

Modern Methods In Medical Microbiology: Systems And Trends

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REVIEW

Current applications and future trends of molecular diagnostics in clinical bacteriology

Jan Weile · Cornelius Knabbe

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Abstract Molecular diagnostics of infectious diseases, in particular, nucleic-acid-based methods, are the fastest growing field in clinical laboratory diagnostics. These applications are stepwise replacing or complementing culture-based, biochemical, and immunological assays in microbiology laboratories. The first-generation nucleic acid assays were monoparametric such as conventional tests, determining only a single parameter. Improvements and new approaches in technology now open the possibility for the development of multiparameter assays using microarrays, multiplex nucleic acid amplification techniques, or mass spectrometry, while the introduction of closed-tube systems has resulted in rapid microbial diagnostics with a subsequently reduced contamination risk. Whereas the first assays were focused on the detection and identification of microbial pathogens, these new technologies paved the way for the parallel determination of multiple antibiotic resistance determinants or to perform microbial epidemiology and surveillance on a genetic level.

Keywords Molecular diagnostics · Real-time PCR · Nucleic acid amplification technique · Microarray · Sequencing · Mass spectrometry · Antibiotic resistance

Introduction

Detection, identification, and drug susceptibility testing of microbial pathogens represent the key duty of microbial diagnostics in medicine. Antibiotic susceptibility testing especially provides important information towards adequate treatment decisions. Also of great importance is the epidemiological genotyping of isolated microorganisms with respect to monitoring and surveillance of routes of infection. This is an essential task in order to develop strategies to prevent or successfully treat infections, both in the community and the health care facilities. Recent progress and extensive research on microbes as well as the development of new nucleic-acid-based methodologies have resulted in the increasing use of molecular assays in clinical laboratory with several commercial tests available. We mainly focus this review on nucleic-acid-based molecular techniques for identification and resistance determination in clinical bacteriology, giving a brief overview of currently used modern bacterial diagnostics and providing an outlook on future technologies, especially dealing with the multiparametric detection of infectious disease-related determinants. When appropriate, we will also mention examples from other fields of clinical microbiology, e.g., clinical virology.

Identification and drug-susceptibility testing of microorganisms

Phenotype-based methods

One of the oldest but still very important methods in clinical bacteriology is the detection of human pathogens by direct microscopic examination of the specimen. Many

J. Weile (✉) · C. Knabbe
Department of Laboratory Medicine and Molecular Diagnostics,
Robert-Bosch-Hospital,
Auerbachstrasse 110,
70376 Stuttgart, Germany
e-mail: jan.weile@ikp-stuttgart.de

J. Weile
Dr. Margarete Fischer-Bosch Institute for Clinical Pharmacology,
70376 Stuttgart, Germany



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laboratory in any infection control and developing electronic information systems that streamline this process is essential to resistance trends and identify potential outbreaks The Clinical and The new molecular techniques of subtyping such as plasmid profile typing by.

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