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CURRENT CHALLENGES IN THE DIAGNOSIS AND TREATMENT OF SEPSIS

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Abstract. This literature review describes sepsis as a severe clinical condition that develops as a result of infection and leads to a systemic inflammatory response throughout the body. From a microbiological perspective, a wide range of microorganisms can contribute to the development of sepsis. Bacteria, viruses, fungi, and, in some cases, parasites are considered the main etiological agents of sepsis.Among the most common sources of infection leading to sepsis are infections of the lungs (pneumonia), urinary tract infections, gastrointestinal infections, and infections of the skin and soft tissues. In the treatment of sepsis, a microbiologically oriented approach is initially based on empirical antibiotic therapy, followed by a transition to targeted (etiotropic) therapy after identification of the causative pathogen. The correct and timely selection of antimicrobial therapy not only improves patient prognosis but also plays a crucial role in preventing the development of antimicrobial resistance. This article provides a comprehensive analysis of the microbiological basis of sepsis, modern diagnostic methods, and treatment strategies. In addition, special emphasis is placed on the importance of early diagnosis, the role of laboratory diagnostics, and the impact of effective intensive care management on clinical outcomes. Microbiological surveillance, infection control measures, adherence to hygiene standards, and vaccination are essential components in the prevention of sepsis.

Keywords: Sepsis, Microbiological diagnostics, Blood culture, PCR, Empirical antibiotic therapy, Targeted therapy, Pathogens, Antimicrobial resistance, Intensive care, Prevention.

Causes of Sepsis and Its Microbiological Basis. Sepsis is a serious medical condition associated with infection that leads to systemic inflammatory reactions throughout the body. From a microbiological perspective, the primary cause of sepsis is infection induced by bacteria, viruses, fungi, or parasites. Microbiological diagnostics play a crucial role in identifying the source of infection in patients with sepsis. Early and accurate diagnosis of sepsis significantly increases the chances of survival [1,5,7].

In most cases, infections leading to sepsis are of bacterial origin; however, viral, fungal, and parasitic infections may also result in sepsis. From a microbiological standpoint, the most common microorganisms causing sepsis include the following:

1. Bacteria: Gram-positive bacteria: *Staphylococcus aureus, Streptococcus pneumoniae, Enterococcus spp.*

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Gram-negative bacteria: *Escherichia coli, Pseudomonas aeruginosa, Klebsiella pneumoniae, Neisseria meningitidis*

Anaerobic bacteria: *Bacteroides spp., Clostridium spp.*

2.Viruses: Viruses such as influenza virus, herpes simplex virus, hepatitis viruses, and HIV may contribute to the development of sepsis.

3.Fungi: Fungi such as *Candida spp.* and *Aspergillus spp.* pose a significant risk, especially in immunocompromised individuals.

4.Parasites: Parasitic infections, including malaria and leishmaniasis, can also lead to sepsis.

From a microbiological point of view, sepsis may originate from various sources of infection, including:

Urinary tract infections (e.g., *Escherichia coli*),

Pneumonia or lung infections (e.g., *Streptococcus pneumoniae, Pseudomonas aeruginosa*),

Gastrointestinal infections (e.g., *Salmonella, Shigella*),

Skin and wound infections (e.g., *Staphylococcus aureus*) [2,3,8]

Microbiological Treatment of Sepsis. A microbiological approach is critically important in the treatment of sepsis, as the correct selection of antibiotics or antifungal agents is essential for effective therapy. The treatment strategy for sepsis is generally implemented in two main stages:

1.Empirical therapy: At the initial stage of sepsis management, when the exact type of infection has not yet been identified, broad-spectrum antibiotics or antifungal agents are administered. This approach is aimed at the rapid elimination of microorganisms and provides coverage against a wide range of potential pathogens.

2.Targeted (pathogen-directed) therapy: Once the causative pathogen is identified through microbiological investigations, treatment is adjusted to targeted antimicrobial therapy using specific antibacterial, antiviral, or antifungal agents. For example, in patients with sepsis associated with *Staphylococcus aureus*, treatment may include methicillin-sensitive regimens or the use of vancomycin in cases of suspected or confirmed resistant strains [6,19,17].

Prevention of Sepsis. Microbiological preventive measures include the identification of infection sources and their timely and appropriate treatment. To prevent infections that may lead to sepsis, the following measures should be emphasized:

1.Rational use of antibiotics: Excessive and inappropriate use of antibiotics can increase microbial resistance, which способствует the proliferation of microorganisms that may cause sepsis. Therefore, antibiotics should be prescribed based on clinical indications and microbiological sensitivity testing whenever possible.

2.Vaccination: Vaccination against certain infectious diseases plays a significant role in the prevention of sepsis, particularly vaccines against pneumonia and meningococcal infections.

3.Microbiological investigations: Regular medical examinations and microbiological testing are essential for the early detection and treatment of infectious diseases, thereby reducing the risk of progression to sepsis.

4.Hygiene and sanitation: Strict adherence to hygiene and sanitation standards, especially in healthcare settings, is crucial for the prevention of infections and, consequently, sepsis [12,13,20].

From a microbiological perspective, sepsis is considered a highly dangerous disease due to the rapid spread of infection and the induction of systemic inflammatory responses in the body. Microbiology plays a central role in the diagnosis and treatment of sepsis. Through accurate diagnostics and microbiological testing, pathogens can be identified, allowing for the selection of an appropriate and targeted treatment strategy.

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Furthermore, effective prevention and management of infection require the reduction of antimicrobial resistance, as well as strict adherence to hygiene and sanitation standards. The identification of pathogens using blood cultures, PCR assays, and other microbiological methods significantly contributes to the accurate and effective treatment of sepsis. Although empirical antibiotic therapy may be initiated at the early stage of treatment, it is essential to transition to targeted therapy once the causative pathogen has been identified.

Conclusion. The microbiological approach plays a crucial role in the treatment of sepsis, as the identification of causative microorganisms is essential for selecting appropriate therapeutic strategies. Microbiological diagnostics also enable the rational selection of antibacterial and antifungal agents, thereby helping to reduce antimicrobial resistance.

For the prevention of sepsis, adherence to hygiene and sanitation standards, vaccination, and early diagnosis of infectious diseases are of paramount importance. Therefore, in the management and control of sepsis, careful attention should be given to microbiological approaches, modern treatment protocols, and preventive measures.

Timely diagnosis and appropriately administered therapy can lead to the successful management of many cases of sepsis, significantly contributing to improved patient outcomes and survival.

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