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Study of respiratory failure in organophorus compound poisoning with reference to ventilatory support outcome

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Abstract
Introduction: Respiratory failure is the most common complication following acute organophosphorus compound poisoning occurs in up to 34% to 56% of patients and is associated with high morbidity and mortality.
Methodology: A detailed clinical examination of patients was done. In patients with respiratory failure, oxygen saturation using pulse oximeter, and with arterial blood gas analysis was done. Other relevant investigations available in the infrastructure was done wherever required.
Results: 43.8% patients were under mild grading, 42% were moderate grading and 14.2% were severe poisoning grading
Conclusion: As the severity of poisoning is more the more number of patients develop respiratory failure.

Keywords: organophosphorus compound poisoning, respiratory failure, DDT

1. Introduction

The organophosphates insecticides are compounds that have been used globally for pest control for over 100 years. They have achieved great popularity because of their effectiveness as insecticides and their lack of persistence in the environment. Because of their unstable chemical structure, they disintegrate into harmless radicals within days of application. Because they do not persist in the body or environment, as do DDT or other organochlorides they have replaced DDT as the insecticide agent of choice [1].

The principal use of these compounds is in agriculture as insecticides, some being used in veterinary medicine. In common, organophosphorus compounds have been used as lubricants, plasticizers and flame retardants.Because of its easy availability, organophosphorus compounds became common agents of suicidal or accidental poisoning [2]

Respiratory failure is the most common complication following acute organophosphorus compound poisoning occurs in up to 34% to 56% of patients and is associated with high morbidity and mortality. The patients with organophosphorus poisoning may have respiratory failure for many reasons including aspiration of gastric contents, excessive secretions in airways, pneumonia and septicemia complicating acute respiratory distress syndrome [3].

Ventilators are special pumps that can support the ventilatory function of the respiratory system and improve oxygenation through application of high oxygen content gas and positive pressure. It is simply a device, a machine designed to alter, transmit and direct applied energy in a predetermined manner to perform useful work. Energy enters the ventilators in the form of electricity or compressed gas (energy = pressure x volume). This energy is transmitted or transformed by ventilators drive mechanisms in a predetermined manner by the control circuit to augment or replace muscles to augment or replace muscle's to perform the work of breathing [4].

2. Methodology

Adult patients admitted with a history of consumption of organophosphorus compound poisoning during study period with characteristic signs and symptoms are included. Name of the compound confirmed by the empty bottles brought by the patient's relatives.

2.1 Exclusion criteria

1. All patients with poisoning due to other than organophosphorus compound will be excluded.
2. Patients with poisoning due to mixed poison will be excluded.
3. Patients with history of chronic lung disease, COPD, asthma, bronchiectasis, extensive pulmonary tuberculosis and interstitial lung disease.
4. Patients with history of chronic cardiac disease.
5. Patients with history of chronic cardiac disease.
6. Patients with a history of neuromuscular disease.

A detailed clinical examination of patients was done. In patients with respiratory failure, oxygen saturation using pulse oximeter, and with arterial blood gas analysis was done. Other relevant investigations available in the infrastructure was done wherever required. Grading of severity of poisoning was done according to clinical features and peradynia organophosphorus scale, and those who require ventilatory support and those who did not require ventilatory support were assessed. Those who required mechanical ventilatory support, were put on mechanical ventilator and data accumulated was analysed with respect to above objectives.

2.2 Diagnosis

Diagnosis is based on

1. History of exposure to organophosphorus compound poisoning.

2. Characteristic manifestations of organophosphorus poisoning including miosis, fasciculations and excessive salvation.
3. Inhibition of cholinesterase activity.
4. Improvement after atropine and oxime therapy.
5. Corroborative evidence like empty containers with smell of organophosphorus compound.

All the cases satisfying inclusion and exclusion criteria were included in this study. A detailed pretested proforma was used to include relevant details of each patient such as name, age, sex, occupation, address, nature of poison and symptoms, and treatment interval and hospitalization treatment received before admission.

Depending on the severity of manifestations patients were classified into three grades as mild, moderate and severe (peradynia organophosphorus poisoning scale). Patients relevant past history, family history and personal history were also noted.

2.3 Investigations

Soon after admission in all patients included in this study, oxygen saturation using pulse oximeter and with arterial blood gas analysis were done. Patients who showed signs of respiratory failure were put on mechanical ventilation and monitored until patient recovered or till death.

2.4 Other investigations

All routine investigations like complete blood count, blood urea, serum creatinine and serum electrolytes, ECG, chest X-ray whenever required. These tests were carried out in all patients.

All patients were managed with decontamination procedures including gastric lavage. IV atropine 2-4 mg bolus and repeated every 5-15 minutes until atropinization, sings of atropinization taken as the clear chest on auscultation, pupils-dilated and drying up of secretions. The atropinisation was maintained for 24-48 hours. Then tapered over days depending upon patients response.

Prolidoxime chloride was given to organophosphorus poisoning patients as 30 mg/kg loading dose bolus over 10-15 minutes immediately after admission and followed by a continuous infusion of 8-10 mg/kg per hour until clinical recovery or 7 days whichever is later.

Patient's airway and need for mechanical ventilatory support were assessed and in needed cases mechanical ventilatory support were given. Follow up of cases was done regarding response to treatment and follow up of cases on mechanical ventilatory support, until discharge or death of the patient. The duration of hospital stay and in hospital outcome was documented.

2.5 Statistical methods

All the collected data of 500 patients were analysed using the appropriate statistical test – Chi-square test

3. Results

The results of the study which included 500 patients of organophosphorus poisoning were as follows.

Table 1: Age and sex distribution

Age group (years)	Male		Female		Total	
	No.	%	No.	%	No.	%
13-20	43	10.8	34	34	77	15.3
21-30	190	47.5	37	37	227	45.3
31-40	100	25	23	23	123	21.5
41-50	45	11.2	3	3	48	9.4
51-60	20	5	3	3	23	4.5
60+	2	0.5	0	0	2	4
Total	400	100	100	100	500	100

p-value = 0.000, Highly significant

The age group ranges from 13 years to 60 years.

In this study mean age for both sexes, for males 31.7% and for females 27.7 years. Majority of the patients were in the age group of 21-30 years followed by 31-40 years.

Out of 500 patients, 400 were males followed by 100 were females. Male to female ratio was 4:1.

Table 2: Name of Organophosphorus compound

Agents	No. of patients	Percentage	Cumulative percent
Dimethoate (Rogor)	159	31.8	54.6
Chlorparifos	114	22.8	22.8
Methylparathion	72	14.4	69
Quinolphos	28	5.6	74.6
Starchin powder	53	10.6	85.2
Others	74	14.8	100
Total	500	100	

$\chi 2 = 130.36$; df = 5; *p*-value = 0.000, Highly significant

Among our patients, dimethoate (Rogor) was the most common agent encountered followed by chlorpyrifos, and methyl parathion and starchin powder.

Table 3: Grading of severity of poisoning

Grading	No. of patients	Percentage
Mild	219	43.8
Moderate	210	42
Severe	71	14.2
Total	500	100

43.8% patients were under mild grading, 42% were moderate grading and 14.2% were severe poisoning gradin

Table 4: Relation between grading of severity of poisoning and development of respiratory failure

Poisoning and grading	IS		RF		NC		Total	
	No.	%	No.	%	No.	%	No.	%
A	0	0	2	2.5	217	61.1	219	43.8
B	38	59.4	35	43.2	137	38.6	210	42
C	26	40.6	44	54.3	1	0.3	71	14.2
Total	64	100	81	100	355	100	500	100

p-value = 0.000, Highly significant

With increase in severity of poisoning the development of respiratory failure also increases and it is statistically significant.

Table 5: Severity of poisoning and number of days ventilation support given to patients

Severity	Number of days
Mild	2.28
Moderate	2.44
Severe	5.87

As the severity of poisoning increases need for ventilatory support also increases. Mean duration of ventilatory support was 4.15 days

Table 6: Number of days of ventilation support given in RF and IS

	Average number of ventilatory support given
RF	3.20 days
IS	10.56 days
NC	0

p-value = 0.000, Highly significant

Average number of days of ventilatory support given are in central RF 3.2 days and in intermediate syndrome 10.56 days.

Table 7: Outcome of ventilatory support

	Expired	Improved	Total
RF	48	33	81
IS	16	48	64
NC	0	355	355
Total	64	436	500

p-value = 0.000, Highly significant

In central respiratory failure out of 81 number of cases, 48 cases expired and in IS out of 64 cases, 16 cases expired.

Table 8: Total number of patient put on ventilatory support and outcome

	Expired	Improved	Total
Total number of patients put on ventilation	64	81	145

Out of 145 cases, mechanical ventilation about 64 cases expired. The proportional mortality rate was 44.13%.

4. Discussion

Table 9: Comparing the complications

Complications	Present study	Sungur *et al.* [5]	Cherian MA *et al.* [3]
Respiratory failure	145 (29%)	29.7%	33%

Respiratory failure was the most common complications seen in 29% of cases (including respiratory failure as a consequence of intermediate syndrome). This is comparable to studies by Sungur *et al.* [5] and Cherian MA *et al.* [3]

Table 10: Severity of grading

Grading	Present study	Bhattarai *et al.* [6]	Anupkumar Kundu *et al.* [7]
Mild	43.8%	-	19.5%
Moderate	42%	26%	50.9%
Severe	14.2%	4%	29.6%

In the present study mild poisoning 43.8% had maximum incidence and moderate poisoning 42% which is comparable to study by Anupkumar *et al.*

Table 11: Severity of poisoning and development of respiratory failure and need for ventilation support

Severity of poisoning	Present study	Goel *et al.* [8]
Mild	20.9%	9.52%
Moderate	34.7%	7.5%
Severe	98.5%	73.81%

Requirement of ventilation support was greater in severe poisoning comparable to Goel *et al.* [8] study.

Table 12: Outcome of ventilatory support

	Total number ventilated	Expired	% of mortality	Sungur *et al.* [5]	Palimar *et al.* [9]
Respiratory failure	81	48	59%	50%	-
Intermediate syndrome	64	16	25%	-	22.3%

Mortality rate in the present study was 59% in respiratory failure and 25% in intermediate syndrome after mechanical ventilation.

This is comparable to Sungur *et al.* [5] and Palimar *et al.* [9]

Table 13: Mortality after mechanical ventilation

Total number of patients mechanical ventilated	Expired	Mortality rate	Sungur *et al.* [5]	Eddleston *et al.* [10]
145	64	44.13%	50%	51%

The mortality rate in the present study is comparable to Sungur *et al.* [5] and Eddleston *et al.* [10] studies.

Table 14: Comparing the mortality

	Mortality
Present study	12.8%
Darren M Roberts [11]	10%
Tzeng Jin din *et al.* [12]	12.71%
Sungur *et al.* [5]	18.7%
Adlakha *et al.* [13]	11%
Goel *et al.* [8]	8.74%
Surjith Singh *et al.* [14]	15%

Mortality rate in the present study was 12.8%. This is comparable to studies by Darren M, Roberts *et al.*, Tzeng Jin din *et al*. and Adlakha *et al.*

5. Conclusion

Respiratory failure frequently occurs in moderate and severe degree of organophosphorus poisoning

6. References

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