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Clinical Microbiology testing to guide antimicrobial therapy

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Abstract

Appropriate and timely identification of significant bacterial pathogens is the primary responsibility of the clinical microbiology laboratory. Equally important and most significant from the treatment point of view is the assessment of the in vitro susceptibility (minimum inhibitory concentration or MIC) of antimicrobial agents. Under certain circumstances, the laboratory provides additional data for optimal antibiotic management. These include minimum Bactericidal Concentration (MBC), Time-kill Kinetic Assays, assessment of interaction among antibacterial agents (e.g. synergy testing for combination therapy) and testing the serum from patients on antibiotics for inhibitory and bactericidal titers against the pathogen. The clinical microbiology laboratory typically tests only the minimum inhibitory concentration (MIC) of antimicrobial agents. For most bacterial infections encountered in clinical practice, this is generally sufficient. The assessment of MBC is important for infections in which a bactericidal effect is considered necessary for optimal management e.g., bacterial endocarditic, chronic osteomyelitis. MBC is defined as the lowest concentration of antibiotic at which a 99.9% (3 log) or greater reduction in growth (compared to the initial inoculums) is observed. The goal of therapy is to have a low MBC close to MIC that is within the susceptibility range. Tolerance, a phenomenon in which the bacteria are inhibited for multiplication but not killed by clinically achievable serum level of an antibiotic occurs when the MIC is low (susceptible range) but the MBC is elevated particularly when it is 32-fold or more higher than the MIC. Time-kill kinetic assays assess the rate of bactericidal activity at varying antibiotic concentrations over time rather than a defined time point. Synergy testing is difficult to perform and interpretation should take into account drug interactions from a pharmacokinetic as well as safety perspective. A checkerboard or time-kill assay can be used for this purpose. The later correlates more closely with in vivo combination antibiotic effects. Serum inhibitory titers (SITs) and serum bactericidal titers (SBTs) are performed in a manner analogous to that for MIC and MBC testing but the serially diluted concentrations of antibiotic are substituted by serial dilutions of the serum from the patient on antibiotic therapy. The activity of the antibiotic contained in the serum is tested against a standardized suspension of the patients' infecting pathogen. This assay mimics the "players" in vivo. However, it is labor and time intensive and needs expert interpretation for clinical usefulness.

Biography

Nancy Khardori is currently a:

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