Use of Molecular Assays for Resistance Detection

Antimicrobial resistance and susceptibility are complex, and current *in vitro* methods have been developed to predict a microorganism's response to antibacterial therapy *in vivo*. Standardized phenotypic methods have evolved over many decades, but faster and potentially more reliable nucleic acid- and protein-based methods have been recently developed to detect antimicrobial resistance. The current challenge for clinical laboratories is to integrate molecular assays for antimicrobial resistance determinants with conventional antimicrobial susceptibility testing procedures, sometimes in spite of an incomplete understanding of test limitations.

The tables in this section provide a practical approach for testing and reporting results among clinical laboratories that routinely use molecular techniques (with or without a phenotypic test) for the detection of antimicrobial resistance. Antibacterial resistance is genetically complex, and based on available data, molecular methods are often used as a tool in the clinical laboratory for screening (e.g., MRSA from nasal swabs) or as a rapid adjunct to traditional phenotypic methods (e.g., KPC from instrument-flagged blood culture bottles). Interpretation requires critical thinking and an understanding of the dynamics between detection of "resistance" determinants and the testing of phenotypic "susceptibility." Detection of a resistance marker does not necessarily predict therapeutic failure of antibacterial agents. The gene may be non-functional or expressed at clinically insignificant levels. Conversely, the absence of the genetic marker does not necessarily indicate susceptibility, as technical issues may interfere with detection (e.g., inhibition of amplification, emergence of genetic variants, etc). In some cases, a molecular approach may be superior to traditional phenotypic methods, such as in the case of low *in vitro* expression, heteroresistance, or poor growth masking higher MICs. Overall, clinical laboratorians should attempt to apply a consistent approach to molecular-based methods and aim to resolve discordant results with repeat or supplementary testing, by referral to a reference laboratory, or by reporting both results in accordance with institutional policies.

As understanding of the molecular mechanisms of antimicrobial resistance continues to develop, more sophisticated approaches to molecular detection of antimicrobial resistance in the clinical microbiology laboratory will undoubtedly emerge. These tables will be updated as needed to ensure the provision of relevant guidance as methods evolve.