

## THE VALUE OF PRESEPSIN COMBINED WITH LAC, SOFA SCORE IN EVALUATING THE PROGNOSIS OF SEPSIS

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### ABSTRACT

**Objective:** To evaluate the Value of Presepsin (soluble CD14 subtype) Combined with blood lactic acid (Lac), SOFA Score in Evaluating the Prognosis of Sepsis.

**Methods:** From May 2017 to September 2018, 138 patients with sepsis admitted to ICU of our hospital were selected and divided into survival group (88 cases) and death group (50 cases) according to the mortality rate within 28 days. The general data of patients were collected and the changes of serum Presepsin, Lac and SOFA scores in the two groups were detected and compared. Multivariate Logistic regression was used to analyze the influencing factors of 28d mortality. ROC curve was used to analyze the value of serum Presepsin, Lac, SOFA score alone or in combination in evaluating the prognosis of sepsis.

**Results:** Serum Presepsin, Lac levels and SOFA scores of patients in the death group were significantly higher than those in the survival group, with statistically significant differences ( $P < 0.05$ ). Multi-variable Logistic regression analysis results show that the APACHE II score, serum Presepsin, Lac, SOFA score are the influence factors of sepsis patients with 28d case fatality rate ( $P < 0.05$ ); The results of ROC curve analysis showed that the area under the curve (AUC) of serum Presepsin, Lac and SOFA scores were 0.889, 0.812 and 0.819, respectively, with sensitivity of 81.0%, 78.1% and 75.8%, and specificity of 92.4%, 88.3% and 87.2%, respectively. The AUC of combined detection was 0.928, significantly higher than that of independent detection ( $P < 0.05$ ).

**Conclusion:** Serum Presepsin, Lac, SOFA score, Sepsis, The prognosis.

**Keywords:** Serum Presepsin, Lac, SOFA score, Sepsis, The prognosis.

DOI: 10.19193/0393-6384\_2019\_6\_520

Received November 30, 2018; Accepted February 20, 2019

### Introduction

Sepsis refers to the systemic inflammatory response syndrome caused by infectious factors, which is one of the main causes of death and disability in critically ill patients. Sepsis is a combination of extreme morbidity and rapid changes in disease conditions, which can lead to organ dysfunction or circulatory dysfunction in severe cases and ultimately lead to death of patients<sup>(1)</sup>. Sepsis in the case fatality rate is higher, can reach 30% ~ 50%, with the development of science and technology, we made a breakthrough in sepsis treatment progress, but in sepsis morbidity and mortality remains high, serious threat to people's physical and mental health<sup>(2)</sup>, the reason may be that the clinical diagnosis of sepsis patients not accurate enough, most of patients with interventional therapy in time, not cause serious infection.

Therefore, finding a method that can detect sepsis early and intervene effectively has become the focus of clinical researchers. In recent years, some scholars have found that serum Presepsin starts to increase at 6h after onset of sepsis, which increases at a higher rate than other serological indicators, and has a higher accuracy in the diagnosis of sepsis<sup>(3)</sup>. Lactic acid is one of the important metabolic indicators of the body, and it participates in almost all activities related to energy metabolism.

The increase of its level indicates significant improvement of organ function. Foreign scholars have found<sup>(3,4)</sup> that 24h Lac level is closely related to the prognosis of ICU patients. SOFA score is an important scoring system used in ICU wards. It can reflect the severity of organ dysfunction in critically ill patients and is correlated with the severity of the patient's condition, with the more serious the condition, the higher the score.

Serum Procalcitonin, Lac and SOFA scores have certain guiding effects on the diagnosis, condition evaluation and prognosis of sepsis patients, and some scholars believe<sup>(5)</sup> that the sensitivity and specificity of these indicators alone are long, and they are not enough to reflect the changes of diseases in patients with severe conditions. Therefore, this study aims to analyze the prognostic value of combined detection of various indicators by detecting the changes of serum Procalcitonin, Lac and SOFA scores in patients with sepsis.

## Materials and methods

### Research subjects

138 patients with sepsis admitted to ICU of our hospital from May 2017 to September 2018 were selected.

#### Inclusion criteria:

- all patients met the relevant diagnostic criteria of the American association of chest physicians/critical care medical association<sup>(6)</sup>;
- 20~80 years old;
- infection occurred or clinically suspected during ICU admission or hospitalization;
- with the approval of the hospital ethics committee, all patients and their families have informed and agreed to participate in this study, and all have signed the informed consent.

#### Exclusion criteria:

- Severe liver, kidney and heart dysfunction;
- serious infectious diseases;
- patients with malignant tumor, blood system and immune system diseases;
- patients with a history of severe mental illness who cannot cooperate with treatment;
- pregnancy or lactation patients.

### Experimental Instruments and Sources

Low-speed centrifuge (Shanghai precision instrument co., LTD., TDL5M); Micro-high speed centrifuge (hangzhou youning instrument co., LTD., model: GL-25MS); Environmental protection equipment (environmental protection equipment co., LTD., model: GDW-45L80); environmental protection equipment (environmental protection equipment co., LTD., model: GDW-45L80) Invitrogen Attune NxT flow cytometry (Thermo Fisher Scientific, USA); Serum Procalcitonin kit (wuhan mersak biotechnology co., LTD.).

### Observation Indexes

On the second day after admission, 5ml of the patient's fasting elbow venous blood was extracted and placed into the standard blood collection vessel, which was treated by centrifugal force at 3000r/min rotating speed for 10min, and the supernatant was taken and stored in the refrigerator at -80°C for testing.

- Serum Procalcitonin: enzyme linked immunosorbent assay (ELISA) was used to detect the changes of serum Procalcitonin in the two groups.

- Lac levels in arterial blood of all patients were measured at 0, 6, 24, 48 and 72 hours after ICU admission, and the lactate clearance rate at 6h = (Lac level in ICU artery - Lac level in 6h artery)/Lac level in ICU artery ×100%.

- Respiratory, Coagulation, liver, circulation, nerve and kidney were graded according to SOFA standard of EURCM. The daily worst value should be adopted in the daily assessment. The higher the score, the worse the prognosis of patients.

### Statistical methods

All the data in this study were statistically analyzed by SPSS20.0 software package, standard deviation ( $\bar{x} \pm s$ ) was adopted for measurement data, and comparison of t-test survival and death data was conducted, and enumeration data was adopted [n (%)], and comparison of survival and death data was conducted by chi-squared test. The value of serum Procalcitonin, Lac and SOFA scores in prognosis assessment of sepsis patients was determined by ROC curve area, and  $P < 0.05$  was considered as statistically significant difference.

## Results

### Comparison of general data between the two groups

138 patients with sepsis were included, and the mortality was divided into the survival group (88 cases) and the death group (50 cases) within 28 days. Among them, there were 47 males and 41 females in the survival group, aged (59.02±18.21) years old. There were 26 males and 24 females in the death group, aged (60.37±16.15) years old.

There was no statistical difference in age between the two groups ( $P > 0.05$ ). Death patients admitted to hospital with APACHE II score patients with mechanical ventilation and proportion were significantly higher than the survival group ( $P < 0.05$ ); There was no significant difference in WBC and neutrophils between the two groups ( $P > 0.05$ ).

	Survival group (n=88)	Death group (n=50)	P
Gender (Male/Female)	47/41	26/24	0.995
Age (Years)	59.02±18.21	60.37±16.15	0.645
APACHEII Score	10(7~15)	19(13~24)	<0.001
Mechanical Ventilation	38(38.7)	19(59.38)	0.041
Cardiovascular Disease	11(11.22)	3(9.38)	0.769
Respiratory System	28(28.57)	10(31.25)	0.772
Nervous System	7(7.14)	4(12.50)	0.344
Digestive System	4(4.08)	1(3.12)	0.807
Severe Trauma	12(12.24)	5(15.63)	0.622
Multiple Organ Failure	8(8.16)	3(9.38)	0.830
Other	2(2.04)	1(3.12)	0.723
Wbc	10.4(7.1~14.5)	10.3(7.2~17.8)	0.626
Neutrophil	7.9(5.1~11.7)	9.6(5.5~15.2)	0.078

**Table 1:** Comparison of general conditions of patients in the two groups [(x̄±s), [n (%)]].

**Comparison of Serum Presepsin, Lac and SOFA Scores between the Two Groups**

Serum Presepsin, Lac levels and SOFA scores of patients in the death group were significantly higher than those in the survival group, with statistically significant differences (P<0.05) as shown in table 2

Indicator	Time	Survival group(n=88)	Death group(n=50)	P
Presepsin(pg/mL)		708.86±205.11	971.12±241.17	<0.001
Lac(mmol/L)	0	3.15±0.47	5.57±1.47	<0.001
	6	2.74±0.32	5.89±0.37	<0.001
	24	2.49±0.21	5.10±0.24	<0.001
	48	2.35±0.20	5.04±0.38	<0.001
	72	2.07±0.17	4.87±0.32	<0.001
SOFA Score		6.47±1.25	9.29±1.74	<0.001

**Table 2:** Comparison of serum Presepsin, Lac and SOFA scores between the two groups (x̄±s).

**Factors Influencing 28d Mortality of Sepsis Patients**

Multivariable Logistic regression analysis results show that the APACHE II score, serum Presepsin, Lac, SOFA score are the influence factors of sepsis patients with 28 d case fatality rate (P<0.05) as shown in table 3.

Indicator	B	SE	Wald	P value	OR	95% CI
Gender	0.027	0.026	1.116	0.603	1.071	0.781~1.345
Age	0.158	0.521	0.043	0.480	1.147	0.432~1.784
BMI	0.069	0.679	0.007	0.114	1.112	0.879~1.287
Chronic illness	0.024	0.382	0.004	0.868	1.123	0.634~1.157
APACHE, Score	0.435	0.338	1.368	0.006	1.024	1.011~1.534
Presepsin	2.117	1.423	1.603	0.002	8.145	1.574~79.124
Lac	0.713	0.360	3.141	0.001	1.554	1.124~2.437
SOFA Score	0.730	0.443	2.214	0.005	2.431	1.031~5.724

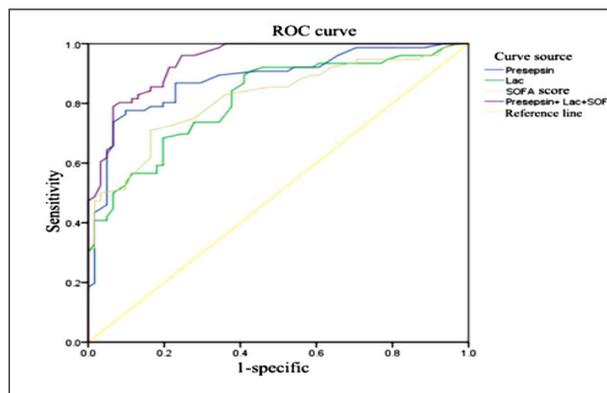
**Table 3:** Factors influencing 28d mortality of sepsis patients.

**ROC Curve Analysis of Serum Presepsin, Lac and SOFA Scores to Evaluate the Prognostic Value of Sepsis**

ROC curve analysis results showed that the area under the curve (AUC) of serum Presepsin, Lac and SOFA scores for sepsis was 0.889, 0.812 and 0.819, respectively, with sensitivity of 81.0%, 78.1% and 75.8%, specificity of 92.4%, 88.3% and 87.2%, and the AUC of combined detection was 0.928, significantly higher than that of independent detection (P<0.05), as shown in table 4 and figure 1.

Indicator	Cut-off	AUC	P	95% CI	Sensitivity (%)	Specificity (%)
Presepsin	785.3	0.889	<0.001	0.861-0.934	81.0	92.4
Lac	2.2	0.812	<0.001	0.745-0.910	78.1	88.3
SOFA Score	5.6	0.819	<0.001	0.714-0.954	75.8	87.2
Presepsin+ Lac+SOFA		0.928	<0.001	0.910-0.992		

**Table 4:** ROC curve analysis of serum Presepsin, Lac and SOFA scores to evaluate the prognostic value of sepsis.



**Fig. 1:** ROC curve analysis of serum Presepsin, Lac and SOFA scores to evaluate the prognostic value of sepsis.

**Discussion**

Sepsis is a systemic suppurative infection, which is a common complication in patients with severe burns, multiple injuries, surgical operations and severe pneumonia. With the aging of the population and the increase of invasive treatment methods, its incidence rate keeps rising, and it is also one of the important causes of death of patients<sup>(7-8)</sup>. Despite aggressive clinical treatment, most patients die of multiple organ failure, which can be classified as sepsis, severe sepsis, and septic shock depending on the severity of the condition. The pathogenesis of sepsis is relatively complex, blood culture and APACHE II can be used to diagnose sepsis at a certain extent, but the sensitivity and specificity is poorer, and blood culture need to be for a long time<sup>(9)</sup>.

Therefore, it is of great significance to search for more sensitive and reliable indicators for the diagnosis of sepsis, to detect the disease in time and control the disease as soon as possible.

Serum Presepsin is an early diagnostic marker of sepsis found in recent years, and many studies have found that it plays an important role in the pathogenesis of sepsis, and is closely related to the prognosis of patients.

The main reasons for its concern are as follows<sup>(10-11)</sup>: it can be detected in the early stage of patients' infection. It can reflect the severity of sepsis and distinguish gram-positive and gram-negative bacterial infection. Their levels were not affected by severe trauma, invasive therapy or burns. Serum Presepsin levels are significantly increased in the early stage of sepsis, which may be due to the involvement of lysosomal enzymes in the phage process during bacterial or other microbial infection, releasing large amounts of SCD14 from the cell membrane into the blood. Some scholars have found that serum Presepsin combined with procalcitonin and other commonly used treatments can significantly improve the predictive value of mortality risk in sepsis<sup>(12)</sup>. Sepsis is mainly caused by hypoperfusion and hypoxia. Lac is an intermediate product of glucose metabolism in vivo and an important indicator of systemic perfusion and oxygen metabolism.

When liver function is normal, the higher Lac content is, the more severe tissue hypoxia is, and when Lac level is higher than 2mmol/L, the scavenging ability of liver is exceeded. When the serum of patients was higher than 4mmol/L during sepsis, tissue perfusion and oxygen supply were insufficient, leading to a significant increase in Lac content and an increased risk of death. Therefore, clinical monitoring of Lac can be used as one of the evaluation indexes of disease severity and prognosis<sup>(13)</sup>. Studies have shown that patients whose Lac level returns to normal within 48h have a good prognosis, while those whose Lac level is still at a high level have a poor prognosis after 48h<sup>(14)</sup>. SOFA score for commonly used assessment tool in the ICU, with objective, simple and clinical data collection easier and dynamically observe the evolution of the disease process, studies have found that SOFA score total mortality in patients with hospital infection is about 10%, it can reflect the degree of organ dysfunction in critically ill patients, the infection has good prognosis effect<sup>(15)</sup>.

The results of this study showed that serum

Presepsin, Lac levels and SOFA scores of the patients in the death group were significantly higher than those in the survival group ( $P < 0.05$ ). Multivariable Logistic regression analysis results show that the APACHE II score, serum Presepsin, Lac, SOFA score are the influence factors of sepsis patients with 28 d case fatality rate ( $P < 0.05$ ), indicating serum Presepsin, Lac level and SOFA score to evaluate the prognosis of sepsis has a certain value, in line with foreign scholars study; In order to understand the three separate and joint detection value evaluation of the prognosis of sepsis further, this study through the ROC curve analysis, according to the results of serum Presepsin, Lac, SOFA score evaluation of sepsis area under curve (AUC) were 0.889, 0.812, 0.819, sensitivity of 81.0%, 78.1% and 75.8% respectively, specific degrees are divided into 92.4%, 88.3%, 87.2%, the joint detection of AUC is 0.928, shows that combined detection has better effectiveness assessment.

In summary, there were significant increases in serum Presepsin, Lac and SOFA scores in sepsis patients, all of which were influencing factors of 28d mortality in sepsis patients, and the combined detection of the three had higher clinical value in assessing the prognosis of sepsis.

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