Conventional versus Molecular Methods for Pathogen Detection and the Role of Clinical Microbiology in Infection Control

Until the last decade, the methods employed in clinical laboratories involved natural amplification in culture, requiring viable pathogens and a relatively extended time period, usually at least overnight, for replication to the limit of detection. The advent of laboratory-friendly molecular methods has resulted in several paradigm shifts: viability of the organism is no longer necessary, replication of a detectable factor can take hours instead of days, and the true positivity rate of some organisms in some diseases is known to be much higher than previously thought based on culture results alone.

Molecular assays have become widely available for diagnostic microbiology, spurred by technological developments and commercial profit motives. But questions arise when new applications for molecular testing are being introduced. Can these tests replace traditional methods? Can our current laboratory professionals be trained to perform some of these highly technically complex assays? Will physicians accept the results and change practice appropriately? Are the decreased turnaround time and improved sensitivity worth the additional cost? What changes in sample collection, transport, and storage are necessary? Four areas of laboratory activity in which molecular methods are still controversial were targeted in this section of the program. Specific pathogens or groups of pathogens and the assays used to detect them were the focus of the first three discussion groups, whereas the group contemplating the role of the microbiology laboratory in infection prevention moved away from the methods arena to present a broader, more holistic view.

The unexpected onslaught of novel influenza A H1N1 virus infection outbreaks appearing at the end of the usual respiratory system infection season in 2009 provided another surprise to the microbiology community: the influenza A and B direct antigen detection tests performed far worse than we had come to expect. But the relatively new molecular platforms were still not widely available; the results took several hours to obtain, resulting in batching of test runs and delays in reporting; and tests were complex to perform. The first discussion section explored the issue of which tests are appropriate for respiratory virus testing today, with extensive discussion of their strengths and weaknesses and a very useful list of references to substantiate the arguments presented. Are there certain viruses for which antigen methods are still relevant? Is seasonal testing still an option? How should samples be collected from different patient populations? The conclusions presented gave laboratories a blueprint for best practices today and a glimpse of what to prepare for in the future.

Clostridium difficile infection (CDI) has become the most important hospital-acquired bacterial disease in the last few years, surpassing methicillin-resistant Staphylococcus aureus (MRSA) infections in prevalence and clinical importance. The acknowledged gold standard test for detection of toxin-producing C. difficile, anaerobic culture followed by a cell culture cytotoxin neutralization assay from broth subcultures of isolates identified as representing C. difficile (a method called toxigenic culture), does not deliver results in time to be of clinical value in decision-making for the patient or for infection prevention. Rapid antigen-based tests for toxin detection are now known to be woefully inadequate in both sensitivity and specificity. But most laboratories in the United States still use them. Where do such tests stand today? The discussion that follows delivers a concise overview of the state of the art of CDI diagnosis now, the role of molecular methods, and the place of algorithms that employ other, more rapid initial assays. What should laboratories with differing levels of resources do, and how often should samples be accepted for testing? The participants came up with some clear conclusions, some areas of continuing controversy, and some questions that still need answers.

With the 2007 mandate from the U.S. Veterans Administration (VA) to test all incoming patients for MRSA, the era of MRSA surveillance in the United States began. Results from a national VA medical center (VAMC) survey have now been published, and they are stunning. After initiating admission screening, the hospitals experienced a 61% decrease in healthcare-associated MRSA infections in intensive care units (ICUs) and a 45% decrease in other units (2). But the debate remains: are molecular methods, with their faster results, responsible for these excellent outcomes? The topics of discussion included the various conventional methods, chromogenic agars, and whether batched molecular testing, with its relatively slower turnaround time of 6 to 24 h, was sufficient or whether rapid molecular methods, with less than 2 h from sample collection to results, really paid off. As previewed by a Point-Counterpoint article in the Journal of Clinical Microbiology, consensus is still elusive (1).

The last document in this section addresses the topic of infection prevention and the role of the microbiology laboratory and its director. Because multidrug-resistant gram-negative rods are among the most important causes of healthcare-acquired infections today and because well-studied or commercial molecular methods are not yet available for their detection, the group discussed the current desired interaction between the laboratory and practitioners with regard to this group of pathogens, and also issued a call for consensus definitions and laboratory reporting responses. In addition, the types of surveillance and data management that help with infection prevention and control activities are becoming more complex but are within the scope of modern information technology (at some cost), so the group issued a call for new products and collaborations. Additional recommendations for laboratory and director activities were summarized.

REFERENCES

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