E CONF SERIES

International Conference on Modern Science and Scientific Studies
Hosted online from Madrid, Spain
Website: econfseries.com 20th February, 2025

MODERN LABORATORY DIAGNOSIS OF SEPSIS

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Sepsis is now considered to be the result of an uncontrolled systemic inflammatory response (generalized inflammatory response) to the presence of infection [1,2,3].

Keywords: sepsis, etiologic factor, diagnosis, technology, bacteriologic study;
Diagnosis of sepsis includes identification of the etiologic infectious factor - determination of the causative agent and the study of its sensitivity to antibacterial drugs, since it is the use of appropriate antibiotics is, all other things being equal, the key to the final cure of the patient [1,2,3].
Traditional methods of etiologic diagnosis of sepsis include:
1. bacteriologic study (determination of the type of pathogen, its concentration and the most effective drug for antibacterial therapy);
2. serologic method (detection of antigen and antibodies);
3. mass spectrometry;
4. polymerase chain reaction (PCR);
5. gas chromatography (rapid method of diagnosing anaerobic infection) [7,8,9].
For clinical practice, the most important information regarding the choice of effective antibacterial therapy is provided by the bacteriologic method. Despite the significant progress in technology with regard to bacteriological studies (use of

selective media, automation, accelerated diagnostic panels), the time to identify the type of pathogen and determine its sensitivity to antibacterial drugs takes at best 24-48 hours [4,5,6,9,10,11,12,13].

At the same time, from the standpoint of evidence-based medicine, it is established that each hour of delay in adequate antibacterial therapy of patients with septic shock, reduces survival by 7.6%. Modern technologies allow reducing the time of etiologic diagnosis and selection of effective antibacterial drugs for the treatment of patients with sepsis to a few hours [14,15,16].

New technological approaches in sepsis diagnosis can be divided into 3 groups:

1. accelerated determination of sensitivity to antibacterial drugs and individualized approach to treatment;
2. accelerated identification of microorganisms and empirical therapy.
3. combination of optimal possibilities of 2 approaches (rapid identification and rapid determination of sensitivity to antibacterial drugs) and individual approach to treatment [17,18,19,20].

The technologies belonging to the first group allow tracking the growth of bacteria in broths designed specifically for urine and human biological fluids, starting from the moment of inoculation. Mathematical processing of bacterial growth results in real time allows to obtain not only a qualitative assessment of the presence/absence of microorganisms in the sample, but also a quantitative assessment of the initial bacterial content in CFU/mL. The test result can be obtained within 3-6 h, and sensitivity to antibacterial drugs can be established within the next 3 hours [21,22,23].

The second group of approaches is based on the use of modifications of the mass spectrometry method. The most actively used is matrix-activated laser desorption/ionization (MALDI - from MALDI, Matrix Assisted Laser Desorption/Ionization) [24,25].

The colony material is mixed with an ionizing matrix, then the sample is irradiated with an ultraviolet laser, which ionizes the soluble proteins of the microorganisms, which are mass/charge distributed. Analysis of protein mass spectra from the colonies with a database of spectra collected from known microorganisms using a database program allows identification of the bacterial species. Based on the

identified bacterial species and literature review, the most effective antibiotic therapy is determined [21,22,23].

Identification of the microorganism species is accomplished within a few minutes. The disadvantage of the method is that it takes time (at least 24 h) to obtain a pure culture. The combination of 2 approaches allows to establish the species of microorganism in sepsis patients within a maximum of 6 h and to determine the sensitivity to antibacterial drugs within the next 3 h [17,18,19,20].

Thus, modern technologies allow to reduce the time of etiological diagnosis of sepsis, determination of sensitivity to antibacterial drugs and selection of individual approach to treatment to one working day of specialists of bacteriological laboratory [3,4,5,6,7].

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