Liver Enzymes for Assessment of Severity of Organophosphorus Poisoning

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ABSTRACT

Introduction: Organophosphorus poisoning is the most common mode of poisoning in rural population of agrarian countries. In such resource limited settings proper allocation of the resources based on the need for observation in intensive care unit and ventilator need is essential. A various methods are used to assess the severity of acute organophosphorus poisoning including poisoning scoring systems and estimation of biochemical parameters such as serum acetylcholinesterase. Aims and objectives: The aim of current study was to evaluate the use of liver enzymes in assessment of severity of acute organophosphorus poisoning. Materials and Methods: A total to 320 patients between the period of December 2011 and November 2012 were studied. After applying the inclusion and exclusion criteria, a total of 80 patients were eligible for the study. The data was collected in pretested proforma. The statistical analysis was done using SPSS 17.0 software. Results: Out of the 80 patients studied, 16.3%, 15% and 10% of patients had elevated ALT, AST and ALP respectively. The increase in level of liver enzymes had no statistically significant association with mortality or respiratory depression Discussion and Conclusion: Various studies have shown liver dysfunction in chronic organophosphorus poisoning and have also identified its role in screening for pesticide exposure in high risk individuals. But, there are no studies on its relevance in acute organophosphorus poisoning. The current study shows that estimation of liver enzymes is not useful for severity assessment in acute organophosphorus poisoning.

KEYWORDS: Organophosphorus poisoning, liver dysfunction, AST, ALT, ALP, Peradenya organophosphorus poisoning scale

INTRODUCTION

Suicide is the second most common cause of death in the age group of 21-30 years, according to the WHO report of 2012. The organophosphorus poisoning is the most common cause of suicide in this age group [1]. In developing country like India, the ease of availability of the organophosphorus compound, used for agricultural purposes, makes it a common agent used for suicide in the rural population. The lack of health care facility and transportation in these areas also increase the mortality rate [2].

In a resource limited setting, early recognition of factors determining severity of poisoning and ventilator need is essential. As it will help appropriate allocation of resources, including the intensive care unit. There are various predictors of severity of organophosphorus poisoning. The following are some of the common predictors used to access the severity of poisoning and prognosis:

a. Peradenya organophosphorus poisoning scale[3,4,5,6,7]
b. Modified Driesbach criteria [8,9]
c. Glasgow coma scale[5]
d. Acute Physiology And Chronic Health Evaluation II score (APACHE II)[10]
e. Simplified Acute Physiology Score (SAPS) [10]
f. Sequential Organ Failure Assessment (SOFA) [10]
g. Serum cholinesterase levels[4,5,7,11,12]
h. Amylase [13,14]
i. Lipase [15]
j. Creatine Kinase [16]
k. Long QT interval [17,18]

Binukumar BK et al [19] demonstrated chronic organophosphate (dichlorvos) exposure in rodent model caused liver dysfunction. The study indicated that organophosphate exposure leads to impaired cytochrome oxidase activity and decreased ATP production. This leads to increase in mitochondrial calcium uptake and increase in
reactive oxygen species (ROS) levels; which cause increase in liver enzymes (AST, ALT, and ALP). Studies conducted on individuals with chronic exposure to organophosphate has demonstrated statistically significant increase in liver enzymes [20,21,22,23]. Among the various scores used serum cholinesterase is most extensively studied and validated. The test though is not widely available. The simpler biochemical tests such as liver function test are widely available and easier to obtain. Currently no study has been done depicting the role of liver function test in assessment of severity following acute organophosphorus poisoning.

Aims and objectives
- To study the changes in liver function test in patients with organophosphorus poisoning.
- To study the role of liver function test in assessing the severity.

MATERIALS AND METHODS
The patients admitted to Karnataka Institute of medical sciences, Hubli, between December 2011 and November 2012 were included in the study. The inclusion criteria are:
- History of organophosphorus poisoning
- Willing to consent for the study
- Presenting within 12 hours to hospital and not treated outside.
The following group of patients were excluded from the study:
- Cases with indication of exposure to an entirely different poison other than OP Poison
- Cases with OP poisoning and mixed with any other poison
- Cases who have consumed poison along with alcohol
- Cases who are chronic alcoholics
- Cases with history suggestive of chronic liver disease
- Cases of chronic renal failure

The data was collected using pretested proforma. The relevant history was collected and routine investigations including liver function test was done, at the time of admission. The diagnosis of organophosphorus poisoning was based on the history, clinical features and / or toxicology report. The patients were treated as per established protocols. The clinical outcome was measured in terms of mortality. Statistical analysis was done using SPSS 17.0 software.

RESULTS
A total of 360 patients were evaluated for inclusion for the study. After applying inclusion and exclusion criteria a total of 80 patients were eligible for the study. Most of the patients were in the age group of 21-30 years (45%) and were male (58.75%). The number of patients belonging to the rural areas (70%) was higher. In only two cases the exposure was accidental, rest of the cases (97.5%) it was with suicidal intent. Predominant occupation among the patients was farm related (farmers and farm laborers), accounting for 50% of the study population. 42.5% of the study population was illiterate.

Table 1: Distribution of ALT, AST and ALP among the cases

<table>
<thead>
<tr>
<th></th>
<th>ALT &lt;40IU</th>
<th>ALT &gt;40IU</th>
<th>AST &lt;40IU</th>
<th>AST &gt;40IU</th>
<th>ALP &lt;120IU</th>
<th>ALP &gt;120IU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of cases</td>
<td>67</td>
<td>13</td>
<td>68</td>
<td>12</td>
<td>72</td>
<td>8</td>
</tr>
<tr>
<td>Percent</td>
<td>85.8</td>
<td>16.2</td>
<td>85.0</td>
<td>15.0</td>
<td>90.0</td>
<td>10.0</td>
</tr>
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</table>

Above normal level of ALT was seen in 16.2% and normal levels seen in 83.8% (Table 1). In our study minimum ALT level was 6 and maximum level was 162, mean ALT 23.60, standard deviation of 21.840. Above normal level of ALT was seen in 15 % and normal level seen in 85% (Table 1). Minimum AST level was 7 and Maximum level was 108, Mean AST 24.61, Standard deviation of 17.935.ALP above normal level was seen in 10% and normal level seen in 90% (Table 1).

Minimum ALP level was 16 and Maximum level was 253, Mean ALP 63.81 Standard deviation of 37.956. Out of 80 cases studied 83.75% (67) had ALT<40 IU/L while 16.25% (13) had ALT > 40 IU/L. On comparing 2 groups, 61.54% (8/13) of cases improved in second group compared to 53.73% (36/67) in first group. 23.88% (16/67) cases had respiratory depression in first group compared to 23.08% (3/13) in second group. The mortality in first group was 22.39% (15/67) compared to 15.38% (2/13) in second group (Table 2).
Out of 80 cases studied 85% (68) had AST < 40 IU/L while 15% (12) had AST > 40 IU/L. On comparing 2 groups, 58.33% (7/12) of cases improved in second group compared to 54.41% (37/68) in first group. 23.52% (16/68) cases had respiratory depression in first group, compared to 25% (3/12) in second group. The mortality in first group was 22.05% (15/68) compared to 16.67% (2/12) in second group (Table 3).
Out of 80 cases studied 90% (72) had ALP< 120 IU/L while 10% (8) had ALP > 120 IU/L. On comparing 2 groups, 50% (4/8) of cases improved in second group compared to 55.5% (40/72) in first group. 23.6% (17/72) cases had respiratory depression in first group, compared to 20% (2/10) in second group. The mortality in first group was 23.38% (15/72) compared to 20% (2/8) in second group (Table 4).
Table 2: Correlation of ALT levels and outcome

<table>
<thead>
<tr>
<th>ALT Value</th>
<th>Prognosis classification</th>
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<tbody>
<tr>
<td></td>
<td>Improved</td>
<td>Respiratory depression</td>
<td>Death</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cases</td>
<td>Percent</td>
<td>Cases</td>
<td>Percent</td>
<td>Cases</td>
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<tr>
<td>&lt; 40 IU</td>
<td>36</td>
<td>53.73</td>
<td>16</td>
<td>23.88</td>
<td>15</td>
</tr>
<tr>
<td>&gt; 40 IU</td>
<td>8</td>
<td>61.54</td>
<td>3</td>
<td>23.08</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>44</td>
<td>55</td>
<td>19</td>
<td>23.75</td>
<td>17</td>
</tr>
<tr>
<td>P value</td>
<td>0.6046</td>
<td>0.9503</td>
<td>0.611</td>
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Table 3: Correlation of AST levels and outcome

<table>
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<th></th>
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<tbody>
<tr>
<td></td>
<td>Improved</td>
<td>Respiratory depression</td>
<td>Death</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cases</td>
<td>Percent</td>
<td>Cases</td>
<td>Percent</td>
<td>Cases</td>
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<tr>
<td>&lt;40 IU</td>
<td>37</td>
<td>54.41</td>
<td>16</td>
<td>23.52</td>
<td>15</td>
</tr>
<tr>
<td>&gt;40 IU</td>
<td>7</td>
<td>58.33</td>
<td>3</td>
<td>25</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>44</td>
<td>55</td>
<td>19</td>
<td>23.75</td>
<td>17</td>
</tr>
<tr>
<td>P value</td>
<td>0.8012</td>
<td>0.9121</td>
<td>0.6738</td>
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Table 4: Correlation of ALP levels and outcome

<table>
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<th>ALP levels</th>
<th>Prognosis classification</th>
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<td></td>
<td>Improved</td>
<td>Respiratory depression</td>
<td>Death</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>cases</td>
<td>Percent</td>
<td>cases</td>
<td>Percent</td>
<td>cases</td>
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<tr>
<td>&lt;120 IU</td>
<td>40</td>
<td>55.5</td>
<td>17</td>
<td>23.6</td>
<td>15</td>
</tr>
<tr>
<td>&gt;120 IU</td>
<td>4</td>
<td>50.0</td>
<td>2</td>
<td>20</td>
<td>2</td>
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<tr>
<td>Total</td>
<td>44</td>
<td>55.5</td>
<td>19</td>
<td>23.75</td>
<td>17</td>
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<tr>
<td>P value</td>
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<td>0.9302</td>
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DISCUSSION

The study conducted by Khan DA et al [20] on tobacco farmers of Pakistan, a total of 109 individuals (55 with exposure to pesticides and 54 control), there was a statistically significant elevation in the serum AST and ALT levels in individuals with exposure to pesticides. Similar findings were also observed in studies conducted by Patil JA et al [21] on pesticide sprayers of grape gardens and Tomei F et al [22] on environmental disinfectant workers, also showed similar findings. These studies showed that liver enzymes may be used to assess exposure to the organophosphorus poisoning.

Our study was designed to evaluate the use of liver enzymes for assessment of severity of acute organophosphorus poisoning. The study showed no statistically significant association between the severity of the organophosphorus poisoning.
poisoning and liver enzymes. There are no comparable studies available at this point.

**CONCLUSION**

Liver enzymes may be used to assess chronic exposure to organophosphorus poisoning, but is not useful to assess the severity of organophosphorus poisoning. Currently, in resource limited setting clinical severity assessment with Peradenya organophosphorus poisoning scale, would be most appropriate for proper allocation of the resources. However, there is a need for simpler and widely available biochemical parameters for assessment of severity of poisoning and ventilator need.

**REFERENCES**


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