ORIGINAL ARTICLE

Serum Cholinesterase : A diagnostic & Prognostic marker in cases of Acute poisoning

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INTRODUCTION

Demise due to poisoning has been known since time immemorial. Poisoning is a major problem all over the world, although its type and the associated morbidity and mortality vary from country to country.1 According to W.H.O., three million acute poisoning cases with 2, 20,000 deaths occur annually. Of these, 90% of fatal poisoning occurs in developing countries particularly among agricultural workers.2 More than 50,000 people die every year from toxic exposure in India.3 The monsoon dependent agricultural practice and socioeconomic factors related to it play role in the incidence of acute poisonings.

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A detailed knowledge about the nature and magnitude of the poisoning cases in a particular area is important for early diagnosis and prompt treatment.4 Being predominantly an agricultural country, OP (organophosphorus) compounds are used abundantly for farming in India. Hence, access to these hazardous chemical substances is easy. OP pesticides inhibit carboxylic esterase enzymes including acetylcholinesterase (AChE) and Serum cholinesterase(SChE). AChE can be found in erythrocytes, nervous tissue and skeletal muscles, while SChE can be found in plasma, liver, heart, pancreas and brain. Most of clinical manifestations associated with exposure to OP compounds have been attributed to inhibition of these enzymes.5 Although it has not been fully studied, these anticholinesterase effects can be associated with the extent of decrease of AChE and SChE. This study was designed to investigate the relevance of SChE to clinical manifestations following acute poisoning and to evaluate usefulness of SChE in predicting clinical outcomes.
MATERIALS AND METHODS
This study was conducted in M.P. Shah government medical college, Jamnagar and PDU medical college Rajkot, over a period of 2 years from May 2013 to April 2015. Total 200 cases which presented as acute poisoning were included in the study out of which 120 cases considered were admitted in the Intensive Care Unit (ICU) of MP Shah medical college and the remaining 80 were admitted in the ICU at PDU Medical College. Peak Duration of these cases was during the pre monsoon and monsoon season ie. From May to September.
All 200 cases were managed using clinical signs and symptoms as a guide towards assessing the cause of poisoning. In all cases venous blood samples were collected for baseline investigations of patients and estimation of toxin levels where the poison was known. Suspected OP poisoning cases were assessed using Proudfoot’s classification samples of venous blood to estimate serum cholinesterase levels were collected on the day of admission to the casualty. Another sample to estimate the same was collected on the 5th day after admission, as it is assumed to be the mean time interval for pralidoxime to reverse signs of respiratory insufficiency and obviate the need for ventilator support. Serum cholinesterase was estimated using semi automated analyzer based on the principle of hydrolysis of cholinesterase, having the normal values of ChE range from 5100 to 11700 with mean (SD) of 8440 (1780) IU/L.
Based on Proudfoot classification, mild OP toxicity is defined as less than 10% reduction of ChE, moderate toxicity as 10-50% reduction and severe toxicity as >50% of reduction. In keeping with this definition, 4590-5100 IU/L SChe can be considered as mild, 2550-4590 IU/L as moderate and less than 2550 IU/L as severe toxicity. Samples with a higher value were diluted in 0.9% saline and levels were repeated. Statistical Analysis was done using measures of central tendency (mean and Standard deviation).

RESULTS
Majority of the patients 94.5% hailed from rural areas (189 out of 200 cases studied). Males constituted 70% of the total population under study Table 1. Out of 200 cases 60 cases (30%) were proved to be due to Organophosphate poisoning the rest were due to miscellaneous causes as outlined in Table 2. Out of 200 cases admitted for acute poisoning only 30% patients had Serum Cholinesterase levels below the normal levels on initial analysis of SChe levels. Thus helping to differentiate cases of OP poisoning from those cases of poisoning due to other causes(70%), thereby helping to modify treatment modalities accordingly Table 3.
After 5 days Post hospitalization SChe levels exceeded > 5001 in all cases of suspected OP Poisoning (96.6%) except 2 patients who succumbed to their poisoning (3.4%) Table 2:

Table 1: Gender wise distribution of study subjects.

<table>
<thead>
<tr>
<th>Gender</th>
<th>Number of Patients</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>140</td>
<td>70%</td>
</tr>
<tr>
<td>Female</td>
<td>60</td>
<td>30%</td>
</tr>
<tr>
<td>Total</td>
<td>200</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 2: Causes of Poisoning

<table>
<thead>
<tr>
<th>Type of Poison</th>
<th>Number of Patients</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>O.P. Compounds</td>
<td>60</td>
<td>30%</td>
</tr>
<tr>
<td>Snake bite</td>
<td>32</td>
<td>16%</td>
</tr>
<tr>
<td>Dye</td>
<td>13</td>
<td>6.5%</td>
</tr>
<tr>
<td>Rat kill</td>
<td>24</td>
<td>12%</td>
</tr>
<tr>
<td>Kerosene</td>
<td>32</td>
<td>16%</td>
</tr>
<tr>
<td>Barbiturates</td>
<td>39</td>
<td>19.5%</td>
</tr>
<tr>
<td>Total</td>
<td>200</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 3: Serum Cholinesterase levels in patients at the time of admission

<table>
<thead>
<tr>
<th>Reference range of SChe</th>
<th>Severity</th>
<th>Percentage of Patients (n=200)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1000</td>
<td>Severe</td>
<td>3 (1.5%)</td>
</tr>
<tr>
<td>1001-2000</td>
<td>Moderate</td>
<td>12 (6%)</td>
</tr>
<tr>
<td>2001-3000</td>
<td>Mild</td>
<td>13 (6.5%)</td>
</tr>
<tr>
<td>3001-4000</td>
<td>Mild</td>
<td>18 (9%)</td>
</tr>
<tr>
<td>4001-5000</td>
<td>Mild</td>
<td>14 (7%)</td>
</tr>
<tr>
<td>&gt;5001</td>
<td>Normal Range</td>
<td>140 (70%)</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>200 (100%)</td>
</tr>
</tbody>
</table>

DISCUSSION
Our country primarily being an agrarian economy, a large number of people reside in villages earning their livelihood through farming. Such people are more vulnerable to poisoning whether accidental such as snake bite or self inflicted due to limited resources to sustain themselves in cases of drought or famine and also due to easy
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availability of poisonous substances. Out of the 200 cases of acute poisoning reporting to casualty of both hospitals 189 were from the surrounding rural areas. Similar findings were reported by Krishnamurthy et al.  

Acute poisoning was more common in males (70%) as compared to females (30%) in our study. This correlated well with studies conducted by Arvind et al and V Siva et al both studies showed a male preponderance in their study subjects.  

OP poisoning appeared as the leading cause of acute poisoning in this study amounting to 30% of the cases. This corroborated well with literature published by K Suguna Devi, Srinivas et al and Latha et al who also found OP poisoning as the most common cause for poisoning in their respective studies.  

Our study was mainly done with the purpose to see if estimation of serum cholinesterase levels had any diagnostic or prognostic effect on cases of acute poisoning. In our case 30% of the cases had low serum cholinesterase levels at the time of hospitalization. These cases correlated well with signs and symptoms of neuromuscular suppression seen classically in cases of OP poisoning. Initial Low serum cholinesterase levels were also found in cases due to OP Poisoning in studies conducted by Worek et al. Aygun et al showed that SChE levels were of great help in diagnosis of cases of OP poisoning in acute phase. Goswamy et al have stated that measurement of the acetylcholinesterase level is useful in predicting the prognosis in OP poisoning. Initial levels of SChE also correlate with associated mortality and morbidity. In our study 1.5% of cases had severely low levels of SChE according to Proudfoot’s classification. Out of which 2 passed away on 2nd day after hospitalization there by indicating that extremely low levels of SChE(<1000 IU) do have a correlation with the outcome. This fact was reiterated by Tsao et al who showed that very low SChE levels were associated with fatal outcomes in cases of poisoning due to OP compounds. Similar findings were correlated by Kare et al in a study conducted in the year 2006.  

CONCLUSION

The conclusions drawn from this study were that acute poisoning cases were more common in rural areas possibly due to easy availability of toxic substances mainly used as pesticides for farming. Males outnumbered females as they are more involved in outdoor work in rural areas and thus have a greater exposure to these toxic compounds be it accidental or purposeful. Low SChE levels at the time of admission along with physical symptoms helped to diagnose cases of OP poisoning from those of poisoning due to other causes thereby modifying the course of therapy and thus overall results. Very low levels of SChE were associated with adverse outcomes in patients.  

REFERENCES

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