JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

A Comprehensive Review on Screening and Characterisation Techniques of Pathogenic Microorganisms in Clinical Microbiology

Mr. RAMAN KUMAR, MR.VIVEK SHARMA, MS. PIYUSHI YADAV,
ASSISTANT PROFESSOR,VICE PRINCIPAL, HEAD OF DEPARTMENT
GURU NANAK PARAMEDICAL COLLEGE,DHAHAN KALERAN

Abstract:

Pathogenic microorganisms continue to pose significant challenges to global health. Accurate screening and characterisation of these pathogens are essential for effective diagnosis, treatment, and control of infectious diseases. This review highlights the conventional and modern techniques used in the clinical microbiology laboratory for the identification and characterisation of pathogenic microbes.

Keywords: Pathogenic Microorganisms, Screening, Characterisation, Biochemical Tests, Molecular Diagnostics

1. Introduction

Pathogens are microorganisms capable of causing diseases in humans. Early detection and precise identification are crucial in clinical settings to manage infections and prevent outbreaks. This review presents an overview of the methodologies employed for the screening and characterisation of bacteria, viruses, fungi, and parasites in the clinical laboratory.

2. Classification of Pathogenic Microbes

Pathogens can be broadly classified into bacteria, viruses, fungi, and parasites. Each group requires distinct diagnostic strategies based on their unique biological characteristics.

3. Screening Techniques

3.1 Sample Collection & Processing

Proper collection, transportation, and processing of clinical samples are foundational to successful microbial screening. Techniques vary depending on the type of pathogen suspected.

3.2 Culture-based Methods

These are traditional and gold-standard methods for identifying bacteria and fungi. Growth on selective and differential media provides preliminary clues regarding the organism's identity.

3.3 Rapid Diagnostic Tests (RDTs)

Used especially in resource-limited settings, RDTs such as lateral flow assays offer quick and user-friendly options for screening common pathogens like malaria, dengue, and HIV.

3.4 Serological Tests

These tests detect antibodies or antigens in patient serum and are often used for viral infections (e.g., ELISA for Hepatitis B).

4. Characterisation Techniques

4.1 Biochemical Characterisation

Tests like catalase, oxidase, urease, TSI, and IMViC aid in distinguishing closely related bacterial species.

4.2 Microscopy

Microscopic techniques such as Gram staining, acid-fast staining (Ziehl-Neelsen), and wet mounts are critical in primary characterisation.

4.3 Molecular Techniques

Polymerase Chain Reaction (PCR), Real-Time PCR, and Loop-mediated Isothermal Amplification (LAMP) allow sensitive and specific detection of microbial DNA/RNA.

4.4 Mass Spectrometry (MALDI-TOF MS)

Matrix-Assisted Laser Desorption/Ionization-Time of Flight Mass Spectrometry identifies pathogens by analysing protein spectra - a modern, fast, and accurate approach.

4.5 Antimicrobial Susceptibility Testing (AST)

Determines the appropriate antibiotic therapy using methods like disk diffusion (Kirby-Bauer), broth dilution, and automated systems.

5. Recent Advances in Microbial Identification

Emerging techniques include CRISPR-based diagnostics, next-generation sequencing (NGS), and biosensors, which enhance the speed and accuracy of pathogen detection.

6. Challenges and Limitations

Despite advances, issues such as cost, technical expertise, and false results due to contamination or mixed infections pose hurdles in routine diagnosis.

7. Conclusion

Effective screening and characterisation of pathogenic microbes remain fundamental to infectious disease control.

Integration of traditional and modern methods ensures a comprehensive approach in clinical microbiology.

References:

1. Forbes BA, Sahm DF, Weissfeld AS. Bailey & Scott's Diagnostic Microbiology. 14th ed.

2. Collee JG, Fraser AG, Marmion BP, Simmons A. Mackie & McCartney Practical Medical Microbiology.

3. Ryan KJ, Ray CG. Sherris Medical Microbiology. 6th ed.

4. https://www.ncbi.nlm.nih.gov/

5. https://www.cdc.gov/labstandards/