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LABORATORY DIAGNOSIS IN SEPSIS AND ITS PATHOPHYSIOLOGICAL BASIS

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Abstract: This work provides a detailed analysis of laboratory diagnostics of sepsis and its pathophysiological basis. The systemic inflammatory reactions and coagulation system disorders that occur in the body during the development of sepsis are scientifically reviewed. The role of laboratory diagnostic methods, including a complete blood count, C-reactive protein (CRP), procalcitonin (PCT), lactate level, D-dimer and microbiological tests in the diagnosis is revealed. The importance of each laboratory parameter in the detection and assessment of the severity of sepsis is also highlighted. The need for changes in laboratory parameters based on pathophysiological mechanisms and the need to make clinical decisions based on them is scientifically substantiated. The study emphasizes the vital importance of early diagnosis of sepsis, proper monitoring and treatment strategies. The results of the work show that a correct understanding of the laboratory examination and pathophysiology of sepsis can improve the quality of life of patients and reduce mortality.
Keywords: Sepsis, Pathophysiology, Laboratory diagnostics, Systemic inflammatory response, Coagulation system, Microangiopathy, Procalcitonin, C-reactive protein, Lactate, D-dimer.

ЛАБОРАТОРНАЯ ДИАГНОСТИКА ПРИ СЕПСИСЕ И ЕЕ ПАТОФИЗИОЛОГИЧЕСКИЕ ОСНОВЫ

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Аннотация: В работе дан подробный анализ лабораторной диагностики сепсиса и его патофизиологических основ. Научно рассмотрены системные воспалительные реакции и нарушения системы свертывания крови, возникающие в организме при развитии сепсиса. Объясняется роль лабораторных методов диагностики, включая общий анализ крови, С-реактивный белок (СРБ), прокальцитонин (ПКТ), уровень лактата, D-димер, а также микробиологические исследования в диагностике. Также подчеркивается важность каждого лабораторного параметра для выявления и оценки тяжести сепсиса. Обоснована необходимость научного обоснования изменений лабораторных показателей и принятия клинических решений на основе патофизиологических механизмов. Исследование подчеркнуло чрезвычайную важность ранней диагностики сепсиса, надлежащего мониторинга и стратегий лечения. Исследование показывает, что лабораторные исследования и правильное понимание патофизиологии сепсиса могут улучшить качество жизни пациентов и снизить смертность.
Ключевые слова: Сепсис, Патофизиология, Лабораторная диагностика, Системный воспалительный ответ, Система свертывания крови, Микроангиопатия, Прокальцитонин, С-реактивный белок, Лактат, D-димер.

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Introduction

Sepsis is a serious clinical syndrome that is the result of a systemic inflammatory response in response to infection. This condition can lead to organ dysfunction and multiorgan failure, which is life-threatening. The development of sepsis is mainly associated with infection and occurs as a result of a violation of the body's immune response. The pathophysiology of this condition is complex and occurs with the participation of inflammatory mediators, cytokines and other biologically active substances. Early detection and effective management of sepsis are crucial for saving the patient's life. Laboratory diagnostic methods, including the use of C-reactive protein, procalcitonin and other biomarkers, play an important role in the detection of sepsis and assessment of its severity. However, not all of these tests always give accurate results in patients with sepsis, which further complicates the diagnosis.

The results of laboratory tests in patients with sepsis can often be ambiguous. For example, the level of C-reactive protein or procalcitonin in the blood may be high, but this only indicates the presence of an inflammatory process, and additional tests are needed to determine the exact cause of the infection. In addition, some laboratory tests can take time, which can delay the initiation of prompt treatment in patients with sepsis. Laboratory test results in patients with sepsis can often be inconclusive. For example, the level of C-reactive protein or procalcitonin in the blood may be high, but this only indicates the presence of an inflammatory process, and additional tests are needed to determine the exact cause of the infection. In addition, some laboratory tests can take time, which can delay the initiation of prompt treatment in patients with sepsis.

Laboratory test results in patients with sepsis can often be inconclusive. For example, a high C-reactive protein or procalcitonin level in the blood may indicate the presence of inflammation, and further testing is needed to determine the exact cause of the infection. Additionally, some laboratory tests can take time, which can delay the initiation of prompt treatment in patients with sepsis.

Literature review and method

Sepsis is a condition that causes systemic inflammation and dysfunction in many organ systems as a result of infection. As a result, the infection spreads, the body's immune response deteriorates, and the coagulation system is disrupted. Sepsis is a rapidly developing condition, and severe cases can lead to death, so its early diagnosis and effective treatment are important. There are a number of indicators that help in the detection and monitoring of sepsis through laboratory diagnostic methods.

The pathophysiology of sepsis is mainly associated with an increase in the body's inflammatory reactions. When the inflammatory process intensifies, blood vessels dilate and microcirculation is impaired, which prevents the organs from receiving sufficient oxygen and nutrients. This leads to microvascular ischemia and thrombosis. The coagulation system is activated, resulting in microangiopathic thrombosis, which leads to impaired organ function. The immune system is also altered in sepsis. As a result of the initial inflammatory response, the immune system releases a large number of inflammatory mediators, but over time, the effectiveness of this system decreases. Thus, sepsis is associated not only with infection, but also with dysfunction of the immune system and coagulation systems. Laboratory diagnostics are an important tool in the early detection of sepsis. Unlike other analyzes, laboratory diagnostics allow for a more accurate and faster diagnosis of the disease, which helps to initiate treatment and monitor the patient's

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condition. Among the most commonly used laboratory tests are blood tests, C-reactive protein (CRP), procalcitonin (PCT), lactate, and D-dimer. A blood test is performed to determine the number of leukocytes and their differential analysis. Patients with sepsis usually have leukocytosis, i.e. an increase in the number of white blood cells. However, in some cases, leukopenia, i.e. a decrease in the number of white blood cells, can also be observed. The levels of CRP and PCT indicate the activity of the inflammatory process. Elevated PCT levels are helpful in diagnosing sepsis, especially in cases of bacterial infection. Leukocytosis, or an increase in the number of white blood cells, is the most common laboratory finding of sepsis. At the onset of sepsis, the body increases the number of white blood cells to fight infection. However, in some cases, leukopenia, or a decrease in the number of white blood cells, is also a characteristic symptom of sepsis. Differential analysis, or the determination of the ratio of different types of white blood cells, can help determine the type of infection and the body's immune response. For example, a decrease in the level of lymphocytes or an increase in neutrophils indicates a bacterial infection. Also, in sepsis, changes in the number of lymphocytes and monocytes indicate a weakened or malfunctioning immune system.

CRP is a protein that is rapidly produced when an inflammatory process is suspected to have begun in the body. In sepsis, the level of CRP increases significantly as a result of the development of an infection in the body. The level of CRP indicates the activity of inflammation, and this parameter is an important aid in identifying patients with sepsis. PCT, in turn, is a special marker for diagnosing bacterial infections and sepsis. The level of PCT is highly reliable in diagnosing bacterial infections, since this substance is produced only in response to bacteria. Thus, the level of PCT indicates the bacterial nature of sepsis, which helps in choosing antibiotics for treatment.

Lactate level is a parameter that indicates oxygen deficiency and metabolic dysfunction in the body. In sepsis, especially when the organs need oxygen, lactate levels increase. In cases of delayed sepsis, the organs cannot receive enough oxygen and anaerobic metabolic processes begin. As a result, lactate production increases. An increase in lactate level indicates oxygen deficiency in the body and, at the same time, the severity of sepsis. High lactate levels are a serious condition that requires immediate treatment. A lactate test is important in determining the severity of sepsis and monitoring treatment.

Blood cultures and microbiological tests are essential in determining the cause of sepsis. The microorganisms that grow in a blood sample can identify the pathogens causing the infection. Blood cultures can identify the microorganisms present in the patient's body, which can help determine which antibiotics or antifungal medications are needed for treatment. Bacterial infections and certain types of sepsis, such as fungal or viral sepsis, can also be identified by microbiological tests. Blood cultures are important in determining the type of sepsis and in planning accurate and effective treatment.

In sepsis, the coagulation system is activated, which can lead to microthrombosis and microangiopathic thrombosis. This process can reduce blood flow to organs and tissues, resulting in organ dysfunction. In sepsis, the D-dimer test helps to measure the presence of microthrombi and the activity of the coagulation system. D-dimer is a substance that binds to fibrinogen and thrombin, and its increased level signals a violation of the coagulation system. High D-dimer levels indicate the severity of sepsis and prove the presence of thrombosis. Monitoring the coagulation system is important in monitoring the progression of sepsis and its treatment. The

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diagnosis and treatment of sepsis is a complex process, and laboratory diagnostics are of great importance. The pathophysiology of sepsis is associated with systemic inflammation and dysfunction of the coagulation system, which can rapidly change and lead to severe organ dysfunction. Laboratory diagnostics can be used to detect sepsis, assess its severity, and monitor treatment. This is an important step necessary to save the patient's life.

Discussion

Sepsis is a systemic inflammatory condition associated with infection, the development of which has a serious impact on various systems of the body. Early detection and effective treatment of sepsis are very important in reducing its severe consequences and saving the patient's life. The role of laboratory tests in the diagnosis of sepsis is very large, as it allows for a rapid assessment of the patient's condition and proper planning of treatment. The laboratory diagnostic methods reviewed in this article, including blood tests, CRP, PCT, lactate, D-dimer, and microbiological tests, are effective tools in the diagnosis and monitoring of sepsis.

Laboratory diagnostics can detect early signs of sepsis, such as an elevated leukocyte count or an increased level of procalcitonin. These parameters indicate the presence of an infection and inflammatory process in the patient's body. CRP and PCT tests also help determine the presence of a bacterial infection, which indicates the bacterial nature of sepsis. Lactate levels are used to assess the severity of sepsis, as this parameter indicates the lack of oxygen in the body and the transition of the body to anaerobic metabolism.

In the effective treatment of sepsis, the correct selection of antibiotics and other drugs is of particular importance. Blood culture helps to identify the pathogen of the infection, which helps to select antibiotics or antifungal drugs. Microorganisms, such as bacteria, fungi or viruses, are identified as the causative agents of sepsis, and the effectiveness of this method plays an important role in drawing up a specific treatment plan. In addition, the D-dimer test and assessment of the coagulation system help to prevent the development of microthrombosis and thromboembolism, since in sepsis the coagulation system is rapidly activated and microvascular thrombosis occurs.

The pathophysiology of sepsis includes many factors, therefore, a complete system of laboratory tests is required for its diagnosis. For example, it is not enough to diagnose sepsis by studying only the leukocyte count or PCT level. An increase or decrease in each laboratory parameter indicates different stages of sepsis development and activation of processes in the body. Laboratory diagnostics can also identify complex types of sepsis and determine the necessary strategies for treatment.

However, laboratory diagnostics also have limitations. In some cases, changes in laboratory parameters of sepsis can be confused with other diseases. For example, a high CRP level can indicate not only a bacterial infection, but also other inflammatory processes. Therefore, it is necessary to evaluate laboratory tests in conjunction with clinical symptoms and the general condition of the patient. In particular, the variety of forms and symptoms of sepsis requires an individual approach for each patient.

Results

Sepsis is a serious condition characterized by widespread infection and the onset of systemic inflammatory processes in the body, requiring prompt diagnosis and effective treatment. Early detection and monitoring of sepsis is crucial for saving the patient's life. Laboratory diagnostics, especially blood tests, CRP, PCT, lactate, D-dimer, and microbiological examinations, are

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important tools for ensuring rapid and accurate detection of sepsis. These tests help determine the level of infection and inflammatory processes in the body, as well as the severity of sepsis.
Pathophysiologically, sepsis is associated with systemic inflammation, activation of the coagulation system, microvascular ischemia, and organ dysfunction, and laboratory diagnostics provide an opportunity to detect these processes early. Indicators such as procalcitonin and CRP indicate the presence and severity of bacterial infection, while lactate levels determine metabolic dysfunction. The D-dimer test helps assess the activity of the coagulation system.
The effective use of laboratory diagnostics contributes to the accurate and early detection of sepsis, as well as to the monitoring of the patient's condition, which optimizes treatment and prevents severe complications. Thus, early diagnosis and treatment of sepsis are crucial for saving the patient's life, and laboratory diagnostics are an integral part of this process.

Conclusion

Sepsis is a severe condition that causes a strong systemic inflammatory response and dysfunction of the coagulation system of the body against infection, and its early detection and effective treatment are very important for saving the patient's life. The pathophysiology of sepsis is associated with the disruption of various body systems, including processes of dysfunction of the coagulation system and immune responses. Laboratory diagnostics are necessary for the early detection and monitoring of these processes, and are of great importance for the effective treatment of sepsis.
Laboratory diagnostic methods, such as blood tests, CRP, PCT, lactate, D-dimer, and microbiological tests, allow for early detection of sepsis and monitoring of the patient's condition. All of these contribute to the accurate and reliable diagnosis of sepsis, and also play an important role in optimizing treatment and combating infection. Laboratory diagnostics of sepsis not only helps to identify the pathogen of infection, but also is an effective tool for assessing the activity of the inflammatory and coagulation systems. At the same time, in the diagnosis and treatment of sepsis, along with laboratory tests, it is necessary to take into account clinical symptoms, the patient's history, and other diagnostic methods. This comprehensive approach allows for early detection of sepsis and effective monitoring of the patient's condition. In conclusion, laboratory diagnostics of sepsis and its correct application play an important role in preserving the body and protecting it from the severe consequences of sepsis.

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