Calcium abnormalities in pulmonary tuberculosis

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SUMMARY

Objective: To study the disorders of calcium metabolism in patients with untreated pulmonary tuberculosis.

Design: A cross-sectional comparative study.

Places and Duration of Study: Department of Pathology Army Medical College and Department of Pulmonology MH Rawalpindi, Department of Chemical Pathology and Endocrinology AFIP Rawalpindi from Jan 2002 to Jan 2003.

Subjects & Methods: One hundred and fifty two patients of untreated pulmonary tuberculosis and forty four age and sex-matched disease free controls were included in the study. Blood ionized calcium (Ca\(^{++}\)), pH, sodium (Na) and potassium (K) were analyzed by ion selective electrode method on Easylyte® auto analyzer. Other related parameters were measured by colorimetric methods.

Results: Blood Ca\(^{++}\) levels in patients of pulmonary tuberculosis were found (mean ± SD: 1.15±014 mmol/L) significantly low as compared to control subjects (mean ± SD: 1.23±0.03 mmol/L) (p<0.001). Fifty two (38%) subjects had hypocalcaemia while seven (5%) subjects were found to be falling in hypercalcaemic range. Serum phosphate levels were also low corresponding to Ca\(^{++}\) levels control (mean ± SD: 0.97±0.19 mmol/L vs 1.17±0.21 mmol/L; p<0.001). There was no statistically significant difference in other parameters e.g. albumin, urea, creatinine, pH, Na and K levels in study subjects and controls.

Conclusion: Hypocalcaemia and hypophosphataemia are more prevalent in our population of untreated pulmonary tuberculosis.

Key Words: Pulmonary tuberculosis, Hypocalcaemia, Hypercalcaemia

INTRODUCTION

Pulmonary tuberculosis (Pulm TB) is still a very common cause of morbidity & mortality in our country\(^1\). Keeping in mind its high prevalence all aspects of the disease need to be thoroughly studied. Disturbance in calcium metabolism leading to variations in blood calcium concentration can cause a spectrum of clinical features\(^2\). Such patients may be asymptomatic or may have signs and symptoms, which can easily be attributed to primary disease if calcium abnormalities are not suspected.

Calcium abnormalities have been variably reported in studies carried out on the subject. In a Swedish study hypercalcaemia was found in 25% of 67 patients of Pulm TB\(^3\). In United States 16% to 28% patients of Pulm TB have been found to be suffering from hypercalcaemia\(^4\) though lower incidence of hypercalcaemia has also been reported from US\(^5\). Hypercalcaemia was detected in 25% Greek patients\(^6\) and in 27.5% of the Malaysian patients\(^7\) with pulmonary tuberculosis, with symptoms of hypercalcaemia present in only 5% and 12% of these patients, respectively. Hypercalcaemia and hyperphosphataemia in Pulm TB has also been reported from Germany\(^8\). Albumin Corrected Calcium (ACC) was also found significantly higher in Pulm TB patients from Hong Kong despite a lower calcium intake\(^9\).

However, comparatively low percentage of hypercalcaemia was found in another study from Hong Kongs (6%)\(^10\). Pulm TB has also been found associated with hypocalcaemia in some studies. In a Japanese study 38% patient showed Ca level lower than reference range\(^11\). Serum Ca and Parathyroid hormone (PTH) levels were found significantly reduced in an Egyptian group of Pulm TB patients\(^12,13\). Similar results were also found in a Nigerian study\(^14\).

Calcium abnormalities in pulmonary TB patients have not been studied in any Pakistani population in spite of the fact that this is still a very common disease in our country. A study was, therefore, planned to prepare a preliminary report about spectrum of calcium abnormalities based on the routine biochemical laboratory investigations.

MATERIALS AND METHODS

This cross-sectional comparative study was carried out in the Department of Pathology Army Medical
College Rawalpindi, Department of Pulmonology Military Hospital Rawalpindi and Dept of Chemical Pathology and Endocrinology AFIP Rawalpindi from Jan 2002 to Jan 2003. One hundred and fifty two patients of Pulm TB were selected

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One hundred and fifty two patients of Pulm TB were selected and compared to control population (mean ± SD: 1.17±0.21 mmol/L) (p<0.001) (Fig 1) but there was no significant difference in iP in male and female patients of Pulm TB (Table I). TC and ACC were also significantly low in pulmonary TB group as compared to controls (p< 0.05). Hypocalcaemia defined as Ca++ levels < 1.15 mmol/L was found in 59 (39%) subjects. However, number of hypocalcaemic Pulm TB patients detected by Ca++ was significantly higher as compared to those detected by TC (33 or 22%) & ACC (21 or 19%) (p< 0.05) (Fig 2). Only 9 (5.9 %) patients were found hypercalcemic (Ca++ levels > 1.27 mmol/L) among Pulm TB group. The detection rate of hypercalcemia was also higher by Ca++ as compared to that for TC (4%) or ACC (4%) (Fig 2).

Table 1: Comparison of Calcium and Phosphorus between males and female patients of Pulm TB patients and control subjects.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Group</th>
<th>Sex</th>
<th>n</th>
<th>Mean</th>
<th>SD</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ionized Ca (mmol/L)</td>
<td>Male</td>
<td>137</td>
<td>1.17</td>
<td>0.13</td>
<td>p = 0.39</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>58</td>
<td>1.16</td>
<td>0.10</td>
<td>p = 0.57</td>
<td></td>
</tr>
<tr>
<td>Total Ca (mmol/L)</td>
<td>Male</td>
<td>137</td>
<td>2.23</td>
<td>0.25</td>
<td>p = 0.38</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>58</td>
<td>2.26</td>
<td>0.20</td>
<td>p = 0.73</td>
<td></td>
</tr>
<tr>
<td>Albumin corrected Ca (mmol/L)</td>
<td>Male</td>
<td>137</td>
<td>2.27</td>
<td>0.25</td>
<td>p = 0.31</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>58</td>
<td>2.25</td>
<td>0.20</td>
<td>p = 0.73</td>
<td></td>
</tr>
<tr>
<td>Phosphorus (mmol/L)</td>
<td>Male</td>
<td>133</td>
<td>1.01</td>
<td>0.22</td>
<td>p = 0.011</td>
<td>(NS)</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>56</td>
<td>1.02</td>
<td>0.18</td>
<td>p = 0.034</td>
<td>(NS)</td>
</tr>
</tbody>
</table>

Table 2: Comparison of related parameters in Pulm TB patients and control subjects.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Group</th>
<th>n</th>
<th>Mean</th>
<th>SD</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potassium (mmol/L)</td>
<td>Subjects</td>
<td>151</td>
<td>3.87</td>
<td>0.61</td>
<td>p = 0.011</td>
</tr>
<tr>
<td></td>
<td>Controls</td>
<td>44</td>
<td>3.72</td>
<td>0.51</td>
<td>p = 0.089</td>
</tr>
<tr>
<td>Sodium (mmol/L)</td>
<td>Subjects</td>
<td>151</td>
<td>133</td>
<td>4.72</td>
<td>p = 0.31</td>
</tr>
<tr>
<td></td>
<td>Controls</td>
<td>44</td>
<td>133</td>
<td>3.05</td>
<td>p = 0.634</td>
</tr>
<tr>
<td>PH</td>
<td>Subjects</td>
<td>150</td>
<td>7.33</td>
<td>0.07</td>
<td>p = 0.21</td>
</tr>
<tr>
<td></td>
<td>Controls</td>
<td>44</td>
<td>7.348409</td>
<td>0.10</td>
<td></td>
</tr>
<tr>
<td>Creatinine (µmol/L)</td>
<td>Subjects</td>
<td>141</td>
<td>86</td>
<td>13.9</td>
<td>p = 0.634</td>
</tr>
<tr>
<td></td>
<td>Controls</td>
<td>44</td>
<td>83</td>
<td>15.3</td>
<td>p = 0.634</td>
</tr>
<tr>
<td>Urea (mmol/L)</td>
<td>Subjects</td>
<td>144</td>
<td>4.35</td>
<td>1.19</td>
<td>p = 0.011</td>
</tr>
<tr>
<td></td>
<td>Controls</td>
<td>44</td>
<td>4.42</td>
<td>0.86</td>
<td>p = 0.011</td>
</tr>
</tbody>
</table>

There was no statistically significant difference in concentrations of other biochemical parameters in study and control groups (Table 2).
Calcium abnormalities in pulmonary tuberculosis

DISCUSSION

Abnormalities in calcium, metabolism have not been studied in our population of Pulm TB. The most striking
finding of the present study was presence of hypocalcaemia in these patients. This finding is consistent with earlier studies from Japan, Egypt and Nigeria. Surprisingly the percentage of hypocalcaemic patients found in our study (35%) is also quite close to that reported in Japanese study (38%). The number of pulmonary TB patients with hypercalcaemia was found to be very low (5.2%). This is in contrast to the reports from Sweden, US and Greece while closer to that reported from Hong Kong. The discrepancy in our findings and those from US and Europe could be explained by many factors e.g. ethnic differences, malnutrition and malabsorption associated with our patients of Pulm TB. Presence of nutritional and absorbtional problems as evident form concomitant finding of hypophosphataemia could be a part of the same disease process or could be due to coexisting gastrointestinal disease. Although utmost care was exercised to select control subjects from the same socioeconomic groups, factors leading to hypocalcaemia and hypophosphataemia because of vitamin D deficiency cannot be ruled out. A detailed study is recommended to investigate the vitamin D and PTH metabolism in these subjects.

The mechanism of hypercalcaemia in pulmonary TB is not known. Macrophage activation and disregulated vitamin D production has been implicated with decreased PTH. A French study carried out on bronchoalveolar lavage (BAL) cells has shown that major contribution is from 25 - hydroxycholecalciferol (Vit D3) synthesis by alveolar immune cells. However, no direct relationship between serum Ca and Vit D3 has been found. Ability of Ca²⁺ estimation to pick more cases of Ca abnormalities in pulmonary TB is in agreement with studies carried on other diseases.

CONCLUSION

It is concluded that calcium abnormalities especially hypocalcaemia is quite common in our patients of pulmonary TB and physicians must maintain a high index of suspicion for diagnosis and correction of these abnormalities.

REFERENCES