

ORGANOPHOSPHATE POISONING: PREDICTING THE NEED FOR VENTILATORY SUPPORT



Medical Science

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ABSTRACT

BACKGROUND AND OBJECTIVE: The leading cause of death in Organophosphorus poisoning is respiratory failure, which results from a combination of respiratory muscle weakness, central respiratory depression, increased bronchial secretions, bronchospasm and pulmonary edema. A substantial number of deaths can be prevented with timely institution of ventilator support. The present study was undertaken to identify the factors, which help in predicting the need for ventilator support and monitoring in the ICU.

AIMS AND OBJECTIVES :

To predict the need for ventilator support in organophosphate poisoning.

MATERIAL AND METHODS: 100 consecutive patients of Organophosphorus poisoning admitted to tertiary care centre at north Karnataka from December 2006 to June 2008 were studied. Patients were selected irrespective of age or sex. A provisional diagnosis of Organophosphorus poisoning was made on the basis of a definite history of Organophosphorus poisoning by patient or attenders. This was substantiated by examination of the container, when available. The diagnosis was further substantiated by typical clinical features (hypersalivation, miosis and fasciculations) and characteristic odour of stomach wash or vomitus.

RESULTS: Of 100 patients, 14 required assisted ventilation. The need for ventilator support was significantly more with greater time duration of institution of specific treatment, low level of sensorium at admission, pin point pupils, generalized fasciculations, presence of convulsions and presence of respiratory insufficiency at admission.

CONCLUSION: The ventilator support in organophosphorus poisoning patients decreases the mortality reduces duration of hospitalisation secondary to organophosphorus related respiratory failure.

INTRODUCTION :

India is predominantly an agricultural country hence pesticides, insecticides are used abundantly during cultivation. The contact or usage of these compound may either be accidental, or suicidal and rarely homicidal. Organophosphate poisoning is an ever increasing and troublesome situation in the developing countries and is a major health care challenge in the 21st century^{1, 2}. Hence the present study has been undertaken with special interest for ventilatory support in the treatment of organophosphorus poisoning, since the leading cause of death in organophosphorus poisoning is respiratory failure.^{3,4,5}

Organophosphates may be absorbed by virtually any route including transdermal, transconjunctival, inhalational, across the gastrointestinal mucosa and through directly injection⁶. Onset of systemic symptoms is most rapid following, inhalation and least rapid following percutaneous absorption. Symptom onset may occur in less than 5 minutes with massive ingestions or inhalational exposures or may be delayed, except for the fat soluble Organophosphates such as fenthion or chlorfenthion which are rapidly taken into fat stores and subsequently slowly and intermittently released and metabolized to more active compounds. In this situation the symptoms of toxicity may not occur for up to 48 hours.

The degree of affinity as well as the route of absorption, amount of metabolism, local blood flow, and active site of concentration will determine which signs and symptoms predominate^{7,8}.

AIMS AND OBJECTIVES :

To predict the need for ventilator support in organophosphate poisoning

INCLUSION CRITERIA:

A provisional diagnosis of Organophosphorus poisoning was made on basis of a definite history of Organophosphorus poisoning by patient or attendants, further substantiated by typical clinical features (hypersalivation, miosis and fasciculations) and characteristic odour of stomach wash or vomitus.

EXCLUSION CRITERIA:

. Patients with a concomitant illness or condition likely to ac-

centuate the respiratory failure due to Organophosphorus poisoning were excluded from the study. These included

1. Patients with double poisoning with opioids, diazepam and barbiturates.
2. Patients with chronic lung disease e.g. COPD, extensive pulmonary tuberculosis, interstitial lung disease bronchiectasis, and bronchial asthma.
3. Patients with chronic cardiac disease.
4. Patients with known neuromuscular disease like myasthenia gravis or muscular dystrophy.

STATISTICS:

Data will be analyzed by

1. Diagrammatic presentation.
2. Mean \pm standard deviation.
3. Statistical test, i.e. chi-square test.

RESEARCH HYPOTHESIS:

The ventilator support in organophosphorus poisoning patients decreases the mortality secondary to organophosphorus related respiratory failure

SOURCE OF DATA:

100 consecutive patients presenting with organophosphate poisoning admitted to a tertiary care hospital in north Karnataka from December 2006 to June 2008 are studied.

SAMPLE SIZE:

Mean time taken to relief for cholinergic symptoms (hrs) 92.0 and SD 8.59 (A Goel, Joseph, TK Dutta, JAPI 1998 Vol-46, No. 9) at available error \pm 1. The calculated sample size is N=74. Using statistical formula

$$N = \frac{u^2 \Sigma^2}{L^2}$$

L2

Hospital statistics has shown that about 130 cases of organo-

phosphate poisoning in a year are admitted. Hence all the cases with inclusive exclusive criteria are selected during the period of Dec 2006 to June 2008 [time bound study] so 100 cases are studied.

METHOD OF COLLECTION OF DATA:

100 consecutive patients presenting with organophosphate poisoning were included in the study

GRADING OF SEVERITY OF ORGANOPHOSPHORUS POISONING

REVISED GRADING (BY BARDIN AND VAN EEDEN)³

Table - 1

Grade	Criteria
Mild Poisoning	History of Intake/Exposure Mild Signs: Normal consciousness Secretion, 0+ Fasciculations, 1+
Severe Poisoning	Severe Signs: Altered consciousness Secretion, 3+ Fasciculations, 3+
Life threatening poisoning	Suicide attempt Stupor, PaO ₂ < 75 mm Hg (< 10 mm Hg) Abnormal chest X-ray

GRADING ON THE BASE OF SEVERITY OF POISONING.

Table 2

Grade	Criteria
Mild Poisoning	Normal level of consciousness (Score 12 - 15 by Glasgow Coma Scale) Pupil size > 4 mm Fasciculation score 2 - 4
Moderate Poisoning	Mild alteration of consciousness (score 8 - 11 by Glasgow coma scale) Pupil size 2 - 3 mm, fasciculation score 2 - 4
Severe Poisoning	Stupor/Coma (Score of 7 or less by Glasgow coma scale) Presence of convulsions. Pin point pupils (1 mm or less), Fasciculation score 5 or more, Signs of respiratory insufficiency.

GRADING OF FASCICULATIONS:

Grading done by giving 1 point each to anterior chest, posterior chest, anterior abdomen, posterior abdomen, right thigh, left thigh, right leg, left leg, right arm and left arm.

GRADING ON THE BASIS OF CHOLINESTERASE VALUES:

- Mild poisoning is defined as a depression in cholinesterase activity 20 - 50% of normal
- Moderate poisoning occurs when activity is 10 - 20% of normal.
- Severe poisoning occurs at less than 10% enzyme activity.

GLASGOW COMA SCALE:

Table 3

Clinical parameter	Score
Eye Opening	
Nil	1
To Pain	2
To Voice	3
Spontaneously (with blinking)	4
Motor Response	
Nil	1
Extension	2
Flexion	3
Withdrawal	4
Localizing	5
Voluntary	6

VERBAL RESPONSE	
Nil	1
Growns	2
Words (Expletive)	3
Disorientated	4
Orientated	5

OBSERVATIONS

Of total 226 patients with poisoning, admitted in tertiary care centre at north Karnataka from December 2006 to June 2008, 126 (56%) were of Organophosphorus poisoning, Second only to Lice powder (22%) DDT (14%), Phenyl (6%), Kerosene (2%),

Of 126 patients with Organophosphorus poisoning, 100 were included in the study group. 26 patients were excluded on account of late presentation (more than 24 hrs of exposure), mixed poisoning, or patients having chronic lung diseases.

Clinically, muscarinic symptoms such as pain abdomen (86%), vomiting (54%) excess salivation (31%) altered sensorium (31%), breathlessness (24%), were the predominant clinical manifestations in present study. The typical pungent odor (60%) and nicotinic manifestation like sinus tachycardia (30%), fasciculation (25%) were also observed among the patients at the time of admission. Muscarinic signs like bradycardia (70%), cyanosis (5%), restlessness (37%) miosis (44%) were observed.

The commonest Organophosphorus compound that was encountered in our study was Diamethoate 34%, followed by 18%, Monocrotophos 15%, Paraoxon 14%, Metacol 9%, Dicrotophos 5%. No deviations from normal values were observed in hematological examination of all the patients. Biochemical investigations showed random blood sugar was high (>130mg/dl) in 20% of patients at the time of admission, but none turned out to be diabetic at the time of discharge. Serum Na⁺ was high in 47% (>135m mol/L), which returned to normal level at the time of discharge.

Chest x-ray showed evidence of pulmonary edema in 4% of patients at the time of admission of which all 4 patients (100%) required assisted ventilation. Aspiration pneumonia was seen in 1 out of 6 patients in coma (17%).

Arterial blood gas analysis was done in 90% of patients including all patients who were graded with severe poisoning at the time of admission. In remaining 10% of patients it could not be carried out because of the cost factor. No biochemical abnormalities concerned to renal and hepato-biliary system were seen in study group.

The commonest complication encountered was respiratory failure necessitating assisted ventilation in 14% patients. 14% of patients required assisted ventilation. Latency to ventilation was 24 hrs or less in 9 (64.29%) of these patients. (Table-7). Among the ventilated patients, 8 (57%) recovered completely, while 6 (43%) died. The complications of ventilation in form of pneumonia occurred in 6 patients (43%).

Age and sex distribution of study group

Table - 4

Age in years		FEMALE		MALE	
		Number	Percentage	Number	Percentage
15	25	29	55	13	28
25	35	13	25	18	38
35	45	7	13	11	23

45	56	4	8	5	11
Total		53	100	47	100

Out of 100 patients, 53 were females and 47 were males, of which females dominated at a ratio of approximately 1.2:1. The majority of the cases (73%) fall in 15 to 35 years.

Nature of poisoning of study group

Table - 5

Categories	No of patients	No. of patients ventilated	Percentage
Accidental	2	0	0
Spraying	2	0	0
Suicide	96	14	14
Total	100	14	

Of 100 patients of Organophosphorus poisoning 96% had consumed deliberately out of them 14(%) required assisted ventilation. 2% had poisoning while spraying, 2% had accidental consumption, none of them required ventilation support

Individual OP compound and need for ventilatory support

Table - 6

Name of Poison	No. of patients	No. of patients ventilated	Percentage
Diamethoate	34	13	38
Dicrotophos	5	0	0
Metacid	20	1	5
Monocrotophos	15	0	0
Paraoxan	14	0	0
Metacol	12	0	0
Total	100	14	14

Diamethoate was the common Organophosphorus compound encountered (34%), next to metacid 20%, monocrotophos 15%, paraoxan 14% and need for ventilator support was maximum in patients in diamethoate poisoning

Latency to Ventilation

Table - 7

Duration	No. of patients ventilated	Percentage
24 Hrs of Less	9	64.29
24 to 48 Hrs	3	21.43
More Than 48 Hrs	2	14.29
Total	14	100.00

Effect of time lag to specific treatment on need for ventilatory support

Table - 8

Time Lag to Treatment(hrs)	No. of patients	No. of patients ventilated	Percentage	No. of patients non ventilated
<1	25	1	4	24
1 - 3.00	52	9	17	43
> 3	23	4	17	19
Total	100	14		86

Z - 0.26

P Value - 0.40

Of patients who received specific treatment within less than 1 hour were 25 of which 1 (4%) required ventilation. Of 52 patients who received treatment within 1 to 3 hours of consumption 9 (17%) required ventilation and 23 patients who received treatment after 3 or more hours consumption 4 (17%) required ventilation

Effect of sensorium on need for ventilatory support

Table - 9

GC Scale	No. of patients	No. of patients ventilated	Percentage
3 to 6	8	8	100
7 to 10	32	6	19
11 to 15	60	0	0

Z = -4.9900

P Value - 3.01871645902452E-07

Out of 60 patients with Glasgow coma scale between 11 to 15, 0 required assisted ventilation, 32 patients with glasgow coma scale between 7 to 10,6 (19%) required ventilation, where as 8 patients with glasgow coma scale between 3 to 6, 8 (100%) required assisted ventilation

Effect of pupillary size on need for ventilatory support

Table - 10

Pupil	No of patients	No. of patients ventilated	Percentage
< 1mm	29	1	3
2 - 3 mm	40	0	0
4 mm	3	0	0
Pin Point	28	13	46

Z = 2.68 P Value : 3.68E - 03

Of 28 patients with pin point pupils at admission 13 (46%) required assisted ventilation in comparison to 40 patients with pupil size between 2 to 3 mm, 0 required assisted ventilation. Of three patients with pupil size more than 4mm at the time of admission none required assisted ventilation

Presence of fasciculations and need for ventilatory support

Table - 11

Fasciculation	No. of patients	No. of patients ventilated	Percentage
< 2 +	45	0	0
2 to 4 +	36	1	3
> 4 +	19	13	68

Z = 7.98 p value - 6.66133814775094E - 16

Of 100 cases 19 had fasciculation score more than 4 of which 13 (68%) required assisted ventilation, where as 36 patients with fasciculation score between 2 to 4, 1 (3%) required assisted ventilation

Mean atropine requirements

Table No. 12

	VENTILATED		NON VENTILATED	
	Number	Mean +/SD	Number	Mean +/SD
Total Atropin Required	14	928.94±189.57	86	302.64±128.26

Z = 2.46 P Value = 6.94E - 03

The mean atropine requirement was compared, it was much higher in patients with on assisted ventilation. (928.94±189.5mg), than patients not requiring assisted ventilation (302.64±128.26)

Duration of stay

Table - 13

	VENTILATED		NON VENTILATED	
	Number	Mean +/SD	Number	Mean +/SD
Total Duration of Stay	14	8.6±3.85	86	6.8±1.96

Z = 0.144327 P Value = 0.442621

Requirement of ventilatory support in relation to severity of OP poisoning

Table - 14

Grading	No. of patients	No of patients ventilated	Deaths
Mild	67	2	0
Moderate	19	4	1
Severe	14	8	5

Z = 3.45 P Value = 280E-04

Most of the cases categorized for grading as per Revised BARDIN AND VAN EEDEN grading. 67% were in mild category, 19% in moderate and 14% in severe poisoning at the time of admission (Table 1).

CONCLUSION.

From the present study the following conclusion are drawn

Among the total number of cases of organophosphorus poisoning admitted during study period:

- The females constituted 53% of cases.
- The vulnerable age group was between 11 to 35 years
- 96% consumed with intention of suicide.
- 67% of cases were graded in mild category and 14% of cases in severe category.
- 14% patients required assistant ventilation.
- 64.29% patients were ventilated within first 24 hours.
- Patient on ventilator required large amount of atropine and longer duration of stay in I.C.U.
- Pneumonia was the commonest complication that occurred in ventilated patients.
- Out of the 100 cases, 14 required assistant ventilation, of which 6 died on ventilator with mortality of 43%
- Overall mortality rate in the study is 8%.

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