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Antimicrobial susceptibility testing in biofilm growing bacteria

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Abstract

Biofilms are organized bacterial communities embedded in an extracellular polymeric matrix attached to living or abiotic surfaces. The development of biofilms is currently recognized as one of the most relevant drivers of persistent infections. Among them, chronic respiratory infection by *Pseudomonas aeruginosa* in cystic fibrosis patients is likely the most deeply studied. The lack of correlation between conventional susceptibility tests and therapeutic success in chronic infections is likely consequence of the use of planktonically instead of biofilm growing bacteria. Therefore, several in vitro models to evaluate antimicrobial activity on biofilms have been implemented over the last decade. Microtiter plates based assays, the Calgary device, substratum suspending reactors and the flow cell system are some of the most used in vitro biofilm models for susceptibility studies. Likewise, new pharmacodynamic parameters, including minimal biofilm inhibitory concentration (MBIC), minimal biofilm eradication concentration (MBEC), biofilm bactericidal concentration (BBC) or biofilm prevention concentration (BPC) have been defined in the last years to quantify antibiotic activity in biofilms. Using these parameters, several works have evidenced very significant quantitative and qualitative differences for the effect of most antibiotics when acting on planktonic or biofilm bacteria. Nevertheless, a standardization of the procedures, parameters and breakpoints, by official agencies is needed before they are implemented in Clinical Microbiology Laboratories for routine susceptibility testing. Research efforts should also be directed to obtaining a deeper understanding of biofilm resistance mechanisms, the evaluation of optimal pharmacokinetic/pharmacodynamics (PK/PD) models for biofilm growth and correlation with clinical outcome.

Keywords: biofilm, antibiotic, susceptibility testing, pharmacokinetic/pharmacodynamic parameters, antimicrobial resistance, *Pseudomonas aeruginosa*