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Original Research Article

Organophosphorus poisoning: study of evaluation of clinically relevant indicators

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ABSTRACT

Background: POP scale and serum cholinesterase estimation are purported to be meaningful indicators for mortality prediction in the cases of organophosphorus poisoning. The present study was undertaken to substantiate the correlation of POP scale score and serum cholinesterase levels in acute OP poisoning with mechanical ventilation requirement and mortality in our setting.
Methods: Data of 150 eligible participants was collected, with POP scale and serum cholinesterase levels being assessed during initial presentation in each of them. Clinical course of the cases was monitored and documented.
Results: The observed case fatality rate was 32.7%. POP scale scoring revealed 30 out of 75 patients to be from moderate group and 19 out of 22 patients to be from severe group. Forty nine out of 75 in moderate group & all patients in severe group required ventilator support. With respect to Serum Cholinesterase level; 20 out of 23 and 29 out of 77 patients died in the severe & moderate poisoning categories respectively. Forty eight out of 77 in moderate poisoning and all patients in severe poisoning required ventilator support.
Conclusions: POP scale scoring and serum Cholinesterase level assessments are clinically relevant indicators in acute OP poisoning cases and are of great utility towards assessment of mechanical ventilation requirement and mortality prediction.

Keywords: OP poisoning, POP scale, Serum cholinesterase level, Prognostic marker, Mortality

INTRODUCTION

Usage of organophosphorus (OP) compounds as pesticides is common place owing to their suitable pharmacological properties.[1] Chances of dangerous poisoning with these compounds goes up in rural areas significantly, owing to their almost universal usage in farming and probable lack of knowledge towards extent of harm they may cause. WHO puts the annual number of pesticide poisoning episodes at three million; including upwards of 300,000 deaths.[2] OP poisoning remains one of the topmost medical indication for emergency admissions in India.[3] Case fatality in OP poisoning in India reportedly ranges between 4-30%, with respiratory failure being the commonest mode of death. Thus, timely and at times pre-emptive mechanical ventilation in selective cases may prove crucial. Hence clinical features and criteria are important to be identified early, to predict the requirement & benefit of ventilator support.[3] One of those clinically relevant indicators is RBC cholinesterase assessment. It is a relatively sensitive indicator, but the estimation is not easy and certainly not commonly available.[1] As an alternative, Serum cholinesterase level is supposedly low following acute OP poisoning and can be estimated locally.[4] Another indicator, Peradeniya OP scale (POP scale), hasn't been deliberated upon much as per available Indian literature. It has shown promise as an easy to assess, effective system to determine the

requirement of ventilator support; a claim which needs further substantiation.[5] Hence, the present study was conducted with the objective of correlation of serum cholinesterase levels and POP scale scores with the requirement of ventilation support and with mortality.

METHODS

In this prospective observational study conducted between September 2017 and October 2019 at four hospitals (Vithai hospital, Lotus hospital, Aastha hospital and Narayana hospital) with intensive care units in Nanded (a city in central-west India region), Maharashtra., wherein patients admitted with history of acute organophosphorus poisoning were managed in the intensive care units. For sample size estimation, the Murat study was referred to, where anticipated mortality in patients of OP poisoning was 27.65%.[6] At an absolute precision of 10% & confidence level of 99%, minimum sample size required for study was 133. Hence, total 160 participants were enrolled for the present study, data of 150 out of which were considered for final analysis after due exclusions. Death or discharge from hospital were studied as dichotomous outcomes for the study.

Inclusion criteria

History of OP poisoning within 24 hours of admission and presence of signs/symptoms of OP poisoning with decreased serum cholinesterase level were included in the study.

Exclusion criteria

Patient taken treatment elsewhere for current acute episode, poisoning with other compounds along with organophosphates and those refusing to consent for the study were excluded from the study.

Patients were diagnosed to have Intermediate Syndrome (IMS) based on following criteria: history of acute OP poisoning, the presence of clinical manifestation of intermediate syndrome, recovery from the acute cholinergic crisis of intermediate syndrome.[7] The patients of acute organophosphorus poisoning admitted in the ICU were screened using above mentioned selection criteria. The eligible participants were subjected to detailed history, clinical and biochemical examination as per the pre-tested proforma, after obtaining written informed consent from the participant/responsible next of kin. The patients were categorised into mild (POP score 0-3), moderate (POP score 4-7) and severe poisoning (POP score 8-11) on the basis of clinical score (POP scale) recorded on admission. Blood samples were drawn and sent for plasma cholinesterase level assessment before doing any intervention. The acute OP poisoning cases were graded as normal (>50%), mild (20-50%), moderate (10-20%) & severe (<10%) as per the noted cholinesterase activity (pseudocholinesterase). The case follow-up was up to death/discharge from the hospital, when various correlations between severity of poisoning (as per POP scale & pseudocholinesterase levels) and mortality were studied. The data were entered in MS-Excel and SPSS (version 18.0) was used for data analysis. Chi-Square test was employed for analysis and $p<0.05$ was considered for defining level of significance.

RESULTS

The age group 21-30 years (44.67%) was the most commonly affected, followed by more than 40 years old (21.33%), less than 20 years old (17.33%) and 31-40 years old (16.67%). Significant male preponderance (60%:40%) was observed amongst the 150 study participants (Table 1).

Table 1: Demographic details of the participants.

Variable	N	%
Age (years)		
<20	26	17.33
20-30	67	44.67
30-40	25	16.67
>40	32	21.33
Gender		
Male	90	60
Female	60	40

Most cases had history of attempted suicide (96%) as mode of poisoning, with oral route being used for all the suicidal attempts. Significantly higher case fatality rate was observed amongst participants with more quantity of OP compound consumed, those with more time lag between consumption of poison and starting of treatment and in those with IMS. The POP scale assessment revealed 53 (35.33%) patients as having mild poisoning, while 75 (50%) had moderate and 22 (14.67%) patient severe poisoning amongst participants. There was no death or ventilator support requirement in the mild poisoning group, while 30 out of 75 patients in moderate category and 19 of the 22 severely poisoned patients succumbed ($p=0.034$), suggestive of significant direct relationship between POP scale score & mortality.

Ventilator support requirement was also directly related to POP scale score, the statistical significance being very high for the trend ($p<0.001$) (Table 2). The participants were categorised as per the Cholinesterase levels and it was observed that 45 (30%) patients belonged to mild, 77 (51.33%) to moderate and 23 (15.33) patients to severe poisoning category. As is evident from the data, lower Cholinesterase levels were noted to be directly correlated to mortality and ventilator support requirement, both the relationships being statistically significant ($p<0.05$) (Table 3). Further, the correlation between the POP scores and Pseudocholinesterase levels was also studied, which revealed statistically significant negative correlation with the r value of 0.7588 (Figure 1).

Table 2: Correlation of severity of poisoning and mortality as per POP scale.

POP scale	Total number (%)	Ventilator support		No ventilator support	
		Survival	Mortality	Survival	Mortality
0-3 (Mild)	53 (35.33)	-	-	53	0
4-7 (Moderate)	75 (50.0)	19	30	26	0
8-11 (Severe)	22 (14.67)	3	19	0	0
Total	150 (100)	22	49	79	0

Table 3: Correlation of severity of poisoning and mortality as per pseudocholinesterase level.

Pseudocholinesterase level	Total number (%)	Ventilator support		No ventilator support	
		Survival	Mortality	Survival	Mortality
<10% (Severe)	23 (15.33)	3	20	-	-
10-20% (Moderate)	77 (51.33)	19	29	29	-
20-50% (Mild)	45 (30)	-	-	45	-
>50% (Normal)	5 (3.33)	-	-	5	-
Total	150 (100)	22	49	79	-

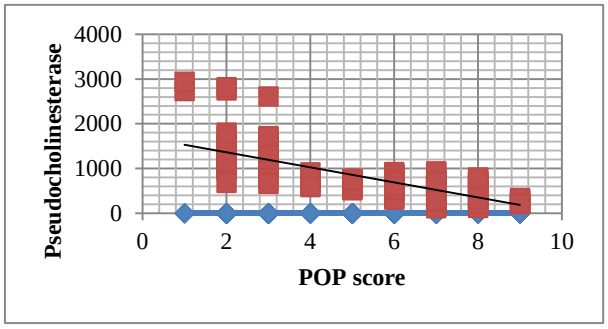

Figure 1: Correlation of POP score and pseudocholinesterase level (r=0.7588).

DISCUSSION

This present study focussed on the validation of clinically relevant indicators which could be of direct utility in cases of acute OP poisoning. The incidence of OP poisoning was notably more in young adults, much in line with previous similar studies.[3,8,9] Suicide was reported to be the predominant mode of poisoning, which is corroborative of findings by Mood et al who reported it to be at 94.3%.[10] It was reported at 67% by Murat et al and at 68% by Laudari et al, which is still on the higher side and has much to do with relatively poor availability of toxic compunds.[6,11] Laudari et al further observed increase amount of OP poison intake (>40 ml) to be having significant correlation with increase in the mortality rate (p=0.02).[11] Thungs et al also reported incidence of death (6.3%) to be higher in participants having taken >30 ml compound than those with <30 ml intake (2.7%) during acute OP poisoning episode.[12] Results of the present study are in agreement with these observations, with the mean quantity of OP compound consumed in survival group being 17.30±10.73 ml versus 28.89±9.37ml in mortality group, the difference being statistically significant. Higher case fatality was observed amongst participants reporting late to the hospital after acute OP compound consumption in this study; a finding which is not in agreement with Laudari et al, but supported by findings of studies by Kavya et al and Patil et al.[3,11,13] It may be noteworthy here that the findings of Laudari et al were statistically insignificant.[11] As for severity of poisoning, in a study carried out by Kavya et al, 27% were in mild category, 50.8% were in moderate category and 22% were severely poisoned. [3] In the study conducted by Sen et al 29% patients had mild, 45% moderate and 26% had severe poisoning.[14] In study conducted by Nermeen et al, 51.7% had mild, 33.3% moderate and 15% had severe poisoning.[15] The categorisation of participants as per the POP scale revealed 35.33% participants to be belonging to mild category, 50% to moderate category and 14.67% to severe category. Thirty out of 75 patients belonging to moderate category and 19 out of 22 patients belonging to severe category died, with no deaths being reported from the mild category. Thus, POP scale was seen to be correlating with mortality significantly. As for ventilator support requirement, 49 out of 75 in moderate poisoning and all patients in severe poisoning required ventilator support. Thus, ventilator support requirement was also decisively higher in patients with high POP scale score.

In the present study, 30% patients had mild poisoning, 51.3% had moderate and 15.33% patients were reportedly severely poisoned as per the estimated Pseudocholinesterase levels. Twenty out of 23 severely poisoned patients died, whereas 29 out of 77 moderate category patients expired. No deaths were observed in the mild group. Direct statistically significant correlation was thus observed between decreased serum cholinesterase level and case fatality. Similarly, 48 out of 77 in moderate poisoning group and all patients in severe poisoning required ventilator support and the trend was statistically significant. So, ventilator support requirement was higher in people with low pseudocholinesterase level. Kavya et al observed significant correlation between severity of poisoning and the serum cholinesterase at the time of initial presentation

of the patients ($p<0.001$).[3] There was also positive relationship between POP scoring and lower Pseudocholinesterase level to that of need for ventilation. Incidence of mortality was significantly associated with lower Pseudocholinesterase level and POP Scoring. Similar findings were reported by Shah et al.[8]

The current study observed significant negative correlation of POP score and Pseudocholinesterase level, with an r value of -0.7588. This is suggestive of more severe POP scale scores with lower pseudocholinesterase levels and is sitting well with observations of previously similar studies. The cases belonging to predominantly rural populace and relatively smaller sample size are two noteworthy limitations of present study. Studies with larger sample sizes with good urban proportions are recommended for substantiation of findings of present study.

CONCLUSION

Both POP scale score and Pseudocholinesterase level estimation in acute OP poisoning cases are clinically relevant indicators and add significant value in the assessment of severity, need for ventilator support and as predictor of mortality.

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REFERENCES

1. Taylor P. Anticholinesterase agents. Goodman and Gilman's The Pharmacological basis of Therapeutics. 11th ed. United States of America: Taylor and Francis; 2006:176-82.
2. Mancini F, Janice LS, O'Malley M. Reducing incidence of acute pesticide poisoning by educating farmers on integrated pest management in South India. Int J Occup Environ Health. 2009;15(2):143-51.
3. Kavya ST, Srinivas V, Chandana, Madhumati R. Clinical Profile of Patients with Organophosphorus poisoning in intensive care unit in tertiary hospital. Int J Cases Investigat. 2012;4(3):24-31.
4. Rehiman S, Lohani SP, Bhattarai MP. Correlation of serum cholinesterase level, clinical score at presentation and severity of OP poisoning. J Nepal Med Assoc. 2008;3(170):47-52.
5. Senanayake N, de Silva HJ, Karalliedde L. A scale to assess severity in organophosphorus intoxication: POP scale. Hum ExpToxicol. 1993;12:297-9.
6. Murat S, Muhammed G. Intensive care management of organophosphate insecticide poisoning. Crit Care. 2001;5:211-5.
7. De Bleecker JL. Intermediate syndrome: Prolonged cholinesterase inhibition. J Toxicol Clin Toxicol. 1993;31(1):197-9.
8. Shah H. Acute organophosphorus poisoning and clinical admission Score association among patients admitted in emergency ward of tertiary hospital of medical college. J Pharma Biomed Sci. 2012;17:11-7.
9. Weissmann-Brenner A, Aviv-Vidan A and Hourvitz A. Organophosphate poisoning: A multi-hospital survey. IMAJ. 2002;4:573-6.
10. Balali-Mood M, Balali-Mood K, Shirazi HF. Organophosphate side effects. Iranian J Pharma Res. 2006;2:79-87.
11. Laudari S, Patowary BS. Analysis of Organophosphorus compound poisoning patients attending CMS-TH, Bharatpur, Nepal. J Coll Med Sci-Nepal. 2011;7:9-19.
12. Thungs G, Sam KG, Khera K, Pandey S, Sagar SV. Evaluation of organophosphorus poisoning cases in a tertiary care hospital. J Tox Env Health Sci. 2010; 2(5):73-6.
13. Patil, Virendra C. Clinical Profile and Outcome of Organophosphorus Poisoning at Tertiary Care Centre in Western Maharashtra. Indian J Foren Med Toxicol. 2012;6(2):239-45.
14. Sen R, Nayak J, Khadanga S. Study of serum cholinesterase, CPK and LDH as prognostic biomarkers in organophosphorus poisoning. Int J Med Res Rev. 2014:2(3):185-9.
15. Nermeen AM, Abdelmonem G. Madboly S. Correlation between serum creatine phosphokinase and severity of acute organophosphorus poisoning. IOSR J Environ Sci Toxicol Food Technol. 2013; 4(5):18-29.

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