

Glycemic Status of Acute Organophosphorus Poisoning Patients at Presentation and its Correlation with the Severity of Poisoning in a Tertiary Care Centre of Tripura

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Abstract

Introduction: Organophosphorus (OP) poisoning is a burning health issue in a agriculture dependent country like India. Its exposure is a serious threat that may affect human and animal health because of their various toxicities. Glycemic status of the patient who has consumed organophosphorus compound may help us to predict the severity and prognosis in such patients.

Aims and Objectives:

1. To check glycemic status by random blood glucose level at time of admission in acute organophosphorus poisoning
2. To correlate the blood glucose level with severity and prognosis.

Method: this was a prospective analytical study, done at Dept of medicine, AGMC & GBPH from July 2022 to June 2023 with 100 patients.

Results: Patients were categorized into hypoglycemic (35%), euglycemic (53%) hyperglycemic (12%) & the outcome in terms of mortality was 57.14%, 5.66% and 41.67% in the respective groups. Further, random blood sugar was compared with POP and PSS to look for statistically significant association between the extremes of glycemic status and higher grades of clinical severity scores using Chi-square test. The established Peradeniya Organophosphorus Poisoning Scale (POP) and Poisoning Severity Scale (PSS) revealed the study to be statistically significant (p value= 0.001) indicating both the extremes of glycemic status are associated with high clinical severity and poorer outcomes.

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Introduction

Organophosphorus insecticides (OP) are one of the most extensively used classes of insecticides. Huge scientific body of evidence suggests that OP exposure is a major toxicological threat that may affect human and animal health because of their various toxicities such as neurotoxicity, endocrine toxicity, immunotoxicity, reproductive toxicity, genotoxicity and ability to induce organ damage, alterations in cellular oxidative balance and disrupt glucose homeostasis.

Mortality among organophosphorus (OP) poisoning patients despite advancements in its management is of concern. Of the various contributing factors, extremes and fluctuation in the glycemic status is a well-documented parameter affecting the outcomes in critical illness although studies with respect to

OP poisoning are deficient. All varieties of glycemic changes from hypoglycemia to hyperglycemia and ketoacidosis in OP poisoning along with other toxicological effects are reported, studies corroborating these findings are only few.[1]

Organophosphorus (OP) poisoning, in addition to its cholinergic manifestations shows metabolic derangements leading to hyperglycemia. Apart from inhibiting acetylcholinesterase it also induces oxidative stress to exhibit this manifestation.[2] Organophosphates (OP) are a diverse group of insecticides used for pest control. Due to easy availability of these compounds over the counter, organophosphate poisoning continues to be a major cause of deliberate self-harm. Although

choline esterase inhibition plays a key role in OP poisoning, other metabolic factors like dysglycemia contribute to the severity of poisoning.[3]

This study was conducted to evaluate the glycemic status at presentation in acute OP poisoning and its relation with severity and prognosis.

Methods

This was a prospective analytical study which was done at Dept of Medicine, AGMC & GBP Hospital, Agartala, over a period of 1 year from July 2022 to June 2023. Sample size of the study was 100. Those 100 Patients were taken from Medicine ward who were admitted with acute organophosphorus poisoning satisfying inclusion and exclusion criteria. A history including age, sex, type of compound consumed and initiation of treatment was taken followed by examination. The blood sugar level at the time of presentation was checked and the patients were categorised into hypoglycemic (less than 70 mg/dl), euglycemic (70

mg/dl to 200 mg/dl) and hyperglycemic (more than 200 mg/dl).

Inclusion Criteria

1. Patients who are more than 18 years of age.
2. Patients with alleged history of Organophosphorus poisoning.
3. Patients and parties who have consented for the study.

Exclusion Criteria

1. Patients who are less than 18 years.
2. Persons with history of diabetes mellitus.
3. Patients who had taken alcohol or mixed poison which can alter their blood glucose level.
4. Patients who were treated elsewhere initially and referred to our centre.

Severity of the poisoning was graded by 2 different scales namely Peradeniya Organophosphorus Scale (POP) and Poisoning Severity Scale(PSS).

Table 1: Peradeniya Organophosphorus Poisoning (POP) Scale [4]

Parameter	Criteria	Score
Pupil size	>=2mm	0
	<2mm	1
	Pinpoint	2
Respiratory rate	<20 cpm	0
	>=20cpm	1
	>=20 cpm with central cyanosis	2
Heart rate	>60 bpm	0
	41-60 bpm	1
	<40 bpm	2
Fasciculation	None	0
	Present, generalized/continuous.	1
	Both generalized and continuous	2
Level of consciousness	Conscious and rational	0
	Impaired response to verbal command	1
	No response to verbal command	2
Seizures	Absent	0
	Present	1

0-3=mild, 4-7=moderate, 8-11=severe

Table 2: Poison severity scale (PSS) [5]

System	0	1	2	3
Gastrointestinal system				
Respiratory system				
Nervous system				
CVS				
Metabolic derangement				
Liver				
Kidney				
Blood				
Muscular system				
Skin/local				
Eye				

0-3=mild, 4-7=moderate, 8-11=severe

The glycaemic status of the patients were correlated with the severity and clinical outcome using descriptive statistics, association and test of significance.

Results

On analysis of these 100 patients, it showed male preponderance and most common cause of poisoning was suicidal.

Patients were categorized into hypoglycemics (35%), euglycemics (53%) hyperglycemic (12%) & the outcome in terms of mortality was 57.14%, 5.66% and 41.67% in the respective groups.

Table 3: Glycemic Status of the patient and Mortality

Glycemic status	Number of patients	Expired	Percentage of death
Hypoglycemia (<70 mg/dl)	35	20	57.14%
Normoglycemia (70-200 mg/dl)	53	3	5.66%
Hyperglycemia (>200 mg/dl)	12	5	41.67%

Among 35 hypoglycemic patients, 20 expired; among 53 normoglycemic patients, 3 expired; and among 12 hyperglycemic patients, 5 expired which showed mortality of 57.14%, 5.66% & 41.67% respectively.

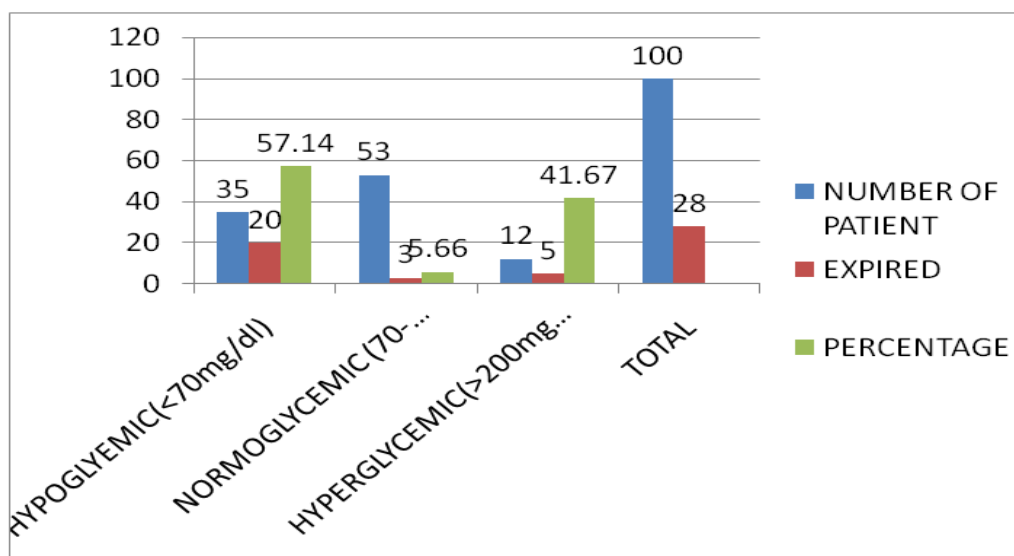


Figure 1: Glycemic status and mortality with percentage of death

This bar diagram showing mortality of OP poisoning patients in hypoglycemic, normoglycemic, hyperglycemic groups.

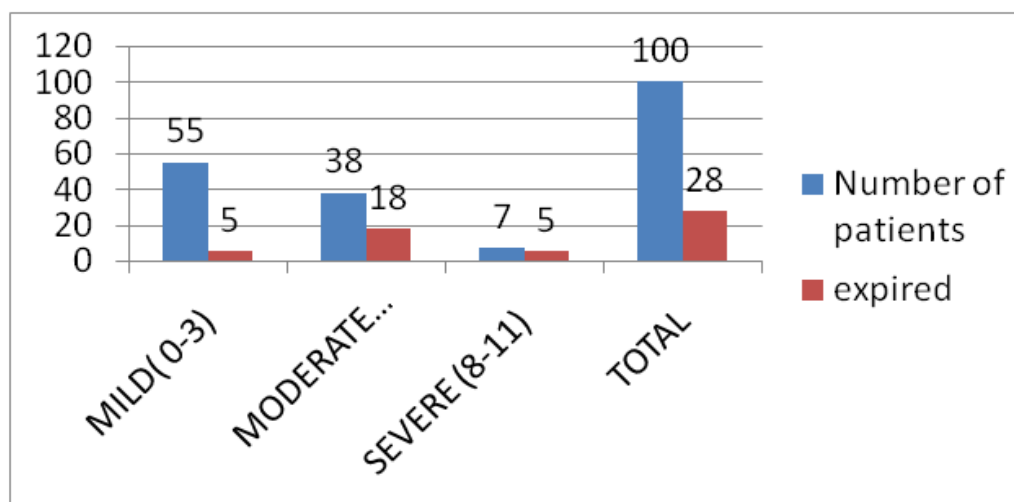


Figure 2: POP Score and Mortality

This bar diagram showing number of expired OP poisoning patients in mild, moderate, severe categories according to POP scale.

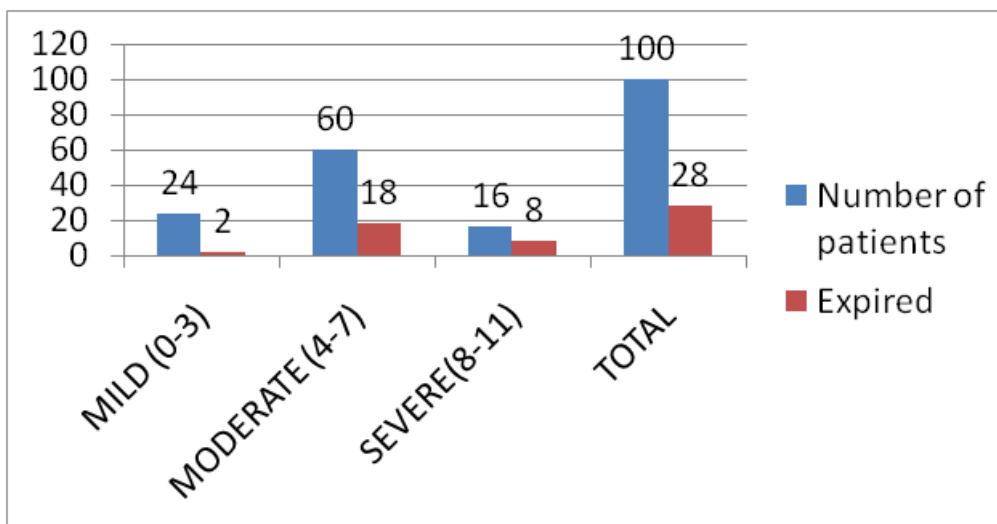


Figure 3: PSS Score and Mortality

This bar diagram showing number of expired OP poisoning patients in mild, moderate, severe categories according to PSS scale.

Table 4: Association of glycemic status (RBG) of patients with POP score

POP	Number	Hypoglycemia (<70 mg/dl)	Normoglycemia (70-200 mg/dl)	Hyperglycemia (>200 mg/dl)
Mild (0-3)	51	15	35	1
Moderate (4-7)	40	15	15	10
Severe (8-11)	9	5	3	1
Total	100	35	53	12

Among patients with mild POP grade, maximum (35 out of 51) were normoglycemic; in contrast with severe POP grade, maximum (5 out of 9) were hypoglycemic.

Table 5: Association of glycemic status (RBG) of patients with PSS score

PSS	Number	Hypoglycemia (<70 mg/dl)	Normoglycemia (70-200 mg/dl)	Hyperglycemia (>200 mg/dl)
Mild (0-3)	24	2	21	1
Moderate (4-7)	60	23	28	9
Severe (8-11)	16	10	4	2
Total	100	35	53	12

Among patients with mild PSS grade, maximum (21 out of 24) were normoglycemic; in contrast with severe grade, maximum were hypoglycemic (10 out of 16).

POP score and PSS score was compared with mortality of the patients.

Further, random blood sugar was compared with POP and PSS to look for statistically significant association between the extremes of glycemic status and higher grades of clinical severity scores using Chi-square test. The established Peradeniya Organophosphorus Poisoning Scale (POP) and Poisoning Severity Scale (PSS) revealed the study to be statistically significant (p value= 0.001) indicating both the extremes of glycemic status are associated with high clinical severity and poorer outcomes.

Discussion

WHO has estimated that a considerable number of people worldwide die from pesticide poisoning

every year. The most common poisoning in India and southeast Asian region is OP poisoning. Due to limited availability of infrastructures and finances in the developing countries all OP patients cannot be managed in the intensive care unit (ICU). It is therefore important that clinical features and other simple, accessible, affordable factors which indicate severity of poisoning and predict the need for ventilatory support should be emphasised. It should be identified at the beginning of admission at emergency room considering the benefit of the patients.

This study showed that the severity of poisoning was of grade 2 or more in both the extremes of glycemic status and majority of the euglycemics had grade 1 poisoning which is in correlation with study by Ali Mohammad Sabzghabee et al. [6]

The mortality in Ali mohammad Sabzghabee et al. [9] was 10.4%, 3.71% and 15% in hypoglycemics, euglycemics and hyperglycemics whereas the overall mortality was higher in our study but keeping in trend with the previous study in the order of decreasing frequency-hypoglycemia (57.14%), hyperglycemia (41.67%) and normoglycemia (5.66%).

This finding shows clear relation of prognosis with extremes of blood sugar and supports the observation of Raghapriya R et al. [1] In that study they found that the extremes of glycemic status at presentation in acute OP poisoning is significantly associated with severity, complication and mortality.

The relation of extremes of glycemic status with severity is also similar with the study done by Sagah et al. [7]

In a resource limited country like India, Glycemic status can be used as cheap, simple, affordable, reliable marker for prognosis of OP poisoning patients. Further work up on the mechanism of glycemic variability in OP poisoning patients and its effect on the clinical outcomes is important as in this study it is showing a significant association.

Early interventions like ventilator support and intensive care can be planned according to the glycemic status of the patients.

Glycemic extremes including both hyperglycemia and hypoglycemia are common in patients with acute OP poisoning and are significantly associated with morbidity and mortality. It can be used as a simple and reliable predictive marker to identify patients in need of intensive monitoring and admission to intensive care unit (ICU).[8]

Although the studies enlightening the mechanistics of glycemic variability in acute OP poisoning are few, the few attributable causes like the factor of stress hormones, Overproduction of proinflammatory mediators, Pancreatic insufficiency and altered liver metabolism due to depletion of enzymes by the poison may play role in metabolism of glucose.[9-12]

Hyperglycemia and fluctuation in the glycemic status are found to be detrimental in critical illness as they raise the overall complications, morbidity and mortality.[13]

Similarly, hypoglycemia is an independent marker of severity and mortality in critical illnesses. The common cause of death categories in patients with critical illness and hypoglycemia are: [14]

1. Neurological.
2. Hypoxic injury.
3. Respiratory involvement.
4. Cardiovascular.

Shortcomings

The study did not include the dose of the ingested poison, the cause for ingestion, comorbid, previous attempts of suicide, history of substance abuse, use of other medication, psychiatric disease history, addictions, socioeconomic status, educational history.

Conclusion

Extremes of glycemic status at presentation in acute Organophosphate poisoning is associated with higher chance of complication and mortality. Random blood glucose can be used as cheap, simple, reliable, affordable marker of prognosis with the OP Severity score like POP and PSS in developing country like India.

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