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Medicine

INDICATORS OF RESPIRATORY FAILURE AND VENTILATOR REQUIREMENT IN OPC POISONING

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ABSTRACT Organophosphorus compounds (OPC) are used worldwide for pest control. WHO estimates there are 3 million cases of OPC poisoning worldwide mostly in developing countries[1]. OPC poisoning are common suicidal agent in Asian and Developing countries[2, 3]. This study is carried out to analyze the factors which will indicate the impending respiratory failure and subsequent requirement of ventilator. This study was conducted from 01/01/2006 till 01/12/2006. All the patients admitted with history suggestive of consumption of OPC or green colored poison admitted in MICU were included in the study. This study shows factors like type of poison, time lag, NMW, maximum atropine dose requirement within 1st hr and 24hrs, ABG, convulsions, hypotention BP<100mm of Hg, Hb, WBC, RBS, ALT, abnormal CXR, cholinergic crisis, IS, aspiration pneumonia, serum cholinesterase level, receipt of PAM, can significantly predict the impending respiratory failure and ventilator requirement.

KEYWORDS : organophosphorus poisoning, respiratory failure, ventilator requirement

INTRODUCTION

Organophosphorus poison is popular insecticide because of their effectiveness and non-persistence's in the environment. Owing to their unstable chemical nature they do not persist in body or environment as to other organochlorine compound[4]. Their more than 1000 active substances incorporated in 35,000 preparation of pesticide use in agriculture.

Medical applications of organophosphate and carbamate include reversal of neuromuscular blockade eg. Neostigmine. Pyridostigmine, edrophonium and treatment of glaucoma, myasthenia and Alzheimer. It is estimated that more than 700,000 deaths occur each year as a result of poisoning. About 345,000 occur from unintentional poisoning, and more than 370,000 from suicidal causes. Majority of the suicidal cases are due to pesticide poisoning[5]. A comprehensive knowledge about the nature, magnitude, morbidity and mortality of a particular poison is necessary not only for its prompt diagnosis and treatment, but also to make necessary precautions to avoid such incidents[6]. Intentional and unintentional pesticide poisoning has been acknowledged as a serious problem in many agricultural communities of low- and middle-income countries[7]. OP insecticides inhibit both cholinesterase and pseudocholinesterase activities, as they are irreversible cholinesterase inhibitors. The inhibition of cholinesterase activity leads to accumulation of acetylcholine at synapses, causing overstimulation and disruption of neurotransmission in both central and peripheral nervous systems[8]. The fatal issue is often related to a delay in diagnosis or an improper management. Management of severe poisoning is difficult, requiring intensive care and use of atropine and oxime cholinesterase reactivators. Key to survival lies in early diagnosis followed by rapid decontamination and definitive therapy.

Aims and Objectives:

1. To study the factors which may predict the impending respiratory paralysis.
2. To study the clinical profile of OPC poisoning.
3. To predict the need of ventilator in OPC poisoning.

Material and Methods:

A retrospective study was conducted on patients with OP poisoning admitted to intensive care unit (ICU) between January 2006 and December 2006 in a tertiary care hospital in Mumbai. Ethical clearance was obtained from the hospital administration for the disclosure of the records which was only for academic purpose. However, the confidentiality of the patients was maintained. All the OP poisoning victims attending to the casualty and subsequently requiring ICU management were screened.

Inclusion Criteria:

Those with confirmed history of consumption of organophosphorus compound and having clinical manifestation of same were included for study.

Exclusion Criteria:

Those in whom later evaluation ruled out possibility and those who had concomitant poisoning with other agents other than organophosphorus compound poisoning were excluded.

Patient's profile including age, sex, educational qualification, reason for consumption of organophosphorus compound, presence of premorbid illness was noted, type of poison consumed and time lag between consumption of poison and seeking medical attention were noted, prior addiction were assessed. Clinical features including vital parameter (Respiratory status, Neurological status) investigations and response to treatment were noted. The diagnosis was supported by measuring plasma or red blood cell anticholinesterase levels. All patients received standard treatment including removal of clothes and body wash with soap water and gastric lavage with charcoal. Physiological antidote Atropine started as 2 mg IV bolus followed by 2-5 mg every 5-15 minutes till atropinisation. Atropine dose can be doubled as per requirement[9] therapeutic end point being cleaning of secretion and cessation of bronchoconstriction[10]. Pralidoxime (PAM) was started when indicated. Atropine was subsequently replaced by glycopyrrolate. PAM in the dose of 30mg/kg IV infusion followed by 8mg/kg/hr[11] was continued until fasciculation disappeared or skeletal muscle weakness was relieved. Sedation and analgesia was obtained administering midazolam and fentanyl as intravenous bolus followed by infusion. Supportive therapy with oxygen, Endo Tracheal intubation, mechanical ventilation, and Inotropes were administered when necessary. Patients requiring ventilatory support were initially put on assist pressure control mode and subsequently weaned off by synchronised intermittent mandatory ventilation (SIMV), pressure support (PS) ventilation. Positive end expiratory pressure (PEEP) was added as per the lung characteristics. Patients were extubated using rapid shallow breathing index (RSBI) or spontaneous breathing trial (SBT) as the extubation criteria. Duration of ICU stay, duration of mechanical ventilation, complications like neuromuscular weakness (NMW), development of arrhythmia, aspiration Pneumonia (AP), nosocomial infection and mortality were calculated. Impact of type and amount of poison, time lag between consumption of organophosphorus poison and initiation of treatment, presence of comorbid conditions, need of mechanical ventilation and other therapeutic intervention outcome were analysed using chi-squared test, student's t test.

Results:
Total 670 admissions of poisoning were screened over 1 year from 01/01/06 to 31/12/06. Out of which 69 patients satisfied inclusion criteria, however 3 patients with concomitant poisoning with other agents (Benzodiazepine, Phenyl, Antiepileptic drug) were excluded.

Table 1 & 2 shows Age and Sex distribution of study group. Half of the study population is educated while half is uneducated. In maximum cases poison is unknown (22.7%) followed by Baygon (16.7%). Most common symptom in these cases is fasciculation (74.24%) followed by neck muscle weakness (69.6%) and diaphoresis (54.54%). Tables 4 & 5 give idea about the relation of ventilator use and symptoms & investigating parameter. Those with significant relation with ventilator use are depicted in tables.

Table 1: Sex distribution in study group

Sex	No. of cases	Percentage
Male	34	51.5%
Female	32	48.5%
Total	66	100%

Table 2: Age distribution in study group

Age in years	No. of patients	Percentage
12-25 yrs	35	53.0%
26-45 yrs	24	36.4%
46-65 yrs	06	9.1%
65 yrs +	01	1.5%
Total	66	100%

Table 3: Type of poison and Use of Ventilator

Type of poison	Use of Ventilator		Total
	No	Yes	
Baygon	8	3	11
Green	0	7	7
Khatnil	6	4	10
Malathion	0	1	1
OPC (unknown)	6	9	15
OPC endosulphur	1	0	1
Rogor	0	10	10
Super D	1	0	1
Tik-20	6	4	10
Total	28	38	66

$X^2 = 22.67$, df= 8, p= 0.004

In Rogor and Green poisoning cases, 100% cases required ventilator support.

Table 4: Correlation between symptoms and assisted respiration

Symptoms		Use of Ventilator		Total	X^2	Sig. (2-sided)
		Yes	No			
Neuromuscular Weakness	Yes	34	12	46	16.58	<0.0001
	No	4	16	20		
Fasciculations	Yes	31	18	49	2.52	0.112
	No	7	10	17		
Convulsions	Yes	20	0	20	21.14	<0.0001
	No	18	28	46		

Table 5: Relation between investigative parameters and assisted respiration

Parameter	Ventilator	Number of patients	Mean	Sig. (2-tailed)
Systolic BP	Yes	38	97.76	0.019
	No	28	115.50	
Diastolic BP	Yes	38	60.16	0.034
	No	28	70.50	
ALT	Yes	38	51.05	0.01
	No	28	38.75	
Cholinesterase	Yes	38	2384.32	<0.0001
	No	28	4196.93	
PH	Yes	38	7.25%	0.001
	No	28	7.35%	
Time Lag (hrs)	Yes	38	6.79	0.006
	No	28	1.46	
Haemoglobin	Yes	38	12.23	0.014
	No	28	13.41	
WBC	Yes	38	8905	0.005
	No	28	5663.93	
Random Blood Sugar level	Yes	38	143	0.014
	No	28	112	

Discussion:
Among the 66 cases of OPC poisoning 34 were males and 32 were females. In a study in Turkey showed preponderance increase in number of female patient (63.4%) [12]. In this study there was no significant difference between distribution of male and female pattern, male (51.5%) and female (48.5%). In present study OPC poisoning patients constituted approximately 10% of total ICU patients, thus OP poisoning is an important cause of ICU admission.

A prospective study in Srilanka of 2189 patients there were many young patient, median age was 25 years[13]. In another study of 8040 patients two third patients were less than 30 years[14]. In this study maximum number of patient with self poisoning were below age 30 years out of 66 patients studied the highest age group was 12-25 (53%) mean age 28.88%.

Type of OPC poison also influences the need of ventilator, there were 15 (22.7%) of unknown OPC followed by Dimethoate (Rogor) 10 (15.2%), and Khatnil 10 (15.2%). In a study by Pavan Soni et al[15] proportion with dimethote (rogor) was significantly higher. In this study we have maximum number of patients requiring ventilator in dimethote (rogor). Toxicity of carbamate is less severe and short duration due to rapid hepatic metabolism[16].

In this study quantity of poison consumed was independent of respiratory paralysis. In a study by M. Eddleston et al[17] no difference in alcohol use that mild account for variable toxicity noted. In this study alcohol consumption with OPC does not influence ventilator requirement.

In this study significant difference was noted between OPC consumption and time taken by patient to seek treatment (time lag) with respiratory paralysis. However mean time taken by patient to seek medical attention in patient who required ventilator was >1.5 hrs.

In a study by Asari et al[18] fatalities were noted in patient with OPC poisoning due to cardio vascular collapse because of in appropriate vasodilatation, hypotension and metabolic acidosis. In this study patients having BP<100/70mm of Hg required ventilator more frequently.

In a study by A. P. N. Kumar et al[19] commonest muscarinic symptoms seen were salivation, lacrimation, vomiting following by nicotinic symptoms FSC 55% and IS 18%. In this study maximum patient had nicotinic symptoms FSC (74.2%), NMW (69.6%) followed by muscarinic symptoms diaphorasis (54.54%), loose motions (46.95%), vomiting (42.43%). In this study patients having more nicotinic symptoms are 46 (69.7%) had NMW 34 (89.5%) required ventilator. High number of patients required ventilatory support with NMW.

In this study 49 (74.42%) had fasciculations and 31(63.38%) required ventilator. In spite of high number of patients having fasciculation no significant difference was noted in patient of OPC having FSC with mortality and ventilatory support (table3). In a study[20, 21] lower serum cholinesterase does not correlate with severity of poison but could serve as diagnostic tool for OPC poisoning but cannot be taken as indicator of severity of poisoning. In this study, low CHE was associated with increased need for ventilator. Thus, lower cholinesterase value was associated with adverse outcome.

In a study by A.K. Bane et al[22] type II respiratory failure occurring in OPC compound poisoning and treatment of choice is ventilatory support. Ventilatory support cannot be guided by clinical assessment but by arterial blood gas. Irrespective of level consciousness with respiratory effect if ABG shows respiratory acidosis then patient needs ventilatory support. In this study respiratory acidosis i.e. low pH and high increase pCO_2 is associated with increased need for ventilatory support and mortality.

In a study by A P N Kumar[23] average atropine required was 380 mg in first 24 hrs. In this study mean atropine required was 339.65 patient requiring high dose of atropine in first 24 hrs as increase need of ventilatory care. Maximum dose of atropine does not influence mortality. Patients who required high dose of atropine in first 24 hrs has high chance of requiring ventilatory support.

Mortality is not significantly different whether or not patients are treated with pralidoxime sulfate[24]. In this study, we found no benefit of PAM treatment in addition to atropine. In a study of Senaneyake et al[25] 40% of OPC poisoning patients had altered level of neurologic symptoms of NMW, IS, respiratory failure. In other study[26] 376 patients with OPC poisoning having neurologic symptoms 90 (24%) required intubation. Twenty (30%) patients had convulsion and all 20 required ventilatory care. The test was significant p value <0.005. Convulsion is associated with increase need for ventilatory care. In this study by A. P. N. Kumar et al[27] complications in OPC poisoning were Tachycardia (41%), IS (18%), AP (28%) other study by Senanayake et al[28] showed IS 40%. In this study arrhythmia 9 (13.63%), AP 16 (24.24%), IS 21 (31.82%), CC 34 (51.55%), OPIDN 4 (6%), PT 2 (3%). 34 (51.4%) had CC 25 (73.5%) required ventilator. CC increased the need for ventilatory requirement significantly. 21 patients had IS and all 21 (31.8%) required ventilatory care (Table 8). IS increases the need for ventilator care but is independent of outcome. 16 (24.2%) patients had AP p value <0.005. AP increases the need for ventilatory support but is not dependent on outcome.

In this study biochemical parameters like anaemia, leucocytosis, increased ALT, low RBS showed associated with significant (p value<0.005) higher need of ventilator. To conclude OP poisoning constitute important cause of admission in ICU and factors like presence of nicotinic symptoms, CNS involvement, aspiration pneumonia ,respiratory acidosis, atropine requirement in the first 24 hrs, time lag, anaemia, leucocytosis, high ALT, low RBS ,Type of poison (Rogor, Unknown compound), lower serum cholinesterase value predict the impending respiratory paralysis and need of ventilator. Other factors like concomitant Alcohol consumption, Quantity of poison, presence of cholinergic symptoms, arrhythmias, serum electrolytes, RFT taken did not show statistically significant relation with need of ventilator.

Conclusion:

1. This study indicates that factors which indicate impending respiratory paralysis and subsequent requirement of ventilator in the patients of OPC poison are time lag, consumption of poisons like rogor and green poison, presentation with NMW and CNS involvement, presence of cholinergic crisis, intermediate syndromes, atropine requirement (within 24 hrs),hypotension, hypoglycemia, anemia and leucocytosis.
2. Maximum number of patient were below the age group of 30 years.
3. Patient who had expired required very high dose of atropine in first 24 hrs.
4. Factors like quantity of poison, concomitant alcohol ingestion, presence of tachycardia did not affect ventilator requirement.

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