



**ORIGINAL RESEARCH PAPER**

**General Medicine**

**SIGNIFICANCE OF ACID BASE STATUS AT ADMISSION IN ACUTE ORGANOPHOSPHORUS POISONING AND ITS IMPACT ON OUTCOME- HOSPITAL BASED OBSERVATIONAL STUDY FROM NORTH EAST INDIA**

**KEY WORDS:**

Organophosphorus compounds (OPCs), Arterial Blood Gas Analysis

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**ABSTRACT**

**BACKGROUND:** Organophosphorus compounds (OPCs) are being used worldwide as an insecticide, herbicide, fungicide in agriculture field and household garden. Acute respiratory failure has been found to be the most common cause of death in OPC poisoning due to increased secretions and decreased ventilation leading to acid base disturbances. This study was undertaken to assess acid base status in patients with acute OPCs poisoning and to determine its association with the clinical outcome in patients with acute OPCs poisoning. **MATERIALS AND METHODS** This was a prospective observational study conducted in Dept of General Medicine, Silchar Medical College and Hospital from 1st June 2021 to 31st May 2022 for a period of one year. It was a hospital based observational study. A total of 100 patients were evaluated, with history of ingestion of OP compound and clinical features suggestive of acute OPCs poisoning after fulfillment of inclusion and exclusion criteria. **RESULTS** Total 100 patients were studied and majority were in the age group of 21-30 years. On Arterial Blood Gas Study, 88% had acid base imbalance and 12% had normal acid base balance. Majority of the patient had respiratory alkalosis (49%), followed by respiratory acidosis (16%), metabolic acidosis (15%), metabolic alkalosis (8%). The overall mortality in our study was 19%. The mortality rate in metabolic acidosis group was 46.66%, respiratory acidosis group was 37.5%, metabolic alkalosis group was 12.5 % and respiratory alkalosis group was 10.2 %. **CONCLUSION** Acid -base imbalances are present in majority of the patients presenting with acute OPC poisoning. The assessment of the initial acid base status can help in determining the prognosis of the patients, help to intensify management and reduce the overall mortality in patients with acute OPC poisoning.

**INTRODUCTION**

Organophosphorus compounds (OPCs) are being used worldwide as an insecticide, herbicide, fungicide in agriculture field and household garden. Acute OP pesticide poisoning is common in developing countries due to easy availability and less awareness among poorly educated farmers. Poisoning due to suicidal intent is however more common than accidental exposure. In Indian studies, the incidence of suicidal poisoning using OPC ranges from 10.3% to 43.8%.<sup>[1]</sup> OPCs are very well absorbed from the lungs, gastrointestinal tract, skin, mucous membrane and conjunctiva following inhalation, ingestion and topical contact. In OPC poisoning, OPCs inhibit acetylcholinesterase activity, increases the activity of acetylcholine in the synaptic gap, decreases the degradation of acetylcholine, thus leading to excessively increased cholinergic symptoms. This excessive synaptic acetylcholine stimulates muscarinic receptors and then depresses or paralyzes the nicotinic receptors. OPCs produce cholinergic crisis by inhibition of acetylcholinesterase in central and peripheral nervous system, with a wide range of clinical effects like pulmonary bronchoconstriction and secretions, seizures and muscle weakness. All these clinical effects result in flaccid and paralyzed muscles, which ultimately leads to respiratory failure and acid base imbalance. Acid Base status in OPC poisoning patients is studied with the help of Arterial Blood Gas (ABG) Report. It can be determined by using pH, PaCO<sub>2</sub> and HCO<sub>3</sub>. despite several parameters available in ABG Report. Heparinized blood from radial or femoral artery was used for ABG Analysis and pH, PaCO<sub>2</sub> and HCO<sub>3</sub> measured using an automated analyser. This study was undertaken as there is scarce data from this part of the country especially north eastern India regarding the role of acid base status in predicting the outcome in patients with acute OPC poisoning.

**MATERIALS AND METHODS**

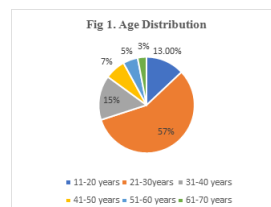
This study was conducted among 100 patients with acute organophosphorus poisoning in the Department of General

Medicine, Silchar Medical College and Hospital. It was a hospital based prospective observational study done from June 2021 to May 2022 for a period of one year. The Institutional Ethics Committee approved the study and written consent was obtained from all the patients or their attendants. All the patients with history of ingestion of organophosphorus compound and clinical features suggestive of acute organophosphorus poisoning were screened for eligibility criteria. Initial resuscitation, detailed clinical history and complete physical examination was done in all cases. Arterial blood gas sample collected and treatment was implemented.

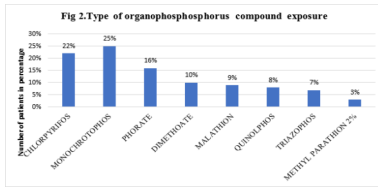
**Inclusion and exclusion criteria:** Patients with organophosphorus poisoning irrespective of age and sex, immediately after admission to hospital and before starting any kind of treatment. However, patients with poisoning other than organophosphorus, already received pralidoxime or atropine before taking of ABG sample and having comorbidities such as chronic kidney disease, chronic obstructive pulmonary disease, congestive heart failure and chronic lung disease were excluded from the study.

**RESULTS**

Tota 100 patients admitted to Silchar Medical College and Hospital was taken for study of which 61 were male and 39 were female. Majority of the patients were in the age groups of 21-30 years (55%) with mean ± 1SD age of patients in the study was 30.99 ± 11.37 years.



Out of 100 patients, 84 (84%) patients consumed organophosphorus compounds with the intention of suicide ,while 16 (16%) patients consumed accidentally. Most common compound consumed in the present study was monocrotophos (25%) followed by chlorpyrifos (22%) and Phorate (16%).



On Arterial Blood Gas Analysis, 88 patients (88%) had acid base imbalance and 12 patients (12%) had normal acid base status. Respiratory alkalosis was seen in 49 patients (49%), followed by respiratory acidosis in 16 patients (16%), metabolic acidosis in 15 patients (15%), metabolic alkalosis (8%) in 8 patients.

**Table 1: Acid Base status in OP poisoning patients and clinical outcome.**

Acid base status	Total patients (N=100)	Number of patients	
		Survived	Expired
Normal	12 (12%)	11 (92.7%)	01 (8.3%)
Metabolic acidosis	15 (15%)	08 (53.33%)	07 (46.66%)
Metabolic alkalosis	08 (8%)	07 (87.5%)	01 (12.5%)
Respiratory acidosis	16 (16%)	10 (62.5%)	06 (37.5%)
Respiratory alkalosis	49 (49%)	44 (89.8%)	05 (10.2%)

Among 100 patients,37 patients required ventilation and 63 patients recovered without ventilator use at all.15 out of 16 patients with respiratory acidosis, 18 out of 49 patients with respiratory alkalosis and 4 out of 15 patients with metabolic acidosis required ventilator. None of the patients with normal acid base status and metabolic alkalosis required ventilator. Death was reported in 19% of cases with 7 deaths in metabolic acidosis group (46.66%), 6 deaths in respiratory acidosis group( 37.5%), 1 death in metabolic alkalosis group(12.5 %) and 5 deaths in respiratory alkalosis group (10.2%).

**Table 2: showing acid base status and ventilator use in OP poisoning patients.**

Acid base status	Total patients (N=100)	Ventilator	
		Yes	No
Normal	12	00	12
Metabolic acidosis	15	04	11
Metabolic alkalosis	08	00	08
Respiratory acidosis	16	15	01
Respiratory alkalosis	49	18	31

**DISCUSSION**

OP poisoning is a common problem in India due to its extensive use as insecticides and pesticides in agriculture and household garden. Organophosphate binds to acetylcholinesterase (AChE) molecule and leads to excessive accumulation of acetylcholine at sympathetic, parasympathetic and neuromuscular junction site,which is the primary cause of most of the toxic effects of OP poisoning. OP poisoning leads to cholinergic crisis causing loss of central respiratory drive, pulmonary bronchoconstriction and bronchorrhea resulting in fluid overload in the lungs causing hypoxia due to stimulation of nicotinic receptors, followed by neuromuscular junction failure producing flaccid and paralysed muscles,which eventually leads to respiratory

failure and acid base imbalance.<sup>[2]</sup>

The present study showed a male preponderance with male: female ratio was 2.2:1, which was similar to the study observed by Gagarin D *et al.*<sup>[3]</sup> in which majority of the patients were males (80%).

Majority of the patients were in the age groups of 21-30 (55%) with mean ± 1SD age of patients in the study was 30.99 ± 11.37 years, which was comparable to the study by ShahNM *et al.*<sup>[4].1</sup> in which the maximum incidence of OP poisoning was in between 20-40 years age group.

In our study,82 (82%) patients consumed organophosphorus compounds with the intention of suicide ,while 18 (18%) patients consumed accidentally.This was similar to the study by Chintale KN *et al.*<sup>[5]</sup> in which out of total 136 cases, 82.35% cases were suicidal, 13.67% cases were accidental and 3.67% were homicidal.Monocrotophos (25%) was the most common OP compound consumed followed by Chlorpyrifos (22%) and Phorate (16%) , while in a study done by Gagarin D *et al.*<sup>[3]</sup> the most common OPC to be consumed was methyl parathion (27%) , followed by chlorpyrifos (22%), monocrotophos (22%) and quinalphos (12%).This difference in studies could reflect the regional variations in the availability of the compounds according to local agriculture and economy.

On Arterial Blood Gas Study, 88% had acid base imbalance and 12% had normal acid base balance. Majority of the patient had respiratory alkalosis (49%), followed by respiratory acidosis (16%), metabolic acidosis (15%), metabolic alkalosis (8%). This was similar to the study done by Sandhyapogu Lakshmi Bai *et al.*<sup>[6]</sup> in which 92.68% of study population had acid base imbalance and only 7.31% had normal acid base balance, with majority having respiratory alkalosis (51.2%) followed by respiratory acidosis (36.6%).

Out of 100,37 patients required ventilatory support and 63 patients recovered without ventilator use at all. 93.7% patients in respiratory acidosis group, 36.7% patients in respiratory alkalosis group and 26.6% in metabolic acidosis needed ventilatory support. The overall mortality in our study was 19%. The mortality rate in metabolic acidosis group, respiratory acidosis group, metabolic alkalosis group and respiratory alkalosis group was 46.66%, 37.5%,12.5% and 10.2% respectively. In our study, metabolic acidosis and respiratory acidosis was associated with increased mortality and was found to statistically significant (p <.05), when compared to patients with normal acid base status. Sandhyapogu Lakshmi Bai *et al.*<sup>[6]</sup> in their study of acute organophosphorus poisoning patients also found 100% mortality in metabolic acidosis group and 27% mortality in respiratory acidosis groups , whereas the mortality in respiratory alkalosis (9.5%) was lower, which was comparable to our study.

**LIMITATIONS**

The study was a hospital based observational study with a small sample size of 100 patients, conducted over a limited period of 1 year. Hence, to gather a more detailed information regarding acid base status in patients with acute OP poisoning, a broader and multi-centric study covering a large number of patients over a longer time period is required. The results of this study tally with most of the studies conducted in India and abroad.

**CONCLUSIONS**

It is evident from the present study that acid -base imbalances are present in majority of the patients presenting with acute OPC poisoning. Patients in the respiratory acidosis and metabolic acidosis groups were associated with increased mortality as compared to respiratory alkalosis or metabolic alkalosis groups. So, acid base status must be studied in all the patients presenting with acute OPC poisoning and special

consideration must be given to patients with respiratory or metabolic acidosis.

#### **DECLARATION OF PATIENT CONSENT**

The authors certify that they have obtained all appropriate patient consent forms.

#### **FINANCIAL SUPPORT AND SPONSORSHIP**

Nil

#### **CONFLICTS OF INTEREST**

There are no conflicts of interest.

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