Review Article

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Blood Culture Methods Advancing in Technology

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Abstract

Culture and sensitivity (C & S) tests are the tests generally used for the detection of the causative microbes. The Culture and sensitivity tests are also important to know the resistance or sensitivity of a particular antibiotics to the microbes cultured and grown. It will be helpful for the physician to decide the line of treatment for the patients. Over period of 3-4 decades the technology of blood culture advanced which resulted into less time in results, easy testing. The BECTEC method is an automated blood culture systems are the important choice for the detection of pathogens from blood specimens. The automated method is better over the manual broth based conventional methods. The method requires laboratories to continuously monitored. The automated blood culture systems for the processing of blood culture specimens are taking lesser time more accuracy in present times. The present study involves the methods and its advancement in the diagnosis. The impact of saving lives due to adoption of advanced method over the conventional ones.

Keywords: Blood Culture; Culture and Sensitivity; Antibiotics; Public Health.

INTRODUCTION

A culture is aninitiation of a matter to an artificial growth culture medium such as liquid (broth), solid (agar), or cell culture lines. These can be classified as selective, non selective, or differential, depending on the growth support needed by microorganisms to be studied. Liquid and solid media are used to culture bacteria and fungi. The cell lines are used to culture viruses and chlamydiae. Culture media are contained in Petri dishes, test tubes, and dilution containers. After the material is introduced into the proper medium, the culture is incubated for a specific length of time (usually 48 to 72 hours for agar and 3 to 7 days for broth media), at a specific temperature [usually 95°F (35°C)], and under other conditions suitable for thesuspected microorganism (e.g., CO_2 for anaerobic culture). Another 24 hours are needed to identify the pathogen that is causing a particular infectious disease.

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In combining with the culture, microorganisms are tested for sensitivity to specific antibiotics. This is known as culture and sensitivity (C & S) testing. The bacteria are classified according to their response to antibiotics as (1) resistant (growth not inhibited), (2) sensitive (growth inhibited), or (3) intermediately sensitive (some inhibition).

Blood cultures are microbiological tests performed to help diagnose bacteremia, septicemia, or infectious diseases such as typhoid, plague, and malaria. When bacteria or fungi enter the blood stream, an infection of greater or lesser severity can occur. Pathogens entering the bloodstream from sites of soft tissue infection, contaminated intravenous (IV) lines, or invasive procedures such as minor surgery, tooth extraction, or cystoscopy do not usually lead to infections severe enough to cause sepsis. But ifthe infection is persistent or recurrent, may lead to septicemia, a life-threatening condition, i.e presenting with severe signs and symptoms of infection. Microorganisms are the most common in adultscausing septicemia are Staphylococcus aureus, gram negative rods such as Escherichia coli, Aerobacter spp. and Klebsiella spp.; in infants, microorganisms are E. coli and haemolyticstreptococcus.

For patients who have received antimicrobial therapy prior to the test, an antimicrobial removal device containing a resin is used to remove the inhibitory effects of antibiotics from the blood sample prior to culture. This practice allows for faster growth and identification of the organism.

Test results are recorded as negative without growth or as positive if growth occurs. After culture, the microbiologist identifies the pathogen based on colony characteristics, Gram staining methods and other biochemical tests. In the past 50 years ago, man had less advanced techniques and tests were mostly done manually. Now, in every industry, newer techniques are emerging day by day that allow the user to easily achieve results in less time than in the past. It was the same with Blood Culture.

A blood culture is a test prescribed to investigate foreign invaders such as bacteria, yeast, and other microorganisms in the blood. If any of these pathogens are present in the bloodstream, it will be a sign of a blood infection called a condition known as bacteraemia.

AUTOMATED BLOOD CULTURE METHODS

There are several automated blood culture systems are available commercially. Some of the most popular continuous monitoring blood culture systems are: BACTEC (Becton Dickinson and Company), BacT/ALERT (bio Mérieux), and Versa TREK (Thermo Scientific).

Composition of Bactec Blood Culture vials

All the BACTEC culture vials has soybean casein digest broth, yeast, amino acids, sugar, vitamins, and sodium polyanetholsulfonate. The resin containing vials hasnon-ionic adsorbing resins and cationic-exchange resins. Sodium polyanetholsulfonate is an anticoagulant and prevents the killing of bacteria by innate cellular and humoral factors. Resin neutralizes the effect of antibiotics present in the blood and increases the chances of recovery of the pathogen.[3]

The study executed by Anja von Laer et al. 2021 concluded that implementation of the automated Blood Culture in a resource limited setting is easy which can provide improvement in the microbiological diagnostic. The automated BC increased yield and shortened turn around times. Regular training and mentorship of clinicians must be intensified to increase number and quality of BC. Pre-analytical training to improve diagnostic stewardship is essential when new microbiological method implemented in the laboratory. The Bectec Dickinson system uses generation of CO_2 by the growing Mycobacterium tuberculosis bacteria as an indicator. This technology of sensing inbuilt into the cultured tubes can give the growth of bacteria too early than the conventional techniques.[1]

Automated continuous monitoring of blood cultures (CMBC) systems is having a key role in the clinical microbiology laboratory. Despite the critical role of these systems in the diagnosis of life-threatening bloodstream infections, their basic technology and performance characteristics have remained essentially unchanged since their introduction in the 1990s. This stability and uniformity allowed the development of qualitative measures such as percent positivity and contamination rate; subsequent diagnostics, e.g., as direct identification and sensitivity testing of microorganisms in positive cultures and clinical recommendations based on time to positivity or duration of bacteremia.[2]

CONCLUSION

The blood culture testing shifted to highly advanced mode. The newer method requires less time for reporting. Due to reduction in time for results the patients get benefits in line of treatment. The test results enable physician to decide the antibiotics to be administered to the patients. Thus, the advancing technology is saving lives and plays an important role in Public Health. The BECTEC method is well adopted by the microbiologists. The review study concluded that more advancement is further needed for the more benefits in future.

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