Research Article

The levels of STREM-1, procalcitonin and IL-18 in sepsis and their evaluation value for disease severity

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Abstract   Objective To evaluate the clinical significance of measuring soluble triggering receptor expressed on myeloid cells-1 (sTREM-1), procalcitonin (PCT), and interleukin-18 (IL-18) levels in assessing the severity of sepsis. Methods This study included ICU patients from our hospital, with 60 cases of systemic inflammatory response syndrome (SIRS) without clinical evidence of infection (Group A) and 58 cases diagnosed with sepsis (Group B), conducted between May 2022 and May 2023. Group B was further stratified by disease severity into sepsis (29 cases), severe sepsis (18 cases), and septic shock (11 cases) subgroups. Levels of sTREM-1, PCT, and IL-8 were measured in both groups to assess their diagnostic value in disease severity. Results sTREM-1, PCT, and IL-8 levels were significantly higher in Group B than in Group A ($P < 0.05$). Within Group B, septic shock patients had higher sTREM-1, PCT, and IL-8 levels than severe sepsis patients, who in turn had higher levels than sepsis patients ($P < 0.05$). While individual detection of sTREM-1, PCT, and IL-18 showed no significant difference in sensitivity and specificity for diagnosing sepsis and septic shock ($P > 0.05$), combined testing significantly improved both sensitivity and specificity compared to individual markers ($P < 0.05$). Conclusion Serum sTREM-1, PCT, and IL-8 levels are elevated in sepsis patients and correlate with disease severity, demonstrating high clinical value in assessing sepsis progression.
Keywords: Soluble triggering receptor expressed on myeloid cells-1 (sTREM-1); Procalcitonin (PCT); Interleukin-8 (IL-8); Sepsis; Systemic inflammatory response syndrome (SIRS); Clinical value

Sepsis is a systemic inflammatory response syndrome (SIRS) triggered by infection, exhibiting high global incidence rates [1]. According to relevant statistics [2], worldwide reported cases of sepsis range between 15 to 20 million annually, with a mortality rate reaching 30% of affected patients. The mortality rate rises to 50% for severe sepsis patients and escalates to 80% for those with septic shock. These figures underscore the critical importance of promptly assessing disease severity and implementing targeted treatments to reduce mortality in sepsis patients. Current research [3] indicates abnormal elevations in serum levels of soluble triggering receptor expressed on myeloid cells-1 (sTREM-1), procalcitonin (PCT), and interleukin-8 (IL-8) in sepsis patients. However, the correlation between these biomarker levels and disease severity remains insufficiently documented.

This study therefore selected 60 SIRS patients without clinical evidence of infection and 58 sepsis patients as research subjects to evaluate the diagnostic value of sTREM-1, PCT, and IL-8 levels in assessing disease severity. The findings are reported below.

1. Research Subjects and Methods

1.1 Research Subjects

This study involved ICU patients from our hospital, including 60 SIRS patients without clinical infection (Group A) and 58 sepsis patients (Group B), conducted

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between May 2022 and May 2023. The male-to-female ratios were 32:30 and 28:28, respectively, with age ranges of 27–71 (mean 50.29 ± 4.32) and 26–70 (mean 50.14 ± 4.51) years. No statistically significant differences were observed in gender or age between the two groups (P > 0.05), permitting comparative analysis.

Group B was further stratified by disease severity into sepsis (29 cases), severe sepsis (18 cases), and septic shock (11 cases) subgroups. All patients met the diagnostic criteria outlined in the 2016 International Guidelines for Management of Severe Sepsis and Septic Shock [4].

1.2 Detection Methods

Fasting venous blood was collected in anticoagulant tubes on the day of admission and centrifuged at 3,000 rpm for 8–10 minutes to isolate serum. Serum levels of sTREM-1, PCT, and IL-8 were measured using enzyme-linked immunosorbent assay (ELISA). Each sample was tested in triplicate, with the average value recorded. If a sample failed quality control, it was re-collected and re-tested.

1.3 Observation Indicators

① Comparison of sTREM-1, PCT, and IL-8 levels between Groups A and B.② Comparison of sTREM-1, PCT, and IL-8 levels among sepsis, severe sepsis, and septic shock subgroups on ICU admission day.③ Analysis of the sensitivity and specificity of sTREM-1, PCT, and IL-8 individually and in combination for sepsis diagnosis. Blood culture results served as the gold standard. Diagnostic thresholds: PCT: <0.05 ng/mL (negative), >2 ng/mL (positive). sTREM-1: ≥59.79 ng/mL (positive), <59.79 ng/mL (negative) [5]. IL-8: ≥75 ng/mL (positive), <75 ng/mL (negative) [6].

1.4 Statistical Analysis

Data were analyzed using SPSS 19.0. Continuous variables were expressed as mean ± standard deviation (±s).

Intra-group comparisons employed paired t-tests, while inter-group comparisons used one-way ANOVA. A P-value <0.05 indicated statistical significance.

2. Results

2.1 Comparison Between Groups A and B

sTREM-1, PCT, and IL-8 levels were significantly higher in Group B than in Group A (P < 0.05, Table 1).

Table 1 Comparison of Test Results Between Groups A and B [± s]

Groups	Cases	STREM-1 （ng/ml）	PTC （μg/L）	IL-18 （μg/L）
A Groups	60	60.19±10.33	2.14±0.43	114.69±20.06
B Groups	58	122.54±10.25	3.26±0.57	155.39±20.57
t		32.903	12.076	10.881
P		<0.001	<0.001	<0.001

2.2 Comparison of Test Results Among Sepsis, Severe Sepsis, and Septic Shock Groups

The levels of sTREM-1, PCT, and IL-18 in the septic shock group were significantly higher than those in the severe sepsis group, while the severe sepsis group exhibited higher levels than the sepsis group (P < 0.05). The differences were statistically significant (see Table 2).

Table 2 Comparison of Test Results Among Sepsis, Severe Sepsis, and Septic Shock Groups [$\bar{x}$ ± s]

Groups	Cases	STREM-1 （ng/ml）	PTC （μg/L）	IL-18 （μg/L）
Sepsis	29	79.88±6.35	0.79±0.21	99.75±13.52
Severe sepsis group	18	135.55±20.41	2.34±0.72	142.55±20.16
Septic shock group	11	157.63±21.65	6.88±1.54	179.81±21.04
F value		133.91	241.06	91.39
P		0.001	0.001	0.001
Sepsis and Severe sepsis group	t	13.735	10.932	8.725
	P	0.001	0.001	0.001
Sepsis and Septic shock group	t	17.747	21.224	14.265
	P	0.001	0.001	0.001
Septic shock group and Septic shock group	t	3.006	12.782	5.159
	P	0.005	0.001	0.001

2.3 Detection Rates of Individual and Combined Biomarkers

Among all subjects: sTREM-1: Positive in 52 cases, negative in 66 cases, PCT: Positive in 50 cases, negative in 68 cases, IL-18: Positive in 49 cases, negative in 69 cases,

Combined testing: Positive in 56 cases, negative in 62 cases. Detailed results are presented in Table 3.

Table 3 Detection Rates of Individual and Combined Biomarkers [n]

Detection method	Test result	Reference standard		Total
		Positive	Negative	
STREM-1	Positive	45	7	52
Detection	Negative	13	53	66
Total		58	60	118
PTC Detection	Positive	42	8	50
	Negative	16	52	68
Total		58	60	118
IL-18 Detection	Positive	40	9	49
	Negative	18	51	69
Total		58	60	118
Combined testing	Positive	55	1	56
	Negative	3	59	62
Total		58	60	118

2.4 Sensitivity and Specificity of Individual and Combined Biomarkers

The sensitivity and specificity of sTREM-1, PCT, and IL-18 in individual detection showed no statistically significant differences for diagnosing sepsis and septic shock (P > 0.05). However, the combined testing demonstrated significantly higher sensitivity and specificity compared to individual biomarker detection (P < 0.05). Detailed results are presented in Table 4.

Table 4 Sensitivity and Specificity of Individual and Combined Biomarkers

Detection method		Sensitivity	Specificity
STREM-1 Detection		77.59（45/58）	88.33（53/60）
PTC Detection		72.41（42/58）	86.57（52/60）
IL-18 Detection		68.97（40/58）	85.00（51/60）
Combined testing		94.83（55/58）	98.33（59/60）
Comparison between	X^2	0.414	0.076
STREM-1 and PTC	P	0.520	0.783
Comparison between STREM-1 and	X^2	1.101	0.288
	P	0.294	0.591
IL-18 Comparison between IL-18 and PTC	X^2	0.166	0.251
	P	0.683	0.616
Comparison between STREM-1 and Combined testing	X^2	7.250	4.821
	P	0.007	0.028
Comparison between PTC and Combined testing	X^2	10.637	5.886
	P	0.001	0.015
Comparison of IL-18 with Combined testing	X^2	13.083	6.682
	P	0.001	0.008

3. Discussion

Sepsis is a critical condition characterized by dysregulated host responses to infection. As the disease progresses, patients may develop tissue hypoperfusion or acute organ dysfunction, potentially escalating to severe sepsis and septic shock, which pose significant threats to patient survival [7]. Current clinical management primarily involves comprehensive interventions such as fluid resuscitation, antimicrobial therapy, and infection source control. Early intervention is strongly associated with improved patient outcomes, and treatment efficacy evaluation heavily relies on laboratory parameters. Therefore, identifying effective biomarkers for early assessment of disease severity is crucial for guiding optimal treatment strategies.

Extensive clinical studies have confirmed the diagnostic value of procalcitonin (PCT) in evaluating sepsis severity [8]. Building on this evidence, our study additionally measured soluble triggering receptor expressed on myeloid cells-1 (sTREM-1) and interleukin-8 (IL-8) levels. The

results demonstrated that all three biomarkers exhibited progressively increasing concentrations corresponding with disease severity.

The biological rationale for these findings includes:sTREM-1: As a soluble form of triggering receptor expressed on myeloid cells (TREM-1), this immunoglobulin superfamily member is released into body fluids (pleural effusion, urine, plasma, or cerebrospinal fluid) by activated phagocytes. It has demonstrated significant utility in assessing therapeutic efficacy and prognosis across various infectious diseases. Lu Yingying et al. [9] confirmed sTREM-1 as an independent prognostic indicator for sepsis patients, particularly in predicting 28-day mortality. Our findings further establish its strong correlation with sepsis severity.

IL-8: This prototypical neutrophil chemotactic and activating factor was shown by Yang Rui et al. [10] to be an independent prognostic factor for septic shock patients through logistic regression analysis. Their work highlighted IL-8's significant predictive value for mortality, reinforcing its close relationship with disease severity.

Conclusion: Serum levels of sTREM-1, PCT, and IL-8 are significantly elevated in sepsis patients and demonstrate positive correlations with disease severity. These biomarkers collectively provide valuable clinical utility for assessing sepsis progression.

Conflict of Interest

None.

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