Analytical Performance and Estimated Clinical Outcomes of a Molecular Multiplexed Bacterial Identification Blood Culture Panel

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Introduction: Timely and accurate detection of bloodstream pathogens is critical in the diagnosis and treatment of patients with sepsis, where patients with bloodstream infections (BSI) have increased mortality, length of hospital stay and hospital costs. The ability of the clinical laboratory to provide a rapid identification of these organisms is vital to aid clinicians in empiric drug regimens and antibiotic management. Use of molecular multiplex panels, such as the GenMark Dx ePan® Blood Culture Identification Gram Positive Panel (BCID-GP), that rapidly identify and provide some antimicrobial resistance data are becoming widely utilized in the clinical laboratory.

Methods: Positive blood cultures containing Gram positive bacteria were run on the BCID-GP and compared to the standard of care (SOC). The BCID-GP analytical performance was determined for 71 blood cultures. To assess the potential impact to patient care, retrospective chart review was performed to estimate the number of antibiotic de-escalations or escalation for patients included in the study.

Results: Median time savings for BCID-GP pathogen identification compared to SOC was 30 hours. Of the 71 samples tested, there were a total of 74 potential identifications and 26 resistance targets. There were three off-panel organisms encountered during this study, Clostridium species and Finegoldia magna, leaving 71 detectable targets. The percent agreement for identification was 95.7%, with 3 discrepant results. Two were poly-microbial BSIs where BCID-GP did not identify a Pan Gram Negative target when an E. coli and P. aeruginosa were present, and the other was a mono-microbial BSI with S. salivarius that was not detected. There was 100% agreement and 100% specificity for the genotypic resistance markers, mecA and vanA, compared to phenotypic SOC results. Retrospective chart review revealed 47.9% of patients had possible antibiotic stewardship interventions if using BCID-GP, with median time to faster antibiotic intervention of 50.55 hours compared to SOC. Appropriate escalation to active therapy could have occurred sooner for Vancomycin-resistant enterococci and Listeria. Faster de-escalation, particularly for methicillin-sensitive Staphylococcus aureus, and complete avoidance of antibiotics would also be possible with BCID-GP results. Overall, 71 doses of vancomycin and 6 doses of linezolid could have been prevented, decreasing antibiotic costs and adverse side effects of these drugs.

Conclusions: The BCID-GP is highly accurate in the identification of organisms and specific resistance genes from positive blood cultures, providing actionable results for antibiotic stewardship to administer more appropriate antibiotics and better patient care.

Abstract

Table 1. Accuracy of BCID-GP ID compared to SOC. (A) Molecular ID from the BCID-GP was compared to the final AMS-ID TOF 480 ID. Targets on BCID-GP that are genus or ‘group’ calls were considered correct if SOC gave same genus or species of that group. (B) Molecular genetic markers (mecA and vanA) were determined to be present in the test panel. mecA and vanA were not detected. GP: Gram-positive cocci; GN: Gram-negative rods.

Table 2. Description of Polynomial Blood Culture Panels (n=5).

Table 3. Discrepant ID Results. ePan data files were analyzed by GenMark Dx for target missed to confirm lack of signal. Samples were not re-tested due to limited kits.

Table 4. Estimated Stewardship Interventions by Pathogen

Figure 1. Estimated Time Savings using BCID-GP.

Figure 2. Anticipated Stewardship Interventions based on BCID-GP Results.

Methods

- Retrospective chart review performed to determine median time to antimicrobial stewardship (AMS) intervention compared to SOC, as well as potential opportunities intervention

- Results from BCID-GP were compared to SOC for ID and AST, when appropriate. Estimated faster median time to ID was calculated compared to SOC.

- The ePan, BCID-GP cartridge and the eSensor® Technology: