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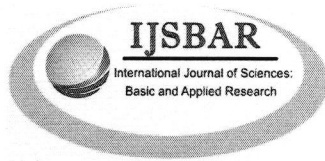
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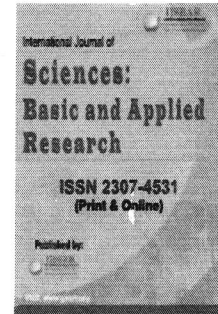
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## Procalcitonin: Biomarker for Diagnosis of Sepsis

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### Abstract

The broth culture method is the gold standard for the diagnosis of bacterial infection, but a definitive result can take 24 hours or more before a conclusive diagnosis. Procalcitonin is one of the promising markers because its concentration is found increasing in sepsis especially in bacterial infections. The objective of this study was to determine the average level of procalcitonin in patients with sepsis. It was a cross sectional study. Seventeen (17) patients who were admitted to the Inpatient Installation Hospital of Wahidin Sudirohusodo Makassar because of sepsis were enrolled into this study. Samples were affordable population that meets the study criteria and selected in the order of admission in the hospital (Consecutive Random Sampling). To validate the results of procalcitonin examination, confirmation was made with the results of the culture as the gold standard. Procalcitonin levels in sepsis patients was ranged from 8,29 - 188,94 ng / ml with an average value of  $60,14 \pm 54,53$  ng / ml. Conclusion of this study is PCT has been proposed as a pertinent marker in the rapid diagnosis of bacterial infection, especially for use in hospital emergency departments and intensive care units.

**Keywords:** Procalcitonin; biomarker; sepsis; culture

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## **1. Introduction**

Sepsis is a clinical syndrome occurring in patients following infection or injury, is a leading cause of morbidity and mortality worldwide [1,2]. Sepsis refers to the systemic response to infection by microbial agents, such as bacteria, fungi, and yeast, where the patient typically develops fever, tachycardia, tachypnea, and leukocytosis. Microbiologic cultures from the blood or the infection site are frequently, although not invariably, positive [3,4]. The signs and symptoms of sepsis are highly variable and are influenced by many factors, including the virulence and bioburden of the pathogen, the portal of entry, and the host susceptibility. Distinguishing inflammation due to bacterial, other microbial infection, or organ rejection is important in the treatment of the immune reaction in hospitalized patients [5].

A common problem in the clinical practice is that the signs and symptoms of bacterial and viral infections are widely overlapping, especially in respiratory tract infections. The traditional method of diagnosis for sepsis includes culturing blood, urine, cerebrospinal fluid (CSF), or bronchial fluid specimens and usually takes 24 to 48 hours. Unfortunately, clinical symptoms frequently manifest themselves in the absence of a positive culture. To date, second to C-reactive protein, Procalcitonin has become the most widely used biomarker in the management of infection and sepsis in Europe and meanwhile has also become available in most parts of the world [6].

## **2. Methods**

It was a cross-sectional study, the study population were all patients with sepsis who entered in the inpatient installation hospital of Wahidin Sudirohusodo Makassar. Sample were affordable population that meets the study criteria and selected in the order of admission in the hospital (Consecutive Random Sampling). The number of sample were 17 patients.

Inclusion criteria were 18-80 years old, treated in emergency room inpatient hospital, fulfilled two of SOFA Score criteria, patients supporting with infection documentation such as culture and serology. Patients were not suffering from thyroid disease and haematological malignancy, and did not get long-term steroid therapy before study. Exclusion criteria was blood samples lysis, lipemic or incomplete data.

Ethical permission was obtained from the ethics committee of Hasanuddin University medical faculty, study consent was from emergency and inpatient Installation Wahidin Sudirohusodo hospital of Makassar. Each subject gets informed consent before participating in the research.

Data is displayed in the form of descriptive tables of sample characteristics.

### 3. Resultt

The clinical characteristics of sepsis patients are age, sex, culture results and average procalcitonin levels can be seen in table 1

Tabel 1. Clinical Characteristic of sepsis patients

| No. | Variabel                     | n = 17 (Sepsis) | Range         | Mean ± SD     |
|-----|------------------------------|-----------------|---------------|---------------|
| 1.  | Age(y)                       |                 | 24-80         | 52,71 ± 15,34 |
| 2.  | Sex / Male (%)               | 9 (52.9)        |               |               |
| 3.  | Status                       |                 |               |               |
|     | • Survived                   | 6 (35.3%)       |               |               |
|     | • Nonsurvived                | 11 (64.7%)      |               |               |
| 4.  | Culture                      |                 |               |               |
|     | • Bacteria                   | 14 (82.35%)     |               |               |
|     | 1. Acinetobacter baumannii   | 2               |               |               |
|     |                              | 3               |               |               |
|     | 2. Burkholderia sp           | 3               |               |               |
|     | 3. Escherichia coli          | 1               |               |               |
|     | 4. Enterococcus faecalis     | 1               |               |               |
|     | 5. Klebsiella pneumonia      | 4               |               |               |
|     | 6. Staphylococcus sp         | 1               |               |               |
|     | • Fungi (Candida Tropicalis) | 1(5.88%)        |               |               |
|     | • No Growth                  | 2 (11.77%)      |               |               |
| 5.  | Procalcitonin                |                 | 8,29 - 188,94 | 60,14 ± 54,53 |

The results of this study showed that the average procalcitonin level of patients with sepsis was  $60.14 \pm 54.53$  ng / ml and blood cultures showed 82.35% positive bacteria, 5.88% fungi and 11.77% no growth.

### 4. Discussion

The use of procalcitonin (PCT) as a potential biomarker for sepsis and infection was first described in 1993. Compared to any other currently available sepsis marker, PCT seems to have some potential to discriminate between infectious and noninfectious systemic inflammation. The culture results obtained in this study show that most of the causes of sepsis are bacteria PCT also seems to have some potential to differentiate between viral and bacterial infections and may indicate the presence of bacterial superinfection in patients with viral diseases [7,8]. Candida-related severe sepsis or septic shock does not necessarily elicit a substantial increase in serum PCT levels. A retrospective comparison of episodes of bacteremia or candidemia in nonneutropenic patients with sepsis showed that PCT levels were significantly lower or near normal in patients with candidemia. Thus, the value of PCT for the diagnosis of fungal infection and sepsis is poor [9].

The most frequently isolated pathogens in patients with sepsis include the gram-positive bacteria *Streptococcus pneumoniae* and *Staphylococcus aureus* and the gram-negative bacteria *Escherichia coli*, *Klebsiella* spp., and *Pseudomonas aeruginosa*. In addition, fungal sepsis, mainly caused by *Candida* species, is on the rise, at least in part due to an increase in immune compromised patients. Pathogens associated with sepsis express an imposing arsenal of virulence factors, each of which contributes to the severity of the infectious insult [10]

While sepsis can potentially be caused by many infectious agents such as bacteria, fungi, parasites or virus, the majority of cases of sepsis are reported to be due to bacteria. One European study reported that the most frequent infectious agent that was associated with sepsis was *Escherichia coli*, with 22.7% share of detected cases. A more detailed study by Vincent et al. surveyed the prevalence and outcomes of infection in intensive care units from 75 countries. The results revealed that the microbiological culture results were positive in 70% of the infected patients with 62% of the positive isolates being gram-negative organisms, 47% being gram-positive, and 19% being fungal in [11]. Bode-J'ansch et al. outline that, at PCT levels <2 ng/mL, bacterial sepsis or septic shock can almost certainly be excluded as cause of death. PCT levels  $\geq 10$  ng/mL can be detected occasionally in conditions other than sepsis. A final assessment should therefore take into account the PCT levels, autopsy results, and the histopathological and microbiological findings. Other authors indicate high diagnostic accuracy for both lipopolysaccharidebinding protein (LBP) and PCT, considered individually and combined, in detecting sepsis-related outcomes in postmortem [12]

## 5. Conclusion

Procalcitonin is a biomarker to determine the presence of sepsis quickly

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## Competing Interest

The authors declare that they have no competing interests.

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