

Abstracts of Outstanding Presentations of the 74th Annual Meeting of the Medical Association of Nippon Medical School

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Abstract of Outstanding Presentation (1)

The Clinical Usefulness of Procalcitonin Measurement for Assessing the Severity of Bacterial Infection in Patients Requiring Corticosteroid Therapy

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Introduction

Early detection and specific clinical intervention has been shown to be crucial for favorable outcomes in patients with sepsis. However, sepsis can be difficult to distinguish from other noninfectious conditions with clinical signs of acute inflammation. Procalcitonin (PCT) was initially described as a prohormone of calcitonin produced in the medullary C-cells of the thyroid gland. Recent studies have demonstrated that variant PCT associated with infection can be produced by many other tissues. PCT has also been shown to be a useful marker for differentiating patients with bacterial infection from other acute inflammatory conditions, and for assessing the severity of bacterial infection. Corticosteroid therapy has been demonstrated to be effective for treating patients with septic shock, late-phase acute respiratory distress syndrome (ARDS), or functional adrenal insufficiency, and the use of corticosteroid in critical illness has recently increased. However, it is well established that corticosteroid modulate inflammatory variables, such as body temperature, the C-reactive protein (CRP) level, and the white blood cell (WBC) count, in acute inflammatory conditions.

The purpose of this study was to evaluate the clinical usefulness of PCT measurement for assessing the severity of bacterial infection in patients requiring corticosteroid therapy.

Materials and Methods

Six patients diagnosed with bacterial infectious diseases, or suspected of having infectious diseases and requiring corticosteroid therapy were enrolled in the study. The indication for corticosteroid therapy were bronchial asthma (1 patient), rheumatoid arthritis (1 patient), interstitial pneumonitis (1 patient), late-phase ARDS (2 patients), and septic shock (1 patient). Levels of PCT and CRP, the Sequential Organ Failure Assessment (SOFA) score, and the Acute Physiology and Chronic Health Evaluation (APACHE) II score were evaluated at

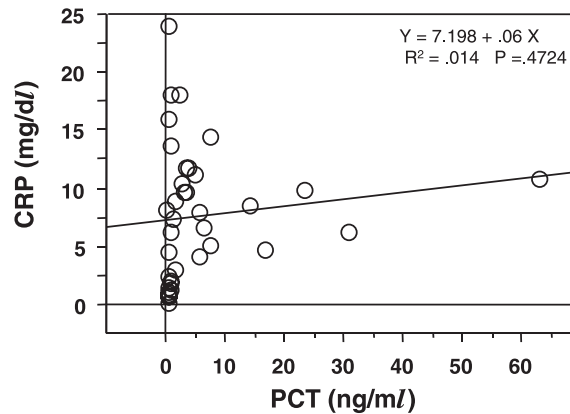


Fig. 1 Relationship between PCT and CRP in patients with bacterial infection requiring corticosteroid therapy

40 time points in the 6 patients. Serum PCT concentrations were measured with immunoluminometric assay (LUMI test PCT; Brahms Diagnostica, Berlin, Germany).

Statistical Analysis

Data are expressed as the mean \pm standard deviation. Correlations were analyzed using Spearman's rank correlation test. The significance of differences between groups was determined with ANOVA. Statistical significance was accepted when $p < .05$.

Results

Relationship between PCT and CRP (Fig. 1)

There was no significant correlation between the serum concentration of PCT and the plasma level of CRP in patients who had bacterial infectious diseases or were suspected of having infectious diseases and requiring corticosteroid therapy.

Relationships between PCT, CRP, SOFA Score, and APACHE II Score

The PCT concentration was significantly correlated with the SOFA score ($R^2=0.467$, $p < 0.0001$) and the APACHE II score ($R^2=0.308$, $p=0.0003$). However, no significant correlations were found between the CRP concentration and the SOFA score ($R^2=0.054$, $p=0.15$) or the APACHE II score ($R^2=0.043$, $p=0.20$).

Comparison of PCT and CRP between Groups Divided According to SOFA Score

Patients were divided into three groups according to SOFA score: 0 to 5, 6 to 10, and greater than 10. No significant differences were present in CRP levels between the groups. However, PCT concentrations differed significantly between patients with a score greater than 10 and patients of the other two groups (**Fig. 2**).

Comparison of PCT and CRP between Groups Divided According to APACHE II Score

Patients were divided into three groups according to APACHE II score: 0 to 10, 11 to 15, and greater than 15. No significant differences were present in CRP levels between the groups. However, significant differences were apparent in PCT concentrations between all groups (**Fig. 2**).

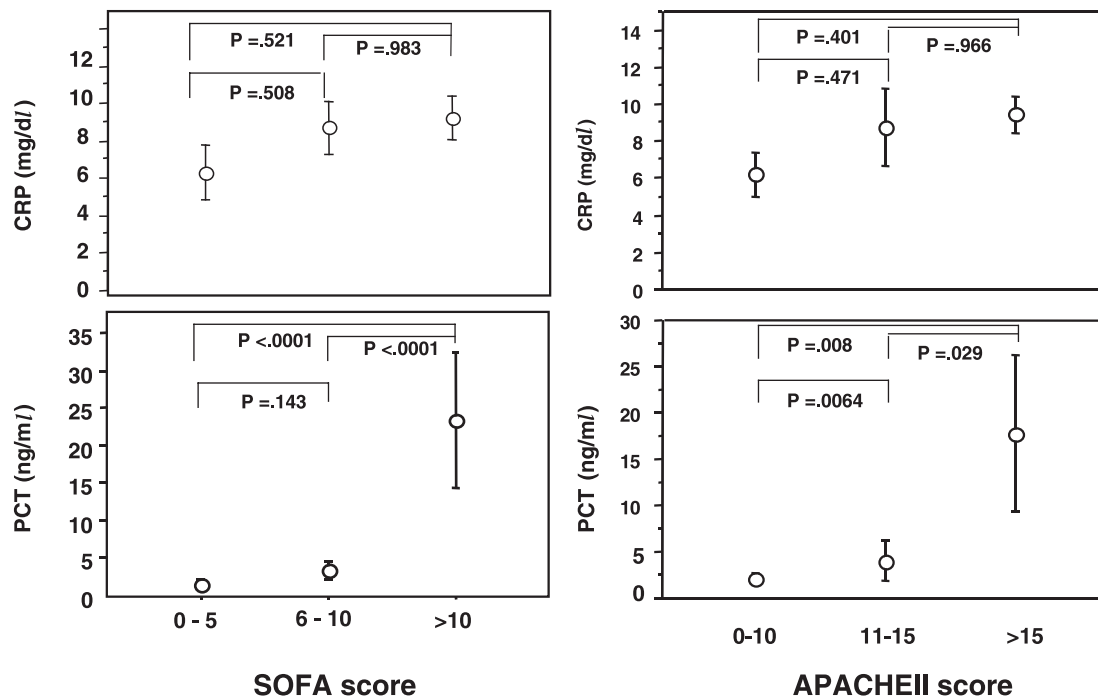


Fig. 2 Comparisons of CRP and PCT in different severity groups according to SOFA score or APACHE II score. Patients were divided into three groups according to SOFA score (0 to 5, 6 to 10, greater than 10: left); APACHE II score (0 to 10, 11 to 15, greater than 15: right). Levels of CRP and PCT were compared between the groups.

Discussion

In this study, PCT has been shown to be a more sensitive and useful marker than CRP for evaluating disease severity and progression as measured with the SOFA score and the APACHE II score, in patients with sepsis who require corticosteroid therapy.

The roles of PCT, its sites of production, and the mechanism underlying PCT induction are still unclear. Recent findings suggest that sources of PCT in systemic inflammatory conditions are extrathyroidal and may include hepatic cells and monocytes/macrophages. Increasing serum PCT levels have been demonstrated to be a more reliable diagnostic and prognostic marker than other inflammatory markers, such as levels of CRP, interleukin-6, interleukin-8, and lactate and the WBC count in patients with severe bacterial infection.

Although the role of corticosteroid therapy during sepsis is still controversial, low-dose corticosteroid have beneficial effects in patients with septic shock associated functional adrenal insufficiency and late-phase ARDS. It is well established that corticosteroid dose-dependently modulate the stress response by preventing an excessive inflammatory response. To date, however, little is known about the clinical value of PCT in patients with bacterial sepsis requiring corticosteroid therapy.

Although it is difficult to evaluate the diagnostic reliability of PCT for bacterial sepsis in patients requiring corticosteroid therapy, PCT has been shown in this study to be a more sensitive and useful marker than CRP for evaluating the severity and progression of the disease in patients with sepsis who require corticosteroid therapy. Further studies are needed to confirm these results in larger groups of patients.