

Original Research Article

A prospective study on the predictors of mechanical ventilation in organophosphate poisoning

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ABSTRACT

Background: Organophosphorus poisoning is one of the most common poisonings often requiring ICU care and ventilatory support. The objective and aim of this study are to identify the factors which predict the need for ventilation in these patients.

Methods: 50 patients who were diagnosed to have consumed organophosphorus compound poison admitted in Konaseema Institute of Medical Sciences and Research Foundation who presented within 24 hours of consumption are included in the study. Patients with double poisonings, concomitant illnesses, chronic lung diseases and those treated outside are excluded from the study.

Results: A total number of 50 patients were studied. 18(36%) patients required ventilation. Generalized fasciculations was a discernible feature in 66% of cases in this study. 69.2% of patients with a fasciculation score of ≥ 4 required ventilation. Ventilation was needed by 55% of patients who had a Glasgow Coma Scale score of ≤ 10 .

Conclusions: Patients who presented with higher fasciculation scores and/or lower GCS scores were more likely to require ventilation. Using GCS scores as a predictor for the requirement of ventilatory support in organophosphate poisoning, a GCS score ten or less was significantly associated with an increased need for ventilatory support.

Keywords: Fasciculations, Glasgow coma scale, Mechanical ventilation, Organophosphate poisoning, Predictive factors

INTRODUCTION

Organophosphate poisoning is a significant health problem in developing countries as well as in western countries. Hospitalisation statistics suggest that nearly half of the emergency admissions due to acute poisoning are due to Organophosphate poisoning.

Organophosphorus compounds are easily available in insecticides shops and have gradually increased suicidal & accidental poisonings. Nearly 90% of poisonings are suicidal with a fatality rate of $>10\%$. 8-10% are accidental and $<1\%$ Homicidal.^{1,2} Occupational exposures account for 1/5th of accidental poisoning with

fatalities of $<1\%$. Organophosphorus compounds combine with esteratic sites of acetyl cholinesterase, that is phosphorylated and phosphorylated esteratic sites undergo hydrolysis. The phosphorylated enzyme is inactive and thus unable to hydrolyze acetylcholine. The biological effects of organophosphates are as a result of accumulation of endogenous acetylcholine at sites of cholinergic transmission. This binding is irreversible, except with early pharmacological intervention. Most organophosphorus compounds are readily absorbed through respiratory, oral, GIT mucosa and through intact skin, as they are lipid soluble.^{3,4} The diagnosis is based on the history of exposure and features of cholinergic over activity.

The treatment includes atropine or glycopyrrolate, which acts as a physiological antidote; PAM which help in reactivating the enzyme (prevents ageing). Complications like respiratory failure, CNS depression and ventricular arrhythmias should be anticipated and treated. The early causes of death in organophosphate poisonings are chiefly related to ventricular arrhythmias, CNS depression, seizures or respiratory failure due to excessive bronchial secretions, bronchospasm, pulmonary edema, aspiration of gastric contents, paralysis of respiratory muscles or apnea associated with depression of the medullary respiratory center.⁵ Late mortality is due to respiratory failure and infections like pneumonia, septicemia or complications related to a mechanical ventilator and intensive care management. As a treatment modality for this complication, mechanical ventilation is necessary.

METHODS

The study was conducted on patients who were diagnosed to have organophosphate compound poisoning admitted in Konaseema Institute of Medical Sciences and Research Foundation who were admitted within 24 hours of consumption of the poison from January 2016 to October 2019.

Based on previous study considering confidence interval 95% power of the study 80% and simplification level of 5% the sample size was calculated to be 50.

Patients were enrolled for this study based on following inclusion and exclusion criteria:

Inclusion criteria

- All patients admitted within 24 hours of consumption of the poison.

Exclusion Criteria

- Patients with concomitant respiratory illnesses
- Patients with double poisoning
- Patients who were treated outside

Fasciculation Score was calculated by giving 1 point each to the presence of fasciculations in the anterior chest, anterior abdomen, posterior chest, posterior abdomen, right thigh, right leg, left thigh, left leg, right arm and left arm. The total Fasciculation score is thus estimated. GCS was calculated on admission.

The included patients were closely monitored for signs of respiratory insufficiency like

- Accessory muscles of respiration in action,
- Respiratory rate of >30 breaths/minute,
- Arterial Blood Gas Analysis (ABG)- PaO₂ <50 mmHg,
- PCO₂ >50 mmHg
- O₂ saturation <90%.

If any one or more above signs are present, the decision for mechanical ventilation was taken.

Statistical methods

Chi-square test (Yates and Pearson) and Fisher Exact test have been used to find the significance of ventilation requirement for all the above study parameters. Odds ratio has been used to find the strength of the relationship between ventilation requirement and the study parameters.

RESULTS

Among 50 patients diagnosed to have organophosphate compound poisoning were studied in relationship to the need for ventilatory support. In the total target study, 18 patients required ventilatory support.

Table 1: Relationship of fasciculation score with ventilation.

Fasciculation Score (n=50)	Number of patients presented	Number of patients who required ventilation	Number of patients without ventilation
0	17 (34%)	5 (29.4%)	12 (70.6%)
1-3	20 (40%)	4 (20%)	16 (80%)
≥4	13 (26%)	9 (69.2%)	4 (30.8%)

X²=8.773, DoF=2, p-Value=0.012* (statistically significant)

Table 2: Relationship of GCS score with ventilation.

GCS Score (n=50)	Number of patients presented	Number of patients who required ventilation	Number of patients without ventilation
≤10	20 (40%)	11 (55%)	9 (45%)
11-15	30 (60%)	7 (23.3%)	23 (76.7%)

X²=5.222, DoF=1, p-Value=0.022,* Odds Ratio=4.01

As per table 1 number of patients without fasciculation were 34% out of them 29% required ventilation and 70.6% did not require ventilation. Number of patients with fasciculation score 1-3 were 40% out of them 20% required ventilation and 80.0% did not require ventilation.

Number of patients with fasciculation score more than 4 were 26% out of them 69% required ventilation and 30.80% did not require ventilation in the present study of 50 patients, generalized fasciculations was a discernible feature in 66% of cases in this study. 69.2% of the patients with a fasciculation score ≥4 were ventilated. This is statistically significant.

In this study as per table 2, out of 50 patients, 30 (60%) patients had a GCS- score of 11-15, out of these,

7(23.3%) patients required ventilatory support. Numbers of patients having GCS score less than 10 were 20 that are 40 %. Ventilatory support was required by 55% of patients who had a GCS score of less than 10. Hence, patients with GCS-score of less than 10 are 4.01 times more likely to receive ventilation when compared to patients with GCS-score 11-15.

DISCUSSION

Acute Organophosphate poisoning is one of the most frequently encountered poisonings in Konaseema Institute of Medical Sciences and Research Foundation. The major cause of poisoning in this study was suicidal attempts (100%). Suicide is the major cause of poisonings in developing countries.^{6,7} In contrast; figures from developed countries like Japan, show accidental exposures form a major bulk of organophosphorus compound poisoning cases.⁸⁻¹⁰ As per the selection criteria, 50 patients who were diagnosed to have organophosphate compound poisoning admitted in Konaseema Institute of Medical Sciences and Research Foundation who were admitted within 24 hours of consumption of the poison. GCS and fasciculation scores were calculated. 18 patients required ventilatory support. 32 patients did not require mechanical ventilation. Which is supported by the work of Eranai KB, Nagraj, Kardkal BL et al and Mutalik GS, Wadia RS and Pai VR et al.^{11,12} Generalised fasciculations was a noticeable feature in 66% of cases in this study. Whereas, studies done by Sarjit Singh et al and Goel et al showed that 100% and 55% of the patients respectively had fasciculations.¹³⁻¹⁴ 40% of the patients had a fasciculation score of 1-3. 26% of the patients had a fasciculation score ≥ 4 . 34% of the patients had no fasciculation.

Of the patients with fasciculation score ≥ 4 , 69.2% required ventilation in our study whereas in a study done by Goel et al., 55% of the patients with fasciculation scores, more than or equal to 4 required ventilation.¹⁴ 29.4% of patients with no fasciculations and 20% of patients with fasciculation score 1-3, respectively required ventilation. Ventilatory support was required by 55% of patients who had a GCS score level of 10 or less. In studies done by Goel et al., 84% of the patients with GCS- score less than 10 required ventilation.¹⁴ 30 patients had a GCS score of 11-15, of which only 7 (23.3%) required ventilation.

CONCLUSION

Using fasciculation scores as a predictor for the requirement of ventilatory support in organophosphorus compounds poisoning in the present study of 50 patients, the presence of higher fasciculation scores (≥ 4) was associated with the higher need for ventilatory support.

Using GCS scores as a predictor for the requirement of ventilatory support in organophosphate poisoning, a GCS score ten or less was significantly associated with an

increased need for ventilatory support. Ventilators are boon to patients with respiratory failure due to poisoning and decrease the mortality secondary to organophosphorus related respiratory failure.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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