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Research Article

# A PROSPECTIVE OBSERVATION STUDY IN PREDICTING THE NEED FOR VENTILATORY SUPPORT IN ORGANOPHOSPHORUS POISONING

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**A R T I C L E I N F O**

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**A B S T R A C T**

**Background:** This study will help us to identify the factors, which help in predicting the need for ventilator support in a patient with consumption of organophosphorus compound. The study was conducted on 100 patients admitted in Osmania General Hospital, Hyderabad. 100 patients diagnosed to have consumed organophosphorus compound poison were studied in relationship to the need for ventilator support. In the total target study of 100 patients, 36 patients required ventilator support. Patients with moderate and severe poisoning required higher doses of atropine as compared to those with mild poisoning. Dose of atropine greater than 150 mg within 48 hours of admission was associated with higher need for ventilator support.



## INTRODUCTION

Organophosphorus compound poisoning is a major health problem not only in developing countries but also in western countries.(1) Hospital based statistics suggest that nearly half of the admissions to emergency with acute poisoning are due to Organophosphorus compound poisoning.(2) Organophosphorus compound were first discovered more than 100 years ago are at present the predominant group of insecticides employed globally for pest control(3). Organophosphorus compound poisonings are found to be a leading cause of death in agricultural countries globally since 50 years.(4) It is believed that between 750000 and 3,00,0000 organophosphate poisoning occur globally every year. Organophosphorus compound poisoning affect globally approximately 3 million population and cause 3,00,000 deaths annually, most of this occurs in developing countries.

Organophosphorus compounds are easily available as insecticides in shops and have resulted in a gradual increase in suicidal and accidental poisoning. Nearly 90% of the poisonings are suicidal with fatality rate of >10%. 8-10 % accidental and <1% homicidal. Occupational exposure accounts for 1/5th of accidental poisoning with fatalities of <1%(5)

Organophosphorus compounds combine with esteratic sites of acetyl cholinesterase, that is phosphorylated & phosphorylated esteratic sites undergo hydrolysis. The phosphorylated enzyme is inactive and unable to hydrolyse acetylcholine.

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The diagnosis is based on the history of exposure and features of cholinergic over activity(6) The treatment includes atropine or glycopyrrolate, which act as a physiological antidote, PAM for reactivating the enzyme. Complications like respiratory failure, CNS depression & ventricular arrhythmias all should be anticipated & treated.

The early causes of death in organophosphorus compound poisoning are chiefly related to ventricular arrhythmias ,CNS depression, seizures or respiratory failure occurs due to excessive bronchial secretions, bronchospasm, pulmonary edema, gastric contents aspiration, respiratory muscles paralysis or apnoea associated with depression of the medullary respiratory centre. Late mortality is associated with respiratory failure and infections like pneumonia, septicaemia or complications related to mechanical ventilator and intensive care management.(7)

### *Aim of the Study*

To identify the factors, which help in predicting the need for ventilator support in a patient with consumption of organophosphorus compound.

## MATERIAL & METHODS

The study was conducted on 100 patients who were diagnosed to have consumed organophosphorus compound poison admitted in Osmania General Hospital, Hyderabad Telangana State from March 2019 to February 2021 who was admitted within 24 hours of consumption of the poison.

The included patients were intensively monitored for signs of respiratory insufficiency like respiratory rate of > 30

breaths/minute, accessory muscles of respiration in action, O2 saturation <90%, Arterial Blood Gas Analysis (ABG) – PaO2 < 50 mmHg, PCO2 > 50 mmHg. If any one or more are present, the decision for mechanical ventilator was taken. Bradycardia was defined as < 60 beats/minute.

Patients accompanying with other respiratory disorders; those consuming organophosphate with other poisoning chronic lung disease and those who treated other hospitals were not taken in the study.

Based on the factors that influence the need for ventilator support, the severity of organophosphorus compound poisoning was graded as mild, moderate and severe poisoning.

***Mild Poisoning includes***

Normal level of consciousness (score of 12-15 by Glasgow coma scale (GCS)).

- Pupil size > 4mm.
- Fasciculation score 0-1.

***Moderate Poisoning includes***

- Mild alteration in level of consciousness (score of 8-11 by GCS).
- Pupil size 2-3mm.
- Fasciculation score 2-4.

***Severe poisoning includes***

- Stupor / Coma (score of 7 or less by GCS).
- Pin point pupil (1mm or less)
- Presence of convulsions
- Fasciculation score 5 or more.
- Signs of respiratory insufficiency

Fasciculations of anterior chest, posterior chest, anterior abdomen, posterior abdomen, right thigh, left thigh, right leg, left leg, right arm and left arm was given one point for each area. Then grading of fasciculation score was estimated.

## RESULTS

100 patients diagnosed to have consumed organophosphorus compound poison were studied in relationship to the need for ventilator support. In the total target study of 100 patients, 36 patients required ventilator support.

**Table 1** Age distribution with ventilation

| Age in years (n=100) | Number of patients presented | Number of patient with ventilation | P Value | Odds ratio (ventilation) |
|---|---|---|---|---|
| 13-20 | 22 (22%) | 8 (8%) | p>0.05 | 1.02 |
| 21-30 | 58 (58%) | 22 (22%) | 0.655 | 1.22 |
| >30 | 20 (20%) | 6 (6%) | 0.61 | 0.71 |

**Table 2** Relationship of fasciculation score with ventilation

| Fasciculation score(n=100) | Number of patients present | Number of patients with ventilation | P value | Odds ratio (ventilation) |
|---|---|---|---|---|
| 0 | 28 (28%) | 6 (6%) | 0.067 | 0.38 |
| 1-3 | 40 (40%) | 10 (10%) | 0.0885 | 0.44 |
| >4 | 32 (32%) | 20 (20%) | 0.0017 | 5.42 |

***Relationship of pupil size with ventilation***

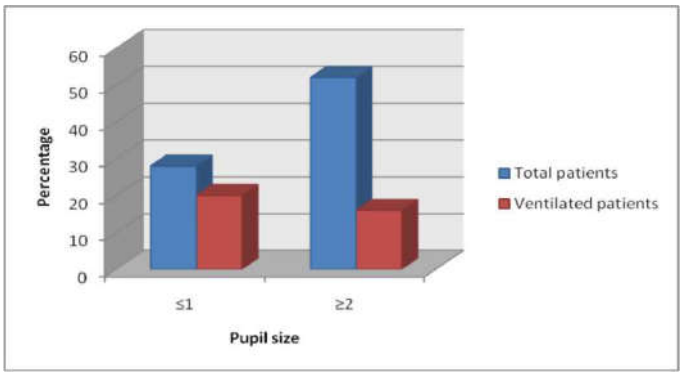


**Table 3** Relationship of GCS-score with ventilation

| GCS – score | Number of patients presented | Number of patients with ventilation | P value | Odds Ratio (Ventilation) |
|---|---|---|---|---|
| <10 | 26 (26%) | 22 (22%) | P<0.001** | 23.57 |
| 11-15 | 74 (74%) | 14 (14%) | P<0.001** | 0.04 |

***Requirement of ventilator support in relation to severity of organophosphorus compound poisoning***

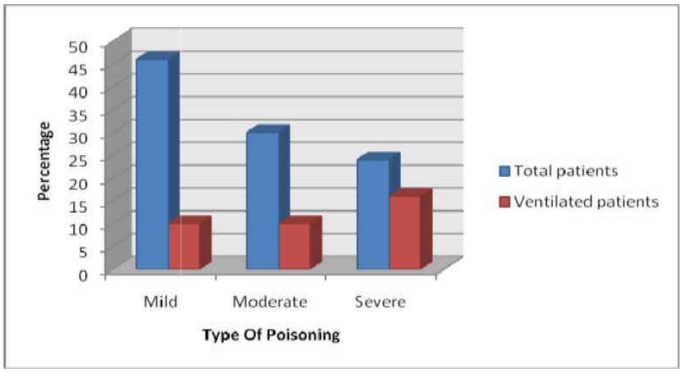


**Table 4** Relationship between time lag of consumption of poison and admission to the hospital with ventilator support

| Time lag | Number of patients Presented | Number patients with ventilation |
|---|---|---|
| <4 hours | 4 (4%) | - |
| >4 hours | 96 (96%) | 36 (36%) |

***Relationship of pulse rate with ventilation***

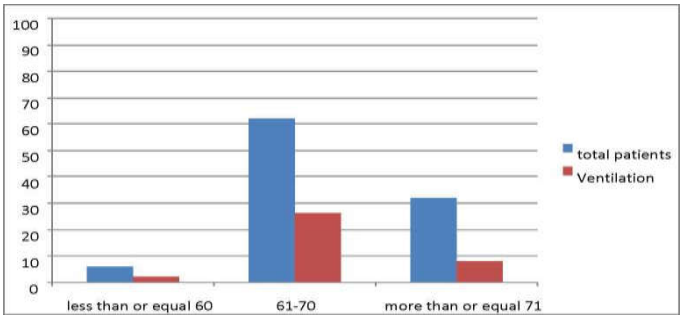


**Table 5** Relationship of respiratory rate with ventilation

| Respiratory rate (n=100) Breath/min | Number of patients presented | Number of patients with ventilation | P value | Odds ratio (ventilation) |
|---|---|---|---|---|
| <20 | 60 (60%) | 6 (6%) | P<0.001 | 0.04 |
| 21-25 | 16 (16%) | 6 (6%) | p>0.05 | 1.08 |
| 26-30 | 18 (18%) | 18 (18%) | P<0.001 | - |
| >30 | 6 (6%) | 6 (6%) | 0.0016 | - |

**Table 6** Relationship of the use of accessory muscles with ventilator support

| Accessory muscles | Number of patients Presented | Number of patients With ventilation |
|---|---|---|
| Not- acting | 64 (64%) | - |
| In action | 36 (36%) | 36 (36%) |

## DISCUSSION

Acute Organophosphorus compound poisoning is one of the most frequent poisonings encountered. According to Vanishree *et al* study[8], pesticides (62%) were most common types of poisoning and among pesticides, OP compounds (36%) were reported as most common cause of poisoning.

Among the 100 cases studied, majorities of the patients were in the age group of 21-30 years (58%). This correlates well with the study done by S.Singh *et al*[9] According to Balani *et al* (1968) [10], Gupta and Patel (1968) [11] peak incidence of suicide was in third decade of life followed by second decade. According to Pavan soni *et al* [12] study, peak incidence of organophosphorus poisoning was in 15-35 years age group.

In the present study, 60% of the patients were males. This correlates with the findings of the previous studies. However, in a study done by M. Vishwanathan *et al* [13], 66% of the patients who consumed organophosphorus compound were females.

Vomiting was the most common symptom in 80% of the patients in this study. This correlates with the studies done by OP Gupta *et al*, Sarjit Singh *et al*[14], and, Goel *et al*[15] where vomiting was present in 90% and 97.08% of the cases respectively. In K. Surya Pavan *et al* study [16], nausea and vomiting are the common symptoms which are present in 85% and 65% of cases respectively followed by abdominal pain, excessive salivation and sweating. Vomiting was probably due to chemical gastritis.

Generalised fasciculations was another conspicuous feature in 72% of cases in this study. Whereas, studies done by Goel *et al* and Sarjit Singh *et al* showed that 55% and 100% of the patients respectively had fasciculations.

In this study 32 (32%) of subjects had fasciculation score of >4. Out of which 20 (64%) were intubated and 12 (36%) did not require ventilator. This finding correlates well with Aravind Varma Datla *et al* [17] study in which number of subjects with fasciculation score of >4 were 26 and out of them 69% required ventilation and 30.8% did not require ventilation which was statistically significant. Also Sudha Mary Philip study[18] showed that 16 (32%) patients presented with fasciculation score of >4, out of which 10 (62.5%) required ventilation.

In Rajeev.H *et al* [19] study 13(72.2%) out of 18 patients with pinpoint pupils required ventilator support as compared to none with pupillary size of more than 4mm.

Bradycardia at admission was present in 6% of the cases in the present study. No statistical association was found between bradycardia and need for ventilator support. In comparison, in a study done by Robert *et al*[20] 19% of the patients had bradycardia, while in a study carried out by Semir Nouria,[21] 17% had bradycardia and in K.Surya Pavan *et al* study, 42% had bradycardia. This has not been compared with the need for ventilation.

Twenty four (24%) patients had respiratory rate >25 breaths/min of which all patients required ventilator support. The higher respiratory rate was probably due to increased secretion and more severe respiratory paralysis caused by the poison itself. According to the study done by G. S. Mutalik *et al* [22] 40% of the patients had a respiratory rate more than 30 breaths/min but this has not been compared with the need for ventilation.

It was observed in this study that 36% of the patient with respiratory failure required mechanical ventilation as compared to 40% of the patients in a study done by T.C.Tsao *et al* [23]. In study done by Rajeev.H *et al* 40% had respiratory insufficiency while in studies by Tsao *et al* and Goel *et al* it was 40% and 42% respectively.

Arterial blood gas analysis was done in 36 patients who had a respiratory rate > 25 breaths/minute and whose accessory muscles of respiration were in action. All of them had respiratory acidosis. Nineteen (38%) patients had oxygen saturation levels of < 89% out of which 18 (94.73%) patients required ventilator support. Eighteen (36%) patients had accessory muscles of respiration in action, of which, all required ventilation. There are no comparative studies available.

In this study, patients who were ventilated required a higher dose of atropine within 48 hours of admission as compared to those who were not ventilated. This was consistent with the findings of the study done by Goel *et al* wherein 90% of patients required ventilator support with 60mg and more of initial atropine requirement as compared to 47% with requirement less than 36 mg. Higher dose of atropine may indirectly indicate the severity of poisoning which might have caused respiratory paralysis requiring ventilation. According to Rajeev. H *et al* study patients requiring more than 60mg of atropine were more prone (all 13 patients -100%) for ventilator support as against none among 21 patients with atropine requirement of less than 35mg.

In study by Rajeev *et al*, methyl parathion was the commonest poison encountered; out of 25 cases, 15 cases (60%) required ventilator support. Among 6 cases of Dimethoate poisoning, 4 cases (66.7%) required ventilator support. According to Puja Madala study (2017), methyl parathion was the frequent compound associated with prolonged ventilation.

In this study ventilator support was required by 84.6% of patients who had a GCS score level of less than 10.This correlates very well with the study done by Goel *et al*, where 84% of the patients with GCS - score less than 10 required ventilation. According to Pavan soni study, 40 patients had GCS of less than 10, out of which 14(35%) were intubated. In study done by Vipinsingh Thakur, 46 (46%) had GCS of <7 out of which 67.4% required ventilator support and out of patients with GCS between 8-11, 32.6% required ventilator.

In this study 21.7% of the patients with mild poisoning and 33.3% of the patients with moderate poisoning required ventilator support. In contrast 66.6% of the patients with severe poisoning required ventilation. Studies done by Goel *et al* have shown that about 4% of the patients with mild and 6% of patients with moderate poisoning required ventilator support whereas 62% of the patients with severe poisoning required ventilator support. In Pavan soni *et al*, 8 (57%) patients with severe poisoning out of 14 required ventilation. In this study,

18 (18%) developed pneumonia, 6 (6%) patients developed intermediate syndrome. According to T. Selvaraj *et al* study, pneumonia developed in 18% of patients and intermediate syndrome in 9% of cases. Similar incidence of complications are also observed in the study of Edwin *et al*[24].

100 succumbed to poisoning in our study with mortality rate of 8%. Mortality rate of 12% was found in T.Selvaraj *et al* study of 118 patients. High mortality rate was observed by Padmanaba *et al* study (25%) and Dayanand *et al* (21.25%). Lower mortality rate of 5.2% was seen by Dhaval *et al*[25]

## CONCLUSIONS

1. The presence of higher fasciculation score (> 4) was associated with the higher need for ventilator support.
2. A GCS score <10 was significantly associated with an increased need of ventilator support.
3. Greater time lag between consumption of poison and admission to hospital (> 4 hours) was associated with higher need for ventilator support.
4. Higher respiratory rate (>25 breaths/minute) and accessory muscles of respiration in action was significantly associated with higher need for ventilator support.
5. Grade 3 severity of poisoning was associated with higher need for ventilator support.
6. Patients with moderate and severe poisoning required higher doses of atropine as compared to those with mild poisoning. Dose of atropine greater than 150 mg within 48 hours of admission was associated with higher need for ventilator support.
7. The relationship between age group and sex with ventilator support was not found to be significant.
8. Size of the pupil and pulse rate, type of organophosphorus compound consumed had no relevance in predicting the need for ventilator support.

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