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Changes of serum pancreatic stone protein and cholinesterase contents in children with sepsis and their correlation with systemic inflammatory response and target organ damage

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ABSTRACT

Objective: To study the changes of serum pancreatic stone protein (PSP) and cholinesterase (ChE) contents in children with sepsis and their correlation with systemic inflammatory response and target organ damage. **Methods:** A total of 64 children with sepsis who were treated in the hospital between January 2015 and January 2017 were selected as observation group, and 50 healthy children who received vaccination in the hospital during the same period were selected as normal control group. The contents of PSP, ChE, inflammatory factors as well as liver and kidney function indexes in the two groups were detected. Pearson test was used to assess the correlation of serum PSP and ChE contents with systemic inflammatory response and target organ damage in children with sepsis. **Results:** Serum PSP content of observation group was higher than that of control group while ChE content was lower than that of control group; serum inflammatory factors PCT, CRP, IL-1, IL-6 and IL-10 contents of observation group were higher than those of normal control group; liver function indexes TBIL, ALT and AST contents were higher than those of normal control group; kidney function indexes Scr and BUN contents were higher than those of normal control group. Pearson test showed that the serum PSP and ChE contents in children with sepsis were directly correlated with the systemic inflammatory response as well as liver and renal function injury. **Conclusion:** Serum PSP content significantly increases while ChE content significantly decreases in children with sepsis and the specific change is directly correlated with the overall disease severity.

1. Introduction

Sepsis is the systemic inflammatory response syndrome (SIRS) caused by infection, and can quickly progress to multiple organ dysfunction syndrome (MODS) after onset in children, so early judging the illness severity and selecting the corresponding treatment is the key step to optimize the clinical outcome[1−3]. Pancreatic stone protein (PSP) belongs to the c-type lectin family, have a specific agglutination effect on bacteria, is highly expressed in circulating blood of a variety of infectious diseases, and is considered to be a new index to objectively judge the severity of infection[4,5]. Cholinesterase (ChE) is secreted by the liver and catalyzes the acetylcholine hydrolysis, it has been discovered that ChE expression decreases in patients with acute infection, myocardial infarction, malnutrition and others, and it is valuable for the auxiliary diagnosis of disease and the judgment of severity[6,7]. In this study, serum PSP and ChE contents were detected, and their inner link with inflammation and target organ damage was further determined in order to clarify the clinical value of PSP and ChE for measuring the sepsis condition.

2. Information and methods

2.1 Case information

Between January 2015 and January 2017, 64 children with sepsis were selected as observation groups, 50 healthy children with

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vaccination were selected as normal control group, and the family members signed informed consent. Inclusion criteria: (1) meeting the diagnostic criteria for sepsis; (2) < 18 years old; (3) cooperating with and completing the treatment, and not withdrawing independently. Exclusion criteria: (1) combined with serious congenital heart disease and so on; (2) combined with severe autoimmune dysfunction; (3) with history of sepsis within half a year prior to the admission.

Normal control group: 26 male cases and 24 female cases that were 2-14 years old; observation group: 34 male cases and 30 female cases that were 1-12 years old. The difference in general information was not significant between the two groups of children, the follow-up data were comparable and the hospital ethics committee issued the consent form.

2.2 Pancreatic stone protein and cholinesterase content detecting

Immediately after admission, proper amount of peripheral blood was extracted from the two groups at the same time point, put in anticoagulant aseptic EP tube and centrifuged at low speed to get the upper serum. Chemiluminescence was used to detect the contents of pancreatic stone protein (PSP) and cholinesterase (ChE).

2.3 Inflammatory factors and target organ damage

Immediately after admission, peripheral blood serum of the research subjects was also obtained, and enzyme-linked immunosorbent assay was used to determine the levels of inflammatory factors procalcitonin (PCT), C-reactive protein (CRP), interleukin-1 (IL-1), interleukin-6 (IL-6 and interleukin-10 (IL-10); fully automatic biochemical analyzer was used to test serum contents of liver function indexes total bilirubin (TBIL), alanine aminotransferase (ALT) and aspertate aminotransferase (AST) as well as kidney function indexes serum creatinine (Scr) and blood urea nitrogen (BUN).

2.4 Statistical processing

PSP, ChE, inflammatory factors as well as liver and kidney function indexes were in terms of mean ± standard deviation (Mean ± SD), comparison between two groups was by t test and correlation analysis between data was by Pearson test. $P<0.05$ was the standard of statistical significance in differences in the statistics after data comparison in the study.

3. Results

3.1 Pancreatic stone protein and cholinesterase contents

Comparison of serum PSP (ng/mL) and ChE (U/L) contents between two groups of subjects was as follows: serum PSP content of observation group was (48.42±6.29) ng/mL and higher than (20.36±2.81) ng/mL of control group ($P<0.05$); ChE content was (2 145.15±278.27) U/L and lower than (7 519.36±788.53) U/L of control group ($P<0.05$), shown in Table 1.

Table 1.

Comparison of pancreatic stone protein and cholinesterase contents.

Groups	*n*	PSP	ChE
Control group	32	20.36±2.81	7 519.36±788.53
Observation group	32	48.42±6.29	2 145.15±278.27
t		12.182	24.386
P		<0.05	<0.05

3.2 Inflammatory factors

Comparison of serum inflammatory factors PCT (μg/L), CRP (mg/L), IL-1 (pg/mL), IL-6 (pg/mL) and IL-10 (pg/mL) contents between two groups of subjects was as follows: serum PCT, CRP, IL-1, IL-6 and IL-10 contents of observation group were (6.29±0.71) μg/L, CRP (11.69±1.85) mg/L, IL-1 (39.74±5.26) pg/mL, IL-6 (51.68±6.42) pg/mL and IL-10 (4.16±0.53) pg/mL respectively and higher than those of normal control group ($P<0.05$), shown in Table 2.

3.3 Liver function indexes

Comparison of serum liver function indexes TBIL (μmol/L), ALT (U/L) and AST (U/L) contents between two groups of subjects was as follows: serum TBIL, ALT and AST contents of observation group were TBIL (11.58±1.74) μmol/L, ALT (119.74±15.38) U/L and AST (176.28±21.61) U/L and higher than those of normal control group ($P<0.05$), shown in Table 3.

Table 3.

Comparison of liver function index contents.

Groups	*n*	TBIL	ALT	AST
Control group	32	6.29±0.71	50.63±6.27	91.25±10.83
Observation group	32	11.58±1.74	119.74±15.38	176.28±21.61
t		9.871	14.726	19.183
P		<0.05	<0.05	<0.05

Table 2.

Comparison of inflammatory factor contents.

Groups	*n*	PCT	CRP	IL-1	IL-6	IL-10
Control group	32	0.57±0.07	4.22±0.58	10.38±1.75	12.29±15.41	0.73±0.09
Observation group	32	6.29±0.71	11.69±1.85	39.74±5.26	51.68±6.42	4.16±0.53
t		8.191	12.398	15.761	11.458	9.263
P		<0.05	<0.05	<0.05	<0.05	<0.05

3.4 Kidney function indexes

Comparison of serum kidney function indexes Scr (μmol/L) and BUN (mmol/L) contents between two groups of subjects was as follows: serum Scr content (224.61±25.53) μmol/L and BUN content (28.95±3.41) mmol/L of observation group were higher than Scr (123.75±14.89) μmol/L and BUN (16.23±2.19) mmol/L of normal control group ($P<0.05$), shown in Table 4.

Table 4.

Comparison of kidney function index contents.

Groups	*n*	Scr	BUN
Control group	32	123.75±14.89	16.23±2.19
Observation group	32	224.61±25.53	28.95±3.41
t		19.862	22.374
P		<0.05	<0.05

3.5 Correlation analysis

Pearson test showed that the serum PSP content in children with sepsis was positively correlated with inflammatory factors PCT, CRP, IL-1, IL-6 and IL-10 contents, liver function indexes TBIL, ALT and AST contents as well as kidney function indexes Scr and BUN contents ($P<0.05$). ChE content was negatively correlated with inflammatory factors PCT, CRP, IL-1, IL-6 and IL-10 contents, liver function indexes TBIL, ALT and AST contents as well as kidney function indexes Scr and BUN contents ($P<0.05$).

4. Discussion

Early judgment of sepsis illness is of decisive significance for the choice of therapy and the optimization of treatment outcome, but there are no clear sepsis illness-related indicators at present, which is one of the important causes of the higher disease mortality in the past[3,8]. It has been reported in different studies that the contents of PSP and ChE may change with the occurrence of inflammatory infection, but the association between them and sepsis is not yet conclusive. It was found in this study that compared with those of normal control group, serum PSP content was higher while ChE content was lower in children with sepsis. The above results indicate that PSP and ChE contents are abnormal in children with sepsis, and the intrinsic relationship of specific PSP and ChE contents with the disease severity needs to be further studied.

Systemic inflammatory response is the most typical pathological change in children with sepsis, and the pathogenic bacteria and the toxins secreted by them enter into the blood circulation, stimulate the massive generation of inflammatory mediators and form a cascade, resulting in various tissue viscera injury and disease progression[9]. PCT is a new type of inflammation factor, its content does not increase significantly in circulating blood of patients with viral infection and mild bacterial infection, but its content increases rapidly in patients with severe bacterial infection and can specifically reflect the infection condition[10,11]. CRP is the most thoroughly studied acute phase protein in clinical study at present, which can be massively secreted and released into the blood in early stage of infection, and can further stimulate mononuclear/ macrophages and neutrophils to gather and secrete IL-1, IL-6 and other pro-inflammatory factors to expand the systemic inflammatory response[12,13]. IL-10 is an anti-inflammatory factor, IL-10 content increases reactively when acute infections occur in order to inhibit inflammation from further expanding, but its increase is less than that of pro-inflammatory factors, so the overall disease still progresses[14]. It was found in the study that compared with normal control group, observation group were with higher serum PCT, CRP, IL-1, IL-6 and IL-10 contents, indicating that there is the imbalance of pro-inflammatory and anti-inflammatory factor expression in children with sepsis. Further Pearson test showed that serum PSP content in children with sepsis was positively correlated with these inflammatory factors while ChE content was negatively correlated with these inflammatory factors, confirming that the PSP and ChE contents can objectively reflect the degree of systemic inflammatory response in children with sepsis.

SIRS can directly lead to important organ injury in children, is the foundation of subsequent MODS, and also indicates the poor treatment outcome, the liver is the most easily involved viscera by sepsis, and followed by the kidney, and testing their functional state also has certain value for judging the disease[15,16]. TBIL is metabolized in the liver, and when the liver function is obstructed, TBIL cannot be effectively decomposed and accumulate, directly resulting in an increase in circulating blood contents[17]. That pathogenic bacteria and toxins directly attack the liver cells, or inflammatory factors damage the liver cells, can both cause the intracellular ALT and AST to cross through the damaged cell wall and enter into the peripheral blood, and the increase content of ALT and AST is the most visible manifestation of liver function injury[18]. Scr and BUN are the most commonly applied clinical renal function indexes, Scr and BUN are unable to be effectively removed from the human body and accumulate in the blood in the case of glomerular/ renal tubular dysfunction, and therefore, the higher their contents, the more serious the renal dysfunction[19,20]. It was found in the study that compared with normal control group, observation group were with higher serum contents of liver function indexes TBIL, ALT and AST as well as renal function indexes Scr and BUN, confirming that there is liver and kidney dysfunction in children with sepsis. Further Pearson test showed that serum PSP content in children with sepsis was positively correlated with the above liver and kidney function index contents while ChE content was negatively correlated with

the above liver and kidney function index contents, confirm the directivity function of PSP and ChE contents for liver and kidney function damage in children with sepsis.

Thus, serum PSP and ChE contents in children with sepsis are directly correlated with the degree of systemic inflammatory response and important viscera damage, can be used as the reliable indexes for long-term sepsis condition judgment, and can also be used as one of the evidences to evaluate the sepsis treatment effect and change the therapy.

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