ORIGINAL ARTICLE

Prevalence and characteristics of organophosphate poisoning at a tertiary care centre in Karachi, Pakistan

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Abstract

Object: The aim of our study is to determine the various factors that affect the morbidity and mortality in patients who present with organophosphates poisoning at a tertiary care hospital in Karachi Pakistan.

Method: The type of study is a cross sectional observational study, conducted for a period of 15 months from January 2014 to March 2015, the total study population consisted of 248 patients, who presented to the emergency department of a large tertiary care hospital in Karachi, Pakistan, with organophosphate poisoning. Data was collected using a pre designed proforma that included various variables such as demographics, laboratory investigations and progress of the patients, whether they recovered or expired. Data was analyzed using SPSS version 23.

Results: The total study population consisted of 248 patients of which 181 (72.98%) were females and 67(27.01%) were males having a mean age of 27.28 ± 11.5 years. 213(85.88%) belonged to the recovery group, while 35(4.11%) belonged to the group of patients who unfortunately did not survive, the causes of death in were, 24(68.57%) died of respiratory failure, 7(20%) died of cardiac arrest, while 4(11.43%) died of renal failure. Illiteracy rates were higher in group B having a p value of less than 0.001, also the patients who came from rural areas to the hospital and those having a pre existing psychiatric illness was also significantly higher in group B having a p value of less than 0.05 in each class of patients. Bradycardia was the most important factor predicting mortality in the patients when analyzed using logistic regression analysis having a p value of less than 0.05.

Conclusion: According to the results of our study the most important predictors for mortality in organophosphate poisoning were found to be age, decreased heart rate, serum glucose, LDH and acidosis. Identifying the most critically ill patients using these parameters and taking appropriate measures may contribute to a decrease in mortality in patients who ingest organophosphates.

Key words: Organophosphate poisoning, mortality, insecticide ingestion, toxicity, bradicardia, acidosis, mydirasis

Abbreviations: OP= Organophosphate, GI= Gastrointestinal, AST= Aspartate aminotransferase, ALT= alanine transaminase, OPD= Out patient department, LDH= Lactate dehydrogenase

Introduction:

During the 1980s, the agricultural practices all over the globe, started to use organo-phosphate compounds (OP) heavily as pesticides, which is toxic to the human body,[1] OP compounds have been used traditionally as insecticides, herbicides and pesticides.[2-4] The easy availability of organophosphate compounds, have led to an increase in its poisoning, and is a major public health concern.[5,6] According to the world health organization about 3,000,000 people are poisoned with organophosphates every year, and about 250,000

of them expire specially in the Asian continent.[7-11] Organophosphates have been used widely for suicide attempts by patients,[12-15] it is reported to be used as an agent of choice for suicide in 10-36.2% of patients in the western countries, and 40-60% in African while 65-79.2% in the currently developing world.[16-18] Accidental ingestion is more common in children and housewives,[19,20] in our country of Pakistan poisoning related to chemicals and gaseous agents have been reported to be about 46%.[21] The mechanism of action of organophosphate poisoning is that acetylcholine accumulates in the body due to the inhibition of acetylcholinesterase enzyme, which affects the whole physiology of the body, by affecting the sympathetic and parasympathetic ganglions, striated muscles and the diaphragmatic muscles affecting respiration and hence causing a life threatening situation.[23] The patient may present with fatigue, nausea, vomiting, dizziness, hyper salivation, hyper secretion, polyuria and coma.[24] The mortality ratio varies between 3 and 25% and depends upon various factors such as amount of substance ingested, time when the treatment was sought, respiratory suppression and support and use of ventilator for assisted breathing.[25] An early diagnosis and treatment prevents mortality. The aim of our study is to determine the various factors that affect the morbidity and mortality in patients who present with organophosphates poisoning at a tertiary care hospital in Karachi Pakistan.

Materials and methods:

The type of study is a cross sectional observational study, conducted for a period of 15 months from January 2014 to March 2015, the total study population consisted of n=248 patients, divided into two groups. Group A consisted of all the patients who recovered after ingestion of organophosphates and group B consisted of all the patients who expired. Patients below the age of 15 years were excluded from the study. All the patients in the study population presented to the emergency department of a large tertiary care hospital in Karachi, Pakistan, with organophosphate poisoning. Data was collected using a pre designed proforma, that included various variables such as demographics (age, gender, education, residence, marital status, psychiatric history exposure to the substance, time period of presentation and ingestion, clinical findings at presentation, laboratory tests including, complete blood count, serum urea, creatinine, electrolytes, AST, ALT, arterial blood gases, electrocardiograph etc, various complication and progress of the patients, either they recovered or expired). Activated charcoal followed by gastric lavage was given to patients who presented to the emergency department with stable hemodynamics and Glasgow coma scale scores. Patients who were hypotensive (systolic blood pressure of less than 90mm of Hg) were given fluids for resuscitation and their urine output was monitored closely. Atropine was also administered to these patients, until a reduction was observed in secretions, mydirasis, flushing and sweating, pralidoxime was administered as a loading dose of 1gm followed by 200mg per hour infusion. Patients who were vitally stable, ingested less amount of organophosphates and did not develop signs of hemodynamic compromise and acidosis were kept under observation for 24 hours and then discharged with due prescriptions and advised to follow up in the psychiatric OPD. Nicotinic and muscarinic symptoms and signs (such as hyper secretions, hyperhidrosis, miosis, bradycardia, abdominal pain etc for muscarinic symptoms and paralysis, myasthenia, tachycardia having a heart rate of greater than hundred beats per minute, fasciculation and hypertension BP>140/90 mm of Hg as nicotinic symptoms) were noted for all patients as well as any signs of central nervous system compromise (such as convulsions, coma, psychosis, dizziness, tremors, headache, anxiety and respiratory depression). Data was analyzed using SPSS version 23. Two sided T test and Chi square test were used to analyze the differences in means and proportions among the two groups. To analyze the independent predictors of mortality logistic regression analysis was done, a p value of less than 0.05 was considered as significant.

Table 1: Characteristics of the patients who recovered as compared to those who did not survive

Characteristics	Group A (n=23)	Group B (n=35)	P-Value
Cause of poisoning			
Suicide	181	33	0.19
Accidental ingestion	32	2	
Symptoms			
Muscarininc symptoms	191	32	0.61
Nicotinic symptoms	81	30	<0.001
CNS symptoms	64	32	<0.001
Time to presentation in ER (hours)	2.96 ± 3.66	4.40 ± 2.3	0.014
Demographics			
Age in years	26.45 ± 10.8	34.3 ± 15.27	<0.001
Male	50	17	0.35
Female	157	24	0.37
Co existing psychiatric disease	90	4	0.001
Level of Education			
No education	63	22	<0.001
Matriculation	12	3	0.87
Intermediate	14	3	0.95
University level education	3	0	-
Level of consciousness			
Fully conscious	166	5	<0.001
Confused	38	7	0.55
Coma	9	23	<0.001
Laboratory investigations			
Urea (mg/dl)	26.1 ± 9.7	26.8 ± 15.1	0.96
Serum Creatinine (mg/dl)	0.78 ± 0.2	0.88 ± 0.3	0.04
Sodium (mmol/L)	137 ± 3.5	139 ± 5.5	0.06
Potassium (mmol/L)	3.5 ± 0.5	3.4 ± 0.5	0.005
Chloride (mmol/L)	101 ± 5.5	105.6 ± 5.3	<0.001
ALT(U/L)	21.5 ± 11.8	35.5 ± 39.4	<0.001
AST (U/L)	21.7 ± 9.2	41.2 ± 55.7	<0.001
LDH (U/L)	286 ± 120.1	416 ± 124.2	<0.001
Creatinine Kinase (U/L)	149 ± 213	217.5 ± 204	0.054
pH	7.35 ± 0.05	7.19 ± 0.15	0.001
Blood glucose (mg/dl)	131.9 ± 60.2	248 ± 69	<0.001
Clinical evaluation			
Systolic Blood Pressure (mm of Hg)	115 ± 20.1	112.5 ± 45.3	0.76
Heart rate (pulse per minute)	80.2 ± 19.4	98.1 ± 35.6	<0.001

Results:

The total study population consisted of n= 248 patients of which n= 181 (72.98%) were females and n= 67 (27.01%) were males having a mean age of 27.28 ± 11.5 years and an age range of 15 to 70 years. N= 213(85.88%) belonged to the recovery group (group A) while n= 35 (4.11%) belonged to the group of patients who unfortunately did not survive (group B or mortality group), the causes of death in these patients were as follows, n= 24 (68.57%) died of respiratory failure, n= 7 (20%) died of cardiac arrest, while n=4 (11.43%) died of renal failure. Illiteracy rates were higher in group B having a p value of less than 0.001, also the patients who came from rural areas to the hospital and those having a pre existing psychiatric illness was also significantly higher in group B having a p value of less than 0.05 in each class of patients. For further differences of characteristics in the study population refer to table 1. The number of patients who remained conscious throughout the course of their illness was higher in survival group, while those who were in a comatose state were more in the mortality group having a p value of less than 0.001. Systolic blood pressures were similar in the two groups while the heart rate was found to be much higher in the mortality group. We also found that bradycardia was the most important factor predicting mortality in the patients when analyzed using logistic regression analysis having a p value of less than 0.05, other independent predicting factors are mentioned in table 2.

Table 2: Predictors of mortality

Characteristics	Odd Ratio	95% confidence interval	P-Value
Age	1.052	1.011-1.099	0.01
Blood glucose	1.021	1.013-1.029	<0.001
LDH	1.003	1.000-1.008	0.033
Bradycardia	12.66	3.122-51.245	<0.001
Coma	5.199	1.753-15.420	0.003
Acidosis	3.752	1.011-13.865	0.04

Discussion:

According to the results of our study the following were the main independent variables predicting mortality rate among the patient population, bradycardia, serum glucose level, lactate dehydrogenase, acidosis and comatose state, the mortality rate in our study was found to be 14.11% while other studies report a mortality rate between 3% and 25%.[26] The time to reach the ER or time until presentation is an important variable when it comes to the mortality and morbidity

of organophosphate poisoning, a study reports a mean time of 4hours until presentation,[27] and another study reports it to be 3.45 hours, but does not report any significant difference when it comes to mortality rate,[28] according to our study the mean time for presentation was found to be 2.96 ± 3.66 hours in the survival group and 4.40 ± 2.3 in the mortality group, but regression analysis did not consider time till presentation to be a predictor of mortality in our study population. The mean age of patients in our study was found to be 27.28 ± 11.5 years, while other studies report mean ages of 39.4 years[29] and 32.2 years.[30] We observed that patients in the recovery group tend to be younger and we also found age to be a predictor of mortality according to the regression analysis data, which may be due to the increased volume of distribution due to more amount of body fat in the elderly and the slower process of metabolism in the liver with advancing age. Some studies also suggested an association of spring and autumn weather with more organophosphate poisoning due to the more use of pesticides and herbicides,[31] we did not perform such analysis in our study. In our study the pH level of blood was lower in the mortality group (due to respiratory failure) as compared to the survival group (due to lack of respiratory issues), in another study the pH value of those who did not survive was less than 7.2, and found to be an independent predictor for mortality having an odds ratio of 10.1 and a p value of 0.002 respectively.[33] We also observed acidosis as a predictor of mortality in our study. Various variables of organophosphate poisoning such as parasympathetic and sympathetic over activity, acidosis, electrolyte imbalances and hypoxia affect the various organs of the body specially the myocardium characterized by changes in the electrocardiograph.[34-36] After the initial exposure, tachycardia ensues due to activation of the sympathetic system, which is immediately followed by bradycardia due to the activation of the parasympathetic system, which is a characteristic finding in patients who have a late presentation to the emergency department following poisoning episode, and is strongly associated with mortality, as our study demonstrates bradycardia is the single most strongest predictor of mortality on its own. According to a study a mean serum glucose level of 144md/dl was determined to be an independent factor in the development of intermediate syndrome (paralysis of the muscles of respiration, proximal limb weakness, motor cranial nerve involvement), and other studies have also looked into it.[29,37-40] In our study the mean glucose level was 131.9 ± 60.2 mg/dl in the survival group and 248 ± 69 mg/dl in the mortality group and was found to be an independent indicator of mortality. In another study they found the mean glucose level of 145 mg/dl and that 67.7% of their patient population had hyperglycemia, which is due to the rapid release of catecholamines from the adrenal glands.[37]

Conclusion:

According to the results of our study the most important predictors for mortality in organophosphate poisoning were found to be age, decreased heart rate, serum glucose, LDH and acidosis. Identifying the most critically ill patients using these parameters and taking appropriate measures may contribute to a decrease in mortality in patients who ingest organophosphates.

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Role and contribution of authors:

Dr. Aftab Ahmed, Resident Emergency Medicine, collected the data and collected the references and did the initial writeup

Dr Lutuf Ali, Resident Emergency Medicine, helped in collection of references and data.

Dr Lal Shehbaz, Registrar Emergency Medicine, helped in writing of introduction and methodology.

Dr Shua Nasir, Registrar Emergency Medicine Ziauddin University Hospital collected the data and helped in introduction, methodology and discussion writing.

Dr. Syed Raza Hussain Rizvi, Professor and Head of Department Neurosurgery, Jinnah Postgraduate Medical Centre, critically review the article and gave the final touchup to the article

Dr Muhammad Zaeghum Aman, House officer, collected the data and references

Dr Zain Ali. House officer, collected the data, references and helped in discussion writing.

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