Evaluation of the Accelerate PhenoTM for direct identification and antimicrobial susceptibility testing from positive blood cultures in bloodstream infections with Gram-negative pathogens

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Background: Bloodstream infections (BSI) are an important cause of morbidity and mortality. Increasing rates of antimicrobial resistant pathogens, in particular Gram-negative bacteria, limit treatment options and lead towards an empirical use of broad-range antibiotics. Fast and reliable diagnostic tools are needed to speed up identification and antimicrobial susceptibility testing (AST) from blood culture in order to provide adequate therapy in a timely manner.

The Accelerate Pheno™ system (Accelerate Diagnostics, Inc., Arizona, USA) is a fully automated test system which allows to perform identification and AST directly from positive blood cultures within approximately seven hours. In the following study, we aim to evaluate the Accelerate Pheno™ system in comparison to conventional culture-based identification and AST in BSI with Gram-negative bacteria.
**Material/methods:** The first positive blood culture of each patient with Gram-negative rods in the initial microscopy was included in the study. The Accelerate Pheno™ system was performed according to manufacturer's instructions which involved the transfer of 5 ml from the blood culture bottle into the cartridge and starting the system: a total of approx. 2 minutes hands-on-time. Culture-based diagnostics was considered the gold standard. It included subcultures of the positive blood culture bottles, followed by identification using the MALDI-TOF mass spectrometer (Microflex LT, Bruker Daltonics, Germany) and AST using the VITEK 2 system (bioMérieux, SA) and Etest (bioMérieux, SA) for confirmation. Agreement of AST was determined and erroneously AST were categorized as follows: very major error (false susceptibility), major error (false resistance), or minor error (intermediate versus susceptible or resistant).

**Results:** In total, 116 episodes of BSI with Gram-negative bacteria were included in the study. The Accelerate Pheno™ system correctly identified the pathogen in 104 of 116 (89.7%) specimens. Considering the organisms included in the identification panel of the Accelerate Pheno™ system, 104 of 108 isolates were correctly identified (96.3%).

The Accelerate Pheno™ system generated an AST result for 95 of the 104 correctly identified isolates (91.3%) comprising of 960 single AST measurements. The overall category agreement with VITEK2 and Etest was 97.0%. The detailed category agreements were as follows: ampicillin-sulbactam 95.3%, piperacillin-tazobactam 92.0%, cefepime 90%, ceftriaxone 97.6%, ertapenem 100%, meropenem 98.9%, amikacin 97.8%, gentamicin 100%, tobramycin 98.9%, ciprofloxacin 95.7% and colistin 100%. One very major error was detected in a *Pseudomonas aeruginosa* isolate for amikacin (1.0%; 1/96). Major errors occurred in 1.6% (14/864) and minor errors also in 1.5% (14/960). For 26 AST measurements, discordant results occurred between the VITEK2 and Etest which are currently being resolved and have not yet been included in the evaluation.

**Conclusions:** The Accelerate Pheno™ system can be a valuable tool to speed up diagnostic results, especially in a high-risk patient population.