



ORIGINAL RESEARCH PAPER

General Medicine

ACUTE ORGANOPHOSPHOROUS POISONING: ELECTROLYTE DERANGEMENTS AS A PROGNOSTIC MARKER

KEY WORDS: Hypokalaemia, organophosphorus compound toxicity, and prognosis.

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ABSTRACT

Background: In rural India, one of the most frequent causes of poisoning is organophosphorus compounds (OPCs). Although serum cholinesterase is used to identify OP compound toxicity, it is not an accurate indicator of how the poisoning will progress. This study examines how serum electrolytes are used to determine the prognosis of OP poisoning. **Aim:** To assess the prognostic significance of the serum electrolytes in individuals who consumed organophosphorus compound(OPC). **Materials And Methods:** This research is prospective and cross-sectional. The Siddhartha Medical College and Hospital admitted 70 patients who had consumed OPC, and who were at least eighteen years old. Individuals were selected for the study regardless of the exposure kind or sex. Patients were evaluated clinically using the Peradeniya OPC Poisoning scale, after which patients were grouped according to their severity. During admission, serum electrolytes were estimated. **Results:** Out of 70 patients in the study, 56 (80%) were men and 14 (20%) were women, for a male to female ratio of 4:1. The majority of patients are between the ages of 18 and 30. In this study, monocrotophos was the poison that was most frequently consumed. According to the Peradeniya OP poisoning scale, the majority of patients presented with moderate clinical severity. The most frequent electrolyte imbalance seen in the study was hypokalaemia, which was substantially linked with higher ventilation requirements and mortality in OPC poisoning. **Conclusion:** The study's findings suggest that hypokalaemia plays a substantial role in both the need for a ventilator and the treatment of OPC poisoning. Serum potassium should be routinely measured because it is a reliable and cost-effective marker that can be used to prognosticate and forecast the course of OPC poisoning. In some patients, aggressive hypokalaemia treatment might well save their lives.

INTRODUCTION

Pesticides containing organophosphorus are frequently used in India. Poisoning from OP compounds is more frequent in rural India because to their simple availability and low price. For the past 25 years, OPC have been accountable for almost 50% of the poisoning deaths in India. The acetyl cholinesterase enzyme, which is in charge of acetyl choline metabolism, is inhibited by OPC, which causes acetylcholine to accumulate at nicotinic and muscarinic receptors⁽¹⁾. Depending on where acetylcholine acts, this causes cholinergic symptoms.

Within 30 minutes of ingesting OP chemicals, the patient experiences symptoms. However in lipophilic substances, it could possibly take up to 24 hours to show⁽²⁾. SLUDGE, which stands for salivation, lacrimation, urination, defecation, gastrointestinal distress, and emesis, explains the muscarinic symptom caused by OPC⁽³⁾. The three main nicotinic symptoms are respiratory muscle paralysis, fasciculation, and muscle twitching⁽⁴⁾.

The main cause of death in OP poisoning is respiratory paralysis, which can happen either during the acute cholinergic crisis phase or during the intermediate state, which typically takes place 1-4 days following poison consumption⁽⁵⁾.

The life of patients depends crucially on early detection and immediate ventilatory assistance. There is no evidence-based approach for OP poisoning prognostication. This investigation aims to examine whether serum electrolytes may be utilised to forecast the outcome of OP poisoning. The goal of the current study was to determine the relationship between serum electrolyte levels in OP compound-

consuming patients and the treatment outcome and ventilatory need.

This study, which was done among acute OP poisoning inpatients admitted to Siddhartha Medical College and Hospital between November 2020 and September 2022, is prospective and cross-sectional.

MATERIALS AND METHODS:

Seventy cases of acute OPC poisoning of both sexes, aged eighteen and above, regardless of the method of exposure, were selected and exposed to this investigation after receiving approval from the institutional human ethical committee and informed consent from the patient or their attenders.

Exclusion Criteria:

1. Patients under the age of 18
2. patients with a history of mixed poison consumption.
3. patients who are known to have chronic renal disease
4. People who are taking drugs that can lead to electrolyte imbalance

At the time of admission, patients were clinically categorised based on severity using peradeniya op poisoning scales. All patients had standard examinations such as blood sugar, serum creatinine, blood urea, serum acetyl cholinesterase, and ECG. During their hospitalisation, their serum electrolytes were also measured. The indirect ion selective electrode method was used to measure the serum electrolytes. Atropine, pralidoxime, other supportive measures, and mechanical breathing, if necessary, were used in the course of treatment as directed. The clinical trajectory and results of the patients were evaluated through Software called

Statistical Package of Social Sciences (SPSS) 23 was used to analyse the data.

Table 1 The Peradeniya OPC Poisoning scale

Parameters	Criteria	Score
Pupil size	> 2 mm	0
	< 2 mm	1
	Pin point	2
Respiratory rate	< 20/ min	0
	> 20/ min	1
	> 20/ min with central cyanosis	2
Heart rate	> 60/ min	0
	41 – 60 min	1
	< 40/ min	2
Fasciculation	None	0
	Present, generalized/ continuous	1
	Both generalized and continuous	2
Level of consciousness	Conscious and rationale	0
	Impaired response to verbal commands	1
	No response to verbal commands	2
Seizures	Absent	0
	Present	1

RESULTS

Table 2- Electrolyte Derangement patients presented with severe grade according to Peradeniya OP poisoning scale.

	FREQUENCY	PERCENT
Hyponatremia (<135)	6	8.6
Hypokalaemia (<3.5)	18	25.7
Hypochloraemia (<98)	4	5.7

Out of 70 patients in the study, the frequency of hyponatremia, hypokalaemia and hypochloraemia were 6 (8.6%), 18 (25.7%) and 4 (5.7%) respectively.

Table 3- Association of Potassium Derangement with Ventilator Requirement

			MV		Total	Statistical Inference
			Yes	No		
Potassium Derangement	Yes	Count	15	3	18	P<0.001 Significant
		Percentage	83.3%	16.7%	100.0%	
	No	Count	2	50	52	
		Percentage	3.8%	96.2%	100.0%	
Total	Count	17	53	70		
	Percentage	24.3%	75.7%	100.0%		

Potassium derangement was present in 15 ventilated and 3 non ventilated patients and this difference was statistically significant.

Table 4- Association of Chloride Derangement with Ventilator Requirement

			MV		Total	Statistical Inference
			Yes	No		
Chloride Derangement	Yes	Count	0	4	4	P = 0.243 Not Significant
		Percentage	0.0%	100.0%	100.0%	
	No	Count	17	49	66	
		Percentage	25.8%	74.2%	100.0%	
Total	Count	17	53	70		
	Percentage	24.3%	75.7%	100.0%		

Table 5- Association of Sodium Derangement with Ventilator Requirement

			MV		Total	Statistical Inference
			Yes	No		
Sodium Derangement	Yes	Count	1	5	6	P = 0.649 Not Significant
		Percentage	16.7%	83.3%	100.0%	
	No	Count	16	48	64	
		Percentage	25.0%	75.0%	100.0%	
Total	Count	17	53	70		
	Percentage	24.3%	75.7%	100.0%		

Chloride derangement was observed in 4 non ventilated patients and not present in ventilated patients and this difference was not statistically significant.

Sodium derangement was present in 5 non ventilated and 1 ventilated patients and this difference was not statistically significant.

Table 6 -Association of Potassium Derangement with Outcome

			Outcome		Total	Statistical Inference
			Survived	Death		
Potassium Derangement	Yes	Count	9	9	18	P < 0.001 Significant
		Percentage	50.0%	50.0%	100.0%	
	No	Count	50	2	52	
		Percentage	96.2%	3.8%	100.0%	
Total	Count	59	11	70		
	Percentage	84.3%	15.7%	100.0%		

Potassium derangement was present in 9 expired and 9 survived patients and this difference was statistically significant.

Table 7- Association of Chloride Derangement with Outcome

			Outcome		Total	Statistical Inference
			Survived	Death		
Chloride Derangement	Yes	Count	4	0	4	P = 0.374 Not Significant
		Percentage	100.0%	0.0%	100.0%	
	No	Count	55	11	66	
		Percentage	83.3%	16.7%	100.0%	
Total	Count	59	11	70		
	Percentage	84.3%	15.7%	100.0%		

Chloride derangement was present in 4 survived patients and not present in expired patients and this difference was not statistically significant

Table 8- Association of Sodium Derangement with Outcome

			Outcome		Total	Statistical Inference
			Survived	Death		
Sodium Derangement	Yes	Count	5	1	6	P = 0.947 Not Significant
		Percentage	83.3%	16.7%	100.0%	
	No	Count	54	10	64	
		Percentage	84.4%	15.6%	100.0%	
Total	Count	59	11	70		
	Percentage	84.3%	15.7%	100.0%		

The difference between the presence of sodium derangement in 5 patients who survived and 1 patient who died was not statistically significant.

There was statistically significant correlation between hypokalaemia and results like the need for a ventilator and death. Other electrolyte derangements (sodium and chloride) were not associated with outcomes in a statistically meaningful way.

Table 9- Association of Potassium Derangement with Pop Scoring

			Pop Scoring			Total	Statistical Inference
			Mild	Moderate	Severe		
Potassium Derangement	Yes	Count	1	4	13	18	P < 0.001 Significant
		Percentage	5.6%	22.2%	72.2%	100.0%	
	No	Count	26	24	2	52	
		Percentage	50.0%	46.2%	3.8%	100.0%	
Total	Count	27	28	15	70		
	Percentage	38.6%	40.0%	21.4%	100.0%		

Thirteen (72.2%) of the 18 hypokalaemia patients are

presented with poisoning of a severe grade. 1 patient (5.6%) had low severity, while the rest 4 patients (22.2%) had moderate severity.

This variation was statistically significant.

DISCUSSION

In this study, patients with OPC poisoning have a male to female ratio of 4:1. The ratio was also found to be 3.2:1 in the study by Tanveer Hassan Banday et al., indicating a trend towards an increase in the incidence of OP poisoning among men⁽⁶⁾. Similar findings were found in the research of Safdar et al. and Aziza et al^(7,9). In this investigation, hypokalemia, which was present in 25.7% of all patients, was the most prevalent electrolyte imbalance found. Nevertheless, Tanveer Hassan Banday et al. and Dandekar et al. revealed in their research that the incidence of hypokalaemia was 15.03% and 63.3%, respectively^(6,9). In this study, the prevalence of hyponatremia and hypochloreaemia was 8.6% and 5.7%, respectively. In this study, severe grades (peradeniya OP poisoning scale) of poisoning cases (72.2%) were more likely to have hypokalemia, followed by moderate (22.2%) and mild (5.6%) instances. In comparison to normokalaemia patients, 83.3% of hypokalemia patients were found to require ventilator assistance, which is also determined to be statistically significant. Studies by Mahadeshwara Prasad et al. and Banday et al. reported similar results^(6,10). Mortality was observed in 50% of instances with hypokalemia, compared to 3.8% in patients with normokalemia. This distinction was significant statistically. Studies by Lyzhnikov EA et al. and Mahadeshwara Prasad et al. reported similar observations^(10,11). OPC may cause hypokalemia through a variety of ways, including severe vomiting, diarrhoea, Hypomagnesemia and sympathetic hyperactivity are associated with ganglionic stimulation⁽¹²⁾.

Muscular deterioration and respiratory discomfort are the most frequently postulated pathways for how OPC exposure results in mortality. Organophosphate problems can also be made worse by hypokalaemia, which raises the risk of death from OP poisoning. Hence, serum potassium levels should be checked in every OPC poisoning episode, and any hypokalaemia that is found needs to be aggressively treated. Another possibility for a measure of OP poisoning severity is hypokalemia.

CONCLUSION:

This study's findings led to the conclusion that hypokalemia greatly affects these patients' need for a ventilator as well as their prognosis. Serum potassium should be routinely measured because it can be a reliable and affordable diagnostic that aids in prognostication and outcome prediction in OPC poisoning.

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