

The Electrocardiographic Changes in Organophosphorus Poisoning Patients: Our Experience in Tertiary Care Hospital.

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Abstract:

Organophosphorus poisoning is not uncommon in India, especially the central and southern part of India. Aims and objective of the study was to find out the ECG changes at the casualty level as soon as the patient arrives. **Materials and methodology:** In this prospective observational study the patients with history suggestive organophosphorus poisoning underwent ECG evaluation as a part of institutional protocol. The ECG changes were recorded accordingly. **Results:** A total of 89 patients reported to the casualty with a history of organophosphorus poisoning, out of which 48 patients (54%) were male. The majority belonged to the farmer community, and accidental exposure was common. The ECG showed sinus tachycardia in 26 (29%), followed by ST-T changes in 11 (12%), QTc prolongation in 16 (18%), and sinus bradycardia in 6 (7%). The remaining patients (34%) had a normal ECG. **Conclusion:** Organophosphate poisoning can lead to notable electrocardiographic abnormalities, including sinus tachycardia, nonspecific ST-T wave changes, and prolonged QTc intervals. As these changes lead to life-threatening arrhythmias and cardiac complications, continuous ECG monitoring is essential.

Key words: Arrhythmias, Cardiac, Electrocardiography, Organophosphate Poisoning, QT Interval, Sinus Tachycardia.

Introduction:

Organophosphorus (OP) poisoning is a major public health issue, especially in developing nations, due to agricultural pesticide exposure and suicidal intake, resulting in a high rate of poisoning episodes. OP agents cause their toxicity by inhibiting acetylcholinesterase, causing overloading of acetylcholine at the synapses of nerves.^[1,2] This is followed by a cholinergic crisis, exhibiting neurological, respiratory, gastrointestinal, and cardiovascular side effects. Of these, cardiovascular effects are most concerning because they may result in fatal arrhythmias and cardiac instability.^[3]

ECG abnormalities are commonly seen in patients with OP poisoning, representing the effect of excessive cholinergic activity on the autonomic control of the heart. ST-T wave changes, sinus tachycardia, prolongation of the QTc interval, conduction abnormalities, and ventricular arrhythmias are some of the ECG abnormalities.^[4] These changes can make patients susceptible to lethal cardiac complications, necessitating early detection and ongoing ECG monitoring for timely intervention. The extent and nature of ECG changes can be variable based on the severity of poisoning, associated comorbidities, and the timeliness of medical intervention.^[5]

In spite of the widely reported toxicities of OP poisoning, regional data on the characteristic ECG findings in poisoned patients are scarce. The interpretation of these alterations can assist with risk stratification, direct clinical management, and enhance patient outcome. In the present study, we share our experience of ECG abnormality assessment in patients with OP poisoning who were hospitalized in a tertiary care center.^[6] Through the pattern analysis of the ECG, we seek to emphasize the role of cardiac monitoring in OP poisoning and reaffirm the importance of early detection of arrhythmias to avoid inappropriate cardiovascular events.^[7-9] The study aimed to know the electrophysiological manifestations of OP poisoning.

Materials and Methodology:

After obtaining institutional ethical clearance this study was conducted for a period of six months, from 1st January 2024 till 30th June 2024. The patients reaching with the confirmed history of organophosphorus poisoning were included. The patients of either gender aged above 18 years and willing to provide the consent by the patient himself or herself or the patient's care taker were included in the study. Patient having OP poisoning with cardiac disorders, comorbid illness like diabetes, hypertension, stroke, alcoholic, on beta blockers or sympathomimetics were excluded.

Results:

A total of 89 patients reported to the casualty with a history of organophosphorus poisoning, out of which 48 patients (54%) were male. The majority belonged to the farmer community, and accidental exposure was common. The ECG showed sinus tachycardia in 26 (29%), followed by ST-T changes in 11 (12%), QTc prolongation in 16 (18%), and sinus bradycardia in 6 (7%). The remaining patients (34%) had a normal ECG as shown in Fig 1.

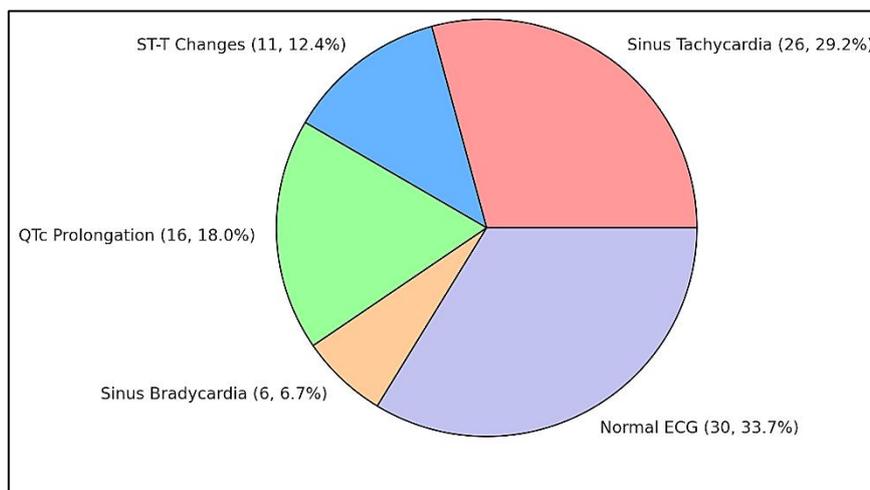


Fig 1: ECG findings in OP poisoning patients

Out of 89 patients (100%), 52 (58%) were exposed to the OP compound during farming, which they claimed as accidental. Ten (11%) patients attempted suicide by consuming OP compounds readily available in their homes. The remaining 27 (30%) did not disclose the reason for their exposure. The quantity of consumption varied between 5 ml and 500 ml. Among the 89 patients, 9 (10%) had a Glasgow Coma Scale (GCS) score of less than 7, indicating the need

for emergency intubation and mechanical ventilation. A total of 36 (40%) patients had a GCS score between 11-12, while the remaining 44 (49%) patients had a GCS of 14-15 at the time of admission. The total number of patients who died during hospitalization was 5 (6%).

Based on the chemical content, 43 (48%) patients consumed chlorpyrifos, 33 (37%) consumed malathion, 6 (7%) consumed an unspecified OP compound, and 7 (8%) patients were exposed to a combination of chlorpyrifos and cypermethrin.

Discussion:

Organophosphorus (OP) poisoning remains a significant public health concern, particularly in agricultural regions of developing countries like India. According to the World Health Organization (WHO), approximately 3 million cases of OP poisoning occur globally each year, resulting in around 300,000 deaths.^[10-12] In India, pesticides, predominantly OP compounds, account for a substantial proportion of poisoning cases, with incidence rates ranging from 10.3% to 43.8%.^[13-17]

In our study of 89 patients, 54% were male, aligning with findings from other Indian studies where males constituted a higher percentage of OP poisoning cases. For instance, a study reported that 69% of OP poisoning patients were male, with a male-to-female ratio of 2.22. The predominance of males may be attributed to their greater involvement in farming activities and increased access to pesticides. The majority of our patients (58%) reported accidental exposure during farming activities, while 11% were cases of intentional self-harm. This contrasts with some studies indicating higher rates of suicidal intent.^[18] For example, a study observed that 67.4% of OP poisoning cases were due to suicide attempts. The lower percentage of suicidal cases in our study might reflect regional differences in pesticide usage patterns and accessibility.^[19]

Electrocardiographic (ECG) abnormalities are common in OP poisoning due to the compounds' cardiotoxic effects. In our study, sinus tachycardia was observed in 29% of patients, ST-T changes in 12%, QTc prolongation in 18%, and sinus bradycardia in 7%. These findings are consistent with previous research. For instance, a study reported sinus tachycardia in 31.8% of cases and ST-T changes in 17.6%. The presence of such ECG abnormalities necessitates vigilant cardiac monitoring to prevent potentially fatal arrhythmias.^[20]

The Glasgow Coma Scale (GCS) scores at admission are critical indicators of OP poisoning severity. In our cohort, 10% of patients had a GCS score below 7, requiring emergency intubation and mechanical ventilation. This aligns with findings from other studies where lower GCS scores correlated with increased morbidity and mortality. For example, a study reported that patients with GCS scores below 7 had a higher likelihood of requiring intensive care interventions.^[21]

The case fatality rate in our study was 6%, which is within the range reported in other Indian studies. For instance, a study observed a mortality rate of 5.78% among OP poisoning patients, with respiratory failure being the primary cause of death. This underscores the importance of prompt and effective respiratory support in the management of severe OP poisoning cases.^[22]

Regarding the specific OP compounds involved, chlorpyrifos was the most commonly implicated (48%), followed by malathion (37%). This distribution reflects the prevalent use of these pesticides in our region. Similar trends have been observed in other studies, highlighting the need for stringent regulations and safer alternatives to these high-risk pesticides.

Limitation of the study: The forensic evaluation of the report was not considered in this study. The parameters collected based on the history and authors cannot guarantee that it is full proof correct information provided by the patient or the relatives. A large multicentric study may help in the studying various parameters in OP poisoning patients. We did not record the time interval between consumption of OP compound and the arrival of the patient to emergency care unit.

Conclusion:

Poisoning due to organophosphorus (OP) compounds can lead to notable electrocardiographic (ECG) abnormalities, including sinus tachycardia, nonspecific ST-T wave changes, and prolonged QTc intervals. Continuous ECG monitoring is crucial for patients exposed to OP compounds, alongside timely and appropriate medical intervention to prevent life-threatening cardiac events. The government authorities and non-government organization should take the responsibility in educating the population. There should be a stringent rule for the access of insecticides. Possibility of drone-based spraying of insecticide should be promoted by the government to reduce the accidental exposure of such chemicals.

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Source of funding: Nil

Conflict of interest: Nil



Submitted: 09/03/2025

Revised: 19/03/2025

Accepted: 29/04/2025

Published: 30/06/2025

Cite this article:

Dr Kirtish Acharya, Lt Col (Dr)Raj Narayan mandal. The Electrocardiographic Changes in Organophosphorus Poisoning Patients: Our Experience in Tertiary Care Hospital. Jour Med Dent Fron 2025;2(1):77 - 82