Role of Procalcitonin in the Early Diagnosis of Neonatal Sepsis

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Summary

Objectives: To evaluate the specificity of Procalcitonin (ProCT) as marker of neonatal infection. Materials and Methods: The study includes 131 newborns admitted to the NICU. ProCT was determined in 5 groups of newborn with Sepsis, Asphyxia, Respiratory Distress Syndrome (RDS), Localized Infection and in uninfected patients. Results: Serum ProCT values were significatively high in sepsis group vs control group (p <0.002). ProCT levels correlate with the severity of Sepsis (p <0.002). Conclusions: In neonatal period, monitoring of PCT allows a rapid diagnosis of infection and is most valuable for evaluating treatment efficacy and prognosis.

Introduction

Serum Procalcitonin (ProCT) has been proposed as indicator of presence of infection especially in children and in newborns in which diagnosis of infection is difficult. ProCT is a propeptide that in normal conditions undergoes post-translational proteolysis into its hormonal derivative Calcitonin. During infections its increase is not associated to hormonal secretion: also occurs in people who have had thyroidectomy. Furthermore ProCT which is not detectable in the plasma of healthy subjects, is consistently released in the circulation 3 hours after a single injection of endotoxin steadily increasing up to 24 hours (1-3). ProCT is markedly high in conditions associated to inflammatory response: severe systemic infections, septic shock, burns, heart failure, major surgery (4). This type of response makes ProCT a potential sensitive marker...
of neonatal infection and can be useful in NICU where patients present a widespread of pathology with similar laboratory findings (5,6).

To evaluate the specificity of ProCT as a marker of infection during neonatal period, we determined ProCT serum in 5 groups of newborn with Sepsis, Asphyxia, Respiratory Distress Syndrome (RDS), Localized Infection (LI) and in uninfected patients.

Materials and Methods

131 newborns, admitted to the Neonatal Intensive Care Unit, were enrolled in this study. Primary diagnosis was recorded at the time of admission using diagnostic category to identify patients with Sepsis, RDS, Localized Infection, Asphyxia and uninfected newborns (tab. 1).

Blood samples were obtained in the first week of life in addition to other laboratory. ProCT was determined by Biochemistry Laboratory of the hospital using an immunoluminometric assay, LUMI-TEST, monoclonal antibodies on specific region of ProCT. It requires 20 μl of plasma and can be complete in 2 hours. Data are presented as mean ± SD (range of normality < 0.5 ng/ml), the Mann Whitney test was used to perform statistical comparison.

Results

Mean of ProCT serum level in five groups with statistical analysis is showed in table (tab. 2). Serum ProCT values were significantly high in sepsis

<table>
<thead>
<tr>
<th>Pathologies</th>
<th>Newborns (total 131)</th>
<th>Gestational Age Mean ± SD</th>
<th>Birth Weight Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asphyxia</td>
<td>20</td>
<td>36.11 ± 5.7</td>
<td>2525 ± 1112</td>
</tr>
<tr>
<td>RDS</td>
<td>48</td>
<td>36 ± 5.35</td>
<td>2545 ± 1024</td>
</tr>
<tr>
<td>Sepsis</td>
<td>21</td>
<td>36.33 ± 4.9</td>
<td>2502 ± 850</td>
</tr>
<tr>
<td>Localized Infections</td>
<td>22</td>
<td>34.7 ± 5.5</td>
<td>2500 ± 1106</td>
</tr>
<tr>
<td>Control</td>
<td>20</td>
<td>36.4 ± 3.3</td>
<td>2746 ± 365</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pathologies</th>
<th>ProCT Mean ± SD</th>
<th>Range</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asphyxia</td>
<td>22.46 ± 11.3</td>
<td>0.14 – 146</td>
<td>&lt; 0.04</td>
</tr>
<tr>
<td>RDS</td>
<td>4.46 ± 1.13</td>
<td>0.1 – 146</td>
<td>= 0.33</td>
</tr>
<tr>
<td>Sepsis</td>
<td>34.93 ± 14.65</td>
<td>1.9 – 146</td>
<td>&lt; 0.002</td>
</tr>
<tr>
<td>Localized Infections</td>
<td>9.02 ± 0.87</td>
<td>0.1 – 37</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>Control</td>
<td>0.37 ± 0.12</td>
<td>0.08 – 1.1</td>
<td>-</td>
</tr>
</tbody>
</table>
group vs control group. Serum ProCT values were highly variable in other groups. RDS has not significant effect on ProCT, only Asphyxia showed significant correlation vs Control (p < 0.04). Comparison between groups showed a statistical significant Sepsis vs Asphyxia, Localized Infection, RDS (p <0.0001).

Discussion and conclusions

In these last years in literature many authors emphasized the role of ProCT as a sensitive and specific marker in infection-related condition, other suggested it as a marker for early diagnosis of bacterial sepsis (7,8). Instead other studies underlined a lack of specificity for sepsis diagnosis in preterm newborn because of influence of varying of neonatal period (9). Our data show increased proCT in Sepsis, in Localized Infection and in Asphyxia but non in RDS as in literature reported (10).

Our research demonstrated that serum ProCT was significatively higher in infection that in non infected newborns (p < 0.002). It’s interesting the ProCT levels in group with Asphyxia vs other conditions (p < 0.04).

We correlated this datum to a possible maternal infective condition (PROM and Chorioamniositis) or to other risk factor during the delivery running to fetal sofferece. Mother’s ProCT serum level could give aid to this hypotesis. In newborns with RDS were not ProCT serum variation. These data confirm the reliability of ProCT as sensitive and specific marker for neonatal infections. No significative effects on serum ProCT of birth weight, gestational age may be detected (p= ns). In conclusion, at birth newborn adaptations and metabolic changes influence meaningfully haematologic index and sensitive tests are of great utility in NICU where patients present a wide variety of neonatal and perinatal disorders with laboratory values similar to those caused by infections.

References

7. SIMON L, GAUVIN F, AMRE DK, SAINT-LOUIS P, LACROIX J. Serum procalcitonin and C-reactive protein levels as markers of bacterial infection: a