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Original Research Paper

Toxicology

PROGNOSTIC VALUE OF LONG QT INTERVAL IN ACUTE AND SEVERE ORGANOPHOSPHATE POISONING

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KEYWORDS :

INTRODUCTION:

Organophosphates have been used as insecticides worldwide for the past 50 years. Suicidal poisoning with organophosphorus (OP) pesticides is common, particularly from rural areas. Organophosphates are potent cholinesterase inhibitors causing severe cholinergic toxicity following ingestion, inhalation or cutaneous exposure. An estimated 3,000,000 people are exposed to organop hosphates each year, with up to 300,000 fatalities.

Cardiac arrhythmias, including heart block and QTc prolongation, are observed in organophosphorus agent poisoning. Several studies have shown that QTc intervals have been used to assess the prognosis and severity of organophosphorus poisoning patients. The duration of hospitalization, Serum Cholinesterase levels, dosage of atropine was more in OP poisoning patients with elevated QTc interval[1]

It has been reported that there have been electrocard iographic abnormalities, including QT-interval prolongation in most patients with acute organophosphate poisoning, and a relation between blood Cholinesterase level and clinical severity in acute Organophosphate poisoning. Studies have also shown negative correlations between QTc interval and Serum Cholinesterase levels. [2] Another study showed mortality was more among patients with prolonged QTc intervals.[3]

OP poisoning patients with elevated QTc intervals had higher incidence of mortality. Respiratory failure is the most serious manifestation and presents a poor prognosis.[4] ECG changes can be seen within the first hour after exposure to organophosphate compounds. Sinus tachycardia and prolonged QTc interval were the most noted changes in these patients.[5]

QTc intervals have shown to be good in predicting respiratory failure and hospital mortality in patients with organoph osphorus poisoning.[6]

This highlights the importance of determining an OP poisoning prognosis to decide how aggressive treatment should be. There are reports suggesting a relationship between prolonged corrected QT (QTC) interval and the severity of poisoning[7,8.]

Studies on the cardiac effects of OP Poisoning have been inconclusive, and sometimes conflicting results have been reported. [7,8.] A relationship between a prolonged corrected QT (QTC) interval on the electrocardiogram (ECG) of patients with OP Poisoning and the severity of poisoning has been reported previously to assist in determining prognosis and therapy [3.]

In the current study, we aim to investigate the relationship between the QTC interval and both the severity and prognosis of Organophosphorus poisoning.

OBJECTIVES

1. To measure QTc interval in patients admitted with Organophosphorus poisoning.
2. To correlate QTC interval with mortality and morbidity in Organophosphorus Poisoning patients.

Materials& Methods

a. **Design of study** – Prospective observational study
b. **Duration of study**-2020 SEPTEMBER to FEBRUARY 2020
c. **Sample size**-40

MATERIAL AND METHOD-

Patients with the primary diagnosis of OP poisoning who will be admitted to the intensive care unit (ICU) will be taken as subjects in this prospective study. Cholinesterase (CE) activity and the QTC interval will be determined for each patient and QTc interval of <440 msec as normal Comparative outcomes of the patients like duration of both hospitalization and mechanical ventilation, serum Cholinesterase activity on admission and its daily level, total amount of atropine administered, analysis of the QT and QTC intervals in the primary ECG on admission and at the end of hospitalization ,and rate of mortality will be recorded and used for correlation in this study.

INCLUSION CRITERIA-

All patients presenting to our EMD with OP poisoning and admitted to our ICU.

EXCLUSION CRITERIA-

1. atrial fibrillation or ventricular conduction defects (QRS interval of 120 ms or longer),
2. high heart rates (⩾100 beats per minute),
3. heart failure,
4. CKD

STATISTICAL ANALYSIS:

Data was entered into Microsoft excel data sheet and was analyzed using SPSS 22 version software. Categorical data was represented in the form of Frequencies and proportions. **Chi-square test** was used as test of significance for qualitative data. Continuous data was represented as mean and standard deviation. **Independent t test** was used as test of significance to identify the mean difference between two quantitative variables.

RESULTS:

Table 1: Profile of subjects with OP Compound poisoning

		Count	%
Age	<30 years	15	50.0%
	31 to 40 years	8	26.7%

	>40 years	7	23.3%
Sex	Female	8	26.7%
	Male	22	73.3%
Diabetes		4	13.3%
Hypertension		1	3.3%
Smoking		7	23.3%
Alcohol		9	30.0%
Tobacco Chewing		2	6.7%

In the present study nearly 50% of the study subjects were aged less than 30 years and 26.7 % were aged between 31 to 40 years and 23.3% aged more than 40 years. Nearly 73.3 % of them were male subjects.

In the present study nearly 73.3% of them were male and 26.7% of them were Females. Diabetes was seen in 13.3%, Hypertension in 3.3%, Smoking was done by 23.3%, Alcohol consumption is seen in 30 % and Tobacco Chewing in 6.7 %.

Table 2: ECG Findings among the study subjects

		Count	%
ST. Segment	Depressed	2	6.7%
	Elevation	8	26.7%
	Isoelectric	20	66.7%
RHYTHM	Irregular	1	3.3%
	Regular	29	96.7%
Qtc INTERVAL	Prolonged	7	23.3%
	Normal	23	76.7%

Based on the ECG Findings among the subjects who have consumed organophosphorus poisoning ST Segment depression was seen in 6.7% of subjects, 26.7% had elevated ST segment and 66.7% ST segment was isoelectric. The Rhythm of the ECG was found to be Regular in 96.7% of the subjects and Irregular in 3.3 % of the subjects. The QTc Interval was prolonged in 23.3% and Normal in 76.7% of the study subjects.

Table 3: Comparison of Vital parameters, Laboratory parameters with respect to QTc interval

	Qtc Interval				P value
	Prolonged		Normal		
	Mean	SD	Mean	SD	
PR	95.00	19.87	88.17	18.30	0.430
RR	16.00	2.19	15.82	3.02	0.892
Temperature	37.47	.33	37.37	.46	0.644
Hemoglobin	12.33	2.42	11.74	2.61	0.619
Total WBC Count	2950.33	3296.57	3399.22	2802.90	0.738
ESR	15.00	10.42	33.89	26.99	0.190
RBS	29.00	34.22	31.65	29.09	0.862
Creatinine	2.30	2.58	2.17	2.44	0.912
Sodium	136.60	5.50	137.59	5.74	0.729
Potassium	4.16	1.01	4.08	.76	0.846
CPK-MB	22.50	27.58	20.91	7.13	0.851
Troponin-I	3709.50	876.11	8616.36	13714.87	0.635

On Comparison of QTc Interval with various Vital parameters and laboratory parameters it was found to be statistically insignificant.

Table 4: Association between morbidity and morbidity with respect to QTC interval

		Qtc Interval				P value
		Prolonged		Normal		
		Count	%	Count	%	
ABG	Acidosis	2	28.6%	9	39.1%	0.815
	Alkalosis	1	14.3%	4	17.4%	
	Normal	4	57.1%	10	43.5%	
Outcome Of	Death	0	0.0%	4	17.4%	0.345
	Improved	7	100.0%	15	65.2%	
	Unchanged	0	0.0%	3	13.0%	
	Worsened	0	0.0%	1	4.3%	

On comparing the outcome of the patient among the subjects with Prolonged QTc Interval all the 7 subjects (100%) were Improved and among the subjects with normal QTc Interval 17.4% of them died, 65.5% condition improved, 13 % subjects condition remain unchanged and 4.3% subjects condition worsened.

DISCUSSION:

In the present study majority of the study subjects were less than 30 years of age indicating that younger age subjects consumed the organophosphorus Poison. In the study done by Shahin Shadnia et al [9] also the mean age of the study subjects was around 33 years of age and nearly 76.2 % of the subjects were less than 40 years of age. In the study done by Raman Prabhakaran et al [10] also the mean age of the Population who consumed OP Poison was found to be 30.18 years. Among Both the Studies the mean age of the study subjects was found to be similar to our study findings.

On comparing with the gender of the study subjects 73.3% of them were Male subject, similarly in the study done by Raman P et al [10] Male to Female Ratio was 1.8:1. In the study done by Budhathoki S et al [11] also Male constituted 76 % of the Study population. Whereas in the Study done by Shahin S et al [9] it was contrast where Female were 52.4% and Male 47.6% consumed OP poisoning.

In the present study the study subjects were found to be suffering from Comorbid Conditions like Diabetes and Hypertension along with smoking and Alcohol consumption which would act indirectly in the progression of the Condition of the subjects after OP Consumption.

ECG abnormalities—such as QT-interval prolongation and polymorphic ventricular tachycardia (e.g., torsades de pointes), ST-T changes, and disturbance of the cardiac conduction system in OPP—have been reported previously in other studies. The mechanism by which OPs cause cardio toxic effects is not yet known, but cholinergic innervation of the heart results in both negative chronotropic and negative inotropic that slows myocardial conduction or repolarization. However, unequal sympathetic stimulation of myocardial cells, and interactions with potassium channels and the Nα+/Ca2+ exchanger in the myocardial cell membrane are probably responsible for the occasional prolonged QTC interval.[12,13,14]

In our study the QTc Interval was found to be Prolonged in only 23.3% of the study subjects with OP Poisoning. In the study done by Raman P et al [10] prolonged QTc Interval was seen in 27.8% of Male and 16.67% of female were reported to have a Prolonged QTc interval. In the study done by Chuang F R et al [15] nearly 43.5 % of them had Prolonged QTc Interval. In the study done by Okhan Akdur et al [16] nearly 50 % of them had Prolned QTc Interval. In the Shahin S et al [9] 59.5% of the OP Poisoning subjects had prolonged QTc Interval

The outcome of the study subjects with OP Poisoning in our study found no significant association between the QTc Segment and the survival of the subjects. In the Okhan Akdur et al [16] study also proved that prolonged QTc interval, are not effective in determination of short-term prognosis.

In the study done by Shahin S et al 9 also showed that in nearly 48% of the subjects who died due to OP poisoning had prolonged QTc Interval and the association was also found to be significant.

In the study done by Deshpande et al [6] and Raman P et al [10] showed that QTc Interval was prolonged among those who had died due to OP poisoning and the association was found

to be significant.

CONCLUSION:

The organophosphate poisoning is associated with cardiac complications and most of them occur during the first few hours of poisoning. Hence early and adequate atropinization will reduce the mortality to a great extent.

Organophosphorus compounds are commonly used agents for suicidal purpose because of their easy availability. The main determining factors for mortality are the type of poisonous agent used, the severity of the poisoning, the stage at which treatment is started and the presence or absence of intensive care facilities.

Overall from our study it was concluded that QTc Interval was found to be statistically insignificant in predicting the Mortality among subjects who have consumed OP Compound.

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