Saudi Journal of Medicine (SJM)
Scholars Middle East Publishers
Dubai, United Arab Emirates
Website: www.saudijournals.com

ISSN 2518-3389 (Print)
ISSN 2518-3397 (Online)

To Estimate the Level of Pseudo Choline Esterase in Organophosphorus Compound Poisoning

Dr. Vinayak vishwanath Jatale[1], Dr. Nitin Rawat[2*]
[1]Dept. of Medicine, Index Medical College, Indore, India
[2]Clinic, Barwani, India

***Corresponding author**
Dr. Nitin Rawat

Article History
Received: 1.04.2018
Accepted: 10.04.2018
Published: 30.04.2018

DOI:
10.36348/sjm.2018.v03i04.008

Abstract: This is a cross sectional study of 60 patients with organophosphorus poisoning admitted at MGM Medical College and Maharaja Yashwantrao hospital Indore from June 2013 to May 2014. Severity of poisoning and requirement of ventilator support were studied in these patients. The POP scale and pseudo cholinesterase levels both showed a significant association in predicting the need for ventilatory support. Lower grade of poisoning had a better outcome whereas higher severity of poisoning had a poorer outcome.

Keywords: Pseudocholine, Organophosphorus & Poisoning.

INTRODUCTION

Organophosphorus compound (OPC) poisoning has assumed alarming proportions with an annual incidence of over 3 million patients in 1990. Organophosphorus compound poisoning is primarily a problem of the developing countries [1]. Organophosphorus compound poisoning is the most common medico toxic emergency in India. Acute Organophosphorus compound poisoning is an important indication for emergency admission in most hospitals throughout India [2]. Organophosphorus compounds were first developed by Schrader shortly before and during the Second World War. They were first used as an agricultural insecticide and later as potential chemical warfare agents [2].

Organophosphorus (OP) compounds are used as pesticides, herbicides, and chemical warfare agents in the form of nerve gases [2]. Its widespread use and easy availability has increased the likelihood of poisoning with these compounds. Although poisoning can result from occupational exposure or accidental ingestion, in most cases there is suicidal intent. Their common availability renders OP insecticide poisoning a worldwide health problem affecting millions of patients.

India is a tropical country where agriculture forms the backbone of the nation. More than 60% of Indians are farmers. This being the fact, pesticides is the most frequent hazardous compounds that farmers are exposed to, OPC being most common in addition to the accidental intoxication from use of these compounds as agricultural insecticides; these agents are employed frequently for suicidal and homicidal purposes largely because of their easy availability at the moment of frustration and low cost [3].

MATERIALS & METHODS

The study was conducted at Mahatma Gandhi Medical College and Maharaja Yashwantrao Hospital, INDORE from June2013 to May 2014.

There were 449 patients of OP compound poisoning admitted to the Department of Medicine during the study period. After applying inclusion and exclusion criteria, 60 patients who fulfilled all the criteria were chosen as study subjects. (n=60).

Inclusion Criteria

A history of exposure to organophosphorus compound within previous 24 hours with characteristic clinical manifestations of organophosphorus compound poisoning

Exclusion Criteria

Patients who receive treatment with atropine, before admission
Patients with doubtful diagnosis
Mixed poisoning with other substances
H/o serious systemic illness

METHOD OF COLLECTION OF DATA

All patients who presented to emergency department with history of poisoning with known compound were taken as study subjects. A detailed history, clinical examination and relevant biochemical investigations were performed. Patients were included in the study if they had a history of pesticide ingestion

as indicated by patient or relatives, the referring doctor, or the pesticide bottle.

A thorough clinical examination was carried out with particular reference to vital parameters, pupil size, assessment of central nervous system, respiratory system, cardiovascular system as per prescribed proforma. This examination took place during initial resuscitation and treatment of the patient.

Peradeniya OP poisoning scale was applied to all study subjects and the severity of OP poisoning was graded as mild, moderate, severe.

In all study subjects, 3 ml of plain blood was collected on admission before administration of atropine and plasma cholinesterase was estimated. Plasma cholinesterase was estimated by colorimetric method by kit provided by "Raichem of USA". The instrument used was RA- 50.

METHOD

3 ml of plain blood was drawn and 5micro ml of blood was centrifuged at 3000 rpm for 5 minutes. The serum of the patient was taken and added to the tube containing 1.55ml of the reagent.

Principle

Cholinesterase hydrolyses butryl thiocholine to butyrate and thiocholine. Thiocholine reacts with 5, 5' dithio bis -2- nitrobenzoic acid(DTNB) to form 5 mercapto -2- (MBNA) which has intense yellow colour.

Reaction

Butryl thiocholine + H2 0 -----Butyrate + Thiocholine
Thiocholine + DTNB ----Mixed disulfide + 5- MBNA

The rate of formation of yellow colour is read spectrophotometrically at 410 nm. It is directly proportional to the activity of pseudocholinesterase in the serum. The reading was taken after 1.25 seconds. The normal values ranged from 2710- 11510 U/L at 370 C.

According to cholinesterase activity the organophosphorus poisoning was graded as:

Grade of poisoning	**Cholinesterase activity**
Normal	> 50% (more than 50%)
Mild	20-50%
Moderate	10-20%
Severe	<10% (less than 10%)

All patients were managed with decontamination procedure including gastric lavage. Intravenous atropine 2-4mg bolus and repeated every 5-15minutes initially until atropinization. The end point of treatment was taken as the drying up of secretions. The atropinization was maintained for 24-48 hours with intermittent doses, every 15-30 minutes or depending on the need, and then tapered over days depending upon patient's response. Pralidoxime chloride was given to all patients as 2g IV bolus over 10-15minutes immediately after admission and 0.5g-1.0g IV 6th hourly for 48hours depending on patient's condition.

Patients were kept under strict observation during their stay in hospital. Assessment of patient's airway and need for endotracheal intubation was done. Patients with respiratory failure were intubated and mechanical ventilator support was given. Psychiatric counseling was done for the patients who survived. Autopsy was conducted on all patients who expired.

STATISTICAL TESTS

Pearsons Chi square test was used to calculate test of significance. Ethical committee clearance was obtained before commencing the study.

OBSERVATIONS & RESULTS

Table-1: Showing severity of poisoning according Pseudo cholinesterase levels

Severity	No. of patients	Patients
Less than 10%	3	5
10 – 20 %	1	1.7
20- 50 %	17	28.3
Normal	39	65
Total	60	100

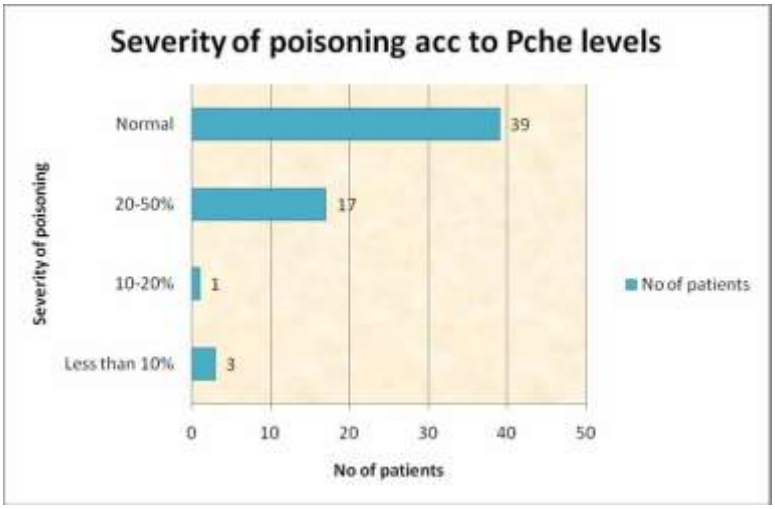

Fig-01: Graph showing severity of poisoning according Pseudo cholinesterase levels

In this study 65% of patients had PChe levels more than 50%, normal range. Only 5% of patients had severe poisoning with PChe levels less than 10%.

Most of patients with normal grade of severity of poisoning acc to Pseudo cholinesterase levels (68%) had consumed less than 30 ml of poison.71% of patients who had consumed less than 50 ml had normal grade. Only 2 of 8 patients who had consumed more than 50 ml had severe grade of severity of poisoning acc to Pseudo cholinesterase levels. This was not statistically significant.

Table-02: Showing correlation between Pseudocholinesterase levels and quantity of poison consumed

Severity of poisoning acc to pseudocholineesterase levels	Quantity consumed			Total
	Less than 30 ml	30 – 50 ml	More than 50 ml	
Less than 10 %	0	1 (4.8)	2 (5)	3
10 – 20 %	0	1 (4.8)	0	1
20 – 50 %	10 (32.3)	4 (19)	3 (37.5)	17
Normal	21 (67.7)	15 (71.4)	3 (37.5)	39
Total	21	31	8	60

Numbers in parenthesis indicate percentage
Pearson Chi-Square - 11.955a p - 0.063 NS (Not significant)

DISCUSSION

Organophosphorus poisoning

History

The first account of the synthesis of a highly potent compound of the organophosphorus anticholinesterase (anti-ChE) series, tetraethyl pyrophosphate (TEPP), was published by Clermont in 1854, 10 years prior to the isolation of physostigmine [2]. It was remarkable that the investigator survived to report on the taste of the compound which was a surprising fact as pointed out by Homstead a century later5. Thousands of people were affected in Caribbean during 1930s due to adulteration of a popular medicine with Organophosphate triorthocresylphosphate (TOCP) - "Jamaican ginger paralysis"6.Modern investigations of the organophosphorus compounds started as early as 1932 in a publication from Lange and Krueger on the synthesis of diethyl and dimethyl phosphofluoridates. The author's statement that inhalation of these compounds caused a persistent choking sensation and blurred vision apparently was instrumental in leading Schrader to explore this class of compounds for insecticidal activity. Upon synthesizing approximately 2000 compounds, Schrader2 (1952) defined the structural requirements for insecticidal (and as learned subsequently, for anti –ChE) activity. One compound in this early series, parathion (a phosphothioate), later became the most widely used insecticide of this class [5-7].

The organophosphates have achieved great popularity because of their effectiveness as insecticides and their lack of persistence in the environment. Because of their unstable chemical structure, they disintegrate into harmless radicals within days of application. Because they do not persist in the body or environment, as do DDT and other organochlorides, they have replaced DDT as insecticide agent of choice.

The principal use of these compounds is as pesticides in agriculture, mainly as insecticides. Some formulations are used as veterinary and human medicine. In commerce organophosphorus compounds have been used as lubricants, plasticizers and flame retardants. The development and use of some of these compounds as very potent agents of warfare is of global

significance. Table-1: Sources of organophosphorus pesticides [4]

Domestic

- Garden sheds—in particular insecticidal preparations but also other products.
- That are marketed as fertilizers but contain some organophosphorus pesticides,
  Available as solid or liquid formulations
- Surface and room sprays
- Baits for cockroaches and other insects (for example, chlorpyrifos)
- Shampoos against head lice (for example, Malathion)
- Pet preparations (for example, pet washes, collars)

Industrial or occupational

- Crop protection and livestock dipping
- Large scale internal control, including fumigation

Terrorism or warfare (nerve agents)

CONCLUSION

OP poisoning is one of the most common modes of suicidal deaths in our country. Quantity of poison consumed did not correlate with severity of poisoning. Pseudo cholinesterase levels were significantly depressed in patients who required ventilatory support and correlated with mortality. Pseudo cholinesterase levels estimation in conjunction with Peradeniya OP poisoning score is a useful parameter for grading severity of OP poisoning and in predicting the need for ventilatory support and mortality.

REFERENCES

1. Jeyaratnam, J. (1990). Acute pesticide poisoning: a major global health problem.
2. LE, L., AG, G., Benet, L. Z., Kroetz, D. L., Sheiner, L. B., Ross, E. M., ... & Wilson, J. M. (1996). *Goodman & Gilman's the pharmacological basis of therapeutics*.
3. Buckley, N. A., Roberts, D., & Eddleston, M. (2004). Overcoming apathy in research on organophosphate poisoning. *BMJ: British Medical Journal*, *329*(7476), 1231.
4. Roberts, D. M., & Aaron, C. K. (2007). Management of acute organophosphorus pesticide poisoning. *BMJ: British Medical Journal*, *334*(7594), 629.
5. Kamanyire, R., & Karalliedde, L. (2004). Organophosphate toxicity and occupational exposure. *Occupational medicine*, *54*(2), 69-75.
6. Bergen, D. C. (1996). The world-wide burden of neurologic disease. *Neurology*, *47*(1), 21-25.
7. Moretto, A., & Lotti, M. (1998). Poisoning by organophosphorus insecticides and sensory neuropathy. *Journal of Neurology, Neurosurgery & Psychiatry*, *64*(4), 463-468.