. Praveen Vasepalli: Prognostic value of clinical and lab parameters in assessing the severity of organophosphorous compound poisoning Indian Journal of Basic and Applied Medical Research 2014;4:77- 91.

9. Goswamy R, Chaudhuri A, Mahashur AA. Study of respiratory failure in organophosphate and carbamate poisoning. *Heart Lung*. 1994;23:466-72.
10. Rehiman S, Lohani SP, Bhattarai MD. Correlation of serum cholinesterase level, clinical score of presentation and severity of Organophosphorous Poisoning. *J Nepal Med Assoc*. 2008;47(170):47-52.
11. Weissmann-Brenner A, David A, Vidan A, Hourvitz A. Organophosphate poisoning: A Multihospital Survey. *IMAJ* 2002;4:573-576.
12. Zawar S D et al. Correlation between Plasma cholinesterase Level and clinical severity of acute organophosphate and carbamate poisoning. *JAPI*. 2001;149:91
13. Sundharam, Augustinsson K. The normal variation of human blood cholinesterase activity. *Acta Phys Scand* 1955;35:40-52.
14. Chuang FR, Jang SW, Lin JL, Chern MS, Chen JB, Hsu KT. QTc prolongation indicates a poor prognosis in patients with Organophosphorus poisoning. *American journal of emergency medicine* 1996; 14: 451-453.
15. Shankar PS. Diazinon poisoning. *The Antiseptic* 1967;64(3):118
16. Namba T, Nottle C, Jackrel J, Grob D. Poisoning due to organophosphate insecticides, acute and chronic manifestation. *Am. Journal of Med*. 1971;50:475-92.
17. Wadia RS. et al. Neurological manifestation of the organophosphorus compounds *IJMR* 1977;66:460 -68.
18. Sunder Ram J, Kumar SS, Jayarajan A, Kuppaswamy G. Continuous infusion of high doses of atropine in the management of organophosphorus compound poisoning. *J Assoc Physicians India*. 1991;39:190-193.