

## Original Research Article

# Study of role of prognostic markers in the management of organophosphorus poisoning patients

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### ABSTRACT

**Background:** POP scale and serum cholinesterase levels may be effective indicators for mortality in organophosphorus poisoning. The objective of this study was to assess the POP scale score and serum cholinesterase levels at initial presentation in OP poisoning and its correlation with need for ventilator support and mortality.

**Methods:** One hundred and fifty eligible participants were recruited, and POP scale and serum cholinesterase levels were assessed.

**Results:** Total 32.7% patients died; of which 30 out of 75 belonged to moderate and 19 out of 22 patients belonged to severe group; as per POP scale score. 49 out of 75 in moderate poisoning and all patients in severe poisoning required ventilator support. With respect to serum cholinesterase level; 20 out of 23 and 29 out of 77 patients died in the severe and moderate poisoning categories respectively. Forty eight out of 77 in moderate poisoning and all patients in severe poisoning required ventilator support.

**Conclusions:** Assessment by POP scale and serum cholinesterase levels is useful in assessing the need for ventilator support and are indicators of mortality in OP poisoning cases.

**Keywords:** OP poisoning, POP scale, Serum cholinesterase level

### INTRODUCTION

Organophosphorus (OP) compounds are commonly used as pesticides.<sup>1</sup> Easy availability and widespread use has increased the likelihood of poisoning with these compounds. WHO estimates three million pesticide poisoning episodes annually; of which a minimum of 300,000 die.<sup>2</sup> OP poisoning is an important indication for emergency admission in hospitals throughout India.<sup>3</sup>

Mortality in OP poisoning is reported 4-30% in various Indian studies. Respiratory failure is the commonest complication leading to death: prompt ventilator support may improve survival. With limited availability of resources, all OP poisoning patients are not managed in ICUs in India. Hence clinical features and criteria are

important to be identified early, to predict the need for ventilator support.<sup>3</sup>

RBC cholinesterase level is a sensitive indicator<sup>1</sup>, but its estimation is difficult and not commonly available. Serum cholinesterase level, which can be routinely estimated locally, is decreased after OP poisoning.<sup>4</sup> Peradeniya OP scale (POP scale) hasn't been studied much in Indian scenario. It could be a simple and effective system to determine early the need for ventilation, as has been speculated internationally.<sup>5</sup>

The present study aims to correlate POP scale score and serum cholinesterase levels and the need for ventilation and mortality.

## METHODS

### Study design

It consists of prospective observational study.

### Study setting

ICU at a tertiary care hospital.

### Study duration

1<sup>st</sup> December 2013 to 30<sup>th</sup> November 2016.

### Sample size estimation

Based on Murat study, anticipated mortality in patients of OP poisoning was 27.65%.<sup>6</sup> At absolute precision-10% and confidence level-99%, minimum sample size required for study was 133. Total 150 participants were studied.

### Outcome measures

Death/discharge from hospital.

### Participant selection

#### Inclusion criteria

- History of OP poisoning within 24hr of admission.
- Presence of signs/symptoms of OP poisoning with decreased serum cholinesterase level.

#### Exclusion criteria

- Patient taken treatment elsewhere for current episode.
- Poisoning with other compounds along with organophosphates
- History of chronic liver/pancreatic disease.
- Pregnancy.
- Diabetes.
- History of alcohol consumption and/or drug abuse.

The diagnostic criteria of intermediate syndrome (IMS) included

- History of acute OP poisoning.
- The presence of clinical manifestation of intermediate syndrome.
- Recovery from the acute cholinergic crisis of intermediate syndrome.<sup>7</sup>

All patients with history of OP poisoning who were admitted to ICU in Department of Medicine were put through the selection criteria. Eligible patients underwent history, clinical examination, biochemical examination. Information was collected through pre-tested proforma. Clinical score (POP scale) was noted on admission and accordingly patients were grouped into mild (POP score 0-3), moderate (POP score 4-7) and severe poisoning (POP score 8-11). Blood samples were taken immediately and sent for estimation of plasma cholinesterase level before doing any intervention. According to cholinesterase activity (pseudocholinesterase) the OP poisoning was graded as normal (>50%), mild (20-50%), moderate (10-20%) and severe (<10%). Patients were followed up to death/discharge.

## RESULTS

Majority of cases (56.7%) were between the age group 20 to 40 years, with male predominance (71.3%). Main motive for majority of poison consumption was suicidal (86%), the major route of poisoning being oral ingestion (96.7%). Chi-square analysis for trends showed increasing mortality rate amongst participants with higher quantity of compound consumed, more time lag between consumption of poison and starting of treatment and in those developing IMS; all of the results being statistically significant.

According to POP scale assessment, 53 (35.33%) patients had mild poisoning while 75 (50%) had moderate and 22 (14.67%) patient had severe poisoning (Table 1). Nineteen out of 22 severely poisoned patients died, while in moderate category 30 out of 75 patients died. When analysed statistically it was found to be statistically significant (P=0.034) suggestive of more severe POP scale score more is mortality. 49 out of 75 in moderate poisoning and all patients in severe poisoning required ventilator support. Need of ventilation was more in people with high POP scale. Chi-square test for trend revealed highly significant correlation (P<0.001) between POP scale score and the need for mechanical ventilation.

**Table 1: Correlation of severity of poisoning and mortality as per pop scale (n=150).**

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

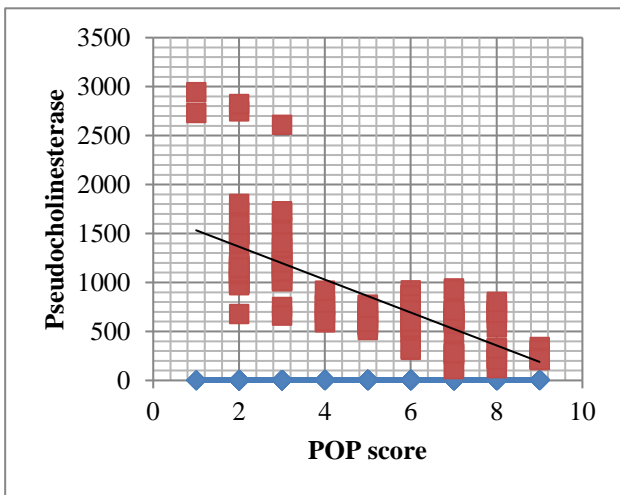
Categorisation as per cholinesterase levels revealed 45 (30%) patients in mild, 77 (51.33%) in moderate and 23 (15.33) patients in severe poisoning category. 20 out of 23 patients and 29 out of 77 patients died in the severe and moderate poisoning categories respectively; suggestive of lower cholinesterase level being directly correlated to mortality, which was statistically significant. 48 out of 77 in moderate poisoning and all patients in

severe poisoning required ventilation. Chi-square test for trend applied to compare cholinesterase level and ventilator support depicted high statistical significance ( $P < 0.001$ ) (Table 2).

Negative correlation was observed between the POP score and pseudocholinesterase level, with statistically significant r-value of 0.7588 (Figure 1).

**Table 2: Correlation of severity of poisoning and mortality as per pseudocholinesterase level (n=150).**

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 (u/l) (r- 0.7588).**

**DISCUSSION**

The incidence of OP poisoning was higher in young adults, with almost two third participants being males, as reported in previous studies with similar hypothesis.<sup>3,8,9</sup>

Suicide being the main motive (86%) for poison consumption has been corroborated by Mood et al, who reported it to be at 94.3%.<sup>10</sup> It was reported at 67% by Murat et al and Saadeh et al as a 68%.<sup>6,11</sup>

In study carried out by Laudari et al, increase amount of OP poison intake (>40ml) had significant correlation with increase in the mortality rate ( $p=0.02$ ).<sup>11</sup> Suliman et al, reported higher mortalities (6.3%) in those consuming >30ml than those <30ml (mortality being 2.7%).<sup>12</sup>

Findings of both the studies are in-line with our study, in which mean quantity consumed in survival was  $17.30 \pm 10.73$ ml and in mortality group was  $28.89 \pm 9.37$ ml.

In present study, we observed higher mortality rate amongst participants reporting late to the hospital after OP consumption; which was refuted by Laudari et al, but supported by statistically significant findings of Kavya et al and Patil et al.<sup>3,11,13</sup>

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.<sup>3</sup> In study conducted by Sen et al, 29% patients had mild, 45% moderate and 26% had severe poisoning.<sup>14</sup> In study conducted by Nermeen et al, 51.7% had mild, 33.3% moderate and 15% had severe poisoning.<sup>15</sup>

In present study, according to POP scale, out of 150 patients, 35.33% were in mild category, 50% in moderate category and 14.67% patients fell in severe category. A total of 32.7% of the patients died, of which 30 out of 75 patients belonged to moderate and 19 out of 22 patients belonged to severe group. So, POP scale correlated, directly and significantly, with mortality. 49 out of 75 in moderate poisoning and all patients in severe poisoning required ventilator support. Need of ventilation was reported to be more in people with high POP scale.

In present study, according to assessment of Pseudochoolinesterase levels, 30% patients had mild poisoning, 51.3% had moderate and 15.33% patients were severely poisoned. 20 out of 23 patients who were severely poisoned died, while in moderate category 29 out of 77 patients died. Thus, a direct correlation was also observed between decreased serum cholinesterase level and mortality, which was statistically significant.

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 with lower Pseudocholinesterase level.

According to pseudocholinesterase levels, 48 out of 77 in moderate poisoning and all patients in severe poisoning required ventilator support and trend was statistically significant. Need of ventilation was reported to be more in people with low Pseudocholinesterase level. In study by Kavya et al, there was significant correlation between severity of poisoning and the serum cholinesterase at the time of initial presentation of the patients ( $P < 0.001$ ).<sup>3</sup> 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.<sup>8</sup>

## CONCLUSION

We concluded that, assessment by POP scale and by pseudocholinesterase levels at initial presentation in OP poisoning cases is useful in assessing the severity and need for ventilation; at the same time being important indicators of mortality.

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