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Random blood sugar at the time of presentation in acute organophosphorus compound poisoning and its correlation with prognosis

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Abstract
Background and Objective: The random blood sugar level is one of the factors which influence the severity of organophosphorus compound poisoning. This study aims to predict the prognosis and mortality of organophosphorus compound poisoning based on random blood sugar levels and correlate it with pseudocholinesterase activity.
Methods: 103 cases of OP poisoning admitted to the rajah Muthiah medical college Hospital between November 2019 – October 2021 were studied. Patients above 18 years of age were included and those patients with mixed poisoning, Alcohol consumption, and diabetes were excluded. Detailed history and clinical examination were done according to the proforma with special reference to the need for ventilatory support, admission RBS and pseudocholinesterase levels.
Results: Of the 103 patients, males were 57%, females 43%, the majority were between 18-25 years with farmers (55%) as the main group and suicidal ingestion (93%) as the main cause. Methyl parathion was the commonest compound (15%) consumed but most of the time the compound was unknown (33%). The commonest symptoms were vomiting (94%) and salivation (94%). Respiratory failure was the commonest complication (30%). Hyperglycemia occurred in 39% of patients with 73% developing complications and 50% requiring a ventilator. Pseudocholinesterase was less than 4000U/L in 19% of patients, with complications occurring in 100% and 79% requiring ventilator support. Mortality was 35% in patients with hyperglycemia (p<0.05 S) and 79% in patients with pseudocholinesterase <4000U/L (p<0.001HS).
Conclusion: Admission Random Blood sugar >200mg/ dl and Pseudocholinesterase <4000 U/L are reliable parameters to predict mortality and ventilator requirement in organophosphorus compound poisoning. By Chi-Square Test, drop-in Pseudocholinesterase level and increase in blood sugar level were associated with ventilator requirements, mortality, and complications, and was found to be significant.

Keywords: Organophosphorus poisoning, hyperglycemia, pseudocholinesterase.

Introduction
The world thrives well on the revolution in agricultural practices that have resulted in a massive thrust in agricultural productivity. One of the most important steps in the green revolution is pesticides. Pesticides are a class of toxic substances that are intentionally released into the environment for the greater good it does that exceeds their toxicological concern. In the developing world, Poisoning is a common method of suicide. Pesticide poisoning is a major health hazard in the developing world [1]. Millions of people are exposed to these dangerous chemicals because of occupational hazards and also because of unsafe storage practices. However, it is the deliberate self-poisoning that causes the majority of the deaths and a difficult health strategy to manage among health services, especially in Asia. India is an agricultural country and Organophosphorus compounds are used greatly for agriculture in India [2]. Therefore the access to these harmful pesticide substances is so easy. In many reports from India, the rate of suicidal poisoning with Organophosphorus compound ranges from 10 to 43%. Among these patients mortality rate is as high as 20 to 70%. In developed countries like the United Kingdom, the death due to Organophosphorus compound relates to only 1% [3]. This is because in developing countries like India the facilities for early diagnosis and treatment are very limited. The morbidity and mortality in these patients depend on the time lag between the exposure and the onset of management [4]. Organophosphorus insecticides inhibit acetylcholinesterase causing accumulation of

acetylcholine at central and peripheral cholinergic nerve endings, including neuromuscular junctions. Organophosphorus compound poisoning is treated by decontamination, antidotes, anticholinergic atropine, an oxime-pralidoxime, and respiratory [5].

Methodology

One hundred and three patients with organophosphorus poisoning admitted to Rajah Muthiah medical college hospital, Annamalai University from November 2019 to October 2021 were included in the study.

Inclusion criteria: Patients were selected irrespective of sex, but cases above the age of 18 yrs were included in the study. Patients with a history of consumption of organophosphorus compound presenting within 24 hours.

Exclusion criteria: Patients with age less than 18 years. Patients who had consumed alcohol, other poisons, drugs, mixed poisons. Patients with a history of diabetes mellitus. Patients already treated at other centers and referred to our center for further management were excluded from the study. A provisional diagnosis of OP poisoning was made based on the definite history of OP poisoning by the patient or attendants, and this was substantiated by examination of the container when available. The diagnosis was further substantiated by typical clinical features (miosis, hypersalivation, fasciculation) and the characteristic odor of stomach wash or vomitus. Each patient enrolled for the study underwent a detailed clinical examination as per the proforma, specially designed for the study, which included examination for the presence of respiratory failure, detailed assessment of CNS, and cardiovascular examination. All patients were given stomach wash, body, and eyewash, in patients who had exposure via uncovered skin and/or eyes. This was followed by a 1 gm bolus dose of PAM (Pralidoxime) by slow IV injection. Thereafter, a bolus dose of atropine (2 mg iv push) was administered after correcting cyanosis, till signs of atropnization (clear lungs, dry axilla, dry mucosa, heart rate 100 bpm, and dilated pupils). All patients were monitored closely and continuously and all clinical signs were assessed 12^{th} hourly till complete recovery and were followed till discharge from the hospital. Method with S-butyryl thiocholine iodide using Dibucaine as an inhibitor. Cholinesterase catalyzes the hydrolysis of S-butyryl thiocholine Iodide to thiocholine iodide and butyrate. Thiocholine iodide reacts with 5.5 – dithiobis – 2 – nitrobenzoate (DTNB) and forms the yellow-colored product 5-mercapto – 2 -nitrobenzoate. The substrate specificity prevents interference with cholinesterase liberated from erythrocytes even during slight hemolysis. The rate of formation of 6 mercapto – 2 – nitro benzoate is directly proportional to the catalytic cholinesterase activity. It is determined by measuring the increase in absorbance at 480 nm. Normal values of serum pseudocholinesterase range from 4150 to 7200 U/L.

Statistical Analysis

All the collected data of 103 patients were analyzed using the appropriate statistical test – Chi-Square (x^2) for detecting the p-value. Other statistical tests like One-way ANOVA, Student's unpaired t-test, and Karl Pearson's coefficient of correlation were used wherever appropriate.

Table 1: Age Distribution

Age	No. of patients	Percentage
18 – 25	57	55
26 – 35	27	26
36 – 45	13	13
46 – 55	5	5
56–65	1	1

Table 1: Age groups range from 18 – 65 years. Mean age of the patients is 27.87yrs. Majority of the poisoning is found in the age group of 18-25 years (55%). Out of 102 cases, 59 were males and 44 were females with a male to female ratio of 1.34:1.In this study, male predominance is seen 57%.93 cases were due to suicide, and 10 were accidental. So suicidal ingestion was the main motive of poisoning- 90%

Table 2: Mode of Poisoning

Mode	Number	Percentage
Ingestion	93	90
Inhalation	0	0
Dermal	10	10

Table 2: Ingestion in 93 cases (90%) was the main mode of poisoning followed by dermal exposure in 10 (10%) Farmers are the main group involved in poisoning in 55 cases (55%), followed by students - 20 (19%)

Table 3: Showing the type of Poison

Types of poison	Number of cases	Percentage
Methyl Parathion (MPN)	15	15
Malathion (MTN)	14	14
Monocrotophos (MCS)	10	10
Chlorpyriphos (CPS)	10	10
Fenthion (FTN)	8	8
Parathion (PTN)	8	8
Dicrotophos (DCR)	2	2
Dimethoate (DMT)	1	1
Temephos (TMS)	1	1
Unknown OP (U)	34	33

Table 3: In this study the most common agent encountered is Methyl parathion, followed by malathion and monocrotophos. However, in 33% of the case, the poison was unknown op. In this study, the majority of cases had consumed between 50 – 100 ml.

Table 4: Symptoms

Symptoms	Percentage
Vomiting	94
Salivation	94
Sweating	64
Lacrimation	64
Blurring	50
Breathlessness	39
Convulsions	16

Table 4: In this study vomiting and hypersalivation-94% was the major symptom followed by sweating (64%), Lacrimation (64%), Blurring (50%). In this study, 42% of patients developed complications.

Table 5: Complications

Complications	Percentage
Respiratory failure	30
Convulsion	16
ARDS	9
Pneumonia	5
Cardiac arrest	3

Table 5: Most common complication in this study was respiratory failure requiring ventilatory support in 30% of patients.

Table 6: Occurrence of Hyperglycemia

Blood Sugar	Number of patients	Percentage
Hyperglycaemic	40	39
Normoglycaemic	63	61

Table 6: In our study, 40 patients (39%) had RBS > 200 mg/dl which was taken as hyperglycemia

Table 7: Admission Pseudocholinesterase Levels

Pseudocholinesterase	Number of patients	Percentage
<4000	19	18
4000-5000	37	36
>5000	47	46

Table 7: In our study 18% patients had pseudocholinesterase < 4000 U/l. 36% between 4000-5000 U/l and 46% > 5000 U/l.

Table 8: Association between admission RBS and Complications

Blood Sugar	Complications present (%)	Complications absent (%)
Hyperglycemic	29(73%)	11(27%)
Normoglycemic	14(22%)	49(78%)

Table 8: Of all the patients with hyperglycemia, 29 (73%) developed at least one complication, while complications were absent in 49 (78%) of normoglycemic patients X^2 =25.4 P<0.001 HS

Table 9: Admission pseudocholinesterase and Complications

Pseudocholinesterase	Complications present (%)	Complications absent (%)
<4000	19 (100%)	0
4000-5000	21(57%)	16(43%)
>5000	3(6%)	44(94%)

Table 9: 19 (100%) patients with Pseudocholinesterase < 4000 U/l developed complications whereas complications were seen in 21 (57%) with pseudocholinesterase between 4000-5000 U/l. complications where absent in 44 (94%) patients whose Pseudocholinesterase was > 5000 U/l X^2 =54.1 P<0.001 H.

Table 10: Hyperglycemia and need for Ventilator

	Ventilator	
Blood Sugar	Yes	No
Hyperglycemic	20(50%)	20(50%)
Normoglycemic	14(22%)	49(78%)

Table: 10 ventilator support as compared to 14 (22%) of normoglycemic patients20 (50%) patients with hyperglycemia needed. X^2 =8.5 P<0.05 S

Table 11: Pseudocholinesterase and need for Ventilator

	Ventilator	
Pseudocholinesterase	Yes	No
<4000	15(79%)	4(21%)
4000-5000	16(43%)	21(57%)
>5000	3(6%)	44(94%)

Table: 11 (79%) of patients with pseudocholinesterase < 4000 U/l needed ventilator support. Only 3 (6%) patients with Pseudocholinesterase > 5000 U/l needed ventilator. X^2 =34.9 P <0.001 HS85

Table 12: Hyperglycemia and its Relation to Outcome

	Outcome	
Blood Sugar	Improved	Expired
Hyperglycaemic	26(65%)	14(35%)
Normoglycaemic	59(94%)	4(6%)

Table: 12 (82%) of patients out of 103 survived while 18 (18%) expired. 26 (65%) patients with hyperglycemia improved whereas 14 (35%) expired as compared .to 59 (94%) of normoglycemic patients who improved. X^2 =13.9 P<0.05 S15 (79%) of patients with Pseudocholinesterase < 4000 U/l expired as compared to 1 (2%) of patients with Pseudocholinesterase > 5000 U/l.

Table 13: Association between admission RBS and mean Pseudocholinesterase

Blood Sugar	Pseudocholinesterase Mean	SD
Hyperglycaemic	4284.58	1490.69
Normoglycaemic	5626.25	1468.00

Table 13: The mean Pseudocholinesterase and RBS were correlated. RBS >200mg/dl was shown to be associated with a mean Pseudocholinesterase level 4284.58 with an SD of 1490.69. Mean difference 1341.68 P* Value: p < 0.001 HS *Students unpaired t-test.

Discussion

Acute Organophosphorus poisoning (OP) is widespread in the developing world and its frequency is increasing. WHO has estimated that nearly 2,00,000 people worldwide die from pesticide poisoning. In India also it is the commonest poisoning. Owing to the limited availability of facilities and finances in developing countries, all OP patients cannot be managed in the intensive care unit. It is therefore important that clinical features and other factors which indicate the severity of poisoning and also predict the need for ventilatory support, be identified at the initial examination at admission in the emergency ward. In this study, the maximum incidence of poisoning was among the 18-25 years of age group (55%) which is consistent with the studies [6]. This age group in all probability is more vulnerable to the various emotional conflicts which occur during this phase of life. In the present study, the majority of the cases of poisoning were suicidal which is consistent with the observation made by Erdman AR *et al.* [7] Suicidal poisoning is very common since these compounds are easily available for farmers and whenever there is an impulse to commit suicide, they are ready in hand [8] Methyl parathion was the commonest OP compound consumed by the victims

in the present study, which is comparable with studies done by Kwong TC *et al.* [9] Vomiting was the commonest symptom in 94%followed by Hypersalivation 94% and Respiratory failure was the most common complication seen in 30% of patients which is comparable to studies by Laurence DR. *et al.* [10] In this study it was observed that admission hyperglycemia (RBS>200 mg/dl) was associated with complications in 73% as compared to 22% in normoglycemic. This showed a correlation that was highly significant ($p<0.001$). In addition, hyperglycemia also showed a significant association with the need for ventilator support ($p<0.05$). 50% of patients with hyperglycemia were found to need ventilator support as compared to 22% with normoglycemia [11]. In our study, it was noted that Pseudocholinesterase values <4000U/L (p<0.001) were associated with complication in 100% and ventilator support in 79% (p<0.001) these observations were statistically significant. The present study showed overall mortality of 18% comparable with Proudfoot AT *et al.* [12] It was observed that there was a mortality of 65% in patients with hyperglycemia which was significant ($p<0.05$) [12]. Mortality among patients with Pseudocholinesterase <4000U/L was 79% (p<0.001). The above results indicate RBS value >200mg/dl is a good marker for predicting mortality and also for assessing the need for ventilator support. Admission RBS was comparable to the drop in pseudocholinesterase levels [13]. Further, RBS was correlated with the Pseudocholinesterase levels RBS >200mg/dl was shown to be associated with a mean Pseudocholinesterase level 4284.58 with an SD of 1490.69, with a p<0.001 which was highly significant. These observations suggest that admission hyperglycemia is a prognostic indicator in op compound poisoning and it is comparable to pseudocholinesterase. Further studies are needed in this area [14, 15].

Conclusion

Young males of rural backgrounds with the agricultural occupation are the risk factors associated with poisoning cases. Poisoning is diagnosed based on history and clinical examination which can be confirmed by the biochemical investigation. Hyperglycemia can occur in moderate to severe organophosphorus poisoning. The occurrence of hyperglycemia correlates with complications, the requirement of ventilator support, and poor prognosis. Hyperglycemia is also correlated with low levels of pseudocholinesterase in predicting mortality and ventilator support.-In conclusion admission, RBS > 200 mg/dl can be considered as a prognostic factor in predicting the morbidity and mortality of organophosphorus poisoning

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