



# Presepsin Levels in Emergency Patients with Bacterial and Viral Infection

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## Abstract

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**BACKGROUND:** Sepsis is a major problem with a high mortality rate, and emergency rooms are the first service point at which sepsis patients are treated. Blood presepsin levels are used as a tool to identify patients who may suffer from sepsis caused by bacterial infection, necessitating immediate antibiotic treatment.

**AIM:** The aim of the study was to evaluate presepsin levels in patients with bacterial and viral infections in the emergency department.

**METHODS:** This was a prospective study consisting of 88 patients over 18 years of age who visited the Srinagarind Hospital emergency room and fulfilled one or more criteria for systemic inflammatory response syndrome. Presepsin levels in the leftover blood specimens were tested.

**RESULTS:** In the bacterial infection group, 63.6% of the patients were male, and the mean age was 43.7 ± 10.5 years. Mean presepsin levels were 2904.73, pg/ml in the bacterial infection group and 204.88 pg/ml in the viral infection group.

**CONCLUSION:** Presepsin levels in the bacterial infection group were significantly higher than in the viral infection group, in which they were below the standard cutoff point.

## Introduction

Sepsis is a major problem with a high mortality rate. Diagnosis relies on history-taking, physical examination, and laboratory testing. There are more than 19 million patients per year diagnosed with sepsis worldwide. In the United States, there are more than 750,000 patients found per year, or 300 cases per hundred thousand people [1]. Up to 10% of cases of sepsis are critical, and it is the leading cause of death in critical care units in the Thailand (20–30%). The disease has a mortality rate as high as 52.6% [2].

Emergency rooms are the first service point at which sepsis patients are treated. In the United States, there are over 260,000 cases per year that presents at emergency rooms (123 cases/100,000 population) [3]. Although rapid diagnosis and treatment are needed to reduce the mortality rate, the most laboratory tests currently being employed lack effective tools to diagnose this condition. It takes a long time to receive blood culture results, and the positive culture rates are low [4], [5], [6].

Presepsin (sCD14-ST) is a protein substance that is part of the truncated N-terminus of CD14, which enters the bloodstream when bacteria are eradicated through monocytes, macrophages, and neutrophils [7]. Therefore, presepsin values in the blood can be used as a tool to identify patients who may suffer from sepsis from bacterial infection [8], [9], [10], [11] and, thus, require immediate antibiotic treatment. There have yet been no studies on presepsin conducted in the Thailand, but studies from other regions have determined that the reference values in cases of suspected bacterial infection should be >600 pg/ml.

## Methods

This was a prospective study. The sample consisted of 88 patients over 18 years of age who visited the Srinagarind Hospital emergency room between February 2019 and April 2019 and fulfilled one or more of the following diagnosis criteria for systemic

inflammatory response syndrome: (1) Temperature >38 or <36°C, (2) heart rate >90/min, (3) respiratory rate >20/min or PaCO<sub>2</sub> <32 mmHg, and (4) white blood cell count >12,000 or <4000/mm<sup>3</sup> or immature granulocytes ≥10%. The exclusion criteria were autoimmune disease and undergoing immunosuppressive therapy for tumors. Ethics approval was provided by the Khon Kaen University Ethics Committee for Human Research (HE621107).

The sample size was calculated based on the mean and standard deviation of presepsin levels reported in a previous study by Endo *et al.* [12]. To achieve a confidence interval of 0.95 and a power of test of 0.8, we determined that a sample size of 88 would be required. Statistical analysis was performed using SPSS for Windows version 16.0 (SPSS Inc., Chicago, IL, USA). Categorical data were presented as percentages, and continuous data were presented using mean and standard deviation. Univariate analysis was performed using a two-sample t-test for numerical data and a Chi-squared test or Fisher’s exact test for data comparison between the two groups.

The patients were classified into two groups: (1) The bacterial infection group, consisting of patients who were diagnosed with bacterial infection by a physician and had culture-positive samples (e.g., blood, sputum, urine, and abdominal fluids) and (2) the viral infection group, consisting of patients diagnosed with viral infection by a physician and tested positive on an influenza rapid test or for the dengue NS1 antigen. The presepsin level was measured by PATHFAST® point of care kits.

## Results

Eighty-eight subjects were examined, the characteristics of whom are shown in Table 1. In the bacterial infection group, a total of 63.6% (n = 14) of patients were male. The mean age was 43.7 ± 10.5 years. Heart rate was 119.9/min, respiratory rate 28.9/min, temperature 39.1°C, and white blood cell count 14,200/mm<sup>3</sup>. The duration to the onset of fever was 3.6 days in both groups.

**Table 1: Characteristics of the subjects**

Characteristics	Bacterial infection (n=22), n (%)	Viral infection (n=66), n (%)
Sex: Male	14 (63.6)	38 (57.6)
Age±SD (years)	43.7±10.5	46.2±9.6
Onset of fever (days)	3.6	3.6
Heart rate (/min)	119.9	120.5
Respiratory rate (/min)	28.9	26.5
Temperature (°C)	39.1	39.3
White blood cell count (/mm <sup>3</sup> )	14,200	6542

In the bacterial infection group, 31.8% of patients had positive sputum cultures and another 31.8% had positive blood cultures. Infections were

caused by Gram-positive bacteria in 36.4% of cases, Gram-negative infection in or 31.8% of cases, and mixed Gram-positive and Gram-negative bacteria in 31.8% of cases, as shown in Table 2.

**Table 2: Source of bacterial infection (n=22)**

Source of infection	n (%)
Specimens	
Sputum	7 (31.8)
Blood culture	7 (31.8)
Abdominal fluids	4 (18.2)
Urine	2 (9.1)
Cerebrospinal fluids	2 (9.1)
Type of infection	
Gram-positive infection	8 (36.4)
Gram-negative infection	7 (31.8)
Mixed Gram-positive and Gram-negative infection	7 (31.8)

The cause of infection in the viral group was influenza in 65.2% of cases and dengue in 34.8% (Table 3).

**Table 3: Source of viral infection (n=66)**

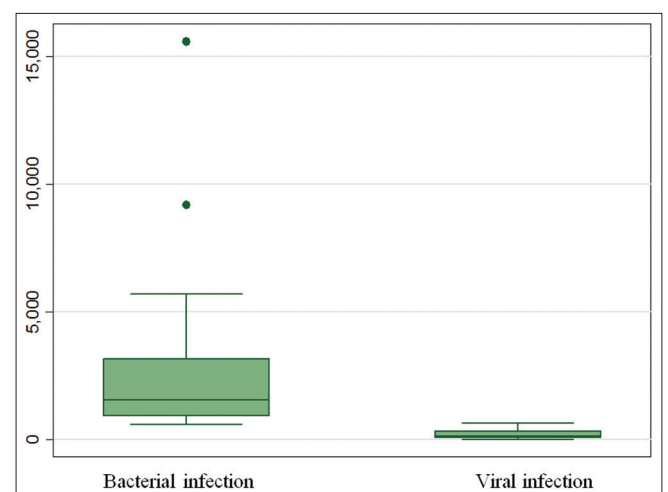
Source of infection	n (%)
Influenza rapid test	43 (65.2)
Dengue NS1 antigen	23 (34.8)

The mean of presepsin level in bacterial group was 2904.73 pg/ml and that in the viral group was 204.88 pg/ml, as shown in Table 4 and Figure 1.

**Table 4: Presepsin level**

Presepsin level	Mean (pg/ml)	Standard deviation	95% CI
Bacterial infection (n=22)	2904	3540	1334–4474
Viral infection (n=66)	204	165	164–245

The presepsin level mostly in patients with blood culture positive 2261 pg/ml and cerebrospinal fluids culture positive 2244 pg/ml with significantly associated with patients culture negative (p < 0.001; Table 5).



**Figure 1: Presepsin level (pg/ml)**

## Discussion

Presepsin, found in 2004, is a highly specific biomarker for bacterial infection and sepsis because it

**Table 5: Presepsin level with factors**

Culture groups	Presepsin level (pg/ml)			p-value
	Mean	25 <sup>th</sup> percentile	75 <sup>th</sup> percentile	
Culture negative, negative Gram's stain	154	74	327	
Culture positive				<0.001
Sputum	1551	681	4057	
Abdominal fluids	949	740	1609	
Urine	1264	940	1588	
Cerebrospinal fluids	2244	1336	3152	
Blood culture	2261	1125	5687	
Positive organism				<0.001
Gram-positive infection	1979	1378	3874	
Gram-negative infection	1125	689	2261	
Mixed Gram-positive	1336	653	4057	
Gram-negative infection				

is produced by bacterial phagocytosis [13]. This study was found that presepsin levels in the bacterial infection group were significantly higher than in the viral infection group, which is consistent with the results of the previous studies [7], [8], [9], [10], [11], [12], [13], [14]. The previous studies have found presepsin level cutoff points of >600 pg/ml [12], >407 pg/ml [7], and >413 pg/ml [14] in patients with bacterial infection. These studies also found presepsin levels below the standard cutoff points in patients with viral infection [7], [12], [14] (both influenza and dengue).

A study by Lu *et al.* [7] found that presepsin levels were associated with both Gram-positive and Gram-negative infection, which is similar to the results of this study, with the exception that there was no significant difference in presepsin levels between Gram-positive and Gram-negative bacterial infections.

This study showed that presepsin levels were useful for diagnosis of sepsis in patients with bacterial infection, as they were higher than the standard cutoff point. This was the case in both blood culture-positive patients and patients with other culture-positive specimens, which is similar to the results found by Endo *et al.* [12]. However, this study was limited in that it had a small sample size and did not test in patients with other types of infection (such as fungal infection).

## Conclusion

Presepsin levels in the bacterial infection group were significantly higher than in the viral infection group, which were below the standard cutoff point. Presepsin can be used as a rapid detection tool for the diagnosis of bacterial infection in emergency patients.

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