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Changes of serum Se selectin, ACTH, LPS and SIRT1 levels in patients with acute pancreatitis and their correlation with disease severity

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ABSTRACT

This experiment was designed to explore the changes in serum Se selectin, ACTH, LPS and SIRT1 levels in patients with acute pancreatitis and their correlation with the severity of the disease. To do this research, from March 2019 to December 2020, 86 patients with different degrees of acute pancreatitis were selected as the research object. They were divided into mild acute pancreatitis (MAP) group (n = 43), moderately severe acute pancreatitis and severe acute pancreatitis (MSAP + SAP) group (n = 43) and healthy group (n = 43). At the same time, the serum levels of Se selectin, ACTH, LPS and SIRT1 were detected after hospitalization. Results showed that the levels of serum Se selectin, ACTH and SIRT1 in the MAP group and MSAP + SAP group were lower than those in the healthy group; The LPS of the MAP group and MSAP + SAP group were higher than that of the healthy group. The results showed that serum Se selectin, ACTH and SIRT1 decreased with the development of the disease, showing a negative correlation; The change of LPS in patients will increase with the development of the disease, showing a positive correlation. Serum Se selectin, ACTH, SIRT1, and LPS can be used as diagnostic criteria and indicators of acute pancreatitis to achieve early prevention and treatment and improve the prognosis and quality of life of patients.

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Introduction

Acute pancreatitis is one of the most common acute abdominal diseases, showing an upward trend year by year in China. Biliary pancreatitis is the most common, ranking fourth in the incidence rate of digestive tract diseases (1). Acute pancreatitis is one of the most dangerous acute abdominal diseases. The mortality rate of severe acute pancreatitis is as high as 25%, which is closely related to biliary pancreatitis, irregular daily life and eating habits (2). The pathogenesis and pathological changes of acute pancreatitis are complex and changeable. It is due to the activation of pancreatic enzymes in the pancreas, which promotes the inflammation reaction of self-digestion, edema, hemorrhage and necrosis of the pancreas (3). It is mainly manifested as acute upper abdominal pain, fever, nausea and other symptoms, which cause damage to various organs to varying degrees, and is accompanied by complications such as pancreatic brain and renal failure, which may endanger life in serious cases (4). In recent years, there are many methods for judging acute pancreatitides, such as Apache - II scoring method and CT grade scoring method(5). It can be divided into mild acute pancreatitis (MAP), moderately severe acute pancreatitis (MSAP) and severe acute pancreatitis (SAP) according to the change of disease condition. With the continuous progress of society, the quality of life is getting better and better, and eating habits are also changing. The number of patients with acute pancreatitis is increasing year by year, mainly due to overeating and alcoholism, so it is particularly important to treat them as soon as possible. Early detection and treatment can judge the severity of the disease and play an active role in the treatment of acute pancreatitis. When serum soluble E-selectin (SE selectin) is absent in normal blood vessels, it is mainly manifested that endothelial cells feel the activation of inflammatory cytokines, which makes the increase of Se selectin and participates in the inflammatory response in vivo(6). SE-selectin enters the blood through shedding, secretion and necrosis, which increases the level of sE-selectin in the blood. Adrenocorticotropic hormone (ACTH) is a hormone that is secreted by the pituitary gland and can promote the secretion of glucocorticoids by the adrenal gland (7). When the body is stimulated, the sympathetic nerve will have an endocrine response, so this is the adaptive response produced by the body(8). However, when the body is strongly stimulated and has adverse effects on the body, ACTH decreases significantly. Lipopolysaccharide (LPS) is a component of Gram-negative bacteria and is released after cell lysis(9). Its toxic component is mainly lipoid A. When the body is infected, the level of toxins in the blood of patients will be significantly increased, so the level of LPS in SAP patients will significantly increase. Silent information regulator 1 (SIRT1) can inhibit the growth of bacteria, participate in the survival and metabolic process of cells, promote the ability metabolism of the body, and make the energy metabolism of the body in a balanced state(10). In order to further explore whether the changes of serum sE-selectin, ACTH, LPS and SIRT1 can indicate the severity of acute pancreatitis and have a significant effect on the prognosis of acute pancreatitis, 86 patients with acute pancreatitis were selected to observe the changes of serum sE-selectin, ACTH, LPS and SIRT1.

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Materials and Methods

General Materials

86 patients with acute pancreatitis of different degrees admitted to the Department of General Surgery of our hospital from March 2019 to December 2020 were selected as the subjects of this study. Inclusion criteria: ①All of them met the criteria established by Chinese pancreatic disease scholars (4);②Acute pancreatitis was diagnosed for the first time after examination; ③Accord with Apache - II scoring method and CT grade scoring method;④The patients and their families should sign the informed consent form and obtain the consent of the ethics committee of our hospital.

Exclusion criteria: ①Patients with biliary tract diseases such as cholecystitis and gallstones were excluded; ②Tumor patients were excluded; ③Patients with long-term use of glucocorticoids were excluded; ④Patients with liver and kidney diseases and incomplete data were excluded. There were 48 males and 38 females; They were randomly divided into MAP group and MSAP + SAP group (43 cases each); In the MAP group, there were 25 males and 18 females, with an average age of (55.23 ± 2.25) years; In MSAP + SAP group, there were 23 males and 20 females, with an average age of (54.26 ± 2.68) years; The patients in both groups were admitted within 2 days of onset; In MAP group, Apache - II score was below 8 and CT grade was below D; In MSAP + SAP group, Apache - II score was above 8 and CT grade was above D; At the same time, 43 healthy people were selected as the healthy group for comparison, including 20 males and 23 females, with an average age of (54.89 ± 2.55) years. There was no significant difference among the MAP group, MSAP + SAP group and healthy group in age, sex and time of onset ($P > 0.05$).

Methods and instruments

①Methods: 5ml venous blood was collected from the MAP group, MSAP + SAP group and healthy group on the first, third and seventh day of hospitalization in the morning. 5ml venous blood was collected on an empty stomach in a vacuum blood collection vessel without anticoagulation. Alcohol and a high-fat diet were prohibited within 24 hours before collection. Shake the extracted blood well, put it in a centrifuge for 15 minutes at a speed of 3000r / min after standing for 60 minutes at room temperature, and take out the upper serum and put it into a 1.5ml test tube. Put it in a refrigerator at - 20 ℃ to avoid repeated freezing and thawing.

②(i)Serum sE-selectin detection instrument: the serum sE-selectin detection kit is provided by Zhenke Biology Co., Ltd. The double antibody one-step sandwich enzyme-linked immunosorbent assay was used. The detection antibody was added to the coated micro-pores of soluble sE-selectin, incubated in the greenhouse and then thoroughly cleaned. It turns blue under the catalysis of peroxidase and finally turns yellow under the action of acid. The change of color was positively correlated with serum Se selectin. The concentration of the sample was calculated by the absorbance of the enzyme instrument at the wavelength of 450nm. (ii)ACTH detection instrument: the chemiluminescence method is used for detection. The ACTH kit is produced by Shanghai Yuchun Biotechnology Co., Ltd. and the chemiluminescence instrument of the German DPC Company was used for detection. (iii)LPS detection instrument: the immune transmission turbidimetric method is used for detection, and the Limulus reagent dynamic turbidimetric method is used for detection. The LPS kit is from Wuhan Saipei Biological Co., Ltd., and the au680 automatic biochemical analyzer and mb-80s microbial dynamic rapid detection system are used. All operations are in accordance with the instructions. (iv) SIRT1 detection instrument: the ELISA kit is used to detect SIRT1, and the luciferase method is used to detect its function. All operations are carried out in strict accordance with the instructions of the kit.

Statistical results

SPSS17.0 statistical software was used for statistical analysis in this study. The measurement data were expressed in the form of mean ± standard deviation (x±s) and t-test was used;the measurement data is expressed by the rate (%) and tested by X^2. $P < 0.05$ was statistically significant.

Results

Comparison of serum sE-selectin in MAP group, MSAP + SAP group and healthy group

After admission, the serum sE-selectin of the MAP group, MSAP + SAP group and healthy group were compared. The serum Se selectin of healthy group was within the normal range; Compared with the healthy group, the serum Se selectin in the MAP group was not within the normal range and higher than that in the healthy group. The value was the highest on the first day after admission, while it showed a downward trend on the third and seventh days compared with the first day; However, the change of serum sE-selectin in the MSAP + SAP group was the highest among the three groups, with the highest value on the third day. Compared with the other two groups, the change range was the largest, with a significant difference ($P < 0.05$). See Table 1.

Comparison of ACTH among MAP group, MSAP + SAP group and healthy group

The level of ATCH in the healthy group was within the

Table 1. Comparison of serum sE-selectin in MAP group, MSAP + SAP group and healthy group (x±s, μg/L).

Group	n	Serum sE-selectin		
		Day 1	Day 3	Day 7
MAP Group	43	88.67±13.52*	97.56±14.21*	40.55±3.64*
MSAP+SAPGroup	43	42.36±9.89*#	16.42±3.14*#	10.98±2.97$^{\Delta}$
Healthy Group	43	10.78±2.63	10.21±2.41	10.34±2.10

Note: Compared with the healthy group, *$P < 0.05$,$\Delta P > 0.05$; Compared with MAPgroup, #$P < 0.05$.

Table 2. Comparison of ACTH among MAP group, MSAP + SAP group and healthy group.

Group	n	ACTHIndex		
		Day 1	Day 3	Day 7
MAP Group	43	15.47±7.56*	13.25±7.23*	10.63±6.98*
MSAP+SAPGroup	43	11.69±9.68*#	9.56±8.69*#	7.33±8.21*#
Healthy Group	43	18.99±4.25	19.22±4.30	19.10±4.33

Note: Compared with the healthy group,*$P < 0.05$; Compared with the MAP group, #$P < 0.05$.

Table 3. Comparison of LPS levels in MAP group, SAP group and healthy group (EU/mL).

Group	n	LPS Index		
		Day 1	Day 3	Day 7
MAP Group	43	1.01±0.03*	1.24±0.03*	1.27±0.02*
MSAP+SAP Group	43	1.21±0.06*#	1.33±0.05*#	1.45±0.05*#
Healthy Group	43	0.05±0.01	0.04±0.01	0.06±0.01

Note: Compared with the healthy group,*$P < 0.05$; Compared with MAP group, #$P < 0.05$.

Table 4. Comparison of SIRT1 levels in MAP group, MSAP + SAP group and healthy group.

Group	n	SIRT1Index		
		Day 1	Day 3	Day 7
MAP Group	43	1.23±0.33*	1.19±0.31*	1.08±0.29*
MSAP+SAP Group	43	1.09±0.14*#	0.87±0.11*#	0.69±0.09*#
Healthy Group	43	2.56±0.56	2.59±0.51	2.52±0.50

Note: Compared with the healthy group,*$P < 0.05$; Compared with MAP group, #$P < 0.05$.

normal range, and the level of ACTH in the healthy group was lower than that in the MAP group; Compared with the MSAP + SAP group, the decrease of ACTH was more obvious with the increase of the disease days, with a significant difference $P > 0.05$; Compared with the MAP group, the change range of the MAP group was smaller than that of the MSAP + SAP group, and there was no significant difference ($P > 0.05$). See Table 2.

Comparison of LPS levels in MAP group, SAP group and healthy group

Compared with the patients in the healthy group, the LPS levels in the MAP group and the MSAP + SAP group increased gradually with the increase of the disease days; compared with the healthy group, the change in the MAP group was smaller; Compared with the healthy group, the change range of MSAP + SAP group gradually increased, with a significant difference ($P < 0.05$), as shown in Table 3.

Comparison of SIRT1 levels in MAP group, MSAP + SAP group and healthy group

Compared with the healthy group, the level of SIRT1 in the MAP group decreased significantly with the increase in the number of sick days; The SIRT1 level of patients in the MSAP + SAP group decreased significantly with the number of days ($P < 0.05$), as shown in Table 4.

Healthy group, MAP group and MSAP+SAP group

The serum sE-selectin, ACTH and SIRT1 in the MAP group and MSAP + SAP group increased gradually with the severity of the disease and were higher than those in the healthy group. However, LPS in the MAP group and MSAP + SAP group increased significantly with the severity of the disease. Therefore, the serum Se selectin, ACTH and SIRT1 in the patients increased significantly, and the LPS level in the patients decreased, which indicated the severity of acute pancreatitis.

Discussion

The symptoms of acute pancreatitis are mainly manifested in severe pain in the upper abdomen, nausea and vomiting, and pain radiating to the waist and back (11). As the pathogenesis and pathological changes of acute pancreatitis are complex and changeable, it has attracted the attention of medical and scientific researchers. Due to the improvement of the quality of life and the irregularity of eating habits, various phenomena of binge drinking and overeating have increased, and the number of patients with acute pancreatitis has also increased. Acute pancreatitis has the characteristics of rapid development and high mortality. It has become a hot spot in the clinic to establish and improve the evaluation mechanism and quickly judge and treat the disease (12). The severity of acute pancreatitis can accumulate multiple organ damage, resulting in brain, kidney and other organ failures (13). Due to the severity of acute pancreatitis, it is divided into MAP and SAP. SAP can be accompanied by hypotension and shock, accompanied by different degrees of fever. The patients mainly show symptoms such as slow pulse, restlessness and dyspnea, combined with multiple organ failure and high mortality (14).

The se selectin in the blood participates in the inflammatory reaction and has an adhesive effect. It can carry out signal transmission in cells and mutual recognition between cells. In the process of physiology and pathology, it can play a positive role in cell growth and development,

immune regulation of the body itself, and accelerating the repair of tissues. In the case of systemic inflammation, the patient's sE-selectin will be significantly increased (15). The secretion of Acht can regulate the self-cardiovascular function, and can regulate the damage of nerve function and the imbalance of the immune system. The secretion of ACTH alternates day and night. When stimulated, the secretion of ACTH increases, strengthening resistance and can be applied to inflammation and allergic reactions. LPS in the patient's body can be rapidly secreted with the rupture of pancreatic cells, causing the increase of endotoxin in the body, accelerating the progress of acute pancreatitis, and entering the blood circulation to participate in the inflammatory reaction, so as to detect the sharp rise of LPS in the body, causing damage to pancreatic cells in the body. SIRT1 is a highly conserved protein that can participate in cell growth and material metabolism in vivo and has positive effects. It can also participate in the stability of glucose and insulin secretion in vivo and maintain the balance of blood glucose in vivo by maintaining the balance of the internal environment. When the SIRT1 level in the body drops sharply, it indicates that the internal environment in the patient is in an unstable state.

In conclusion, the serum sE-selectin, ACTH and SIRT1 in patients will decrease with the development of the disease, showing a negative correlation; the changes of LPS in patients will increase with the development of the disease, showing a positive correlation. It shows that serum sE-selectin, ACTH, SIRT1 and LPS can be used as diagnostic criteria and indicators to judge acute pancreatitis so as to achieve early prevention and treatment and improve the prognosis and quality of life of patients.

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