



Utility of Serum Cholinesterase as Predictor of Clinical Outcome in Organophosphorus and Organocarbamate Poisoning

KEYWORDS

Serum cholinesterase, Organophosphorous , organocarbamate

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ABSTRACT *Poisoning is a common method of suicide. Organophosphorous and organocarbamate compounds are commonly used pesticides in agriculture. These are potent cholinesterase inhibitors. Estimation of Serum cholinesterase (SchE) is simpler and accurate than estimation of RBC cholinesterase. SchE seems recover far more rapidly than RBC cholinesterase. In inpatient case records clinical status, ventilator requirements and SchE levels at admission, 24, 72,120 hrs and at discharge were collected and analysed. SchE levels determined by measuring the rate of hydrolysis of substrate catalysed by SchE using UV- Spectrophotometry. In survivors, SchE recovery was statistically significant for admission - 24 h, admission - 72 h, 24 -72 h, 24 - 120 h and admission -120 h ($p < 0.001$). Increasing trend observed in serial SchE levels during recovery phase. SchE levels increased in cases of OP and OC poisoning who survived. Estimation of SchE levels may be a useful predictor of clinical outcome.*

INTRODUCTION

Poisoning is a common method of suicide. Rates of poisoning with intention of suicide range from 20% (10% organophosphorus) to 56% (44% organophosphorus) (6).

Organophosphorous (OP) and organocarbamate (OC) compounds are the most commonly used pesticides in agriculture. In hospital based studies mortality rates associated with pesticides have been reported up to as high as 50-70%.

Organophosphorus and organocarbamates are potent cholinesterase inhibitors capable of causing severe cholinergic toxicity following cutaneous exposure, inhalation, or ingestion (1). Organophosphorus compounds bind to acetylcholinesterase leading to overabundance of acetylcholine in the synapse. By the time the compound undergoes a conformational change (aging) renders the enzyme irreversibly resistant to reactivation.

Carbamate compounds unlike organophosphates, are transient cholinesterase inhibitors.

In acute poisoning, manifestations generally occur only after more than 50% of serum cholinesterase (SchE) is inhibited and severity of manifestations parallels the degree of inhibition of SchE activity.

There are two forms of cholinesterases :

True cholinesterase or acetyl cholinesterase is located in erythrocytes, neuromuscular junctions and gray matter of brain. Pseudo cholinesterase or serum cholinesterase is primarily present in serum but is also present in liver, pancreas and heart. Both these types of enzymes are inhibited in pesticide poisoning.

Estimation of SchE has an advantage because the measurement is simpler and more accurate than estimation of RBC cholinesterase. So, SchE seems to recover far more rapidly than RBC cholinesterase

Till date there are very few studies to predict outcome in both OP and OC poisoning. This study evaluates the significance of estimating SchE levels to predict the clinical outcome (10).

MATERIALS AND METHODS

This was a retrospective study (SchE levels are routinely estimated in these poisoning cases in our Department of Clinical Pharmacology & Therapeutics)

Data from medical records of patients of either sex, aged 18-60 years with history of OP or OC poisoning was collected from September 2010 to December 2011. From inpatient case records, clinical status along with ventilator requirements and SchE levels at admission, 24, 72,120 hrs and at discharge were collected and analysed.

Medical records of patients who were not having atleast 3 SchE levels were excluded from the study. SchE levels were determined by measuring the rate of hydrolysis of substrate (an ester, benzyl choline) catalysed by SchE using UV- Spectrophotometry.

Based on these SchE values, the severity of poisoning (according to Proudfoot classification) was assessed as

- Mild poisoning : SchE level 20 - 50 % of normal (0.2-0.6KU/L)
- Moderate poisoning: SchE level 10 - 20 % of normal (0.1-0.2KU/L)
- Severe poisoning: SchE level is < 10 % of normal (<0.1KU/L)

The normal physiological levels of the serum cholinesterase enzyme is 0.6 -1.4 KU/L.(9)

Statistical analysis:-

ANOVA & Paired student t-test were used for comparing serial change in serum cholinesterase levels. All the other parameters were expressed in proportions or percentages.

All statistical analysis were performed using Graph Pad PRISM software 4 .

Observations

Table I : Patient Characteristics

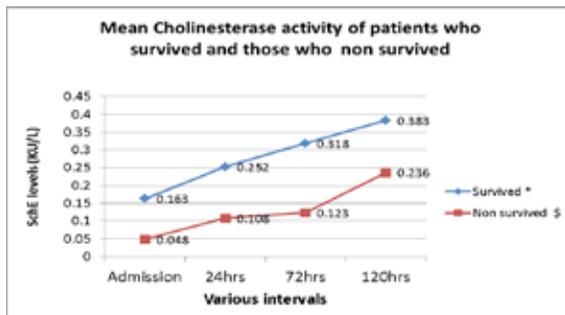
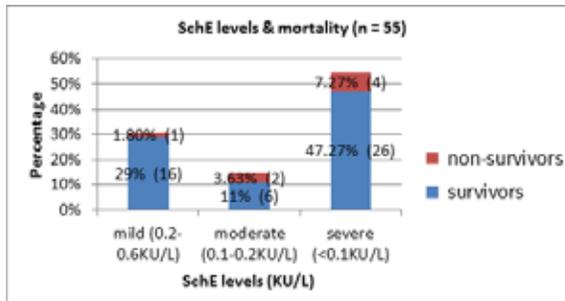
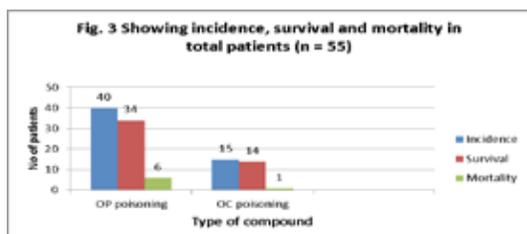
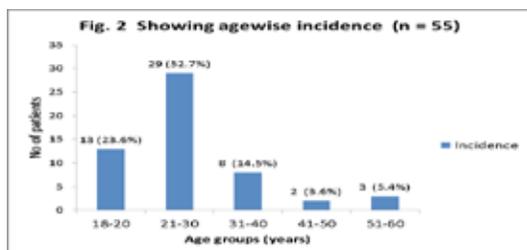
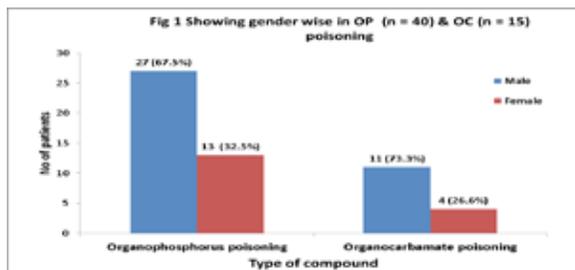
Total number of patients	55
Male : Female	38 : 17
Mean age (years) (Mean ± SD)	26.94 ± 10.42
Number of OP poisoning cases	40
Number of OC poisoning cases	15

Table II : Type of OP compound, incidence, and mortality (n = 40)

Organophosphorus compound	Number of patients & (%)	Mortality
Monocrotophos	26 (65%)	5
Chlorpyrifos	6 (15%)	0
Edifenphos	1 (2.5%)	1
Others	7 (17.5%)	0

Table III : Type of OC compound, incidence, and mortal-

Organocarbamate compound	Number of patients & (%)	Mortality
Propoxur	8 (53.3%)	1
Others	7 (46.6%)	0



RESULTS

The mortality in OP and OC poisoning were 15% and 6.66% respectively.

Of all OP compounds, poisoning with monocrotophos was reported in 65% of cases, with a mortality of 19.23% and of all OC compounds, poisoning with propoxur was reported in 53.3% of cases with a mortality of 12.5%.

In survivors, SchE recovery was statistically significant for admission - 24 h, admission - 72 h, 24 -72 h, 24 - 120 h and admission -120 h (p < 0.001).

In non survivors, SchE recovery was not statistically significant for admission -24 h, admission - 72 h, 24- 72h , 24 - 120 h and admission - 120h

(p = 0.07, P = 0.2015, P= 0.924, 0.435. and P = 0.149 respectively).

CONCLUSION

An increasing trend was observed in serial SchE levels during recovery phase. Serum cholinesterase levels increased significantly in cases of OP and OC poisoning who survived . Hence, the estimation of SchE levels may be a useful predictor of clinical outcome.

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REFERENCES

- Namba T.,Nolte C. T., Jacker J., Grob D. Poisoning due to organophosphorus insecticides, acute and chronic manifestations, Am. Journal of Med. 1971; 50:475-92
- Patel et al.Predictors of mortality in organophosphorus poisoning,JAPI 1996;44 (19):951.
- Anantha Krishna Ramani et al. Serum cholinesterase levels as a indicator of prognosis in organophosphorus poisoning, JAPI 1988;36 (1):23.

4. Mehta A.B. et al. Clinical features and plasma acetyl cholinesterase activity in poisoning with insecticidal organophosphorus compounds, *JAPI* 1971;19:181-84.
5. Adlakha A. et al. Organophosphorus compounds and carbamate poisoning in punjab, *JAPI* 1988; 35 (3) :230.
6. Nilamadhab Kar. et. Lethality of suicidal organophosphorus poisoning in an Indian population: exploring preventability, *Annals of General Psychiatry* 2006, 5:17 doi:10.1186/1744-859X-5-17
7. J Cunha, P óvoa, L ão, AL Santos, AS is et al. Severe poisoning by organophosphate compounds. An analysis of mortality and of the value of serum cholinesterase in monitoring the clinical course *Med Port* (1995) 8: 469-75.
8. Palmer Taylor. Anticholinesterase agents, Goodman-Gilman's The pharmacological basis of therapeutics 12th Ed, McGraw Hill, New York, p 239.
9. Proudfoot AT, Vale JA Pesticides in Weatherall J, Ledingham JGG, Warrell DA, ed. *Oxford text book of medicine*. Vol. 3, 3rd edn. Oxford Medication Press: 1996. 1120-22
10. Eddleston 1,2,3, P. Eyer 4, F. Worek 5, M.H. Rezvi Sheriff 2,3 and N.A. Buckley 3,6 Predicting outcome using butyryl cholinesterase activity in organophosphorus pesticide self-poisoning. *Q J Med* 2008; 101:467-474.