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Significance of Presepsin in the Early Diagnosis of Sepsis in Children

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Annotation: Resume.

Infectious processes occurring in children of early age often have a non-specific clinical appearance. This, in turn. can lead to interpretation of symptoms and late diagnosis of the disease.

The purpose of the study is to determine the significance of the amount of presepsin in lhe blood plasma in the early diagnosis of sepsis in young children.

Materials and methods. 62 children with early age sepsis were included in the study. Among them, 27 patients made up the comparison group i.e. children not complicated by sepsis, and 35 patients made up the main group - children with sepsis caused by pneumonia.

Result. When the level of presepsin was checked on the lst-3rd days of hospitalization, it was found that the level of presepsin in the blood plasma of the patients of the main group was significantly higher than that of the patients of the control group. (358.9 [279.8 - 675.7] and 245.6 [125-353]). In addition, it was found that there is a correlation (r<0.05) between the duration of time the patients on the mechanical ventilator and lhe high level of presepsin in the blood (R=0.34; r=0 02)

Conclusion. Presepsin level in blood plasma exceeding 325 ngl can serve as a diagnostic cntery for the possibility of sepsis in the background of pneumonia.

Keywords: pediatrics, pneumonia, sepsis, presepsin.

Incomplete functioning of children's immune system leads to rapid spread of infectious process, rapid formation of systemic inflammatory reaction and damage to various organs. The percentage of fatal cases caused by sepsis in premature children is characterized by high indicators (from 15 to 50%), this condition is associated with insufficient development of immunity' In addition, there are risk factors for the development of nosocomial sepsis, which include an increase in the number of invasive measures, as weh as long-term treatment of children in the intensive care and intensive care units. [3. 16, 13].

Starting on time the antibiotic therapy and microbiological analysis of the blood collected earlier, adequate infusion and vasopressor therapy with dynamic checking of lactate and presepsin concentrations lead to a 3 .9% decrease in the lethality rate among children. [16].

Thus, at present there is no universal laboratory method for early diagnosis due to the variety of factors that cause sepsis and the inadequacy of specific aspects of sepsis clinic. Development of new, integrated approaches and improvement of laboratory diagnostic methods of sepsis early' diagnosis, monitoring guarantee the ability' to predict and reduce negative consequences.

The "perfect" marker of sepsis should provide reliable monitoring of the effectiveness of the treatment given to the patient. Unlike reference biomarkers, its indicators help to start antibacterial therapy' on time. Delaying antibiotic therapy' even by 1 hour leads to an increase in the level of lethality [1, 5,11].

Presepsin (PSP) is a marker of the N-terminal part of the CD14 macrophage receptor, and its concentration in the blood increases rapidly' in systemic inflammation, sepsis, and septic shock. Presepsin was discovered by Japanese scientists Yoshikazu Okamura and Ralph Thome in 2005. PSP exists in two foniE: cm the surface of macrophages, monocytes, granulocytes in a membrane-bound state (mCD14) and in a soluble state circulating in the bloodstream (sCD14. s- soluble) [2, 7, 13. 17].

As soon as the bacteria enters the bloodstream, the components of its cell wall bind to this receptor, which leads

to the activation of phagocytosis. When the protein components of bacteria begin to break down, proteinases simultaneously break down the mCD14 receptor and form a specific protein fragment with a molecular weight of 13 kDa. which can be detected in rhe bloodstream [6. 8,12,4].

It has been noted that in sepsis the increase in the level of PSP occurs faster than the increase in markers such as TNF-a, IL-6, IL-10, PCT. and CRP [9, 12, 15].

Material and **methods.**

The clinical research was conducted in 2023-2024 at the "Republican Emergency Medical Research Center" in the departments of pediatric ICTJ and pediatrics 1.

Study inclusion criteria:

> children who had a complicated delivery

> patients with suspected immunodeficiency

> the presence of two or more clinical manifestations of sepsis;

> X-ray confirmed signs of pneumonia

> poly organic deficiency;

Exclusion criteria:

> newborn babies up to 1 month

> genetic pathology and metabolic diseases:

> several malformations, congenital heart and kidney defects.

Pneumonia was diagnosed based on medical history; clinical laboratory and X-ray examination. At the same time, pregnancy and childbirth anamnesis, premoibid background, previous diseases, antibiotic therapy treatments received in ambulatory' and inpatient conditions were also studied.

All children aged 1 to 3 years with suspected pneumonia complicated by sepsis were included in this study. The main (first) group included patients aged 1 mouth to 3 years who had a score of more than 2 on the qSOFA scale upon arrival at the clinic, suspected or confirmed pneumonia complicated by sepsis treated at BSR. and had signs of poly organic failure. Children aged 1 mouth to 3 years, whose pneumonia was complicated by sepsis, but who did not have signs of poly organic failure, were included. All patients were tested for the detection of the Presepsin marker in the blood plasma for the purpose of early diagnosis of sepsis. The main material of rhe study was the blood collected from the peripheral and central veins of the patients.

A hematology analyzer MINDREY BC-5300 (Shenzhen Mindray Bio-Medical Electronics Co..Ltd.. China) was used for complete blood analysis.

Venous blood collected from the patient and plasma stored at under all storage conditions were used in the procedures of the examination. The analysis w[r]as c arried out in the special laboratory' of the Republican Emergency Medical Research Center, strictly following the instructions given by the manufacturers of the test system.

Analysis of the obtained results is done using the method of correlational analysis and "Statistica 6.1". conducted using the standard package. The obtained results are presented in rhe form of M±SD. where M is the arithmetic mean value, SD is the standard deviation.

For visualization of statistical significance non-parametric U-criterion Mann-Whitney and Spearman's correlation coefficient were used. ROC analysis was also performed.

Results and their analysis.

32 patients in the main group were connected to the mechanical ventilator. Depending on the seventy or severity of the pathological process, the connection to the ventilator lasted from 1-2 to 10-14 days. Children who were connected to the ventilator for more than 1 week had signs of poly organic failure (p=0.02). ’ ’ ’

AU patients were treated with pathogenetic and symptomatic treatment, taking into account antibacterial and vital parameters.

During the standard laboratory tests, the laboratory' criteria of inflammation were noted- leukocytosis in the blood, shift of the leukocyte formula to the left, increase in the amount of C-reactive protein and procalcitonin.

In the comparative analysis of inflammation indicators in the general blood analysis, the differences in leukocytosis in the main and control groups were 16.7 [9.4-18.7] and 16.0 [8.8-17.4]) C reactive protein (r<0.05) increased almost the same in both groups (6.2 [5.5-7.0] gl) (6.5 [5.1-7.6]) was recorded, (table 1)

Table 1. Data of the general blood test (leukocytes, leukocyte formula) and CRP in patients of the study groups.

Parametres	Patients with sepsis caused by pneumonia(n=30)	Patients with septic shock(n=5)	Control group (patients with pneumonia) (n=27)
leucocytes(xl 09/л)	13.8 [9.1-16,2]	16.8 [8.8-17,41*	13,5 [9,72-15,7]
Band neutrophils(%)	4.8 [3,5-5.2]	5.4 [3.9-6.4]	4,1 [2.9-4,71
Seg.neut.(%)	39,8 [31.6-47,5]	43,65 [28,648,9]	41.6 [32,747,6]
CRB(mg.'ml)	5,3 [4,2-6,8]	6,2 [5.5-7.01	6.1 [5.1-7.61)

Notes: * -P<0,05.

A significant increase in presepsin level on days 1-3 was observed more in the children of the main group than in the control group 458.9 [379.8-675.7] and 245.6 [125-353].

It was found that there is a positive correlation (r<0.05) between the duration of the time the patients on ventilator and the high level of presepsin in the blood (R=0.34: r=0.02).

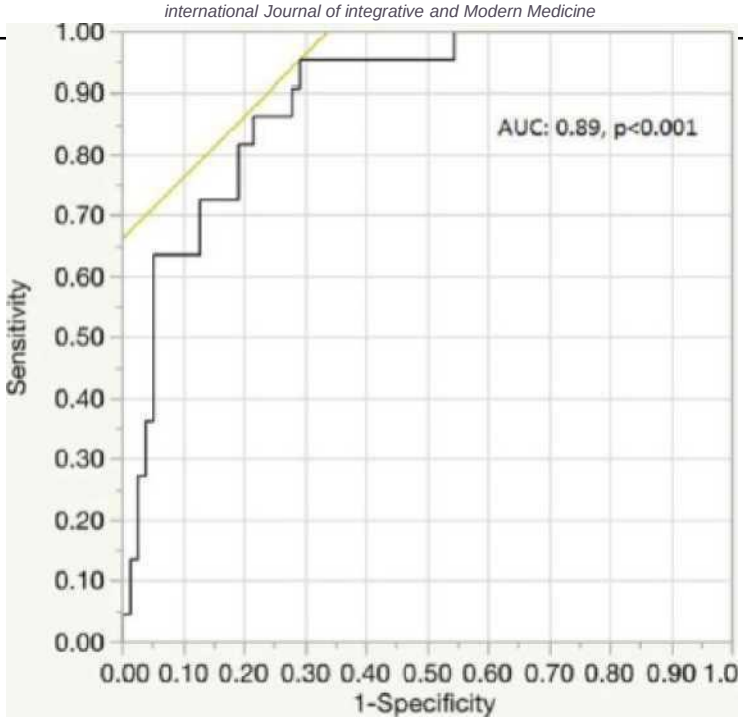
Analyzing the level of presepsin. it should be noted that the level of presepsin was significantly higher in patients with sepsis complicated by poly organic failure. (1=0.0002). (table 2)

Table 2.Concentration of presepsin in blood plasma.

Days	Patients with sepsis caused by pneumouia[n=30)	Patients with septic shock (n=5)	Control group(patients with pneumonia)[a=2 7)
I-day	245.6 [125-3531*	358.9 [279.8-675.7]*"	150.6 [68-248]’*
3rd day	238 [63423]*	325,5 [191-825]"*	124,5 [90-167]"

Notes: * -Pl-2<0,01; **-Pl 3-0.05: ***-P2-3<0,001.

ROC analysis was performed for early diagnosis of sepsis in early' age children. A presepsin level higher than 325 ngl on the lst-3rd day' of hospitalization is a criteria for the occurrence of sepsis against the background of pneumonia (Fig. 1).



False Positive

Conclusion.

1. The level of presepsin increases in patients with sepsis and reflects the severity of the inflammatory process.
2. The limit value of presepsin for early diagnosis of sepsis is 325 ng 1.
3. Monitoring of presepsin during the antibacterial treatment reflects its effectiveness more clearly than C-reactive protein.

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