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CKMB Role as Cardiac Toxicity Prognostic Marker in Acute Organophosphorus Poisoning

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Abstract

Introduction: Acute Organ phosphorous compound (OPC) poisoning is an important indication for emergency admission in most hospitals throughout India. Cardiac complications that often accompany poisoning with these compounds may be serious and are often fatal. These complications are preventable, if they are recognized early and treated adequately. Objectives of the study is to assess the cardiac toxicity in Organ phosphorous compound poisoning and to associate electrocardiogram changes and CKMB levels among Organ phosphorous compound poisoning patients. *Materials and methods:* A hospital based observational study among 37 adult patients who presented to emergency department of tertiary care centre with Organ phosphorous Compound Poisoning. Informed consent and institutional ethical clearance was obtained before study. Electrocardiography (ECG) was done, plasma Pseudocholiesterase levels and CKMB levels were measured. Outcome measures considered were recovery or death. Post mortem Histopathological findings of cardia were recorded. *Results:* In the study 37 adult patients with OP poisoning were included. Mortality rate was 8.1% (3). Significant association was observed between outcome and CKMB levels. All the patients who mortality had significantly higher levels of CKMB compared to others. There was also significant association between outcome and ECG changes. Out of 3 patients who died 2 had abnormal ECG changes. All the patients who died had consumed chlorpyriphos compound. Histopathological findings of heart in all the subjects who had mortality showed myocardial interstitial edema, vascular congestion and Patchy interstitial inflammation and one showed patchy myocarditis with other findings. *Conclusion:* Patients with organophorphorus compound poisoning should beevaluated for electrocardiogram along with CKMB which helps in predicting cardiac toxicity and can be considered as a surrogate prognostic marker.

Keywords: Organ Phosphorus Compound (OPC) Poisoning; Cardiac Toxicity; Electrocardiographical Abnormalities; CKMB.

Introduction

India is a predominantly agrarian country with about 60-80% of rural population. Pesticides are routinely used for advanced farming and they are readily available over the counter. Therefore, a pesticide is an easy access source for the suicidal purpose [1]. Acute Organ phosphorous compound (OPC) poisoning is an important indication for emergency admission in most hospitals throughout India [2]. Cardiac complications that often accompany poisoning with these compounds may be serious and are often fatal. These complications are preventable, if they are recognized early and treated adequately. The common electrocardiogram (ECG) findings of OPC poisoning consist of a "characteristic" diffuse ST-segment depression,T wave inversion and QTc-prolongation, seen usually in severe poisonings. These electrocardiographic changes will be present in patients as early as 6 hours and last for up to 6 days after admission [3]. OPC poisoning may be associated with a serious and often fatal Q-T interval prolongation with malignant ventricular arrhyth-mias of the "torsades de pointes" type. This insidious complication may lead to delayed recovery or may cause sudden death after the patients appears to be well on the way to recovery [4]. As there

is limited literature on cardio toxicity in OPC poisoning, many health care professions may not be fully aware of this complications. Hence we need to study cardio toxicity in patients presented with acute OPC poisoning.This helps in early recognition and preventing patients from life threatening arrhythmias.

Objectives

- To assess the cardiac toxicity in Organ phosphorous compoundpoisoning.
- To associateelectrocardiogram changes and CKMB levels among Organ phosphorous compoundpoisoning patients.

Materials and Methods

Ahospital based observationalstudy was doneamong 37 adult patients who presented to emergency department of tertiary care centre with Organ phosphorous Compound Poisoning, after obtaining informed consent and institutional ethical clearance. The diagnosis was based on the definite history of OP ingestion and clinical features. Patients with past history of cardiac diseases like ischemic heart disease, valvular heart diseases and chronic exposure to OPC and poisoning with multiple poisons were excluded. The age, sex, cause of ingestion, compound involved, duration of presentation after the ingestion of OPC poison, need for assisted ventilation, cardiac manifestations were recorded. Chest radiographs and estimation of serum electrolytes, plasma Pseudocholiesterase levels and CK-MB levels by kinetic assay in an auto analyzer were done on admission and whenever required. Pulse rate, blood pressure and ECG were recorded at admission and once daily, during their stay in the hospital. ECG analysis included the rate, rhythm, ST/T abnormalities, conduction defects and measurement of P-R and Q-T_c intervals. Cardiac symptoms and signs if any, along with ECG and cardiac monitoring were studied in detail and managed accordingly. Patients who developed respiratory distress and intermediate syndrome were managed in the intensive care unit with help of mechanical ventilators. Outcome measures consid-ered were recovery or death. Post mortem Histopa-thological findings of cardia were recorded.

Statistical Analysis

Data was entered in to Microsoft excel after coding and was analyzed using EPI info 7 version software. Frequencies, proportions were computed and Chisquare test and Fischer exact tests were the test of significance for qualitative data, Mean and standard deviation were computed for qualitative data and p value <0.05 was considered statistically significant.

Results

The age of the patients ranged from 18 to 56 years. The mean age was 29.32±10.94 years. Majority 24 (65%) of the patients were in the 20 to 30 years age group. There were 27 (73%) males and 10 (27%) females. The male to female ratio was 2.7:1. Out of 37 patients 12 (32%) were illiterate and 25 (68%) were literates. Poisoning in 34 (92%) cases was suicidal and 3 (8%) were due to occupational exposure, homicidal and accidental causes. Among suicidal cases 14 (41%) were due to conflicts with parents, 12 (35%) due to conflicts with spouse, 3 (9%) were due to love affair problems, 3 (9%) due to financial problems and 2(6%) due to miscellaneous causes. (Table 1). Four (11%) patients had a history of previous suicidal attempts. 29 (78%) of the patients presented within 6 hours, 2(5%) in 7-12 hours and 6 (16%) within 24 hours. The most commonly consumed organophorphorus compound was chlorpyriphos among by 23 (62.2%) patients.

Table 1: Sociodemographic profile of subjects.

		Frequencies (n=37)	Percentage (%)
Age	<20 yrs	6	16
	20 to 30 yrs	24	65
	>30yrs	7	19
Sex	Males	27	73
	Females	10	27
Education	Illiterates	12	32
	Literates	25	68
Type of poisoning	Suicide	34	92%
	Others (Homicidal, accidental causes)	3	8%

Table 2: Association between outcome, CKMB and ECG changes among the subjects.

		Outcome		Total	×²p value
		Death (n=3)	Recovered (n=34)		
CKMB	< 25	0	12	12	7.717, df=1,0.021**
	25 to 50	0	14	14	
	>50	3	8	11	
ECG	LBBB	0	1	1	11.799, df=3,0.008**
	SINUS TACHYCARDIA	1	12	13	
	VPC	1	0	1	
	Normal	1	21	22	

LBBB – Left bundle branch block, VPC- Ventricular Premature Contractions.

Table 3: Histopathological findings of the heartamong subjects who had mortality.

Sl.No.	Myocardial interstitial edema	Vascular congestion	Patchy interstitial inflammation	Patchy myocarditis
1	Present	Present	Present	Absent
2	Present	Present	Present	Present
3	Present	Present	Present	Absent

In the study mortality rate was 8.1% (n=3) and 91.9% (n=34) of patients recovered. It was observed that there was significant association between outcome and CKMB levels. All the patients who died had a significant higher levels of CKMB compared to others. There was a significant association between outcome and ECG changes. Out of 3 patients who died 2 had abnormal ECG changes. All the patients who died had consumed chlorpyriphos compound (Table 2).

Histopathological findings of heart in all the 3 subjects who had mortality showed myocardial interstitial edema, vascular congestion and Patchy interstitial inflammation and one showed patchy myocarditis with other findings (Table 3).

Discussion

The mechanism by which organophosphates and carbamates induce cardiotoxicity is still uncertain. Ludomirsky et al. [4] described three phases of cardiac toxicity after organophosphate poisoning: Phase 1, is a brief period of increased sympathetic tone; Phase 2, is a prolonged period of parasympathetic activity; and Phase 3, Q-T prolongation is followed by torsade de pointes ventricular tachycardia, and then ventricular fibrillation. The cardiac toxicity associated with organophosphate and carbamate poisoning is caused by more than one mechanism.Possible mechanisms postulated are sympathetic and parasympathetic over-activity, hypoxemia, acidosis, electrolyte derangements and a direct toxic effect of the compounds and atropine itself on the myocardium.

Electrocardiography in Acute Opc Poisoning

Hypertension and sinus tachycardia, are nicotinic effects, while hypotension and sinus bradycardia are cholinergic manifestations [8]. Although bradycardia is thought to dominate in the early cholinergic phase of the poisoning, sinus tachycardia was a more frequent finding in our study. The main cardiac rhythm abnormality seen in our study was sinus tachycardia (n=13; 35.13 %) out of which 1 (8%) of them had mortality. Other ECG changes seen are Ventricular Premature Complex (VPC) (n=1; 3%), left bundle branch block (LBBB)(n=1; 3%). Out of 3 patients who died 2 had abnormal ECG changes. Hence abnormal ECG changes may predict cardio toxicity and poor patient outcome. Sinus tachycardia is an indirect evidence of nicotinic effect of the poison, this effect is also the cause of respiratory failure in OPC poisoning,hence may be the poor prognosis indicator.

CKMB in OPC Poisoning

In the study it was observed that CKMB is associated with cardio toxicity. 11 (30%) subjects out of 37 had gross increase in CKMB and among them 3 subjects (30%) died. As per a study by Saadeh et al. cardiac complications developed in 31 (67%) patients. These were pulmonary edema 20(43%), cardiac arrhythmias 11(24%), electrocardiographic abnormalities including prolonged QTc interval 67%, ST-T changes 41%, and conduction defects 9%. Sinus tachycardia occurred in 35% patients and sinus bradycardia in 28%. Hypertension

developed in 22% of patients and hypotension in 17% [9]. A study conducted at PGI Chandigarh by Anand S et al. showed patchy myocardial involvement which could be result of direct cardiac toxicity was one of factors responsible for serious cardiac complications. On histopathology myocardial interstitial edema, vascular congestion, patchy interstitial inflammation, patchy myocarditis and mural thrombus was found postmortem. In the present study out of 3 postmortem Histopathological examination of cardia of the expired patients, one subject showed patchy myocarditis, and all 3 had myocardial interstitial edema, vascular congestion and Patchy interstitial inflammation.

Conclusion

Most of cardiac complications occur during the first few hours after exposure to OPC poison. Cardiac complications associated with organophorphorus compound poisoning are not fully appreciated by many physicians. Once the condition is recognized, the patient should be immediately transferred to an intensive or coronary care unit where appropriate monitoring and resuscitative facilities are available. Need for early recognition of cardiotoxicity,intensive supportive treatment, meticulous respiratory care, and administration of atropine and PAM in adequate doses very early in the course of the illness are the keys to successful management of these patients. Patients with organophorphorus compound poisoning should beevaluated by electrocardiogram along with CKMB, which helps in predicting cardiac toxicity and can be considered as a surrogate prognostic marker. *CKMB is useful as prognostic marker only in acute cases and along with ECG*

Conflict of Interest

The authors declare that they have no conflict of interest.

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