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Original research article

Glycemic status at the time of admission and its association with severity of acute organophosphorous poisoning: A prospective study

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Abstract

Objective: (1) To assess the glycemic status by estimating random blood glucose level at the time of admission in cases of acute organophosphorous poisoning.

(2) To correlate the documented blood glucose levels with the severity and clinical outcome

Material and Methods: The prospective study was conducted in tertiary care hospital. After obtaining informed written consent from patients or relatives, 100 confirmed acute OP compound poisoning patients were enrolled for the study, underwent a detailed clinical examination as per the proforma, specially designed for the study. The Random Blood Glucose level at the time of admission was taken and patients were monitored closely and continuously for severity of clinical signs and symptoms. The data obtained were entered in a Microsoft Excel sheet, and statistical analysis was performed using statistical package for the social sciences (SPSS 21.0 Version). Results were presented as Mean (Median) ±SD, counts and percentages and diagrams. Association of Categorical variables was found using Chi square test. $p<0.05$ will be considered statistically significant.

Results: Present study hyperglycemia was detected in 32% of the patients. Out of which 54.8% hyperglycemic patients developed complications compared to 35.7% in normoglycemics. Mortality rate was 15.6% in patients with hyperglycaemia which showed highly significant (p=0.001).

Conclusion: Hyperglycemia can occur in moderate to severe organophosphorous poisoning. Hyperglycemia (RBS > 160 mg/dl) at the time of presentation can be considered as a prognostic factor in predicting the morbidity and mortality of acute organophosphorous poisoning.

Keywords: Glycemic status, hyperglycemia, organophosphorous poisoning, random blood sugar

Introduction

Acute Organophosphorus poisoning (OP) is prevalent in the world and its numbers are constantly on the rise [1]. World Health Organisation (WHO) has estimated that nearly 2 lakh die from pesticide poisoning in the world. In India, it is the most common poisoning and exposure to OP compounds in the form of nerve agents and pesticides poses an ever ending threat [2]. India has about 60-80% of rural population. Thus, pesticides are routinely used for state-of-the-art farming and are readily available over the counter. Therefore a pesticide is an easy source for lethal purposes [3]. Organophosphorus (OP) poisoning, in addition to its cholinergic manifestations shows metabolic derangements leading to hyperglycemia. Apart from inhibiting Acetylcholinesterase/Pseudo-cholinesterase it also induces oxidative stress to exhibit this manifestation. In literature, following OP poisoning, hyperglycaemia has been reported and non-ketotic hyperglycaemia can also develop [4]. Mortality rate is 7-12% and death is usually due to respiratory paralysis [5].

Hence, the present study aims to assess the glycemic status at the time of admission to know its correlation with severity in acute OP compound poisoning patients

Objective of the study

1. To assess the glycemic status by estimating random blood glucose level at the time of admission in cases of acute organophosphorous poisoning.
2. To correlate the documented blood glucose levels with the severity and clinical outcome

Material and Methods

The prospective study was conducted in tertiary care hospital, Shri B.M.Patil's medical college hospital

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and research centre, Vijayapura from October 2018 to June 2020 after obtaining institutional ethical committee clearance. After obtaining informed written consent from patients or relatives, patients over 18 years of age with alleged history, clinical signs and symptoms with diagnosis of Organophosphorous poisoning were included in the study.

Patients of age less than 18 years, with history of Diabetes Mellitus, who had consumed alcohol, drugs, mixed poisons and already treated at other centres and referred to our centre for further management with no details available at the time of first admission were excluded from the study.

100 patients were studied over the period of 20 months and their demographic parameters were noted. Each patient enrolled for study underwent a detailed clinical examination as per the proforma, specially designed for the study, which included examination for presence of respiratory failure, detailed assessment of CNS and cardiovascular examination. Patients were given stomach wash, body and eye wash, in patients who had exposure via uncovered skin and / or eyes. This was followed by 1 gm bolus dose of PAM (Pralidoxime) by slow IV injection. Thereafter, a bolus dose of atropine (2 mg iv push) was administered after correcting cyanosis, till signs of atropinisation (clear lungs, dry axilla, dry mucosa, heart rate ≥ 120 bpm, and dilated pupils). All patients were monitored closely and continuously and all clinical signs assessed 12^{th} hourly till complete recovery and were followed till discharge from hospital.

Ventilator support was provided if patient had persistent cyanosis, hypoventilation, apnoea, persistent tachypnoea or deranged ABG ($PaO_2 < 60$ mm Hg, $PaCO_2 > 50$ mm Hg, pH < 7.2)

All enrolled patients were underwent biochemical investigations such as Blood routine: Hb%, TC, DC, ESR; blood sugar, blood urea, serum Creatinine, Urine: albumin, sugar, microscopy, ECG, Serum pseudo-cholinesterase levels, Serum electrolytes, ABG (arterial blood gas) analysis, Liver function tests were performed at the time of admission and whenever required. The Random blood sugar (RBS) on the day of admission was measured. Random plasma glucose >140mg/dl was taken as hyperglycemia [6, 7].

Statistical Analysis

The data obtained were entered in a Microsoft Excel sheet, and statistical analysis was performed using statistical package for the social sciences (SPSS 21.0 Version). Results were presented as Mean (Median) ±SD, counts and percentages and diagrams. Association of Categorical variables was found using Chi square test. $p<0.05$ will be considered statistically significant. All statistical tests will be Performed two tailed.

Results

100 patients of acute OP compound poisoning were studied. In this study, maximum incidence of poisoning was among 20-29 years of age group (39%). Female were the more common victims in the present study.

32 patients were presented with hyperglycemia out of which 23 patients developed at least one complication, while only 15 out of 63 patients who presented with normoglycemia developed complications. 16 of 32 hyperglycemic patients needed ventilator support. 15.6% mortality was seen in those who had hyperglycemia at the time of admission and overall mortality 56% was seen with hyperglycemic OP poisoning patients.

Table 1: Demographic parameters of studied acute OP compound poisoning patients. (n=100)

Demographic Parameters		Number of patients	Percentage
Age distribution (Years)	18 - 20	17	17.0%
	20 - 29	39	39.0%
	30 - 39	28	28.0%
	40 - 49	10	10.0%
	>50	6	6.0%
Gender	Female	59	59.0%
	Male	41	41.0%
Occupation	Agriculture	34	34.0%
	House wife	37	37.0%
	Student	19	19.0%
	Self Employed	10	10.0%
Marital status	Married	77	77.0%
	Unmarried	23	

Table 2: RBS (Random Blood Sugar) values of OP compound Poisoning patients at the time of admission (n=100)

Glycemic status	No. of patients	Percentage
Hypoglycemia	5	05.0%
Normoglycemia	63	63.0%
Hyperglycemia	32	32.0%
Total	100	100.0%

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Table 3: Association between RBS and Complications in OP compound Poisoning patients (n=100)

Glycemic status	Complications			Chi square test	"p- value"
	No	Yes	Total		
Hypoglycaemia	1	4	5	X^2=23.246	"p=0.001"*
Percentage	1.7%	9.5%	5.0%		
Normoglycemia	48	15	63		
Percentage	82.8%	35.7%	63.0%		
Hyperglycemia	9	23	32		
Percentage	15.5%	54.8%	32.0%		
Total	58	42	100		
*Highly significant					

Table 4: Association between RBS and Ventilator support in OP compound Poisoning patients (N=100)

Glycemic Status	Ventilator support			Chi square test	"p- value"
	No	Yes	Total		
Hypoglycaemia	2	3	5	X^2=21.981	"p=0.001"*
%	2.7%	12.0%	5.0%		
Normoglycemia	57	6	63		
%	76.0%	24.0%	63.0%		
Hyperglycemia	16	16	32		
%	21.3%	64.0%	32.0%		
Total	75	25	100		
*Highly significant					

Table 5: Random Blood Sugar level at the time of admission and its correlation with patients outcome (n=100)

Glycemic effect	No. of patients	Expired	Recovered
Hypoglycemia	5	2 (22.0%)	3 (3.3%)
Normoglycemia	63	2 (22.0%)	61 (67.0%)
Hyperglycemia	32	5 (56.0%)	27 (29.8%)
Total	100	9 (100.0%)	91 (100.0%)

Discussion

Organophosphorus poisoning has been diagnosed as a prime problem in developing countries like India because of its predominant use in pest control and for crop protection. They have been imported in India since 1951, but no one knew the fatality of these compounds, till the Kerala food poisoning tragedy in 1958.This tragedy lead to the death of more than 100 people due to inadvertent stocking of food stuff and folidol packages in the same container leading to contamination of food stuff [8].The diagnosis of OP poisoning is mainly based on the history of ingestion or exposure, clinical features, low serum cholinesterase levels and therapeutic response to atropine [9, 10]. OP poisoning is treated by gastric lavage, antidotes, an anticholinergic, an oxime-pralidoxime and respiratory support [11].

Hyperglycaemia and glycosuria have been reported in OP poisoning though ketonuria is absent.[11] In 1971, Namba *et al*. reported that in severe OP poisoning transient hyperglycemia and glycosuria occurs which was again proven in 2013 in a study by sudhir *et al*. [12].

Though the changes in blood glucose and amylase are well known in OP compound poisoning, the mechanism is not clear. Earlier it was postulated that acetylcholine accumulation at sympathetic ganglia sites leads to "Pheochromocytoma-like" increases in catecholamine secretion with subsequent development of hyperglycemia, glycosuria and metabolic acidosis in severe cases [13]. Other probable mechanisms explained are, inhibition of cholinesterase allowing accumulation of acetylcholine at cholinergic sites resulting in continuous stimulation of cholinergic fibers leading to marked catecholamine excess which can lead to hyperglycemia [14], occurrence of pancreatitis may be responsible as hyperamylasemia often accompanies hyperglycemia, Persistent cholinergic stimulation on nicotinic receptors could be causing changes in pituitary hormones and can contribute to hyperglycaemia and as a result of increased breakdown of hepatic glycogen [15].

In this study, maximum incidence of poisoning was among 20-29 years of age group (39%) which is consistent with the studies done by Shankar PS *et al*. [16] and Lograj M *et al*. [17].

Female were the more common victims in the present study in contrast to male predominance in findings of Goel *et al*. [18], Vikram P *et al*. [19], Shobha TR *et al*. [20] but consistent with findings by Karki P *et al*. [21] and Panda S *et al*. [7].

Hyperglycemia was detected in 32% of the patients in this study which is comparable to findings in the study by Shobha *et al*. [20], Sungur M *et al*. [22], Ravindra K.R *et al*. [23].

In this study it was observed that on complications associated with on admission hyperglycemia (RBS >160 mg/dl) was 54.8% as compared to 35.7% in normoglycemics. This is highly significant (p=0.001). In addition hyperglycemia also showed a significant association with need for ventilator support

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(p=0.001). Out of 25 patients 64% of patients with hyperglycemia were found to need ventilator support as compared to 24% with normoglycemia.
Out of 9 patients who expired, 5 patients had hyperglycaemia at the time of admission out of which 3 of them had RBS > 200 mg/dl. Mortality rate of 15.6% was observed in patients presented with hyperglycemia which was significant ($p<0.05$).
The above results indicate RBS value is a good marker for predicting the mortality and also for assessing the need for ventilator support. All the above observations suggest that admission hyperglycemia is a prognostic indicator in OP compound poisoning.

Conclusion
Hyperglycemia can occur in moderate to severe organophosphorous poisoning. Random blood glucose level at the time of admission correlates with complications, requirement of ventilator support and prognosis.
In conclusion admission RBS >160 mg/dl can be considered as a prognostic indicator in predicting the morbidity and mortality of organophosphorous poisoning.

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