Research Article

Investigation of acid base status in organo-phosphorus poisoning cases

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Abstract

Introduction: Organophosphate (OP) compounds have been used worldwide for pest control for over 100 years. They are the insecticides of choice in the agriculture world and are the most common cause of poisoning among the organic insecticides. Varity of complication are being seen in the patients of OP poisoning. Which are supposed to be due to the changes in the acid base status. **Aims and objectives:** to study the acid base status in organo phosphorus poisoning cases **Materials and Method:** in the present study 20 cases of OP poisoning were studied. Arterial blood was collected to analyze the acid base status of these patients. Acid Base analysis of ABG report includes PH, PCO_2, PO_2, HCO_3^-, SO_2%, BEB, Hb, BE-ECF, HCt, A and a/A. Estimation of these parameters was done by using "Arterial blood gas analyzer. **Results:** Out of 20 OP poisoning patients included in the study 7 were females 14 were males. The age group most of the people belong to 20 – 45 years. Majority of the cases were of respiratory alkalosis (65%), followed by respiratory acidosis (15%) and metabolic alkalosis (5%). No cases showed metabolic acidosis in the study. 15% cases showed normal acid base status in the study. **Conclusion:** Vide variation was seen in the acid base status of patients of OP poisoning. And it is also essential to identify the complications and manage them accordingly.
Keywords: organo-phosphorus, poison.

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INTRODUCTION

Organophosphate (OP) compounds have been used worldwide for pest control for over 100 years. They are the insecticides of choice in the agriculture world and are the most common cause of poisoning among the organic insecticides. They are common agents of suicidal and accidental poisoning as a result of their ready availability and easy accessibility. Several people around the world die each year from OP poisoning, especially in developing countries.[1] OP poisoning results either from suicidal or accidental poisoning or from occupational exposure such as farming. A large proportion of patients presented to the ICU following an acute suicide attempt.[2,3] Most patients are young (less than 30 years) with a male preponderance.[4] Occupational and accidental poisoning occurs less commonly in India.[3] The OP compounds are popular insecticides because of their effectiveness and nonpersistence in the environment owing to their unstable chemical nature. They do not persist in the body or environment as do organochlorides and have become the insecticide group of choice replacing DDT, an organochloride compound.[5] Organophosphorus insecticides irreversibly inhibit acetyl cholinesterase and cause accumulation of Acetyl Choline at muscarinic and nicotinic synapses. Excess synaptic acetyl choline stimulates muscarinic receptors and stimulates but then depresses or paralyzes the nicotinic receptors. Abnormal neuromuscular transmission, mediated through nicotinic receptors, may cause carbon dioxide retention and alter the acid – base balance. Death is most often due to increased pulmonary secretions and inadequate ventilation. Subsequent measures must be directed at securing the air way patency and recognizing and correcting the acid base disturbance at the earliest

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possible time.[6,7,8] One of the cause for these complication is imbalance in the acid base status. Thus the present study was undertaken to study the acid base status in the patients admitted to the medical intensive care unit for the treatment of OP poisoning.

AIMS AND OBJECTIVE

To study the acid base status in organo phosphorus poisoning cases

MATERIAL AND METHOD

The present study was conducted in the SVS medical college and Hospital. The study was conducted on patients with organo phosphorus poisoning admitted in medical intensive care unit of SVS Hospital and medical college. Total 20 were included in the study. Out of 20 OP poisoning patients included in the study 7 were females 14 were males. The age group most of the people belong to 20 – 45 years. Related detail case history of these patients was noted on a prestructured proforma. Routine biochemical investigation, like serum electrolytes, random blood glucose, urea, creatinine, cholinsterase levels were done where ever required. To study the acid base status in the study subjects arterial blood (radial artery, femoral artery) was collect. The radial artery at the wrist was the most preferred site of ABG specimen collection as it has adequate collaterals where inadvertent puncture of vein was unlikely. When this was not feasible femoral artery was chosen to collect the sample. The injection site was cleansed with alcohol. The index and middle finger of the other hand were used to palpate the artery. Heparinized syringe with 22 gauge needle was held like a pen with 45^0 angle [with beveled edge of the tip facing downwards] and the artery was punctured just 2 cm above the wrist crease. Acid Base analysis of ABG report includes PH, PCO_2, PO_2, HCO_3^-, SO_2%, BEB, Hb, BE-ECF, HCt, A and a/A. Estimation of these parameters was done by using "Arterial blood gas analyzer". The results of ABG were recorded and analyzed. Then according to the report patients acid base status was determined.

RESULTS

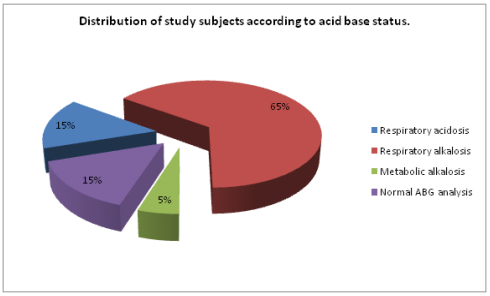
Table 1: Age and sexwise distribution of study subject

	Variable	No.	Percentage
Age	≤ 20 yrs	06	30
	21 to 30 yrs	07	35
	31 to 40 yrs	03	15
	41 to 50 yrs	03	15
	> 50 yrs	01	5
Sex	Male	13	65
	Female	07	35

In the present study it was observed that individuals were young and were less than 30 years of age (65%). Sexwise distribution showed that 65% were male and 35% were female.

Table 2: Distribution of study subjects according to acid base status

Acid base status	No.	Percentage
Respiratory acidosis	3	15
Respiratory alkalosis	13	65
Metabolic acidosis	0	0
Metabolic alkalosis	1	5
Normal ABG analysis	3	15



It was observed that majority of the cases were showing respiratory alkalosis (65%) on ABG, followed by respiratory acidosis (15%) and metabolic alkalosis (5%). No cases showed metabolic acidosis in the study. 15% cases showed normal acid base status in the study.

Table 3: Distribution of study subjects according to subtypes of respiratory acid base status

Acid base status		No.	Percentage
Respiratory acidosis	Acute	2	10%
	Partly compensated	1	5%
Respiratory alkalosis	Acute	4	20%
	Partly compensated	6	30%
	Fully compensation	3	15%

The cases of respiratory acidosis and apodosis were further classified in to acute, partly compensated and fully compensated. Out of the total 20 cases 2 cases (10%) showed acute respiratory acidosis whereas 1 case (5%) showed partly compensated respiratory acidosis. 4 cases (20%) showed acute respiratory alkalosis. Whereas partly and fully compensated respiratory alkalosis was observed in 6 (30%) and 3 (15%) cases respectively.

DISCUSSION

The aim of the present study is to investigate the changes in acid base status in patients admitted for organo phosphorous poisoning. The present study included 20 organo phosphorous poisoning cases admitted in medical intensive care unit of S.V.S. Hospital. Out of them, 16

were referred from Rural Health care centers. The latent time interval between exposure to OP compounds and blood sampling for Arterial blood gas analysis on an average was found to be 4-6 hours in the present study. Most of them are subjected to immediate gastric lavage 2-3 times. In all the cases serum cholinesterase levels, electrolytes and other routine biochemical investigations were carried out. Serum cholinesterase levels were lowered in all cases confirming organo phosphorous poisoning. Arterial blood was drawn for acid base analysis and many had lower partial pressure of oxygen showing inadequate ventilation. Majority of the cases (85%) had the acid base disturbances whereas only 15% cases had normal acid base reports. Respiratory alkalosis as indicated by changes in P^H towards alkaline side, decreased PCO_2 and normal levels of bicarbonate. It was observed that there were total 13 (65%) cases of respiratory alkalosis. The analysis of these changes indicates it is compensated respiratory alkalosis in 9 cases (6 cases partly and 3 cases fully). Acidosis is a frequently encountered complication of OP poisoning, and it was previously suggested that both the degree and type of acidosis can be a predictor of outcome in OP poisoning.[9] In our study respiratory acidosis was contributed by 3 cases (15%). One case had metabolic alkalosis and the rest (3 cases) showed no acid base disturbance. Most OP`s are well absorbed from skin, oral mucous membranes, conjunctival mucous membrane, and gastrointestinal and respiratory routes. Subsequently, most OP compounds are hydrolyzed by enzymes, the A esterases or paroxonases which are not inhibited by OP compounds. These enzymes are found in the plasma and in the hepatic endoplasmic reticulum and split the anhydride, P-F, P-CN, or ester bonds.[10] The metabolic products are then excreted in the urine. OP compounds that bind to acetyl cholinesterase block the conversion of acetylcholine to its degradation products, namely, acetic acid and choline. This leads to a build-up of excessive acetylcholine at synapses, which is the primary cause of most of the toxic effects of OP compounds. Time of death after a single acute exposure may range from less than 5 minutes to 24 hours depending on the dose, route of exposure and other factors. The cause of death primarily is respiratory failure usually accompanied by secondary cardiovascular complications. The mortality rate in different studies ranged from 12-27.6%. However in our study 3(15%) mortalities were reported. The rest of the cases recovered due to advanced supportive life care like mechanical ventilation and appropriate treatment like Atropine, Pralidoxamine (PAM) and corrective measures directed against altered acid base changes have contributed for satisfactory recovery. Thus a wide variation was observed in the acid base status in the cases of OP poisoning. A retrospective analysis of OP poisoned patients by Liu *et al*[11] found a direct correlation between the severity of poisoning and mortality and the presence of pretreatment metabolic and respiratory acidosis. Thus the management of OP poisoning varies according to the acid base status of the patients and associated complication. Investigation of acid base status in organo phosphorus poisoning cases is also very essential to identify respiratory failure, which can be corrected by life saving measures like endotracheal intubation, mechanical ventilation and drugs like atropine.

CONCLUSION

Thus in the end we can conclude that vide variation was seen in the acid base status of patients of OP poisoning. And it is also essential to identify the complications and manage them accordingly.

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