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PSEUDOCHOLINESTERASE LEVEL IN ORGANOPHOSPHORUS POISONING – A PROSPECTIVE STUDY

Biochemistry

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ABSTRACT

Organophosphate poisoning comprises of poisoning by organophosphorous group of compounds either in accidental, suicidal or homicidal manner. These Organophosphate compounds find application in Agrisector as pesticides/insecticides, in pharma industry (medications) and also as nerve agents. Predominant clinical symptoms comprises of a mix of nicotinic and muscarinic symptoms like increased salivation and lacrimation, diarrhea, vomiting, miosis, sweating, muscle tremors, and confusion. While onset of symptoms is often within minutes to hours, some symptoms can take weeks to appear. Symptoms can last for days to weeks. In this prospective study, all the cases with history of consumption of insecticides that were autopsied from the date of 1st January 2019 to 31st December 2020 were analyzed at the department of Forensic Medicine and Biochemistry, Adichunchanagiri Institute of Medical Sciences. In the present study, Maximum number of victims (20 cases) belongs 31-40 year age group followed by (14 cases) belongs to 41 to 50 year age groups with male female ration is 2:1. Maximum number of victims (31 cases) had serum cholinesterase level < 700 IU/L. Restrictions on access of very toxic pesticides through national polices and enforcement, public education on storage and safe use, early recognition of poisoning, and appropriate medical management may reduce the incidence of poisoning and death.

KEYWORDS

Pseudocholinesterase, Organophosphorus Poisoning

INTRODUCTION:

Organophosphate poisoning comprises of poisoning by organo phosphorous group of compounds either in accidental, suicidal or homicidal manner. These Organophosphate compounds find application in Agrisector as pesticides/insecticides, in pharma industry (medications) and also as nerve agents. Predominent clinical signs and symptoms comprises of breathlessness, increased salivation and lachrymation, GI symptoms like vomiting and diarrhea, miosis, increased sweating, muscle fasciculation's and tremors, mental confusion and drowsiness. The usual onset of symptoms is drastic in minutes to hours but some symptoms may take weeks to manifest. Symptoms may persist depending upon the severity of exposure, for many days to few weeks.[1,2]

The circumstances and manner of poisoning by Organophosphate poisoning predominantly is by suicidal manner particularly in farming communities of the developing and less developed countries. Accidental and homicidal poisoning is less common. The mode of exposure can be from inhalation, ingestion, dermal or mucosal contact. The mode of action of Organophosphates is mainly through inhibition of acetylcholinesterase (AChE), resulting in the accumulation of acetylcholine (ACh) at neuromuscular or synaptic junctions in the body. Organophosphorous poisoning is diagnosed or suspected mainly from the clinical signs and symptoms in addition to measurement of serial plasma pseudocholinesterase levels or butyrylcholinesterase activity in the blood. The other variant of OP poisoning like Carbamate poisonings, have a similar clinical presentation.[3,4]

In chronic poisoning, efforts should be directed in preventive efforts tackling OP poisoning incidences like controlled, regulated use or rather banning of extremely harmful and toxic types of organo phosphates. Agricultural Sprayers in fields or those working in pesticides industries should have adequate protective gear while at work and proper bathing and showering before resting to home should be encouraged. Persons exposed to Organophosphates through any routes and depending upon the severity of symptoms and lab findings are treated with Atropine, Oximes like Pralidoxime along with diazepam. If presented early, all OP poisoning patients are decontaminated with stomach wash but usually with less success. However supportive and general measures like adequate hydration, oxygenation, sedation, anticonvulsants when indicated and other measures are also recommended. There is a very small and very insignificant risk of Health care providers themselves being poisoned while taking care of a OP poisoned patient.[5,6]

Globally, OPs constitute a majority and most common causes among poisoning. Statistically, about 3 million poisonings cases are reported among which two lakh deaths result both in treated and untreated cases. Also roughly 15% of Poisoning cases suffer fatality as a result. Organophosphate poisoning cases are reported worldwide since long time since 1962.[7]

OBJECTIVE:

- This study is to estimation of serum pseudo cholinesterase level in death due to organ phosphorus poisoning cases.

METHODOLOGY:

In this prospective study, all the cases with history of consumption of insecticides that were autopsied from the date of 1st January 2019 to 31st December 2020 were analyzed at the department of Forensic Medicine and Biochemistry, Adichunchanagiri Institute of Medical Sciences.

INCLUSION CRITERIA:

Autopsied cases with history of insecticide poisoning

EXCLUSION CRITERIA:

Autopsied cases where history unknown.

STATISTICAL ANALYSIS:

Data were presented either as mean ± standard deviation (SD) or as percentage and median. A comparison between Groups A and B was made by Mann-Whitney U test/two sample *t*-tests for quantitative data and Fisher's exact test for categorical data. A factor influencing outcome of interest was considered significant if its *P* value was <0.05. Analyses was performed with the statistical software Strata, version 11.1.

RESULTS:

Table 1: Year Wise Distribution Of Cases:

Year	Total no. of poisoning cases
2019	34
2020	16
Total	50

In 2019, total numbers of poisoning cases autopsied were 34 and in 2020 were 16.

Table 2: Age & Sexwise Distribution Of Cases:

AGE GROUP	MALE	FEMALE	TOTAL
< 20 YEAR	01	01	02
21 TO 30 YEAR	02	02	04
31 TO 40 YEAR	12	08	20
41 TO 50 YEAR	08	06	14
>50 YEAR	06	04	10
TOTAL	30	20	50

Maximum number of victims (20 cases) belongs 31-40 year age group followed by (14 cases) belongs to 41 to 50 year age groups with male female ration is 2:1.

Table 3:serum Pseudo Cholinesterase Level:

PSEUDO CHOLINESTERASE LEVEL	NUMBER OF CASES
<700 IU/L	31
701 – 1400 IU/L	13
1401 – 3500 IU/L	06
>3501 IU/L	00

Maximum number of victims (31 cases) had serum cholinesterase level < 700 IU/L.

DISCUSSION:

In the present study, Majority number of poisoned victims (20 cases) were in the age group 31-40 year followed by (14 cases) in the 41 to 50 year age groups with male female ratio being 2:1. The important observation is that OP poisoning were seen in predominantly young male population below 40yrs age mostly un rural areas. This can be explained on the premise of males being outdoors in agricultural activities most of times with easy accessibility to OP compounds. Our current study also reflects the main route of poisoning that is through ingestion and with an underlying suicidal intent mindset. As OP compounds have bitter taste and smell, their accidental manner of ingestion or poisoning is a rarity but cannot be ruled out completely. Few patients initially presented with history of accidental ingestion, but later on it was revealed that OP compounds were taken because of suicidal intention. Also from the occupational hazard perspective, frequent unknown and accidental exposures mainly through dermal or oral route is witnessed among Agricultural and Industrial workers due to lack or neglect in taking protective measures. Also the timing in seeking medical treatment varies. More than 50% of the patients were brought to the Hospital Emergency Room in about 3 to 5 hrs after exposure to OP compounds. This could be explained from the fact that a large number of the OP poisoning patients were from agricultural backgrounds residing predominantly in Rural areas and were needed to be transported to the hospital from their residence or the site of poisoning for management.

In the present study, Maximum number of victims (31 cases) had serum cholinesterase level < 700 IU/L. The present study found that the level of PCE on the day of presentation was reduced in all cases of OP poisoning. Similar to our finding, Areekul *et al*.,[8] have made statistical findings of decreased levels of PCE than Baseline normal in their studied subjects suffering from OP poisoning. However, a study by Mehta *et al*.,[9] revealed that there was decreased levels and activity of PCE seen in more than 70% of studied subjects on presentation at Emergency. The major inference that can be drawn is that the Serum cholinesterase levels will invariably be decreased after organophosphorus (OP) poisoning, and as documented and concurred by various cited studies done previously. The laboratory confirmation of organophosphate poisoning is mainly through serial measurements of cholinesterase activity. For diagnosis and management, red blood cell (RBC) and plasma pseudocholinesterase levels can both be used, however RBC cholinesterase correlates better with central nervous system (CNS) features. So therefore, enzyme Acetylcholinesterase can be considered as a vital and important marker used in management of organophosphate poisoning. Organic phosphates inhibit Acetylcho linesterase in all parts of the body due to which acetylcholine accumulates at the parasympathetic, sympathetic and somatic sites. This produces a syndrome of over activity or cholinergic crisis with rapid accumulation of unhydrolysed acetylcholine at synaptic junctions and peripheral tissues resulting in three distinct toxic actions manifested by a range of muscarinic, nicotinic and central nervous system effects.

CONCLUSION:

Due do sporadic economic and agricultural sector crisis, suicide by OP compounds are increasingly being reported particularly among the young and vulnerable population who have easy access to these toxic compounds and also they being widely used in agricultural activities as pesticides and insecticides. The study highlights the fact that early admission to hospital is necessary to reduce death rates from OP poisoning. Also the study reveals that the management of OP poisoning cases involves adequate history, clinical examination and routine and serial laboratory investigations such as AchE levels, Blood counts, chest radiography etc., for a good clinical outcome. Patients of OP poisoning usually present with muscarinic and nicotinic signs and symptoms along with CNS stimulation or depression features. OP poisoning patients are more prone for going into respiratory failure more often requiring a need for Mechanical ventilator and also go in for ARDS scenarios, complicating the management aspect and affecting morbidity and mortality. However, chances of improved clinical outcomes are high among patients who reached the hospital earlier and received immediate treatment in intensive care unit. Injections Atropine and PAM used routinely are very helpful to treat the patients.

Regulations and Restrictions on access of very toxic pesticides through national polices and enforcement, public education on storage and safe use, early recognition of poisoning, and appropriate medical management may reduce the incidence of poisoning and death.

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