Characteristics of Organophosphate Poisoned Patients Admitted to Emergency Hospital

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KEYWORDS
Organophosphates, Clinical Manifestations, Plasma cholinesterase,

ABSTRACT

Poisoning with organophosphates is a great health hazard particularly in the developing countries especially in rural areas. It acts by inhibition of true cholinesterase and plasma cholinesterase enzymes leading to severe cholinergic toxidrome. This work was performed to assess demographic and clinical findings of organophosphates-poisoned cases among patients admitted to Mansoura Emergency Hospital and to find out the correlation between clinical findings and level of plasma cholinesterase enzyme. A cross sectional study was done from 3rd march 2014 to 1st November 2016 where 120 organophosphates-poisoned patients were included in the work. Demographic data, clinical findings and level of plasma cholinesterase were assessed. The mean age of cases was 34 years. Female to male ratio was 1.6: 1. Poisoning was more common in married than non-married persons (78.4% and 21.6 % respectively). Self-poisoned cases represented 67.5 %. No homicidal cases were recorded. Majority of cases were housewives (46. 6%), farmers (31. 6%), students (17.5 %) and shop-keepers (2.5%). 76.6% of patients were from rural area while urban cases represented 23.4%. The oral route of exposure represented 85% of patients while cases exposed to poison through skin contamination and inhalation constituted 15 %. The main clinical manifestations observed were miosis (91.6 % of cases). vomiting (85.8 %), fasciculations (56.1%), abdominal colic (51.6 %), generalized weakness (28.8%), coma not responding to painful stimuli (11.6 %), defecation (5 %) and convulsions (3.3 %). Deceased cases represented 8.3 % of patients. A poor correlation was found between plasma cholinesterase enzyme and clinical findings.

Introduction ·

Poisoning by pesticides is a major health problem particularly among developing countries especially in rural areas (Eddleston et al., 2004). Organophosphates (OP) toxicity represents the most common poisoning among pesticides-poisoned cases (Aardema et al., 2008). Organophosphates acts as strong inhibitor of cholinesterase enzyme which is present in two forms: the first is acetyl cholinesterase that is found in erythrocytes, skeletal muscles and nervous system, while the other form is butyryl cholinesterase (PChE) that is present in plasma, liver and heart (Agrawal et al., 2007). Inhibition of these enzymes will lead to accumulation of acetylcholine in central nervous system, muscarinic receptors, autonomic ganglia and myoneural junction. Poisoning by OP may be self-inflicted or accidental, uncommon to be homicidal (Banerjee et al., 2012).

Cases of death reported with OP were mainly attributed to respiratory failure either due to cholinergic crisis or respiratory muscle paralysis (Eddelston et al., 2006). Measuring the level of PChE is used as laboratory evidence for diagnosis of OP poisoning (Banerjee et al., 2012). Some papers reported that estimation of PChE is useful in diagnosis

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of OP poisoning but with no relation to severity of manifestations (Rehiman et al., 2008; Tripathi and Srivastava, 2008).While some authors reported a strong correlation between measurement of enzyme level and severity of manifestations (Devaanur et al., 2013). This cross-sectional work represented an attempt to identify demographic, clinical and laboratory characteristics among OP poisoned patient presented to Mansoura Emergency Hospital and to evaluate the extent of correlation between clinical findings and level of PChE among these patients.

Subjects and Methods

A prospective cross sectional study was conducted for one and half-year in Mansoura Emergency Hospital, Egypt. Each patient with history of exposure to OP and manifestations of poisoning was assessed regarding age, sex, occupation, degree of toxicity, level of PChE at time of admission. Exclusion criteria included cases presented more than 5 hours of exposure to poison, hepatic patients, age above 60 years, pregnant women or on contraceptive drug therapy. Informed consent was obtained from competent patient or the legally authorized representatives.

According to Proudfoot classification, patients were classified into 3 groups according to clinical symptoms and signs (Table 1). Severe case is that one associated with either coma not responding to painful stimuli, convulsion, pin point pupil or generalized fasciculation. Moderate case is that one associated with either reactive miosis, generalized weakness or localized fasciculation without severe symptoms. Mild case is that one associated with either vomiting, diaphoresis, abdominal colic or defecation without severe or moderate signs (Proudfoot, 1982).

A blood sample of 5 ml was taken from each patient at time of admission for measurement of pseudocholine-esterase (PChE) lavel. Lower normal reference level in the kits used is 3500 U/L. Mild reduction of PChE associated with appearance of manifestations occurs when enzyme drops to 20-50 % of its value i.e. 700-1750 U/L, moderate reduction occurs when enzyme is reduced to 10- 20 % of its normal value i.e.350 -700U/L, while severe reduction occurs when enzyme is reduced to less than 10 % of its normal value i.e. less than 350 U/L (Ellenhorn and Barcelox, 1988 and Namba et al., 1971).

Statistical analysis

Data collected was analyzed in computer by using the Statistical Package for Social Sciences (SPSS) program version 10. Data analysis was done by using descriptive and inferential statistical methods: frequency, percentage, means, standard deviation (SD). A two-tailed p-value less than 0.05 was considered to be statistically significant.

Results

During the period of the study, 120 patients were assessed regarding their demographic data (Table 2) where the mean age of cases was 34 years. Female to male ratio was 1.6:1.Poisoning was more common in married than non-married persons (78.4% and 21.6 % respectively). Self-poisoned cases represented 67.5 % while accidental cases constituted33.5%. No homicidal cases were recorded. Concerning occupation, a 46.6% of patients were housewives, farmers (31. 6%) and students (17.5%). Cases from rural areas represented 76.6% of cases while urban patients represented 23.4%.The oral route represented 85% of cases.

Table (3) illustrated the main clinical manifestations in poisoned cases. They included miosis (91.6 %), vomiting (85.8%), fasciculations (56.1%), abdominal colic (51.6 %), generalized weakness (28.8%), coma not

responding to painful stimuli (11.6 %), defecation (5 %) and convulsions (3.3 %). Death occurred in 8.3 % of patients.

The level of PChE was measured for each manifestation (Figure 1), where the mean level in patients with coma not responding to pain was310 U/L, convulsions (508U/L), generalized fasciculations (1010 U/L), pin point pupil (950 U/L), reactive miosis (320U/L), generalized weakness (1106 U/L), local fasciculations (492 U/L), vomiting (822 U/L), diaphoresis (1001 U/L), abdominal colic (945 U/L) and defecation (321 U/L).Mortality was reported in patients with mean enzyme level of 551 U/L. Correlation between manifestations of O.P poisoning and reduction of PChE was assessed using Spearman correlation coefficient.

Table (1): Differentiation between organophosphate cases according to severity of manifestations

Severe case	Moderate case	Mild case
Coma	Reactive miosis	Vomiting
Convulsion	General weakness	Diaphoresis
Generalized fasciculation	Localized fasciculation	Abdominal colic
Pin point pupil		Defecation

Table (2): Demographic data of studied organophosphate poisoned cases (n=120)

Variables	Number (%)
Mean age	34
Sex	
Male	46 (38.3%)
Female	74 (61.7 %)
Marital status	
Unmarried	26 (21.6 %)
Married	94 (78.4%)
Occupation	
Housewives	56 (46. 6%)
Farmers	38 (31. 6%)
Students	21 (17.5 %)
Shopkeepers	3 (2.5%)
Others	2 (1.6 %)
Mode of poisoning	
Suicidal	81 (67.5%)
Accidental	39 (33.5%)
Homicidal	None
Rural	92 (76.6%)
Urban	28 (23.4%)
Route	
Oral	102 (85%)
Skin and lung	18 (15%)

n: number

Table (3): Frequency of clinical manifestations in studied cases (n=120)

Manifestation	%
Coma	11.6
Convulsions	3.3
Generalized fasciculations	21.6
Pin point pupil	42.5
Reactive miosis	49.1
Generalized weakness	28.8
Local fasciculations	34.5
Vomiting	85.8
Diaphoresis	64.7
Abdominal colic	51.6
Defecation	5
Mortality	8.3

n: number

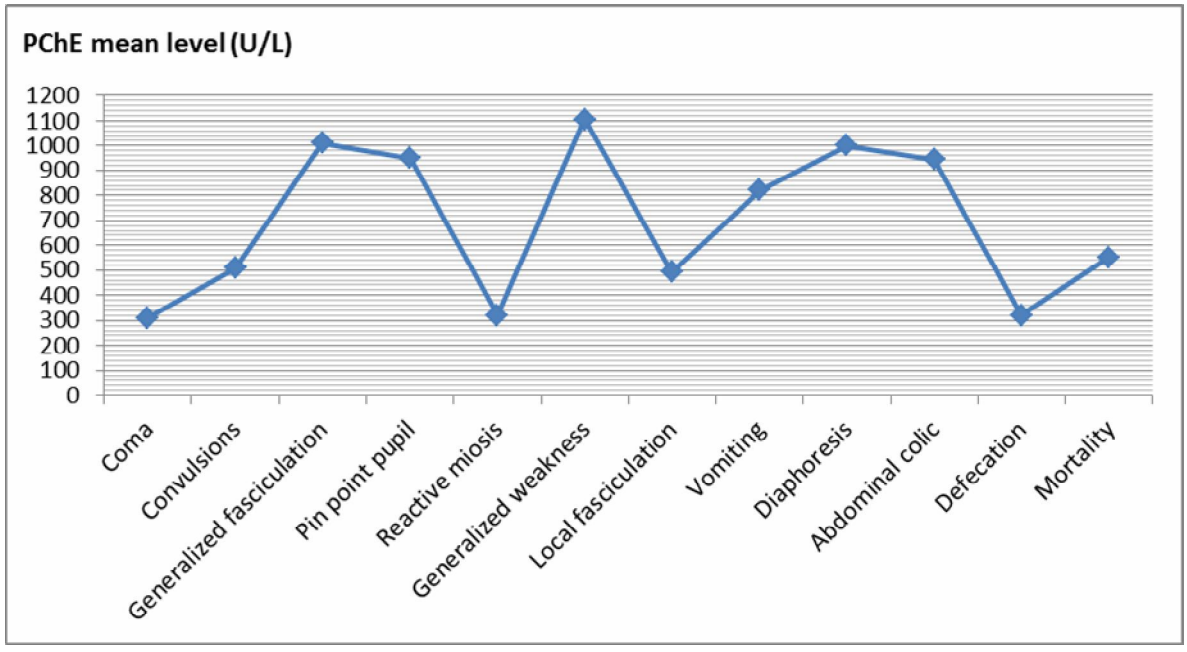

Fig. (1): Mean pseudocholine-esterase (PChE) enzyme levels according to each manifestation of organophosphate poisoning in the studied patients (n=120)

Discussion

Poisoning with OP is a great health hazard particularly in the developing countries; it kills millions of people every year particularly in rural areas (Behere, 2008).

In the present work, the mean age of studied cases was 34 years. People at this age are most active physically, mentally and socially so they are more liable to life stress. It was found that 76.6% of cases were from rural areas owing to wide availability of pesticides used for dusting crops A similar result obtained by Khan et al. (2016) who studied 80 OP poisoned Indian patients where their age range was between 30-44 years. Most of cases were from rural areas. The present finding is in agreement with the studies done by Agrawal et al. (2007) and Bahrash et al. (2010) where most of cases were from rural areas.

The present results revealed that females predominate males where the ratio is 1.6:1. This could be explained by tendency of females to commit suicide by self-poisoning secondary to their emotional liability. Venkateshwarlu et al. (2013) studied 200 OP poisoned Indian cases where 106 cases were females. On the contrary is the result of Khan et al. (2016) who studied 80 Indian OP poisoned patients, where females represented 28 % only, this may be due to variation in religious and social beliefs.

The present study showed that poisoning was more common in married patients (78.4%) as they are more liable to domestic, social, financial and occupational problems. In accordance with this result that reported by Khan et al. (2016). They found that 78% of cases were married. This also explains why the higher percentage of cases was housewives (46.6%).

In the present work, farmers represented 31.5% of poisoned cases. This is due to the fact that poison exposure among farmers occurs mainly during dusting of fields, where pesticides are widely used for agricultural purposes, being accessible and of low cost.

Most of the present studied cases committed suicidal poisoning. This may be attributed to poverty, unemployment, marital problems and stressful life. Similar results were obtained by Venkateshwarlu et al. (2013) where suicidal cases represent the majority of studied Indian poisoned patients.

The commonest route of exposure was oral as most of cases committed suicide by ingesting the poison. No cases due to homicidal poisoning were reported as organophosphates are easily detected due to its characteristic odor and taste.

In the studied patients, the most common sign of poisoning was miosis, while the most common symptom was vomiting. These results are consistent with those obtained by Banerjee et al. (2012) who stated that vomiting and miosis were the commonest clinical findings. Mortality was low (8.3%) due to early presentation, rapid interference with antidotes. Death was attributed to respiratory failure due to excessive bronchial secretions, bronchospasm and respiratory muscle paralysis. Contradictory to the current finding, Agrawal et al. (2007) reported high mortality in cases who presented late due to delayed interference with supportive measures and antidotal therapy.

In the present work, it was found that manifestations of severe toxicity were associated with only mild or moderate reduction of enzyme. For example, the mean PChE levels were as follows: 508 U/L with convulsions, 1010 U/L with generalized fasciculations and 950U/Lin case of miosis. On the other hand, some moderate clinical manifestations were recorded in association with severe reduction of the enzyme. The mean PChE level in relation to reactive miosis

was 320 U/L, while generalized weakness was associated with mild reduction of the enzyme (mean level 1106 U/L). Mortality occurred at mean enzyme level of 551 U/L. Correlation between manifestations of O.P poisoning and reduction of PChE was assessed using rho Spearman correlation coefficient where p value was greater than 0.05. This indicates poor correlation between manifestations of O.P poisoning and the reduction of the enzyme, hence the necessity for relying on clinical manifestations and erythrocyte true choline esterase level if possible in establishing degree of toxicity and the proper lines of treatment. PChE should be only used as a marker of exposure to OP and no more.

In consistence with the present findings, Rehiman et al. (2008) stated that the level of PChE and severity of manifestations not always correlate with each other. In addition, Tripathi and Srivastasia (2008) reported that PChE is just a marker of OP poisoning indicating excess absorption of OP. Also, Eddleston et al. (2008) and Worek et al. (2005) stated that PChE enzyme measurement lack sensitivity and specificity and not correlated with severity of manifestations. On the contrary, Devaanur et al. (2013) reported a strong correlation between PChE and severity of manifestations.

Conclusion

The present work revealed that OP poisoning is more common in females more than males and at mean age 34 years with more predominance in rural areas especially among housewives and farmers. The majority of cases was suicidal followed by accidental poisoning. No homicidal cases were reported. The most common sign was miosis while the most common symptom was vomiting. A poor correlation was found between PChE level and severity of manifestations of O.P toxicity. So, it is better for the toxicologist to rely on severity of manifestations and the level of erythrocyte true cholinesterase if possible to predict prognosis and determine proper lines of treatment. Hence, PChE can be used only as a marker indicating acute exposure to OP.

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خصائص مرضى التسمم بمركبات الفوسفات العضوية الذين تم إدخالهم إلى مستشفى الطوارئ

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يشكل التسمم بمركبات الفوسفات العضوية خطرا صحيا كبيرا وخاصة في البلدان النامية وتحديدا في المناطق الريفية. وهو يعمل عن طريق تثبيط إنزيمي الكولين استيريز الحقيقي والكولين استيريز المتواجد بالبلازما. وقد تم تنفيذ هذا العمل لتقييم النتائج الديموغرافية و السريرية لحالات التسمم بمركبات الفوسفات العضوية بين المرضى الذين تم إدخالهم إلى مستشفى الطوارئ ، جامعة المنصورة و كذلك للكشف عن مدى علاقة النتائج السريرية ومستوى الكولين استيريز المتواجد بالبلازما.

وقد بدأت هذه الدراسة منذ الثالث من مارس عام ٢٠١٤ حتى الأول من نوفمبر عام ٢٠١٦ ، حيث تم إدراج ١٢٠ مريض تسمم بمركبات الفوسفات العضوية في العمل و تم تقييم البيانات الديموغرافية والنتائج السريرية ومستوى الكولين استيريز بالبلازما.

وقد سجلت الدراسة أن متوسط عمر الحالات كان ٣٤ عاما وكانت حالات التسمم بين الإناث أكثر من الذكور وبين المتزوجين أكثر من غير المتزوجين وكذلك كان التسمم في معظم الحالات قد تم بغرض الانتحار أكثر من التسمم العرضي ولم يلاحظ أية حالات تسمم جنائي وكانت الغالبية العظمى من الحالات ربات بيوت ثم المزارعين ثم الطلاب وكان معظم المرضى من المناطق الريفية

وقد لوحظ أن معظم المرضى كانوا قد تعرضوا للمبيد الحشري عن طريق الفم بينما تعرض القليل منهم له عن طريق تلوث الجلد أو الاستنشاق . وبخصوص العلامات السريرية، فقد كانت حسب نسبة حدوثها من الأكثر إلى الأقل كالتالي : ضيق بحدقة العين ، قيئ ، رعشه بالعضلات، مغص بالبطن، ضعف عام، غيبوبة، تغوط ثم تشنجات.

وكانت نسبه حالات الوفاة بين المرضى ٨,٣٪. كما لوحظ مدى ضعف العلاقة بين مستوى إنزيم الكولين استيريز بالبلازما والنتائج السريرية مما يستلزم معه عدم الاعتماد عليه في تقييم تطور أو علاج حالات التسمم بمركبات الفوسفات العضوية ولكنه يعد علامة معمليه لتأكيد التعرض لها .