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Original Article

Liver damage of OPC poisoning patient in Patuakhali Medical College Hospital, Patuakhali

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ABSTRACT

Background: *Organophosphorus (OP) pesticide poisoning is widespread in the developing world .The liver is the main organ that metabolizes various compounds including toxins, chemicals and drugs and eventually excretes from the body.* ***Objective:*** *To find out the level of liver enzymes among the organophosphorus compound poisoning.* ***Methods and Materials:*** *A cross-sectional study conducted from June 2018 to July 2020 in Department of Medicine,Patuakhali Medical College Hospital. Total 51 patients in whom a provisional diagnosis of OPC poisoning was made based on the patient's clinical presentation/history as recorded from the patient's attendant/details of poison containers were included in the study. P values <0.05 was considered as statistically significant.* ***Results:*** *Female patients were predominant 29(56.9%). The most common OP compound found to be abused among this study group was chlorpyrifos in 24 (47.1%) patients, which is an agricultural pesticide. Around 17 (33.3%) cases were found with abuse of methyl parathion (folidol), the cough syrup. AST and RBS were statistically significant compared between low and normal level of cholinesterase. Out of 51 patients, 33(64.7%) were discharge, 14(27.5) were DORB, 2(3.9%) were death, 1(2.0%) absconded and 1(2.0%) transfer out.* ***Conclusion:*** *This study observed young age and female patients were predominant. Majority patients were decreased serum cholinesterase level and blood sugar level was raised in the majority of cases with AST enzymes. Significant relation was found serum AST enzymes and RBS level in OP poisoning patients.*

Key word: *OPC, AST enzymes, AST enzymes*

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INTRODUCTION

The liver is the main organ that metabolizes various compounds including toxins, chemicals and drugs and eventually excretes from the body.[1]

Organophosphorus (OP) pesticide poisoning is widespread in the developing world. Being predominantly an agricultural country, pesticides and insecticides are used abundantly for cultivation, and access to these poisonous chemical substances by the population is easy.[2] Organophosphorus pesticides (OPs) have harmful effects on human health through environmental or occupational exposure.[3] Beside cholinergic effects, OPs induce oxidative stress[4,5], affect metabolic pathways[6], and cause multiple organ dysfunctions such as hypoxia and inadequate tissue perfusion of the liver and heart.[7] In the liver they cause ultrastructural, biochemical, metabolic, and mitochondrial damage, evidenced by changes in hepatic biomarkers such as serum aminotransferase and direct and indirect bilirubin.[8,9] In OPC poisoning, the targeted enzymes under attack are acetylcholinesterase and pseudocholinesterase. These cholinesterases are inhibited by OPC compounds leading to accumulation of acetylcholine at the synapses exhibiting muscarinic, nicotinic and CNS symptoms. Muscarinic symptoms that are exhibited by the parasympathetic fibers include vomiting, diarrhoea, miosis, shortness of breath and salivation[5] while diaphoresis is by the muscarinic receptors at sympathetic fibers. Nicotinic symptoms such as fasciculation, tachycardia and muscle weakness occur due sympathetic and motor effects. Excessive acetylcholine at the synapses in the central nervous system results in symptoms such as seizures, coma and altered sensorium. Pseudocholinesterase levels are used as a potential diagnostic tool in the determination of OPC poisoning.[10] The effects of OPs on the liver, in an attempt to propose general mechanisms of OP hepatotoxicity and possible treatment. Several key biological processes have been reported as involved in OP-induced hepatotoxicity such as disturbances in the antioxidant defence system, oxidative stress, apoptosis, and mitochondrial and microsomal metabolism. Most studies show that antioxidants can attenuate oxidative stress and the consequent changes in liver function.

METHODS AND MATERIALS

A cross-sectional study conducted from June 2018 to July 2020 in Department of General Medicine, Potuakhali Medical College Hospital. All patients in whom a provisional diagnosis of OPC poisoning was made based on the patient's clinical presentation/history as recorded from the patient's attendant/details of poison containers were included in the study. Multiple compound/tablet poisoning, contradictory diagnosis regarding the compound, patients with a history of bronchial asthma/cardiac illness or neuromuscular diseases, Patients who died within few minutes of hospitalization even before the initial treatment could be given were excluded from the study. A detailed case history was taken as per the proforma, general physical examination and systemic examination was done soon after admission. Laboratory investigations such as Complete blood count, Random blood sugar, Renal function test, Liver function test, were done at the time of admission. The patients were monitored regularly until the outcome. The diagnosis was made based on history or evidence of exposure to OP compound within 24 hours; characteristic manifestations of OP poisoning include, miosis, fasciculations, excessive salivation, improvement of signs and symptoms with administration of atropine Were recorded. It was represented as the muscarinic, nicotinic, and central effects of OP poisoning. Statistical analyses were carried out by using the Statistical Package for Social Sciences version 23.0 for Windows (SPSS Inc., Chicago, Illinois, USA).The mean values were calculated for continuous variables. The quantitative observations were indicated by frequencies and percentages. Chi-Square test with Yates correction was

used to analyze the categorical variables, shown with cross tabulation. Student t-test was used for continuous variables. P values <0.05 was considered as statistically significant.

RESULTS

Out of 51 patients, majority 18(35.8%) patients belonged to age group 21-30 years with mean age was 33.5±10.8 years. Female patients were predominant 29(56.9%) whereas male 22(43.1%). Male-female ratio was 1:1.3 (Table I). The most common OP compound found to be abused among this study group was chlorpyrifos in 24 (47.1%) patients, which is an agricultural pesticide. Around 17 (33.3%) cases were found with abuse of methyl parathion (folidol), the cough syrup. Other compounds identified are Sumithion (13.7%), Temphos (3.9%) and Fenthion (2.0%) (Table II). Mean cholinesterase was found 2615.7±2821.2 U/L, mean AST 46.35±28.26 IU/L, mean ALT 37.28±25.10 IU/L, mean ALP 107.31±31.42 IU/L, mean RBS 122.52±55.67 mg/dl, mean total bilirubin 0.92±0.41 mg/dl, mean direct bilirubin 0.31±0.12 mg/dl, mean creatinine 0.77±0.29 mg/dl, mean urea 22.12±10.25 mg/dl and albumin 5.08±0.48 g/dl (Table III). Majority 36(70.6%) patients had low level of plasma Cholinesterase and 15(29.4%) had normal level (Figure-1). AST level <40 was found 23(63.9%) in low level of cholinesterase and 5(33.3%) in normal level of cholinesterase. RBS >110 was found 10(27.8%) in low level of cholinesterase but not found in normal level. AST and RBS was statistically significant compared between low and normal level of cholinesterase. However, ALT, ALP, total and direct bilirubin were not significant between two groups (Table IV). Out of 51 patients, 33(64.7%) were discharge, 14(27.5) were DORB, 2(3.9%) were death, 1(2.0%) absconded and 1(2.0%) transfer out (Table V).

Table I: Demographic characteristics of the study patients (n=51)

Variables	Frequency	Percentage
Age (years)		
≤20	5	9.8
21-30	18	35.3
31-40	12	23.5
41-50	10	19.6
>50	6	11.8
Mean±SD	33.5±10.8	
Sex		
Male	22	43.1
Female	29	56.9

Table II: Types of organophosphorus compounds consumed (n=51)

Types of organophosphorus compounds	Frequency	Percentage
Chlorpyrifos	24	47.1
Methyl parathion	17	33.3
Sumithion	7	13.7
Temphos	2	3.9
Fenthion	1	2.0

Table III: Descriptive statistics of laboratory parameters of the patients with OP poisoning (n=51)

Parameters	Mean	±SD
Cholinesterase (U/L)	2615.7	±2821.2
AST (IU/L)	46.35	±28.26
ALT (IU/L)	37.28	±25.10
ALP (IU/L)	107.31	±31.42
RBS (mg/dl)	122.52	±55.67
Total Bilirubin (mg/dl)	0.92	±0.41
Direct Bilirubin (mg/dl)	0.31	±0.12
Creatinine (mg/dl)	0.77	±0.29
Urea (mg/dl)	22.12	±10.25
Albumin (g/dl)	5.08	±0.48

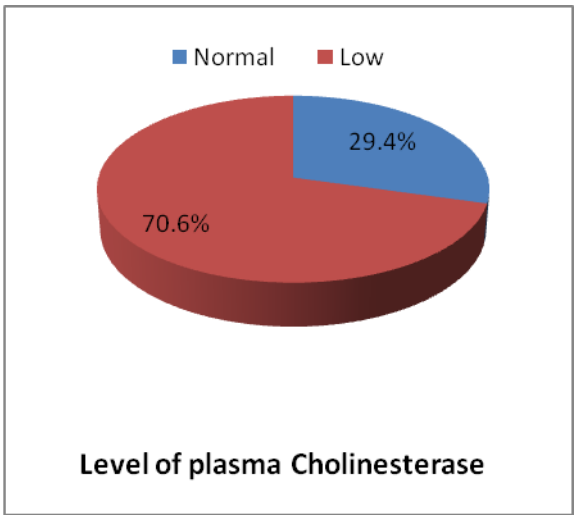

Figure 1: Bar diagram showing level of plasma Cholinesterase in patients with OP poisoning.

Table IV: Level of Cholinesterase with liver enzymes (n=51)

Liver Function Test in serum	Serum Cholinesterase level				P value
	<3930 U/L (Low) (n=36)		>3930 U/L (Normal) (n=15)		
	n	%	n	%	
AST					
>40 IU/L	23	63.9	5	33.3	0.045[s]
≤40 IU/L	13	36.1	10	66.7	
ALT					
>40 IU/L	9	25.0	3	20.0	0.701[ns]
≤40 IU/L	27	75.0	12	80.0	
ALP					
>128 IU/L	11	30.6	3	20.0	0.441[ns]

≤128 IU/L	25	69.4	12	80.0	
RBS					
>110 mg/dl	10	27.8	0	0.0	0.022[s]
≤110 mg/dl	26	72.2	15	100.0	
Total bilirubin					
>1.4 mg/dl	6	16.7	4	26.7	0.412[ns]
≤1.4 mg/dl	30	83.3	11	73.3	
Direct bilirubin					
≥0.5 mg/dl	5	13.9	3	20.0	0.584[ns]
<0.5 mg/dl	31	86.1	12	80.0	

s=significant; ns=not significant; P value reached from chi square test

Table V: Distribution of the study patients by outcome (n=51)

Outcome	Frequency	Percentage
Discharge	33	64.7
DORB	14	27.5
Death	2	3.9
Absconded	1	2.0
Transfer out	1	2.0
Referred	0	0.0

DISCUSSION

In this study observed that majority 18(35.8%) patients belonged to age group 21-30 years with mean age was 33.5±10.8 years. Risal et al.[1] reported that the age group varies with a maximum of 31.5% in the age group 16-25, followed by 22.2% in the age group 46-55 to a low of 13% in the age group 26-35. The minimum age recorded in the study was 16 years and the maximum age was 78 year with mean age group of 39.46±16.9. This result was consistent with the study done by Khadka[11] and Al Jumaan et al.[12]. The study done by Khadka[11] showed that the most commonly affected age group was 21-30 followed by the age group of 11-20 years. And the study done by Al Jumaan et al.[12] showed that the 20-30 age group was significantly more prone to suicide than other age groups [19]. Bag et al.[13] observed maximum cases 63 (42%) belonged to 21-30-year age groups after a group of 11 to 20 years' age 44 (29.33%) with a mean age of 27.6 years. In Salame and Wani[14] study majority of the patients (46%) belonged to age group 21-30 yrs.

In current study showed female patients were predominant 29(56.9%) whereas female 22(43.1%). Male-female ratio was 1:1.3. Risal et al.[13] revealed out of 54 cases with OP poisoning, majority of the patients were female with 64.8% and the rest 35.2% were Male. This result is much similar with the study done by Khadka[11] which showed that 52.3% of total cases of poisoning were female. A study done by Amanvermez et. al.[15] also showed that female were affected mostly than male accounting 52.74% of total cases.

In this study observed that the most common OP compound found to be abused among this study group was chlorpyrifos in 24 (47.1%) patients, which is an agricultural pesticide. Around 17 (33.3%) cases were found with abuse of methyl parathion (folidol), the cough syrup. Other compounds identified are Sumithion (13.7%), Temphos (3.9%) and

Fenthion (2.0%). Bag et al.[13] observed that the most common OP compound found to be abused among this study group was chlorpyrifos in 67 (44.67%) patients, which is an agricultural pesticide. Around 51 (34%) cases were found with abuse of methyl parathion (folidol), the cough syrup. Other compounds identified are Sumithion (12.67%), Temphos (4%) and Fenthion (1.3%).

In current study showed that mean cholinesterase was found 2615.7±2821.2 U/L, mean AST 46.35±28.26 IU/L, mean ALT 37.28±25.10 IU/L, mean ALP 107.31±31.42 IU/L, mean RBS 122.52±55.67 mg/dl, mean total bilirubin 0.92±0.41 mg/dl, mean direct bilirubin 0.31±0.12 mg/dl, mean creatinine 0.77±0.29 mg/dl, mean urea 22.12±10.25 mg/dl and albumin 5.08±0.48 g/dl. Risal et al.[1] reported the mean cholinesterase was found 2705.3±2913.36 U/L, mean AST 48.30±26.10 IU/L, mean ALT 36.70±28.62 IU/L, mean ALP 109.5±33.17 IU/L, mean RBS 125.77±52.3 mg/dl, mean total bilirubin 0.93±0.39 mg/dl, mean direct bilirubin 0.3±0.14 mg/dl, mean creatinine 0.78±0.25 mg/dl, mean urea 24.35±8.48 mg/dl and albumin 4.31±0.59 g/dl.

In present study observed that majority 36(70.6%) patients had low level of plasma Cholinesterase and 15(29.4%) had normal level. Risal et al.[1] reported low level of plasma Cholinesterase was found in 66.7% normal level was 33.3%. Similarly, random blood sugar was significantly found to be raised in this study which is consistent with the study done by Panda et al.[16]. Previous studies have suggested that oral ingestion of several OP may results elevation of counter regulatory hormones reducing insulin sensitivity leading to increased blood sugar which is further accentuated by excessive adrenergic influence on glycogenolysis leading to hyperglycemia.[17] In a study conducted in Japan by Sumiya et al.[18], an increase in plasma amylase levels above the normal range have been found in 50% of the patients who developed respiratory failure. Lin et al.[19] found that mean amylase levels were elevated in patients with respiratory support and serum amylase levels predicted ventilator support in OP poisoning.

In this study showed that AST level <40 was found 23(63.9%) in low level of cholinesterase and 5(33.3%) in normal level of cholinesterase. RBS >110 was found 10(27.8%) in low level of cholinesterase but not found in normal level. AST and RBS was statistically significant compared between low and normal level of cholinesterase. However, ALT, ALP, total and direct bilirubin were not significant between two groups. Risal et al.[1] observed The level of serum cholinesterase and liver enzymes. AST level is elevated in majority of the patients with decreased serum cholinesterase level. Which is similar to the study done by Amanvermez et al.[15]. Similarly, other studies has also shown abnormal liver function tests, hepatic necrosis, and fatty changes in OP poisoning cases.[20-21]

In this study observed that out of 51 patients, 33(64.7%) were discharge, 14(27.5) were DORB, 2(3.9%) were death, 1(2.0%) absconded and 1(2.0%) transfer out. Salame and Wani[14] revealed that the 120 patients in their study, death were reported in 13 (10.83%) patients and 107 (89.16%) patients survived after mechanical ventilation. The overall mortality in our study was 10.83% and this was compared with other study.[22] Deaths from unintentional organophosphorus poisoning are less common than those from intentional poisoning6 and seem to be more common in regions where highly toxic organophosphorus pesticides (WHO Class I toxicity) are available.[23,24] In a large cohort of Sri Lankan patients poisoned with WHO Class II organophosphorus pesticides,[25,26] no deaths resulted from unintentional poisoning.

CONCLUSION

It can be concluded that OP poisoning is more common among the younger population, below 40 years with male preponderance. The most common OP compound found to be abused chlorpyrifos which is an agricultural pesticide and methyl parathion (folidol) the cough syrup. AST and RBS were statistically significant compared between low and normal level of cholinesterase. Mortality was found 3.9%, whereas 2% absconded and 1(2.0%) transfer out. Such patients need to be monitor and practical closely with good supportive care. Similarly, strict accomplishment of the pesticide act and involving a new policy by the government to educate the public and youth in large about the dangerous life-threatening effects of Organophosphorus compounds could help ameliorate the harmful effects of such poisoning.

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