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ANTIBIOTIC SENSITIVITY TEST AGAINST SOME HUMAN PATHOGENS

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ABSTRACT

The clinical microbiology laboratory is frequently used as a detector to detect drug-resistant bacteria. Standardized techniques must be continuously monitored to detect growing phenotypic resistance patterns. The quick warning of medical professionals with susceptibility statistics can start adjustments to antimicrobial chemotherapy and enhance patient care. Microbiology laboratories must keep up current on conventional and developing methodologies, as well as have a thorough understanding of their role in the fight against infectious illnesses. Antimicrobial Susceptibility Testing Protocols specifies the clinical microbiology laboratory's role in integrated patient care and provides a thorough, up-to-date procedure document that may be utilized by a broad range of laboratories. Antibiotic sensitivity testing, also known as antibiotic susceptibility testing (AST), is a crucial process in microbiology and clinical medicine. This testing determines the susceptibility of bacteria to various antibiotics, guiding effective treatment plans for bacterial infections. By identifying which antibiotics a specific pathogen is sensitive to, healthcare providers can choose the most effective medication, ensuring faster and more complete recovery. Targeted antibiotic therapy helps minimize the unnecessary use of broad-spectrum antibiotics, reducing potential side effects for the patient. This artical fouse on the method of antibiotics sensitvity test .

Introduction

Antibiotic sensitivity, also known as antibiotic susceptibility, is a measure of how efficient an antibiotic is at inhibiting or killing microorganisms. It is an important feature in microbiology and medicine since it helps healthcare providers choose the best antibiotic therapy for bacterial infections.When a bacterial infection is suspected, a sample of the contaminated region (such as blood, urine, or tissue) is taken and cultured in a laboratory to allow the bacteria to develop. The farmed bacteria are then subjected to several antibiotics to see which ones inhibit or kill the germs. This procedure is frequently carried out utilizing procedures such as the disk diffusion test (Kirby-Bauer test), E-test, or broth dilution method. Antibiotic sensitivity testing determines which antibiotics the bacteria are susceptible to or resistant to. Sensitivity suggests that the antibiotic is effective against the bacteria, but resistance implies that the medication is useless. This information is crucial for prescribing the proper antibiotic, limiting the usage of broad-spectrum antibiotics, and lowering the risk of antibiotic resistance development. Antibiotic resistance is a developing worldwide health problem, in which bacteria develop methods to withstand exposure to drugs that would otherwise kill or restrict their development. Effective antibiotic sensitivity testing aids in fighting this issue by encouraging the use of targeted antibiotics, retaining the efficacy of current drugs and assisting in the management of bacterial infections.(Ericsson et al.,1971, Russell et al., 2002, Karki et al.,2010,Mahdi et al., 2022)

Purpose and Significance

Antibiotic sensitivity testing is crucial in medicine for several reasons:

1.Effective Treatment Selection: Antibiotic sensitivity testing assists in determining the most

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appropriate antibiotic for treating bacterial infections. Identifying which antibiotics are effective against a certain strain of bacteria allows healthcare practitioners to prescribe treatments that are more likely to work, resulting in speedier healing and a lower risk of antibiotic resistance.(RANTZ etal.,1962)

2.Antibiotic Resistance Prevention: Inappropriate or inadequate antibiotic usage promotes the growth of antibiotic-resistant microorganisms. Antibiotic sensitivity testing ensures that antibiotics be used sparingly, lowering the risk of fostering resistance.(Street et al.,2001)

3.Therapy Optimization: Different bacterial strains may be more or less susceptible to antibiotics. Sensitivity testing enables personalized treatment strategies, optimizing medication based on the unique properties of the infecting microorganisms. This can enhance patient outcomes while minimizing negative consequences.
4.Monitoring antibiotic sensitivity patterns can aid in detecting emerging trends in antibiotic resistance. This information is critical for public health efforts to tackle resistance, since it informs antibiotic stewardship programs and guides the development of new antibiotics.

5.Understanding bacteria's sensitivity patterns can help with infection control measures, such as adopting suitable isolation protocols and preventative actions to minimize the spread of resistant pathogens in healthcare facilities.(Benz et al., 2004,Gentile et al.,2024,Grotelüschen et al., 2020)

The Growing Threat of Antibiotic Resistance

Antibiotic resistance occurs when bacteria evolve mechanisms to withstand the effects of antibiotics that once killed them. This growing threat poses significant challenges to public health worldwide. The emergence of multidrug-resistant bacteria makes infections harder to treat, leading to longer hospital stays, higher medical costs, and increased mortality.(Aminov and Rustam et al.,2009) AST plays a pivotal role in addressing this issue by:

- **Monitoring Resistance Patterns**: Regular AST helps track resistance trends, providing valuable data for epidemiological studies and informing public health strategies.
- **Guiding Empirical Therapy**: In cases where immediate treatment is necessary, AST data can inform the selection of empiric antibiotics likely to be effective against the suspected pathogens.(Friedman et al., 2016,Frieri et al.,2017)

Methods of Antibiotic Sensitivity Testing

Antibiotic sensitivity testing, also known as antimicrobial susceptibility testing, is a crucial process in determining the effectiveness of antibiotics against specific bacterial pathogens. Here's a detailed overview of the methods commonly used for antibiotic sensitivity testing:

1.Kirby-Bauer Disk Diffusion Method:This method involves culturing the bacteria on an agar plate, and then placing paper disks impregnated with different antibiotics onto the agar surface. The antibiotics diffuse into the agar, creating concentration gradients. If the bacteria are susceptible to a particular antibiotic, there will be a clear zone of inhibition around the disk where bacterial growth is inhibited.

- **Procedure**:
  - Bacterial culture is spread evenly over the agar surface.
  - Antibiotic disks are placed on the agar.

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- The plate is then incubated at appropriate conditions for bacterial growth.
- After incubation, the diameter of the zones of inhibition around each disk is measured.

- **Interpretation**: The diameter of the zone of inhibition is compared to standardized tables provided by organizations like the Clinical and Laboratory Standards Institute (CLSI) or the European Committee on Antimicrobial Susceptibility Testing (EUCAST) to determine whether the bacteria are susceptible, intermediate, or resistant to each antibiotic.I(Kassim et al., 2016,Yang et al.,2019,Segawa et al.,2020)

2. **Broth Microdilution Method**: In this method, a series of dilutions of antibiotics are prepared in a broth medium in microtiter plates. Bacterial inoculum is added to each well, and the plates are incubated. The lowest concentration of antibiotic that inhibits visible growth is recorded as the minimum inhibitory concentration (MIC).
    - **Procedure**:
        - Prepare dilutions of antibiotics in a broth medium in microtiter plates.
        - Add bacterial suspension to each well.
        - Incubate the plates under appropriate conditions.
        - After incubation, observe for visible growth in each well.
    - **Interpretation**: The MIC is the lowest concentration of antibiotic that completely inhibits visible bacterial growth. Interpretation is based on established breakpoints provided by organizations like CLSI or EUCAST.(Swenson et al.,2004,Mayrhofer et al.,2008, Tomida et al.,2013)
3. **Etest**:The Etest is a variation of the disk diffusion method that uses strips impregnated with a gradient of antibiotic concentrations. When the strip is placed on an agar plate inoculated with bacteria, a concentration gradient of the antibiotic forms along the strip. The intersection of the ellipse of inhibition with the strip indicates the MIC.
    - **Procedure**:
        - Place Etest strip on agar plate inoculated with bacteria.
        - Incubate the plate under appropriate conditions.
        - Read the MIC where the ellipse of inhibition intersects the strip.
    - **Interpretation**: Interpretation of MIC values is similar to the broth microdilution method.(Hachem et al.,1996,Mayrhofer et al.,2008,Ambaye et al., 1997)
4. **Agar Dilution Method**: Similar to the broth microdilution method, but instead of preparing antibiotic dilutions in broth, antibiotics are incorporated directly into agar plates at different concentrations. Bacterial inoculum is then spread on the agar surface, and MIC is determined.
    - **Procedure**:
        - Prepare agar plates with antibiotics at various concentrations.
        - Inoculate the plates with bacterial suspension.
        - Incubate the plates under appropriate conditions.
        - Determine MIC by observing the lowest concentration of antibiotic that inhibits visible growth.
    - **Interpretation**: Interpretation of MIC values is similar to the broth microdilution method.(Mayrhofer et al.,2008,Hachem et al.,1996,Ambaye et al., 1997)

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These methods are essential for guiding clinicians in choosing the most effective antibiotic treatment for bacterial infections while minimizing the development of antibiotic resistance.

Conclusion

Antibiotic sensitivity testing is an essential part of today's medical practice. It guarantees that bacterial infections are effectively treated, slows the spread of antibiotic resistance, optimizes healthcare resources, promotes infection control, assists in research and development, and improves clinical decision-making. By directing judicious antibiotic usage, AST helps to sustain the efficacy of existing antibiotic treatments and protects public health. Antibiotic sensitivity testing is an essential component of good clinical practice and public health. By finding the most effective antibiotics for treating specific bacterial illnesses, AST enables tailored therapy, slows the spread of resistant germs, and promotes responsible antibiotic usage. As antibiotic resistance remains a critical global health problem, the significance of AST in determining appropriate options for treatment and informing public health policies remains indispensable.

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