CLINICS IN LABORATORY MEDICINE

Clin Lab Med 23 (2003) xi–xii

Preface

Molecular methods in diagnostic microbiology

The development of molecular amplification technologies such as polymerase chain reaction in the mid-1980s provided powerful new tools for detection and identification of microbial pathogens. Further advances in this technology over the past two decades have added capabilities for measuring the quantity of micro-organisms, rapid sequencing method for identification and speciation, and the determination of antimicrobial resistance. These advances have provided a host of new methods to aid in the diagnosis and management of patients with infectious diseases.

Molecular methods can be sensitive and specific if designed properly. Under optimal conditions, they can detect small numbers of microbes within clinical specimens. In most instances, microbial DNA survives the tissue processing procedure with enough integrity that short sequences can be detected from paraffin-embedded tissue blocks. By paying careful attention to primer location and reagent selection, one can identify an individual species of microbe. By altering the primer design, one can provide for the broad identification of an organism by genus. In addition, sequencing of unique regions within the microbial genome can provide positive identification of an isolate at the species level.

The speed and sensitivity of these methods have resulted in improvements in the health care field. The introduction of specific tests for HIV and hepatitis viruses have added a new level of safety to the nation's blood supply. Molecular methods have also provided new tools for public health officials as they try to identify the sources of food-borne illnesses. Hospital epidemiologists rely on these methods as they work to identify and eliminate nosocomial infections.

Despite these advantages, molecular-based methods are frequently more expensive than the traditional microbial detection methods of culturing on solid or liquid media. In the case of most bacterial pathogens, organism growth occurs rapidly in liquid or solid media. Through the use of automated methods of identification and sensitivity testing, the necessary diagnostic information can usually be obtained within a time frame adequate for patient management, without resorting to more costly molecular methods.

0272-2712/03/$ - see front matter
doi:10.1016/S0272-2712(03)00099-4

In the case of slower-growing microbes, the extended incubation times needed to identify the pathogen can delay instituting appropriate antimicrobial therapy. Clinicians are often forced to initiate therapy based on their clinical impression. This requires broad-spectrum antibiotic coverage until a specific pathogen is identified and the sensitivity profile is available. In such cases, molecular identification techniques can significantly reduce the time needed to identify the organism, and appropriate therapy can be instituted in a timely manner. This reduction in time helps optimize patient care by reducing the cost of inappropriate medication, potentially reducing length of stay for hospitalized patients, reducing morbidity, and preventing the development of antibiotic resistance by limiting patient exposure to unnecessary antimicrobial therapy.

In the wake of September 11, 2001, the threat of biological weapons to the general population has been made vividly apparent. The medical and scientific communities have turned to molecular technology to provide for rapid detection of the microbes that are considered to be the greatest threat. Using the speed of real-time amplification detection systems, the results of tests for agents such as anthrax and smallpox can be available within hours following collection of the sample. This provides needed time for reacting to the threat and for administering vaccines or antibiotics to at-risk populations.

Molecular diagnostics is clearly beginning to play a prominent role within the arenas of clinical medicine and public health as we move into the twenty-first century. In this issue of the *Clinics in Laboratory Medicine*, authors with experience in these areas share their insights into the current state of molecular medicine as it applies to the detection and treatment of patients with infectious diseases. We wish to thank each of the contributors for their time and effort in this endeavor. We wish to thank our department chairman, Dr. Samuel Cohen, for providing us with the necessary time to work on this project. We also thank Rebecca Schmidt of Elsevier for her patience and efforts on our behalf as this issue was being developed. Lastly, we wish to thank our wives and families for their patience and understanding during the completion of this project.

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