

Analytical study of biochemical abnormalities in Organophosphorus poisoning at SMS Hospital, Jaipur during 2020-21

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Abstract

The modern world thrives well on revolution in the agricultural practices that has resulted in a massive thrust in agricultural productivity. One of the most important step in green revolution is use of 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 concerns. In the developing world, Poisoning is a common method of suicide. Pesticide poisoning is a major health hazard in the developing world.

Hospital based analytical observational study included 100 cases of OPC poisoning admitted to the hospital during the study period. The study was proposed from 1st August, 2020 to 20th December, 2021. Middle age groups between 18-30 years are more commonly encountered in poisoning by organophosphorus

compounds. General condition correlated significantly to the Acetyl Cholinesterase levels in the present study and lower levels of AChE had poorer outcome and also reported fatality. CPK MB levels were raised with fall in Acetyl Cholinesterase levels and were near significantly related to poorer outcome.

Keywords: Acetyl Cholinesterase, Organophosphorus compounds, Pesticides, Poisoning.

Introduction

Organophosphorus compounds are a heterogenous group of insecticides widely used in agricultural industry. The use of these compounds is common in India owing to extensive use of pesticides and insecticide and so is their toxicity due to easy availability and lack of awareness and unsafe practices during use, leading to higher morbidity and mortality.[1] The exact rate of Organophosphorous Compound (OPC) poisoning in India is not

evident due to under-reporting of cases and lack of data. Literature search of publications from India reveal that the rate of suicidal poisoning with OPCs ranges from 10 to 43%.[2] The organophosphorus compounds act by inhibiting acetylcholine esterase enzymes at neuromuscular junctions resulting in overstimulation of acetylcholine receptors thus producing signs and symptoms due to muscarinic, nicotinic and central nervous system receptor over-stimulation.[3]

OPC poisoning is associated with various biochemical abnormalities among which hyperamylasemia [4,5,6] is well documented and suggested ones are deranged serum lipase [7], creatinine phosphokinase [8] and serum electrolytes [9]. The morbidity and mortality in these patients depends on the time lag between the exposure and the onset of management. So it is very important to recognise the whole spectrum of symptoms in OP poisoning and in a developing country like India with limited resources, there is a need for cheap and easily measurable markers to monitor the prognosis of cases of organophosphorus compound poisonings.[10]

Still, limited studies have been conducted in India to analyse the biochemical changes and their prognostic significance in organophosphate poisoning. This study is thus being undertaken to observe the biochemical abnormalities in cases of OPC poisonings admitted to SMS Hospital, Jaipur.

Material and Methods

Hospital based analytical observational study. The study was conducted from 1st August, 2020 to 20th December, 2021. The study was initiated after seeking permission from research review board and institutional ethical committee and completing all due formalities. After selection of cases as per inclusion and exclusion criteria, 10 ml blood sample was collected using aseptic

precaution (within 24 hours of ingestion) which was subjected to biochemical analysis for Liver enzymes (SGOT, SGPT), serum Amylase, serum Lipase, CPK, CPK-MB, Acetyl cholinestrase, serum electrolytes at the Department of Biochemistry at Central Lab of SMS Hospital & Medical college Jaipur. The principle of all enzymes parameter measured by "Spectrophotometry in fully automated chemistry analyser" AU680 (BECKMEN COULTER).

All cases were observed for final prognosis i.e. recovery or fatality. The biochemical parameters were correlated to the severity of poisoning, clinical condition and to the prognosis of the patient. The obtained results was entered into Microsoft excel sheet and tabulated for data interpretation and further subjected to statistical analysis using Epi Info version 7.2.1.10.

Results & Discussion

Organophosphorus compounds (OPC) are extensively used as pesticides for soft bodied insects in agriculture. They have been imported in India since 1951, but very few knew the nature of these compounds as a virulent poison till the Kerala food poisoning tragedy in 1958.[13] The present study included 100 cases of OPC poisoning admitted to the hospital during the study period. Among them 65% of them were males and 35% of them were females, showing that the incidence of poisoning is more common in males. Ganesan E, et al. 2016 [14] found 76% male and 24% female subject, Senthil Nathan NK, et al. 2017 [11] included 50 patients in their study. Among them, 37 of them were males (74%) and 13 of them were females (26%), showing that the incidence of poisoning is more in males, Maran AT, et al. 2017 [15] found 56% male and 44% female subjects which is similar to present study. Patil A, et al. 2021 [16] found 72% male and 28% female subjects which is similar to

present study. Sert AI, et al. 2018 [17] conducted a study on 47 patients and found results 33 (70.2%) were female and 14(29.8%) were male, which is opposite with present study. Shah NM, et al. 2016 [18] conducted study which results maximum incidence of OPC poisoning was in between 20- and 40-years age group (60%), and male to female ratio was 2:1. The gender wise distribution of OPC poisoning was more or less similar in most of the studies, with male preponderance in all above studies including the present study. In this study age group of 18 to 40 years were most common 77% of total cases with maximum cases (50%) in 18-30 years of age. Shah NM, et al. 2016 [18] reported that the most common age group is 20-40 yrs. In present study use of alcohol with or before ingestion of OPC was seen in 21 subjects. Under influence of alcohol subject may ingest higher amounts of OPC, which may cause higher chances of fatality. This is documented by Eddleston, et al. 2009 [19], but no adverse outcome was reported in cases which had consumed alcohol with OPC in the present study. Senthil Nathan NK, et al. 2017 [20] found use of alcohol with or before ingestion of OPC was seen in 70% cases, which is much higher than 21% cases reported in the present study. In present study manner of poisoning in 78% cases was Suicidal and rest 22% cases were accidental.

In present study, the route of poisoning was mostly oral (98%) and only 2% were by inhalation route, Ganesh an E, et al. 2016 [14] also found oral ingestion is most common route. Maran AT, et al. 2017 [15] found 93.33% oral ingestion and 5.33% inhalation, Sert AI, et al. 2018 [17] found 95.7% oral ingestion and 4.3% inhalation route, which is similar to present study. Patil A, et al. 2021 [16] found 90% oral ingestion and 10% inhalation route, which is similar to the results of the present study. The AChE levels were evaluated within 24 hours of

ingestion of OPC poison. In 67% patients, serum acetyl cholinesterase level was less than 4000 units per liter, in 27% cases, the AChE level was between 4001 to 8000 unit per L and 6% cases had AChE level >8000 unit per L (normal values). Nouri S, et al. 1994 [20] published that degree of poisoning and serum cholinesterase measured on admission has no prognostic value in predicting outcome. In present study shows predisposing factors, 8% subjects had H/O Psychiatric illness, 21% used Alcohol substances, 30% cases due to recent incidence/ failure of love matters and 28% due to family conflicts, 6% patients had previous suicidal attempts.

Table 1: General condition in relation to Acetyl Cholinesterase level

General condition						Total
ACE level	Altered		Stable			
	N	%	N	%		
Up to 4000	38	56.7	29	43.3	67	
4001 – 8000	4	14.8	23	85.2	27	
>8000	0	0.0	6	100.0	6	
Total	42	42	58	58	100	
Chi-square = 18.493 with 2 degrees of freedom; P < 0.001 (S)						

Table 2: Outcome in relation to Acetyl Cholinesterase level

ACE level	Outcome						Total
	Discharge		Abscond/ LAMA		Death		
	N	%	N	%	N	%	
Up to 4000	53	79.1	12	17.9	2	3.0	67
4001	12	44.4	15	55.6	0	0.0	27

-							
8000							
>8000	4	66.7	2	33.3	0	0.0	6
Total	67	67.0	29	29.0	2	2.0	100
Chi-square = 13.786 with 4 degrees of freedom; P = 0.008 (S)							

Table 3: Duration of hospital stay in relation to Acetyl Cholinesterase level

ACE level	Duration of hospital stay						Total
	<3 days		3 – 5 days		> 5 days		
	N	%	N	%	N	%	
Upto 4000	14	20.9	34	50.7	19	28.4	67
4001-8000	10	37.0	17	63.0	0	0.0	27
>8000	17	16.7	5	83.3	0	0.0	6
Total	25	25.0	56	56.0	19	19.0	100
Chi-square = 12.906 with 4 degrees of freedom; P = 0.012 (S)							

Conclusion

In present study, OPC poisoning is the most common modes of suicidal deaths in Jaipur region. Middle age groups between 18-30 years are more commonly encountered in poisoning by organophosphorus compounds. General condition correlated significantly to the Acetyl Cholinesterase levels in the present study and lower levels of AChE had poorer outcome and also reported fatality. CPK MB levels were raised with fall in Acetyl Cholinesterase levels and were near significantly related to poorer outcome. All biochemical enzymes evaluated in the present study showed an elevation in

response to decreased levels of Acetyl Cholinesterase and were hence, negatively correlated to the levels of AChE in the present study. Serum lipase level, Serum amylase level, Serum CPK level along with SGOT, SGPT, and, Serum electrolytes - Sodium, Potassium & Chloride can be used as an additional prognostic indicator with Acetyl Cholinesterase level.

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