

# Clinical outcomes of patients admitted with organophosphorus poisoning in a tertiary hospital in Udupi district

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## Abstract

**Background:** Organophosphorus insecticides are one of the most important causes of accidental and suicidal poisoning in India. There is a high mortality associated with this condition. **Methods:** The aim of this study was to find out the frequency, need for artificial airway and ventilation, evaluate the management and to determine the clinical outcomes of organophosphorous poisoning patients in a tertiary hospital in Udupi district. A total of 177 patients were included in this retrospective study over 3 years (Jan 2005 to Dec 2007). **Results:** Majority of the patients had normal respiratory rate while 44 were tachypnoeic. Out of the 49.15% patients requiring tracheal intubation, 40.1% required mechanical ventilation while 17.24% eventually required tracheostomy. The duration of ICU stay ranged between 1 – 28 days with an average of 6.51 days. The duration of hospital stay ranged between 1 – 63 days with an average of 11.9 days. The in hospital mortality rate was 18.6%. The management of organophosphorous poisoning in this hospital consisted of gastric wash and atropine. The use of pralidoxime, glycopyrrolate and activated charcoal was not uniform. **Conclusion:** Organophosphate poisoning has significantly high rate of requirement for tracheal intubation and mechanical ventilation. Despite appropriate management, it carries a high risk of in-hospital mortality. Mainstay of management of these patients is gastric wash, atropine and mechanical ventilation.

**Keywords:** Organophosphorus poisoning; Tertiary hospital; Intensive care.

## Introduction

Hundreds of Organophosphorus (OP) compounds are currently available as insecticides in agriculture as well as household gardens.<sup>1,2</sup> Easy availability of these contributes to an ever increasing accidental and suicidal OP poisoning, especially in developing countries.<sup>3</sup>

OP act by inhibiting the cholinesterases and pseudocholinesterases by irreversibly binding to these enzymes. This leads to accumulation of acetylcholine at synapses, overstimulation and thereby disruption of neurotransmission.<sup>4</sup> Exaggerated nicotinic and muscarinic effects appear as a consequence of these actions.<sup>5</sup> OP is one of the most important causes of poisoning in India and many developing countries.<sup>6</sup>

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There are several routes by which the OP may get absorbed such as transdermal, gastrointestinal, inhalational and intravenous routes.<sup>4,7,8</sup> Most common contributors to OP poisoning include accidental exposure, suicide and homicidal attempts.<sup>4,9,10</sup> OP

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poisoning is associated with a very high mortality rate which is often attributed to a delay in diagnosis or improper management. Early diagnosis and appropriate treatment, conversely, are often life-saving, although the clinical course of OP poisoning might be quite severe and necessitate intensive care management.

This retrospective study aimed to identify the challenges and prognosis of OP poisoning patients in a tertiary care hospital at Udupi, Karnataka, India. It aimed to find out the frequency of OP poisoning in patients admitted to tertiary hospital in Udupi district, incidence of respiratory failure and need for artificial airway and ventilation, management of OP poisoning and to determine the clinical outcomes in these patients.

### Patients and methods

After obtaining the approval from the Institutional dissertation committee, a total of 177 patients were included in this retrospective study. All patients diagnosed with OP poisoning admitted to Kasturba Medical College, Manipal from 1<sup>st</sup> January 2005 to 31<sup>st</sup> December 2007 (3 years) were included. Those patients diagnosed to have OP poisoning but were discharged against medical advice (DAMA) were excluded.

The number of in-patients in Kasturba Hospital, Manipal from 1<sup>st</sup> January 2005 to 31<sup>st</sup> December 2007 were recorded. The case records of all patients diagnosed with OP poisoning admitted to Kasturba Medical College, Manipal from 1<sup>st</sup> January 2005 to 31<sup>st</sup> December 2007 (3 years) were retrieved from Medical Records Department and were classified under T.60 according to ICD (International Classification of Diseases).

The following data about each patient were collected: demographic data, details of poisoning, condition at admission, treatment given, course in the hospital, complications, number of days of ICU stay, hospital stay and survival to hospital discharge.

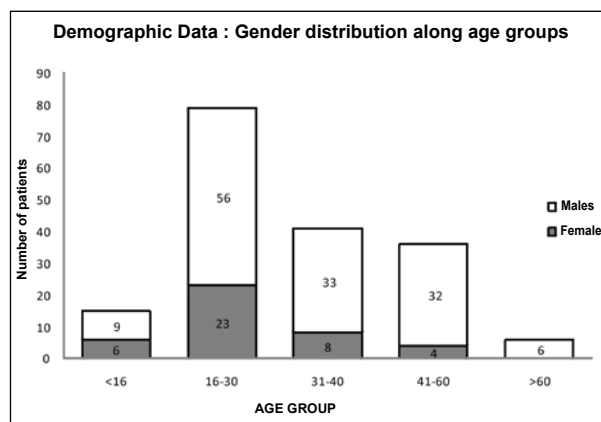
The data were analysed using SPSS 16.0 program (SPSS, Chicago, IL). Qualitative data were analysed

using independent-t test and quantitative data using Chi-square tests to find association.

### Results

Total number of inpatients during (2005-2007) was 1,36,567 and patients admitted with organophosphorus poisoning was 210. The frequency of admission of OP poisoning to this hospital was 0.153%. Of the 210 patients with OP poisoning admitted during this period, 33 patients were discharged from the hospital against medical advice and hence were excluded from the study. The data of the remaining patients (177) were evaluated.

The patient's age range was between 2 – 74 years with a median of 29 years and a mode of 35 years. Of these 15 were children (< 16 years of age) and 162 patients were adults. Nearly half of them (79/162) were in the age range of 16 – 30 years. Only 6 patients were > 61 years. Nearly 84% of the patients were male (*Figure 1*).

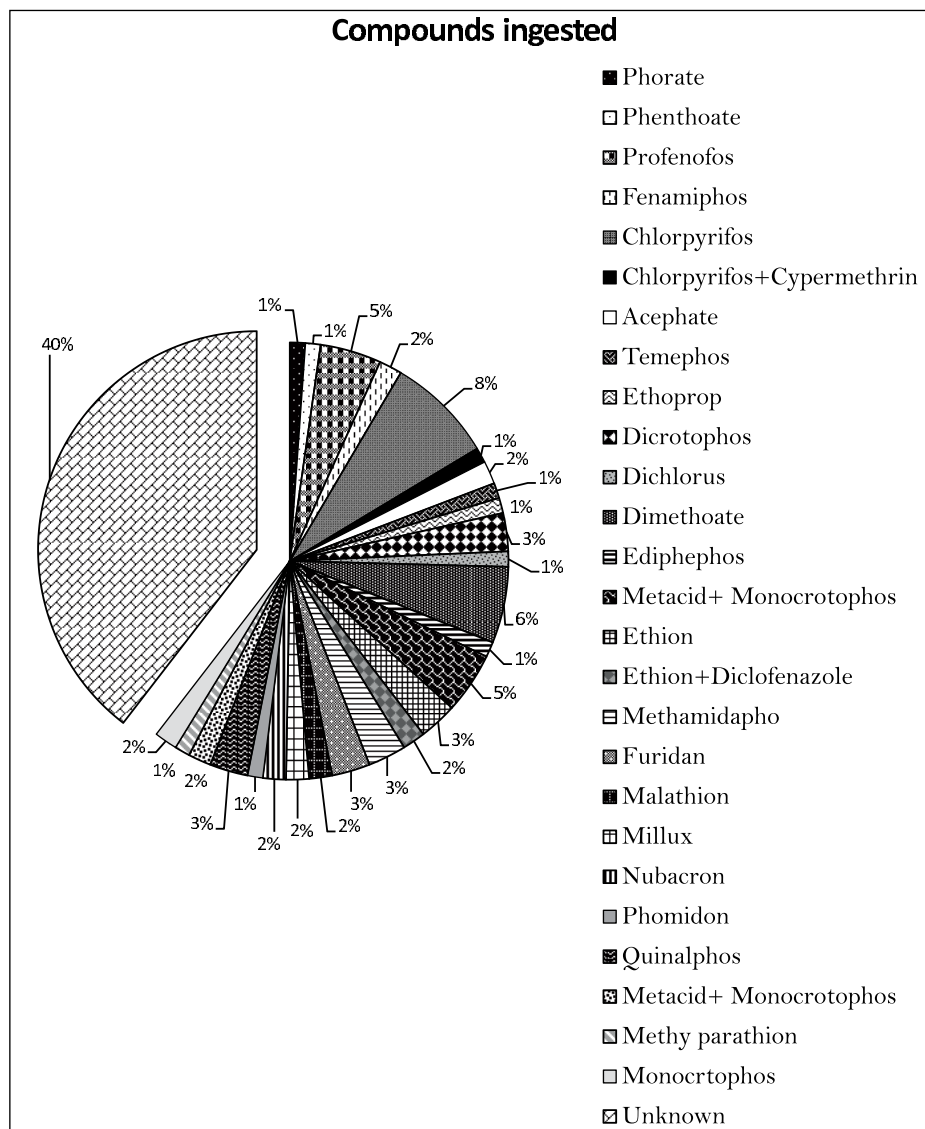


**Figure 1:** Demographic data: Gender distribution along age groups

**Details of poisoning:** The exact composition of the compound ingested was not known in 70 patients. The exact compound and its amount was variable (*Figure 2*). Only 6% mixed it with alcohol before consumption.

### Clinical presentation

At admission, fourteen patients had respiratory arrest, of which two were also in cardiac arrest.



**Figure 2:** Different types of compounds consumed

Majority (119) of the patients had a normal respiratory rate of 14 - 25 breaths per minute (bpm), 34 were slightly tachypnoeic (respiratory rate 25 - 35 bpm) whereas 10 were dyspnoeic as well as tachypnoeic (35 - 50 bpm).

Seventy five patients had a heart rate of < 100/min where as 100 patients had tachycardia at presentation with a median heart rate of 100. Most patients (166) were admitted with a normal blood pressure. Four patients were admitted with unrecordably low blood pressures while seven were hypotensive.

Pupillary size and secretions were variable. A large proportion of patients (94) presented with dilated

pupils, whereas they were constricted in 28 patients. Pupils were normal and reacting to light in 55 patients. Similarly, a large proportion of patients (99) presented with nil or minimal secretions while excessive secretions were observed in 59 patients. Muscle power was found to be normal in more than half the patients (87), whereas it was grade 4 in 22 patients. On admission, the serum cholinesterase was analysed and documented to be low in 140.

**Treatment**

Gastric wash was given to all 177 patients while only 14 of them had tracheal tube *in situ* at the time of performing the gastric wash. Emesis was achieved only in 92 patients.

Nearly all (171) patients received atropine. Glycopyrrolate was used in 44 patients as boluses and 5 patients received it as an infusion.

Pralidoxime stat dose: 72 patients (40%) did not receive pralidoxime whereas others were given a variable dose between 750 mg to 2 g. 3 patients received a dose up to 24 g in a day.

Duration of pralidoxime: Median duration of treatment with pralidoxime was 2 days. Only 2 patients received pralidoxime for a maximum of 12 days. 27 patients were administered activated charcoal.

Nearly half (49.15%, n = 87) of the patients required tracheal intubation. A majority (81.6%) of patients who were intubated also required mechanical ventilation. Nearly one-fifths (17.24%, n = 15) of the patients who required tracheal intubation eventually required tracheostomy. The number of days of requirement of mechanical ventilation was variable.

**Complications:** Infiltrates in the chest X-ray were present in almost one-third (36.72%, n = 65) of the patients. The incidence of intermediate syndrome was low, with only 8 patients (4.5%) developing it.

The duration of ICU stay ranged between 1 – 28 days with an average of 6.51 days. 72.88% (n = 129) required ICU stay for 1 – 7 days, 38 (21.46%) for 8 – 15 days, 2 required 16 – 21 days whereas 8 required an ICU stay of > 21 days (Figure 3).

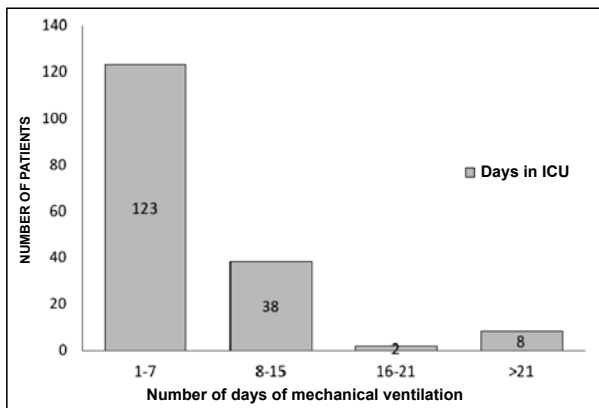


Figure 3: Duration of mechanical ventilation

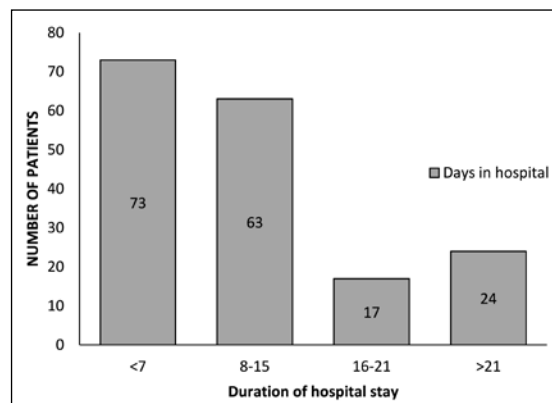


Figure 4: Duration of hospital stay (days)

The duration of hospital stay ranged between 1 – 63 days with an average of 11.9 days. 76.8% stayed in the hospital for 1 – 2 weeks (Figure 4).

81.35% (n = 144) of the patients survived to hospital discharge after being admitted for OP poisoning.

### Discussion

OP poisoning is common in the Indian scenario. It constitutes about one-third of all poisoning. In the current study, out of the 637 patients admitted with poisoning, 210 were found to have OP poisoning. Admission due to poisoning itself was not so common considering it constituted only 0.466% and organophosphorus poisoning was 0.153% of all inpatients to hospital. The pattern was essentially the same every year in all these three years. Data belonging to 177 patients could be used. Of the 177 patients, there were 15 children. Accidental poisoning was the most likely cause in younger children, one of whom was of two years whereas psychological liability of adolescents could not be ignored as 9 of them were adolescents. 91.5% of the patients admitted with OP poisoning were adults, nearly 50% were between 30-60 years. Most of the patients (76.83%) were men in all age groups. This shows that psychological instability to the point of suicidal poisoning is maximum among young Indian men and men in productive age group.

The details of poisoning were not very clear in all cases. Although the compound used was often known, the amount consumed was largely unknown. There

is a wide variety of choices for organophosphorus poisoning. A small number of patients preferred to mix it with alcohol.

In literature review unconsciousness, miosis, fasciculations and a low plasma cholinesterase level were found to be of greatest predictive value for respiratory failure. The current study did not provide any significant variables to predict respiratory failure. This was probably because most patients received treatment at primary (local) health care centers before being referred to our tertiary care center by which time, many of the classical signs of OP were masked.

The pupils were constricted only in 28 patients, dilated in 94 patients while they were equivocal in 55 patients. The secretions were excessive in 59 patients whereas less or minimal in 99 patients. This is because our hospital is a tertiary referral center and many patients have been treated elsewhere or there was ongoing treatment with atropine before being referred to us. The muscle power was inadequate (Grade 0-2) in only 29 patients. It was Grade 3 in 39 patients but the rest had Grade 4 or 5. Thus muscle weakness was not a predominant symptom in most patients.

In a study conducted by Yamashita *et al*,<sup>11</sup> about ¾ of the severely serum cholinesterase-depressed cases needed ventilators. Low cholinesterase levels (less than 50% of normal) are said to be almost diagnostic of OP poisoning. In the present study, no statistical association ( $p>0.05$ ) using Chi-square was found between cholinesterase level and the need for mechanical ventilation.

The mainstay of treatment of organophosphorus poisoning includes gastric wash and atropine. All our patients received a gastric wash, only 14 required tracheal intubation prior to gastric wash. Similarly almost all patients received atropine. Glycopyrrolate was used in < 25 % of patients (44/177). Glycopyrrolate is reported to cause less respiratory infection. In the present study only 10 patients had aspiration pneumonia and none of the patients had hospital acquired pneumonia.

There was wide variation in the use of pralidoxime. Both the dose and the frequency of use varied between physicians. While 72 patients (40%) did not receive any pralidoxime, 2 patients received 750 mg, 5 patients received 500 mg, 77 patients (43%) received 1g, 2 received 1.5g and 19 patients received 2g. Presently, there is so much controversy regarding its usage and utility and may have been the reason for this wide variation. A small number of patients (28/177) were administered activated charcoal. However, its use is also controversial.

The incidence of respiratory complications was high among OP poisoning, one study by Du Toit PW *et al*<sup>12</sup> reported that respiratory failure occurred in 29.7% of the patients with OP poisoning. In the present study, although the muscle tone seemed to be good on admission in many patients, nearly half (49.15%, n=87) of the patients required endotracheal intubation, majority (81.6%) of whom also required mechanical ventilation. Thus, respiratory failure is a major complication of OP poisoning. 33% of all patients developed aspiration pneumonia whereas 3% developed hospital acquired pneumonia. 15 patients (8%) required tracheostomy.

Fortunately, intermediate syndrome was seen in only 4.5% of patients (8/177 patients), in previous literature 20% was the incidence reported.<sup>13</sup> All these patients survived. Out of eight patients, six were intubated and ventilated. Other two did not undergo any airway management but were just observed for further deterioration. These two had a long ICU stay (15 days) and long stay at hospital (63 days) and developed aspiration pneumonia. Among the patients who developed intermediate syndrome, four patients consumed ethion compound, two patients consumed phamidon, compound consumed by the remaining two patients were unknown.

Incidence of mechanical ventilation and duration of mechanical ventilation was reported in a study by Murat Sungur *et al*.<sup>14</sup> Incidence of mechanical ventilation was 21.1%, duration of mechanical ventilation  $4.1 \pm 3.2$  days (mean  $\pm$  SD). In present study, 106 patients (60%) did not require mechanical ventilation. Of the 71 (40%) patients who required mechanical ventilation, 54 patients (76.05%)



required it for less than 7 days. 14 patients (19.71%) required mechanical ventilation for more than 10 days. This implies that half of all patients admitted to our hospital with organophosphorus poisoning would be expected to require mechanical ventilation but most of them would need it for about a week. Prolonged ventilation (> one week) is expected to be seen in only about 1 in 10 patients. Tracheostomy is generally done in patients who are expected to require mechanical ventilation for more than a week. Patients admitted with organophosphorus poisoning would be expected to require tracheostomy only in about 20% of the individuals. This was seen to be true in our series where 15/80 (18.75%) patients required tracheostomy.

Murat Sungur *et al*<sup>4</sup> reported ICU stay duration of  $5.2 \pm 3.0$  days. In the present study, the duration of ICU stay was a little longer than mechanical ventilation. No association was found with ICU stay and survival ( $p > 0.05$ ) using Chi Square. Most of the patients had an ICU stay less than or equal to seven days ( $n=129$ ). Of these cases, 96 patients survived (74.41%). None of the patients who had an ICU stay for more than 7 days died ( $n=48$ ).

The duration of hospital stay was considerably longer, with 136 patients requiring up to two weeks, 17 patients for 3 weeks and 24 patients requiring up to 4 weeks. This reflects the devastating effect of organophosphorus poisoning on body systems, mainly muscle power and that even if they do not require mechanical ventilation, discharge from hospital takes time.

Mortality rate in the study published by Murat Sungur *et al*<sup>4</sup> showed a mortality 27.6% and also found that mortality rate in patients on ventilator was 50%, and not ventilated was 21.6%, Durham *et al*,<sup>15</sup> Desilva *et al*,<sup>16</sup> studies observed a mortality of 12 %, 16% respectively. In the present study, majority of patients (144/177, 81%) survived to hospital discharge. 33 patients (19%) did not survive, and mortality rate of patients on ventilator was 38%.

The condition at admission was an important factor. Two patients were admitted pulseless were

resuscitated and shifted to ICU but died after two days. 14 patients had respiratory arrest on admission. They were all resuscitated but four of them developed cardiac arrest subsequently and died after four days. The remaining ten patients survived with continued care. Most patients presented with a normal blood pressure. Significant association was found with systolic blood pressure and survival,  $p < 0.05$  using independent t-test.

Of the remaining 27 patients who did not survive, cardiac arrest was the major cause of death. ICU stay in these patients was for a mean  $\pm$  SD of  $3.48 \pm 2.16$  days.

No patients died as a result of nosocomial pneumonia. 22 (37.93%) out of 58 patients who developed aspiration pneumonia as a complication died. Significant association was also found with infiltrates in chest X-ray and survival using independent t-test,  $p < 0.05$ . No association was found with age and survival, gender and survival, and in condition of admission using Chi-square.

## Conclusion

The frequency of organophosphorus poisoning in patients admitted to Kasturba Hospital, a tertiary care center in udupi district is 0.153%. The management of OP poisoning in this hospital consists of gastric wash and atropine. The use of pralidoxime, glycopyrrolate and activated charcoal is not uniform. Nearly 50% (49.1%) of the patients require insertion of artificial airway and ventilation in OP poisoning, most often for about a week to ten days. Intermediate syndrome is not common. It is seen in only 4.5% of patients with OP poisoning. The duration of ICU stay on an average could be 7-10 days and hospital stay 2-3 weeks. The duration of ICU stay on an average could be 7-10 days and hospital stay 2-3 weeks. Clinical outcome depends on the condition at admission. Majority (nearly 80%) patients of OP poisoning admitted to this tertiary hospital survive to discharge.

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