

A study on serum cholinesterase level in deaths due to organophosphorus compounds poisoning

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Abstract

Organophosphorus compounds are commonly used in Agricultural fields as insecticides. Poisoning in humans by organophosphorus compound were accidental or suicidal in nature. These compounds commonly absorbed through Skin, lungs and gastro intestinal tract.³ In humans, immediately after absorption these compounds inhibit the enzyme acetyl cholinesterase there by increasing the acetylcholine level in human body producing morbidity and mortality. Pralidoxime and Atropine¹ is the drug of choice in the treatment. In this study the serum cholinesterase levels were estimated in cases of death due to OPC poisoning for which autopsy were conducted at the Mortuary of Madras Medical College, Chennai-3 .This study was conducted after obtaining ethical clearance from the ethical committee .

Keywords: Organophosphorus compounds, Serum acetyl cholinesterase, Acetylcholine , Pralidoxime and Atropine.

Introduction

Organophosphorus compounds are commonly used in Agricultural fields as insecticides are organic derivatives of Phosphoric acid. Most commonly used Organophosphorus compounds are Parathion, Malathion, Monocrotophos and dimethoate.^{1,2} Organophosphorus compounds poisoning is the most commonest type .In India accidental poisoning mostly occurs as occupational exposure while spraying insecticides. The Organophosphorus compounds irreversibly bind to cholinesterase causing phosphorylation and deactivation of acetyl cholinesterase resulting in accumulation of acetyl choline at the neural synapse causing an initial overstimulation followed by exhaustion and disruption of post synaptic neural transmission in the neural system. If the organophosphorus cholinesterase bond is not broken by pharmacological intervention large amounts of cholinesterase are destroyed causing morbidity and death. Normal serum level of cholinesterase is 5300-10,000 units/L. The diagnosis of nature of poison in Autopsy is based on the postmortem findings, chemical analysis of viscera and histopathological examination. But the failure to detect the poison in the visceral analysis may be due to vomiting after consumption of the poison, low quantity of intake, stomach wash, antidote administration and elimination of poison through metabolism. The estimation of serum cholinesterase level in suspected cases of Organophosphorus compounds Poisoning is thus helpful in diagnosis and treatment of Organophosphorus compounds poisoning . In this study, from 36 cases of Organophosphorus compounds⁴ poisoning cases which were subjected to autopsy in the mortuary of Madras medical college ,Chennai ,serum samples were collected and the cholinesterase level was estimated.

Materials and Methods

36 cases with history of organophosphorus compounds poisoning consisting of 28 cases of Male (78%) and 8 cases of females (22%) which were subjected for medicolegal autopsy taken for this study.

Following the routine dissection protocol , the sternum was lifted up and dissected out exposing the thoracic cavity, an inverted 'Y' shaped incision was made on the pericardium and the exposed heart was fixed with hand and blood was aspirated/ withdrawn from the heart using sterile syringe. The blood sample was transferred in to the plain sample collection tube and sent to the Toxicology lab attached to the Rajiv Gandhi Government General Hospital Chennai for the estimation of serum cholinesterase at the same time the visceral samples were collected sent for chemical analysis.

Study design

Results

Table 1

S. No	Age group in years	No of cases
1	0-20	2
2	21-30	7
3	31-40	9
4	41-50	6
5	51-60	7
6	60 and above	5

Table 2

S. No	Chemical analysis	Male	Female
1	Positive	12	3
2	Negative	16	5

Table 3

S.No	Serum Cholinesterase level in units/Ltr	No of cases
1	0-500	1
2	501-1000	10
3	1001-1500	14
4	1501-2000	3
5	2001-2500	3
6	2501-3000	1
7	3001-3500	0
8	3501-4000	1
9	4001-4500	0
10	4501-5000	2
11	5001-5500	1
12	5501-6000	0

In this study out of 36 cases with history of Organophosphorus compounds poisoning 28 cases of Male (78%) and 8 cases of females (22%) were subjected for medicolegal autopsy. In this study 3 cases were brought dead to the hospital and 33 cases underwent treatment as inpatient. In the visceral analysis in 15 cases OPC was detected making 41% of positivity and in all the three cases brought dead to the causality visceral analysis yielded positivity for OPC. The serum cholinesterase level (Table 3) was found in the range with a minimum level of 315units/L to a maximum of 5500 units/L. 11 cases had Serum Cholinesterase level of 0-1000units/L, 17 cases had the level of 1001-2000 units/L, 4 cases had the level of 2001-3000 units/L, 1 case had the level of 3001-4000 units/L, 2 cases had the level of 4001-5000 units/L and 1 case had the level of 5500 units/L

Discussion

In clinical practice all the cases with history of ingestion of OPC poison does not show the classical signs and symptoms. Hence when there is a doubt in the diagnosis estimation of serum cholinesterase level or erythrocyte acetyl cholinesterase level is useful. As different composition of Organophosphorus compounds poisoning are used, it is difficult to estimate the dose of the individual formula at which it inhibits the percentage of serum cholinesterase levels. Enzyme inhibition is dependent on the amount of Organophosphorus compounds absorbed. Serum cholinesterase level varies with age, sex and other factors. Though there are controversies in considering serum cholinesterase level as prognosis indicator but it is accepted as diagnostic indicator.

In this study the serum cholinesterase level varied from 315units /L to 5500units/L and the normal serum cholinesterase level is 5500-10000 units/L. Out of 36 cases 24 cases about 66.7% had the level 500-1500 units/L. The mean value of serum cholinesterase level is 1675+/- 1228. In the three brought dead cases the value varied from 629-1131 units/L and this value correlates with Sachincoiak' ⁷ study and also with Dr. Khaimudabbir ahmed study.

Out of 33 hospital admitted cases with history of OPC poisoning and underwent treatment, in 12 cases OPC was

detected in the visceral analysis and the Serum cholinesterase level was from 315u/L to 2275u/L and this well correlated with Venkateshwaralu 's study.⁶

Conclusion

In clinical practice the estimation of Serum cholinesterase level can be done for the patients with atypical presentation of symptoms in OPC poisoning. In pediatric group from whom it is difficult to elicit history, the estimation of Serum cholinesterase level will be of considerable value. The estimation of Serum cholinesterase level will be useful in the assessment of the health status of the workers of the form and chemical plants.⁵ In Forensic medicine practice for arriving the cause of death in OPC poisoning the estimation of Serum cholinesterase level will be of immense value though the higher values do not assist in diagnosis lower values will be confirmatory.

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Conflict of Interest: None.

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