

Rapid Detection of Carbapenem Resistance Using Laser Light Scattering

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Antibiotics are among the most transformative agents in human health and have had a widespread impact on the practice of medicine, thus the spread of antibiotic resistance threatens effective patient care. The carbapenem class of antibiotics represents the last safe line of defense for serious bacterial infections, but the recent rise in resistance rates poses a serious risk to their clinical utility, which demands the development of rapid diagnostics to accurately predict resistance prior to therapeutic intervention. The BacterioScan laser microbial growth monitor is a compact diagnostic instrument that measures the growth of microorganisms in real-time, with a lower limit of detection of 1×10^4 CFU/ml. The instrument is commercially available to rapidly determine microbial presence/absence in human specimens, and current efforts have focused on applying this technology to rapid antibiotic susceptibility testing (AST). Using meropenem as a representative of the carbapenem class, clinical isolates of Klebsiella pneumoniae and Acinetobacter baumannii were evaluated in the BacterioScan instrument using methods compliant with current clinical microbiology standards. Encouragingly, the phenotypic AST outputs provided by the device showed strong correlation with those obtained using standard methods, although the growth kinetics for meropenem-resistant strains appeared to lag considerably relative to meropenem-susceptible strains. Ciprofloxacin AST evaluation of the same strain panel again correlated with standard methods, but failed to demonstrate the same lag in growth observed when meropenem was tested. This suggests that extended incubation times are required to accurately report minimum inhibitory concentrations for meropenem in resistant strains. It should be noted, however, that meropenem CLSI breakpoint-specific resistance/susceptibility was reproducibly detected in 4-6 hours by the BacterioScan device. Taken together, these data support the use of the BacterioScan instrument to provide rapid phenotypic AST for multiple classes of antibiotics, including carbapenems, enabling clinicians to better select appropriate treatment regimens.

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