A Comparative Study between C-Reactive Protein and Procalcitonin in Iraqi Burn Patients

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Abstract

Association between Procalcitonin (PCT) and C-reactive protein (CRP) and burn injury was evaluated in 80 burned patients from Al-Kindy and Imam Ali hospitals in Baghdad-Iraq. Patients were divided into two groups, survivor group 56 (70%) and non-survivor group 24 (30%). PCT was estimated using (Human Procalcitonin ELISA kit) provided by RayBio/USA while CRP was performed using a latex agglutination kit from Chromatest (Spain).

Our results declared that the mean of Total Body Surface Area (TBSA %) affected were 63.5% range (36%–95%) in non-survivor patients, while 26.5% range (10%–70%) in survivor patients. There is a significant difference between the two groups (P = 0.00), the higher mean percentage of TBSA has a significant association with mortality.

Serum PCT and CRP were measured at the three times of sampling (within the first 48hr following admission, after 5th days and after 10th days). The mean of PCT serum concentrations in non-survivor group (2638 ± 3013pg/ml) were higher than that of survivor group (588 ± 364pg/ml). Significantly high levels of CRP were found between the survivor and non-survivor groups especially in the 10th day of admission P=0.000, present study show that significant differences is found within the non-survivor group through the three times P=0.01, while results were near to significant differences within survivor group through the three times (P=0.05).

Keywords: Procalcitonin, C-reactive protein, Biomarkers, Burned patients.

Introduction

Burns injuries are a prevalent and hard critical care problem. The necessities of specific skills converge on stabilizing the patient, avoiding infection, and enhancing functional recovery [1]. Important progress being made in burn patient...
care, but we still need for comprehension of inflammatory and anti-inflammatory systems (schemes) and their interactions in states of burned patients provides new opportunities to more accurately diagnosis, including progressing wound healing, grafts healing, controlling inflammation and efficiency of treatment [2].

There are many typical inflammatory markers related to the existence of certain infections like Leucocyte count, Erythrocyte Sedimentation Rate (ESR) and C-reactive protein (CRP), which remain elevated in burn patients but their increase or decrease are not always dependable[3].

The kinetics of C-reactive protein is slower than that of the PCT, and C-reactive protein concentrations are induced near to their maximum during less severe symptoms of systemic inflammation and organ dysfunction)[4].

The level of PCT in the circulation system of healthy people is lower than (0.01 µg/L) and it increases in a reaction of proinflammatory of bacterial infection. The PCT has been widely tested for diagnosis and suitable use as antibiotic therapy in both children and adults for different infectious diseases in various researches in different countries [5-7]. The PCT has been studied as biomarker to assist diagnosis and aid prognostication in bacterial infections and sepsis [4][8-11].

This study was conducted in an attempt to prove the efficiency of plasma PCT level as a critical biomarker to detect infection and even death in burned patients.

Material and Methodologies
Eighty (80) burned patients were included in this study they were admitted to the burn emergency department at Al-Kindy and Imam Ali hospitals in Baghdad, Iraq from the period from October/2015 until February/2016. The patients, including were with signs of burn injuries within two days of admission. Patients were only recruited in daytime, as the time between sample collection and laboratory analysis was less than six hours.

Clinical Investigation
The PCT was estimated using (Human Procalcitonin ELISA kit) provided by RayBio/USA which is an in vitro enzyme-linked immunosorbent assay for the quantitative measurement of human Procalcitonin in serum with normal range <0.5 ng/ml according to the manufacturer's specifications, while CRP was performed using latex agglutination kit from Chromatest (Spain).

Statistical Analysis
Data generated from this work were tabulated into Microsoft excel sheets and uploaded to Minitab version 13.0. The PCT and CRP was analyzed using ANOVA test. P-value of <0.05 was considered as statistically significant.

Results and Discussion
In this study Eighty (80) burned sequential patients were admitted to burn unit of hospitals for investigations, 30 (37.5%) patients were from the Imam Ali hospital and 50 (62.5%) from Al-Kindy hospital. Based on the clinical result, patients were divided into 24 (30%) non-survivor group and 56 (70%) survivor group. Our results declared that the mean of TBSA % affected were 63.5% range (36%–95%) in non-survivor, patients while 26.5% range (10%–70%) in survivor patients. There is a significant difference between two groups (P = 0.00) Figure 1 where, the higher mean percentage of TBSA% has a significant association with mortality, but through recent years the progression in intensive care led to a significant reduction in mortality in burn injury patients. Many studies have demonstrated that TBSA% was a critical predictor of burn mortality [12-14].

![Figure 1: Mean of TBSA% for Survivor and Non-Survivor Groups as Predictor for Burn Mortality.](image_url)
following admission, after 5th day and after 10th day, of admission where the averaged values of PCT concentrations have no significant differences (P>0.05) among the non-survivor group and within the survivor group of three times, but there were a strongly significant difference between survivor and non-survivor groups during 10th day time post-burn only (P=0.000).

In other word the mean of PCT serum concentrations (2638 ± 3013 pg/ml) in non-survivor group were higher than the survivor group (588 ± 364 pg/ml). See Table 1, and Figure 2.

Our results showed no-normal distribution of Procalcitonin data in burn patients like other study in Table 2, perhaps there was another or mixed systemic infection like UTI, chest infections etc. Recently they found sometimes other conditions induce PCT (e.g. cardiogenic shock, major surgery including cardiac surgery, accidental trauma, pancreatitis, or burn trauma) [4][15][16].

Corresponds to the results of Rosnova et al., 2015 [9], who found high PCT concentrations in dead patients. So did Castelli et al. [4] and Barati et al. [17] who indicated higher levels of PCT in burn injury patient with infections as compared to burn injury patients without infection.

Table 2: Mean of PCT Concentration (pg/ml) in Survivor and Non-Survivor Groups.

<table>
<thead>
<tr>
<th>Group</th>
<th>No</th>
<th>Mean of PCT Concentration (Pg/ml)±SD</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>48hr</td>
<td>5th Day</td>
</tr>
<tr>
<td>Non-Survivor</td>
<td>15</td>
<td>773 ± 799</td>
<td>1383± 1972</td>
</tr>
<tr>
<td>Survivor</td>
<td>35</td>
<td>827± 852</td>
<td>724± 573</td>
</tr>
</tbody>
</table>

P value

*P<0.05= Significant; **P<0.01= High Significant; P>0.05= Non Significant

Table 3: Differences in PCT Levels Between the Cases with Confirmed and Unconfirmed Infection.

<table>
<thead>
<tr>
<th>Studies</th>
<th>Confirmed Infection</th>
<th>Unconfirmed Infection</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Our study</td>
<td>2.638 ± 3.013</td>
<td>0.588 ± 0.364</td>
<td>0.000</td>
</tr>
<tr>
<td>Von Heimburg et al., 1998 [20]</td>
<td>49.8± 76.9</td>
<td>2.3 ± 3.7</td>
<td>0.005</td>
</tr>
<tr>
<td>Lavrentieva et al., 2007 [23]</td>
<td>11.5 ± 7.6</td>
<td>2.3 ± 3.7</td>
<td>0.05</td>
</tr>
<tr>
<td>Barati et al., 2008 [17]</td>
<td>8.45±7.8</td>
<td>0.5 ± 1.0</td>
<td>0.001</td>
</tr>
<tr>
<td>Seoane et al. 2014 [18]</td>
<td>3.00±5.43</td>
<td>0.56 ± 0.29</td>
<td>0.628</td>
</tr>
<tr>
<td>Mokline et al., 2015 [8]</td>
<td>7.26 ± 7</td>
<td>0.9 ± 0.48</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Table 4: CRP Concentration (mg/L) in Survivor and Non-Survivor Groups.

<table>
<thead>
<tr>
<th>Group</th>
<th>No</th>
<th>Mean of PCT Concentration (Pg/ml)±SD</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>48hr</td>
<td>5th Day</td>
</tr>
<tr>
<td>Non-survivor</td>
<td>15</td>
<td>25.4 ± 32.45</td>
<td>38.6 ± 45.62</td>
</tr>
<tr>
<td>Survivor</td>
<td>35</td>
<td>20.6± 26.1</td>
<td>32.97± 28.48</td>
</tr>
</tbody>
</table>

P value

*P<0.05= Significant; **P<0.01= High Significant; P>0.05= Non Significant
Kim et al. [10] found that PCT levels could serve as a prognostic marker for burn patients and the concentrations ≥ 2 ng/ml provide a mortality marker. Secondary infection was a prevalent complication in burn injuries and late diagnosis is associated with increased morbidity, mortality, and also secondary infection lead to sepsis especially in burn injury patients and for these reasons, recognizing sepsis early is important. However, the systemic inflammation signs including changes in body temperature, tachycardia and leukocytosis are used for diagnosis of sepsis but sometimes can be misleading because critically ill burn patients often manifest a systemic inflammatory response syndrome without infection according to Mokline et al. [8]. Several studies suggested that PCT may not an accurate marker for sepsis in burn injured patients as a result of Rosanova et al.; Seoane et al. [9][18] in vice versa Mann et al. [19] concluded that PCT may be useful to diagnose sepsis in burn patients. Burn injury patients a general and complex example of the inflammatory process, including the inflammation mediators which lead to disruption of homeostasis and multiple organ failure. Significantly high levels (mg/l) of C - reactive protein (CRP) were found between survivor and non-survivor groups especially in the 10th day P=0. 000. Our results showed a significant differences within the non-survivor group and near to significant differences in survivor group through the three times P= 0.01, 0.05 respectively. See Table 4, and Figure 4.

C-reactive protein (CRP) known as acute-phase proteins whose consider as a biomarker for inflammatory response to infection, which indicating that CRP can be predictive of infection as found by Neely et al., 1998 and Barati et al., 2008 [21][17].

Our results were corresponds with Alkazaz et al., 2014 and Jeschke et al., 2013 [22][23] they found significantly increasing of CRP in burn injuries, but Lavrentieva et al., 2007 [24], showed that serum CRP did not correlate with sepsis incidence while Neely et al., 2004 [25] evaluated both CRP and PCT, and found that PCT did not correlate and predict sepsis, this disagreement continues related contradictory studies that investigated the effect of PCT and CRP as a biomarkers of severe infections after a burn injury like Barati et al., 2008 and Sachse et al., 1999 [17][26].

**Figure 4: Comparison CRP Con. (mg/L) in Survivor and Non-Survivor Groups**

CRP and PCT concentrations were analyzed according to the time after burn injury were significantly higher in dead patients as compared with survivor patients.

In this study, we have reached indicate that PCT and CRP both are infected-related parameters. However, both proteins are also induced by noninfectious causes of systemic inflammation and in patients with organ dysfunction. The PCT has demonstrated itself to be a parameter with a wide range of concentrations and clinically useful kinetics, thus being the better parameter of the two to estimate the severity, prognosis, and time course of the disease the result that conducted by Castelli et al. [4].

**Conclusion**

Our study demonstrates that TBSA is a critical predictor of burn mortality. C-reactive protein and procalcitonin are represent an early inflammatory indicator.

**References**


[23] Jeschke, M. G.; Finnerty, C. C.; Kulp, G. A.; Kraft, R.; and Herndon, D. N. Can we use C-reactive protein levels to predict severe infection or sepsis in severely burned patients? International Journal of Burns and Trauma, 2013. 3 (3), 137-143.

