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Research Article

A STUDY OF CLINICAL PARAMETERS AND SERUM PSEUDOCHOLINESTERASE LEVELS IN PREDICTING THE NEED FOR VENTILATORY SUPPORT IN ORGANOPHOSPHORUS POISONING

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ABSTRACT

Background: Organophosphorus (OP) compound poisoning is one amongst the foremost common poisonings in India because of easy availability, often requiring ICU care and ventilatory support. Clinical research has shown that respiratory failure is the most important cause of death due to Organophosphorus poisoning. This hospital-based, observational study is taken up as an attempt to know the clinical and biochemical factors like serum pseudo cholinesterase levels which can predict the timely need for ventilator support.
Materials and Methods: In this Hospital based Observational study, One hundred consecutive patients presenting with organophosphate poisoning during the study period were included in the study. Detailed History, physical examination, Investigations like Random Blood sugar, Blood Urea, Serum Creatinine, Serum Pseudo Cholinesterase, Chest X-Ray, ABG analysis were studied. Important Biochemical parameters studied were serum electrolytes, serum pseudocholinesterase levels.
Results: The most frequent reason for using ventilation is Respiratory failure, which was seen in76% of the patients, followed by altered sensorium in 22%, increased secretions in 19%, and only 6% are due to IMS. Patients who presented after 2-4 hours of consumption of poison had more chance of getting ventilated. Patients with pupil size less than 1mm and the abdominothoracic pattern of respiration was found to be higher in the ventilated group and was statistically significant. Patients with lower pseudocholinesterase levels were significantly ventilated and had a higher mortality rate. Respiratory failure, aspiration, coma were significantly higher in the ventilated group.
Conclusion: From this study, it can be concluded that older age group, presentation to hospital after 2-4 hours, late stomach wash, high BP, abdominothoracic pattern of respiration, use of accessory muscles, severe poisoning, low GCS, low pseudocholinesterase levels, ABG abnormalities had significantly higher chance of being mechanically ventilated after OP poisoning.

INTRODUCTION

Organophosphorus (OP) compound poisoning is one amongst the foremost common poisonings in India because of easy availability, often requiring ICU care and ventilatory support (1). In a developing country like India, acute organophosphorus compound poisoning is a common cause of mortality. Clinical research has shown that respiratory failure is the most important cause of death due to Organophosphorus poisoning which occurs as two distinct clinical syndromes, Acute cholinergic respiratory failure or the intermediate syndrome and respiratory paralysis(2). It result sin respiratory muscle weakness, pulmonaryedema, respiratory depression, increased secretions, and broncho spasm. These complications and death can be prevented by timely Institution of ventilator support.

MATERIAL AND METHODS

This Hospital- based Observational study was carried out on patients of Department of General Medicine at Medical wards, AMC, RICU in SRI Venkateswara Ramnarain Ruia Government General Hospital, Tirupati from September 2018 to September 2019. A total 100 adult subjects (both male and females) of aged ≥ 12 years were for in this study.

Study Design: Hospital- based observational study

Study Location*:* This was a tertiary care teaching hospital based study done in Department of General Medicine, at SRI Venkateswara Ramnarain Ruia Government General Hospital, Tirupati.

Study Duration: September 2018 to September 2019.

Sample size: 100 patients.

Study Subjects: One hundred consecutive patients presenting with organophosphate poisoning during the study period were included in the study.

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Inclusion criteria

Patients presenting with a history of consumption of Organophosphorus compound poisoning were included in this study.

1. Patients with OP poisoning above 12 years ofage.
2. Patients with single poisoning.
3. Patients who presented within 24 hours of poisonconsumption.

Exclusion criteria

The patients with a concomitant illness or condition likely to accentuate the respiratory failure due to organophosphorus poisoning were excluded from the study. These included:

1. Patients with chronic lungdiseases.
2. Patient with known cardiacdiseases.
3. Patients with known neuromuscular junction disorders.
4. Pregnancy.
5. Patients or attended who have refused to giveconsent.

Procedure methodology

After written informed consent was obtained, Detailed History and physical examination were done. Investigations like Random Blood sugar, Blood Urea, Serum Creatinine, Serum PseudoCholinesterase, Chest

X- Ray, ABG analysis were done.
Important Biochemical parameters studied in this study was serum pseudo cholinesterase levels.

Statistical analysis

Data was analyzed by

1. Diagrammatic presentation.
2. Mean ± standard deviation.
3. Using proper Statistical tests, i.e., chi-square test, Fischer's Exact test.

The whole sample was divided into two groups- those who required mechanical ventilation and those who did not need ventilation. Data was analyzed using univariate and multivariate analysis.

Chi-square and Fisher exact tests were performed to test for differences in proportions of categorical variables between two or more groups. The level $P < 0.05$ was considered as the cutoff value or significance.

RESULT

Baseline characteristics

Majority of our study population were females, i.e.,54%, and the males were 46%. The age and gender-wise distribution showed males were higher in the age group of 21 to 35 years (52%); similarly, females were mostly higher in the age group of 21to 35 years (55%). Among the study group, 34% of patients were referred from another hospital due to the ingestion of cholinergic poison. The rest of the patients came with poisoning directly to the hospital. Mode of poisoning was suicide in almost all cases (99%) and accidental in 1%, and the route of poisoning was ingestion in all. The poison name and nature was unknown in 33 patients (33%), and most of them had consumed Chlorpyrifos poison (28%) followed by Quinalphos (21%), and least numbers used Cypermethrin+Chlorpyrifos (12%) followed by Dimethoate (4%) and Cypermethrin+Ethion (2%). The nature of poison was not known in 33% of patients, 53% used Organophosphate, and 14% used Organophosphate+ Pyrethroid compounds. The time of the first presentation to hospital with poisoning symptoms was mostly between more than 1 to less than 2 hours bracket (41%) and least number in more than 12 to less than 24 hours group (2%). Thus the majority (69%) of patients have presented to the hospital with in 2 hours. The time with in which the firsts to mach wash was done was between more than 2 to less than 4 hours (32%) in most patients. Only 23% of patients received the first stomach wash within 1 hour. 51% of patients received the first stomach wash within 2hours.

Increased bronchial secretions was the most frequent muscarinic symptom in our study, seen in 72% of patients, followed by vomiting in 66% of patients, nausea in 54% and miosis in 52%, excessive salivation in 35%, sweating in 30% and incontinence in 24% followed by diarrhea(14%). Bradycardia was present in 12%, bronchoconstriction (10%). The most common nicotinic symptom was hypertension in 24%, followed by fasciculations in 15%, diaphragmatic paralysis in 14%, tachycardia in 9%, and muscle twitching in 4%. 44% of the patients did not have any nicotinic symptoms. CNS symptoms were assessed, and coma was presentinal most a quarter of patients (26%). Drowsiness/altered sensorium was seen in 28% of patients. Convulsions were seen in 8%, tremor, and slurred speech was seen in 3%of patients each. The patients were examined, and the pulserate was normal in the majority of patients (79%), bradycardia was seen in 12%, and tachycardia was seen in 9%. The Blood pressure was elevated (>140/90) in 24% of them. Respiratory rate was more than 20 in 91%, followed by SpO2 levels of more than 85% in 49% and less than 85% in 51%. The respiratory pattern was Abdominothoracic in 58%, pupil size less than 1mm is seen in 17% of patients. The use of accessory muscles of respiration was seen in 88% of the study population. More than half of the patients were severely affected by poison (52%). Single breath count could not be assessed in the majority of the patients (88%), 16 to 20 was seen in 6%, 26 to 30 in 4%, and more than 30% in 2%. Neck muscle weakness was present in 6% of patients,16% came intubated, and GCS was less than 3 in 4% of patients, and a score of 13 to 15 was seen in 29% of patients. Deep tendon reflexes were assessed, and it revealed that in a major chunk of the patients, it was absent (62%), and rest 38% had it. The complications during the admission phase were assessed; in them, respiratory failure was seen in 78% of the subjects and occurred within day one in the majority of patients (69%). Apnoeic spells were present only in 2%. Cardiac arrest was precipitated in just 12% and mostly on day one itself. The occurrence of as piration was assessed, and only 19% had them, and mostlyseenon2ndand 3rd days. Seizures were present in only 8%. IMS was present only in 15% and was precipitated mostly by day 4. 26% of patients were in a comatose state, and ARDS was seen in only 2% of patients.

Only 17 % of patients were not on mechanical ventilation. On day one majority of the patients were ventilated (70%), followed by 9% on day 2 and 4% on day 4. The most frequent reason for using ventilation is Respiratory failure, which was seen in 76% of the patients, followed by altered sensorium in 22%, increased secretions in 19%, and only 6% are due to IMS.

Almost half of the patients died in the end (49%), and rest survived the poison's effect and were stable at the end of the study (51%).

Association of Final Outcome & Other Variables

Association of Clinical Presentation and Outcome

Age showed a relationship with the outcome, as age increased, the likelihood of survival diminished, and this change was statistically significant. The nature of the poison also had a similar effect, when the nature was unknown, there was more chance of death, followed by more deaths among OP group then by OP+ Pyrethroid compound poisoning. It was also noted that if the patient presented early, the chance of survival increased, and if the stomach wash was done faster, the survival probabilities also increased, but these changes are not statistically significant.

Association of Vitals and Outcome

The pulse rate and respiratory rate did not show any significance in the outcome. However, blood pressure elevation meant a higher chance of death; SpO2 levels, if lower, had a high chance of death. Pupil size<1mm had shown a significant chance of death in this study.

Table 1 Association of vitals and outcome

SpO2 levels	Dead N	(%)	Survived n	(%)	Fischers Exact	p-value
≤85%	35	71.4	16	31.4	6.906e-05	0.0004998 (<0.05)
>85%	14	28.6	35	68.6		
Pupil size (mm)	**Dead n**	**(%)**	**Survived n**	**(%)**		
<1	15	30.6	2	3.9	2.886e-06	0.0004998 (<0.05)
2-4	34	69.4	37	72.5		
>4	0	0.0	12	23.5		
Total	49	100	51	100		

Association of the severity of poisoning and outcome

The severity of poisoning was divided into mild, moderate, and severe. As the severity increased, the chance of death also increased, and it was statistically significant. Lower GCS tends to increase the chance of death among such patients. This change was also statistically significant.

Table 2 Association of the severity of poisoning and outcome

Severity of poisoning	Dead n	(%)	Survived n	(%)	Fischer's Exact Test	p-value
Mild	3	6.1	10	19.6	0.002111 (<0.05)	0.003498 (<0.05)
Moderate	14	28.5	25	49.0		
Severe	32	65.3	16	31.4		
Glasgow coma scale	Dead n	(%)	Survived n	(%)		
≤3	4	8.2	0	0.0	6.994e-08	0.0004998 (<0.05)
4-6	6	12.2	3	5.9		
7-9	16	32.6	13	25.4		
10-12	3	6.1	10	19.6		
13-15	10	20.4	19	37.2		
Came intubated	10	20.43	6	11.8		
Total	49	100	51	100		

Association of Pseudocholinesterase Levels and Outcome

Lower pseudocholinesterase levels were significantly associated with higher death rates in this study.

Table 3 Pseudo cholinesterase levels

	Dead n	(%)	Survived n	(%)	Fischer's Exact test	p-value
<900	38	77.5	20	39.2	0.003147 (<0.05)	0.00299 (<0.05)
900-1200	8	16.3	17	33.3		
>1200	3	6.1	14	27.4		
Total	49	100	51	100		

Association of ABG Analysis and Outcome

The presence of ABG abnormalities statistically increased the chance of death, with metabolic acidosis being the most common ABG abnormality in these patients.

Table 4 ABG Analysis

	Dead n	(%)	Survived n	(%)	Fischer's Exact Test	p-value
Normal	2	4.1	12	23.5	0.0008492 (<0.05)	0.0004998 (<0.05)
Metabolic acidosis	39	79.6	20	39.2		
Metabolic alkalosis	2	4.1	5	9.8		
Respiratory acidosis	3	6.1	7	13.7		
Respiratory alkalosis	3	6.1	7	13.7		
Total	49	100	51	100		

Association of Complications and Outcome

The presence of complications like respiratory failure, cardiac arrest, aspiration statistically increased the chance of death in the study population.

Association of Duration of Stay and Outcome

The duration of the hospital, ICU stay, and the number of days on a ventilator all showed that if there is an increase in the number of any of this, there is a statistically significant chance of poor survival.

Predictors of Need for Mechanical Ventilation

On comparing the characteristics of both ventilated and nonventilated groups, the older age group was significantly higher in the ventilated group. While comparing the nature of poison, it was found that in patients in whom the compound is not known, the proportion of ventilated patients was significantly higher.

Table 5

	Ventilation status				p-value
	Non-ventilated n	(%)	Ventilated n	(%)	
Age groups (In Years)					
13-20	4	23.5	0	0.0	0.002999 (<0.05)
21-35	6	35.3	48	57.8	
36-50	3	17.6	17	20.5	
51-65	4	23.5	12	14.4	
66-80	0	0.0	4	4.8	
>80	0	0.0	2	2.4	

Clinical symptoms among two groups

The presentation time showed that patients who presented after 2-4 hours of consumption of poison, had more chance of getting ventilated, which was statistically significant. The first stomach wash time in the ventilated group was after a longer time gap when compared to non-ventilated group, which was statistically significant. Muscarinic symptoms were more in the nonventilated group, whereas CNS symptoms were more in the ventilated group, and nicotinic symptoms were seen in both, and it was statistically significant.

Table 6 Clinical presentation

	Non ventilated N(%)		Ventilated N(%)		p-value
Clinical presentation time (First presentation time)					
≤1 hour	10	58.8	18	21.7	
>1 to ≤2 hours	7	41.2	34	41.0	
>2 to ≤4 hours	0	0.0	18	21.7	0.02599
>4 to ≤8 hours	0	0.0	8	9.7	(<0.05)
>8 to ≤12 hours	0	0.0	3	3.6	
>12 to ≤24 hours	0	0.0	2	2.4	
Clinical presentation time(First stomach wash time)					
≤1 hour	8	47.0	15	18.1	
>1 to ≤2 hours	7	41.2	21	25.3	
>2 to ≤4 hours	2	11.8	30	36.1	0.02649
>4 to ≤8 hours	0	0.0	12	14.4	(<0.05)
>8 to ≤12 hours	0	0.0	1	1.2	
>12 to ≤24 hours	0	0.0	4	4.8	
Nicotinic symptoms					
Nil	6	35.3	38	45.8	
Muscle Twitching	0	0.0	4	4.8	
Fasciculations	2	11.8	13	15.7	0.0009995
Diaphragmatic Paralysis	0	0.0	14	16.9	(<0.05)
Tachycardia	4	23.5	5	6.0	
Hypertension	7	41.2	17	20.5	
CNS symptoms					
Nil	6	35.3	37	44.6	
Emotional Liability	0	0.0	2	2.4	
Tremors	3	17.6	0	0.0	
Convulsions	0	0.0	8	9.6	0.000995
Slurred speech	0	0.0	3	3.6	(<0.05)
Coma	0	0.0	26	31.3	
Drowsiness/Altered sensorium	4	23.5	24	28.9	
Muscarinic symptoms					
Bronchorrhhea	12	70.6	60	72.3	
Excess Salivation	8	47.0	27	32.5	
Sweating	16	94.1	14	16.9	
Lacrimation	1	5.9	1	1.2	
Bradycardia	1	5.9	11	13.2	0.004498
Miosis	15	88.2	37	44.6	(<0.05)
Nausea	15	88.2	39	47.0	
Vomiting	12	70.6	44	53.0	
Diarrhea	6	35.3	8	9.6	
Incontinence	4	23.5	20	24.1	
Total	17	100	83	100	

Vitals among two groups

The blood pressure was significantly higher in the ventilated group. Patients with pupil size less than 1mm were significantly ventilated than others. The abdominothoracic pattern of respiration was found to be higher in the ventilated group and was statistically significant. Accessory muscles were used more among ventilated persons

Table 7 Vitals of two groups

	Ventilation status				p-value
	Non-ventilated		Ventilated		
	n	(%)	n	(%)	
Pulse rate (per minute)					
<60	2	11.8	10	12.1	0.889(By
61 to 100	13	76.5	66	79.5	Fischer's Exact
>100	2	11.8	7	8.4	value)
Blood pressure (mm Hg)					
≤100/60	1	5.9	16	19.3	
>100/60 to ≤120/80	6	35.3	12	14.4	0.01849
>120/80 to ≤140/90	3	17.6	38	45.8	(<0.05)
>140/90	7	41.2	17	20.5	
Respiratory rate (per minute)					
≤20	0	0.0	9	10.8	0.0004998
>20	17	100.0	74	89.2	(<0.05)
SpO2 levels					
>85%	12	70.6	37	44.6	0.049
≤85%	5	29.4	46	55.4	(<0.05)
Pupil size (mm)					
<1	0	0.0	17	20.5	0.0004998
2-4	5	29.4	66	79.5	(<0.05)
>4	12	70.6	0	0.0	

Relationship of Pseudo cholinesterase Levels with Ventilation Status

Lower serum pseudocholinesterase levels were significantly associated with the need for ventilation.

Table 8 Pseudocholinesterase levels

	Ventilation status				p-value
	Non-ventilated n (%)		Ventilated n (%)		
<900	1	5.9	57	68.7	0.0004998
900-1200	6	35.3	19	22.9	(<0.05)
>1200	10	58.8	7	8.4	
Total	17	100	83	100	

Relationship of ABG Analysis with Ventilation Status

Abnormalities in ABG analysis showed a significant relationship with the need for ventilation

Table 9 ABG Analysis

	Ventilation status				p-value
	Non- ventilated n (%)		Ventilated n (%)		
Normal	12	70.6	2	2.4	
Metabolic acidosis	1	5.9	58	69.9	
Metabolic alkalosis	1	5.9	6	7.2	0.0004998(<0.05)
Respiratory acidosis	2	11.8	8	9.6	
Respiratory alkalosis	1	5.9	9	10.8	
Total	17	100	83	100	

Severity and complications among two groups

The severity of poisoning was higher in the ventilated group; the Glasgow coma scale was significantly lower in the ventilated group. Respiratory failure, aspiration, intermediate syndrome, coma were significantly higher in the ventilated group.

Table 10 Severity and complications among two Groups

	Ventilation status				p-value
	Non-ventilated N	(%)	Ventilated n(%)		
Severity of poisoning					
Mild	9	53.0	5	6.0	
Moderate	6	35.3	28	33.7	0.0004998(<0.005)
Severe	2	11.8	50	60.2	
Glasgow coma scale					
≤3	0	0.0	4	4.8	
4-6	0	0.0	9	10.8	
7-9	0	0.0	29	34.9	
10-12	0	0.0	13	15.7	0.0004998(<0.005)
13-15	17	100.0	12	52.2	
Came intubated	0	0.0	16	19.3	
Respiratory failure					
No	14	82.3	8	9.6	0.0004998(<0.005)
Yes	3	17.7	75	11.4	
Apnoeic spells					
No	17	100.0	81	97.6	1.0
Yes	0	0.0	2	2.4	
Cardiac arrest					
No	15	88.2	73	88.0	1.0
Yes	2	11.8	10	12.0	
Aspiration					
No	17	100.0	64	77.1	0.03698(<0.05)
Yes	0	0.0	19	22.9	

Seizures					
No	17	100.0	75	11.4	0.3418
Yes	0	0.0	8	9.6	
Intermediate syndrome					
No	17	100.0	68	81.9	0.049(<0.05)
Yes	0	0.0	15	18.1	
Coma					
No	17	100.0	57	68.7	0.01649(<0.05)
Yes	0	0.0	26	31.3	
Total	17	100	83	100	

DISCUSSION

A total of 100 patients were included in the study, who satisfy out inclusion and exclusion criteria.

Age and Genderwise Distribution

In our study, the majority were females, i.e., 54%, and the rest 46% were males. The age and gender-wise distribution showed that both males and females were higher in the age groups 21 to 35 years, 55% and 52% respectively. This is comparable to the study done by Maqbool F *et al*.,(5) who showed that in their study, the mean age group was 23.3 ± 6.1 years, but in that study majority were males.

Characteristics of Poison

In the current study, 34% of patients are referred from other hospitals due to the ingestion of the OP compound. The rest of the patients came with poisoning to the hospital. Almost all the patients in our study group were suicide attempts with the poison. The route of poisoning was ingestion in all. The poison name was unknown in 33% of patients. Most of them consumed Chlorpyrifos (28%), followed by Quinalphos(21%). In a study conducted by Singh *et al*., Diazinon was the most frequently consumed OP poison. In a study by Goel *et al*.,(3) Monocrotophos was the most commonly used compound.Tick-20 (2% Fenitrothion) was the compound of choiceina study done by Agarwal S.B.(4). These pesticides are preferred for the purpose of suicide due to their easy availability and potent toxicity. Suicide is the major cause of OP poisoning in developing countries.

Time of clinical presentation

In the present study, the time of the first presentation to hospital with poisoning symptoms was mostly presented between more than 1 to less than 2 hours bracket (41%) and the least number in more than 12 to less than 24 hours group (2%). Thus the majority (69%) have presented to the hospital within 2 hours. The firsts to mach wash was done inmost patients between more than 2 to less than 4 hours (32%). Only 23% of patients received the firsts to mach wash within 1 hour. 51% of patients received the firsts to mach wash within 2 hours. If presented early, the chance of survival increased, and if stomach wash was done faster, the survival probabilities increased, and these changes were not statistically significant in this study. It was also found that ventilated patients presented at a later time, i.e., after 2 to 4 hours, compared to the non-ventilated group, and this was statistically significant. The time gap till the firsts to mach wash was longer in the ventilated group when compared to non-ventilated group, which was statistically significant. Similar results have been found in many reviewed studies(5).

Clinical Symptoms

In our study, the most common muscarinic symptom was increased bronchial secretions (72%). The most commonnicotinicsymptom was hypertension in 24%, followed by fasciculations in 15%. Muscarinicsymptoms were more in the nonventilated group, whereas CNS symptoms were more in the ventilated group, and nicotinic symptoms were seen in both, and it was statistically significant. The presenting symptoms in other studies reviewed showed that the common muscarinic features include bronchorrhea, bronchoconstriction, constricted pupils, abdominal cramps, involuntary defecation and urination, tachycardia, QT prolongation, and hypotension. Nicotinic features include twitching of fine muscles, fasciculations, and hyperreflexia, which may progressively lead to flaccid paralysis. The most prominent CNS symptoms were headache, dizziness, drowsiness, confusion, anxiety, slurred speech, ataxia, tremors, psychosis, convulsions, coma, and respiratory depression(6,7).

Clinical Examination

In our study, pulse rate was normal in 79% of patients. Bradycardia was seen in 12% and tachycardia in 9%. Blood pressure was elevated in 41% and high in 24% of them. Respiratory rate was more than 20 in 91%, followed by SpO2 levels of more than 85% in 49% and less than or equal to 85% in 51%. The respiratory pattern was abdominothoracicin 58%. The use of accessory muscles of respiration was seen in 88% of the study population. Pupil size less than 1mm was seen in 17%, and 2 to 4mm size was seen in 71%. There viewed studies also showed that the most common signs were tachycardia, higher blood pressure, poor SpO2 levels, constricted pupils, and common symptoms were bronchorrhea, diarrhea, muscle fasciculation, and increased salivation . This is again consistent with another study conducted by Senanyaka *et al*., which showed respiratory failure in 33% of patients. In a study conducted by Kalinga *et al*.,(8) pinpoint pupils were seen in 24% of patients. Studies conducted by Tsao *et al*., Goel *et al*., Rajeev H *et al*.(9) showed pinpoint pupils in 52%, 64%, and 72%, respectively. Nevertheless, only 17% of the subjects in our study showed pinpoint pupils.

GCS Score

In our study,16% came intubated, less than 3 score was seen in 4 %, a score of 13 to 15 was seen in 29%. The GCS was significantly lower in the ventilated group. In a study conducted by Hasan AM *et al*., GCS less than 7 was seen in 3%o f cases, and all were ventilated. Most of the patients (96.2%) with GCS score between 13 to 15recovered. In a study done by Kalinga *et al* (8)., ventilator support was required in 97% of patients who hada GCS score of less than 11. This result correlates very well with the study done by Goel*et al*.(3) GCS is a scoring system developed by Jennett and Teasdale to evaluate the neurological condition of the patient, particularly in patients with head trauma, but it was reported in 1978 that it could also be used to define prognosis in nontrauma patients. Hypoperfusion occurring in the central nervous system as a result of neuropathy and the added hemodynamic abnormalities in OP poisoning cause the GCS value to decrease, and low values of GCS indicate the potential for the development of respiratory insufficiency and prognosis.

Pseudo cholinesterase Levels

The serumpseudocholinesterase levels was less than 20%ofthenormalin 58% of patients. In our study, almost all (98%) patients with serum pseudo cholinesterase levels less than 20% required ventilatory support. Our study showed a highly significant correlation between PChe levels and the need for ventilator support. Kavya S.T *et al*. (10), in their study, found that 100% of the patients with Pche levels <20% required ventilator support. Rajeev H *et al*.(9) foundadirect correlation between the degree of inhibition of PChe levels and the severity of poisoning in their study, 11 out of 13 (84%) patients with pseudocholinesterase levels less than 20% required ventilator support. Similar findings were seen in studies conducted by Reihman *et al*.(11), Sumathi *et al*.(12), Weissmann-Brenner *et al*.(13), Goswamy *et al*.(14), and Ahmed *et al*.(15). Weissmann- Brenner *et al*. study found a direct correlation between the degree of inhibition of PCh Elevels and the severity of poisoning. Goswamy *et al*., in their study, concluded that a part from clinical indicators, low serum cholinesterase levels were of greatest predictive value for ventilation in OP poisoning. Similar findings were observed by S.D. Zawar *et al*., in their study. Aygun and *et al*.(16) found there is no significant correlation between initial PchE levels and Severity of Poisoning in their study in contrast to our study. Also, Nouira *et al*. study did not find any statistically significant difference in mean serum pseudocholinesterase levels in those mechanically ventilated and those do not need ventilator support. In a study conducted by Kalinga *et al*., patients with severe poisoning based on serum pseudocholinesterase levels required ventilatory support. Studies conducted by Shyam Chand Chaudhary *et al*., (17) Pradeep Kumar Hiremath *et al*.,(18) and Dr.SubhashL. Patil *et al*.(19) showed similar results with a percentage of patients with severe reduction of pseudocholinesterase levels requiring ventilatorysupport being 83.3%, 85%, and 100% respectively. These findings are consistent with the results of our study.

Table : Pseudocholinesterase Levels And Ventilatory Support Study	**Result (Percentage OF Patients With Severe Poisoning Based on Serum Pseudo cholinesterase**
Kalinga *et al*.	78%
Rajeev H *et al*.	84%
Shyam Chand Chaudhary *et al*.	83.3%
Pradeep Kumar Hiremath *et al*.	85%
Dr. SubhashL.Patil *et al*.	100%
Present study	98%

Outcome

In our study, 49% of patients died in the end, and the rest survived the poison's effect and were stable at the end of the study. The mortality was higher in patients who were mechanically ventilated, i.e., 56% of the ventilated patients succumbed. Elevated blood pressure meant a higher chance of death; similarly, higher respiratory rate yielded similar results. Lower GCS also tends to increase the chance of death among such patients. This change was statistically significant. Age showed a relationship with the outcome, as the age increases the likelihood of survival diminished, and this change was statistically significant. An increase in the duration of hospital or ICU stay and the number of days on the ventilator was associated with a statistically significant chance of poor survival.

Among the complications, Respiratory failure was the most common complication perseand most common complication leading to ventilatory support. Respiratory failure, cardiacarrest, and aspiration were the most common complications which showed significant relation to the death of the patients. The reviewed studies showed that mortality was also high in patients requiring mechanical ventilation for more than seven days (33%) (15). The sepatients probably developed lung complications due to prolonged mechanical ventilation. In the reviewed studies, the mortality following OP poisoning varies between 4% to 30%. In a study conducted by Safdar *et al*., 4% of patients who received mechanical ventilator support ultimately expired (20). In another study, mortality was 50% in patients requiring mechanical ventilation (20). In another study, it was observed that the patients probably had increased the lag time or reported late to the emergency room resulting in a severe degree of poisoning leading to severe respiratory failure and high mortality in patients requiring mechanical ventilation for more than seven days.

Mechanical Ventilation

In our study, 83% of patients were kept under mechanical ventilation. On day one, the majority of the patients were ventilated (70%), followed by 9% on day two and 4% on day four. In a study done by Pavan Soni *et al*., out of the patients intubated, 64.29% of patients required ventilator support within 24 hours. The majority of the ventilated patients were females, although this could be because we had a higher number of female patients in our study population. Age could be considered a predictor. As age increased, there was more chance of being ventilated. The time of the initial presentation showed that as time lag increased, the chance of mechanical ventilation increased significantly. Similarly, if the stomach was his delayed, there is more chance of requiring ventilation. The presence of CNS symptoms and scarcity of muscarinic symptoms lead to significantly more chance of ventilation. The presence of higher blood pressure leads to more chances of mechanical ventilation. When SpO2 levels decrease, and when accessory muscles of respiration are used, there is more chance of requiring mechanical ventilation. Severe poisoning, a lower score of GCS, the occurrence of aspiration, respiratory failure and coma in patients leads to more chance of mechanical ventilation, and this was statistically significant. On analyzing the outcome of patients, it was found that the number of deaths was higher among ventilated patients compared to others. Almost 57% of ventilated patients succumbed to death in this study.

In our study, the most frequent reason for mechanical ventilation is respiratory failure/nicotinic effect which was seen in 76% of patients, followed by altered sensorium (22%), increased secretions (19%) , aspiration (8%), followed by IMS (6%) and cardiac arrest (6%). IMS was present in 15% and occurred mostly on day 4. This, in contrast to reviewed studies where the most common reason found to be IMS(1). Studies showed that most patients with IMS develop respiratory failure, which requires mechanical ventilation. Other studies showed that patients are prone to develop respiratory failure for many reasons, and multiple mechanisms including aspiration of gastric contents, excessive secretions, thoracic weakness, decreased respiratory drive, pneumonia, and sepsis-complicating ARDS.

In our study, mortality is directly proportional to age, the severity of poisoning, delay in starting treatment, delayed presentation, lower pseudocholinesterase levels, and duration of mechanical ventilation. No single factor is independently responsible for mortality in these patients. This has been similar to most of the studies reviewed.(7,21,22)

SUMMARY AND CONCLUSION

OP poisoning is a medical emergency that needs rapid diagnosis and treatment. Easy availability and low cost have made OP insecticide an agent of choice for self-poisoning. Mortality is directly proportionate to the severity of poisoning, type of poisoning, delay in starting treatment, and duration of mechanical ventilation. Mortality is more in patients with lower pseudocholinesterase levels. Though each predictor (age, gender, the lag time for presentation and stomach was, the severity of poisoning, low GCS, and duration of ventilation) is associated with mortality, death due to OP poisoning occurs due to combined effect of all these factors. No single factor is independently responsible for mortality in these patients.

Since respiratory failure is the major reason for mortality, careful monitoring, appropriate management, and early recognition of this complication may significantly reduce mortality. Immediate shifting of patients to well- equipped ICU, early use of antidote, and careful timely resuscitation help in the reduction of mortality. A grading system is developed to assess the patients at the time of admission to grade the severity of poisoning and deciding the requirement of assisted ventilation and thereafter, I.C.U. Stay is to be decided.

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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