ABSTRACT

BACKGROUND

Bloodstream infections (BSIs) are a substantial contributor to both morbidity and mortality among hospitalized individuals. Between 2001 and 2007, there was an approximately 97% increase in BSIs, most of which were healthcare-acquired infections (1, 2). Because BSIs pose a potentially life-threatening medical emergency, the rapid identification of pathogens causing them is paramount for optimal patient outcomes (3).

Several technologies are currently available to meet these demands, including fluorescence in situ hybridization and mass spectrometry-based systems. Many of these methods have shown potential for decreasing morbidity and mortality rates, improving infection control practices, and containing costs for healthcare institutions. However, research studies comparing their efficacies are needed to help laboratories decide which system(s) will best suit their needs.

METHODS

For this study, we compared the AdvanDx Gram-Negative QuickFISH™ BC assay with matrix-assisted laser desorption/ionization-time of flight mass spectrometry (MALDI-TOF MS) and the Gram-Negative QuickFISH™ BC assay for identification of Gram-negative bacilli isolated in blood cultures at the Indiana University Health Clinical Microbiology Laboratory.

• A total of 101 positive blood cultures growing Gram-negative rods were prospectively collected and analyzed by Gram-Negative QuickFISH™ BC and matrix-assisted laser desorption/ionization time-of-flight mass spectrometry (MALDI-TOF MS) within 8 h of signaling by a continuous monitoring blood culture system (CMBC).
• CMBC instruments used included BD BACTEC™ FX and BD BACTEC™ 9240.
• Blood culture bottle types included BD BACTEC™ Plus Aerobic/F, Anaerobic/B, Lytico Anaerobic/F, and Peds Plus Aerobic/F.
• Only 1 bottle per unique patient was analyzed to avoid duplication of analysis of the same bacteriological isolates.

Results:

• Gram-Negative QuickFISH™ BC identified 70/70 (100%) of bottles growing these organisms.

• Overall, there is a very good correlation between MALDI-TOF MS, Gram-Negative QuickFISH™ BC, and standard-of-care methods. For identification of these three organisms, MALDI-TOF MS and QuickFISH had 100% correlation. However, these three organisms only accounted for 69% (70/101) of the total isolates.

Discussion:

• Direct analysis of positive blood cultures by MALDI-TOF MS provides a very high percentage of correct organism identifications; however, identification of individual species in mixed cultures is currently a limitation of this method. The Gram-Negative QuickFISH™ BC identified E. coli, K. pneumoniae, and P. aeruginosa in 70/70 (100%) of bottles growing these organisms. For identification of these three organisms, MALDI-TOF MS and QuickFISH had 100% correlation. However, these three organisms only accounted for 69% (70/101) of the total isolates.

• Standard-of-care results reported for patient specimens were used as a reference for identification of the test isolates. Table 1 lists all isolates obtained during this study identified by standard-of-care methods.

• Although the results of this study demonstrate the utility of these methods for direct-from-blood-culture testing, evaluations of these products should be done on an individual laboratory basis.

RESULTS

• MALDI-TOF MS identified at least 1 organism that was isolated in the standard-of-care culture in 92/101 (91.1%) bottles tested.
• No reliable ID or “no peaks” was obtained in 9 samples: 4 (44%) contained an aerobes; 1 (11%) contained Campylobacter jejuni; 1 (11%) contained Moraxella sp.; 1 (11%) contained Haemophilus influenzae; 1 (11%) contained Stenotrophomonas maltophilia; and, 1 (11%) contained Stenotrophomonas maltophilia.

• Gram-Negative QuickFISH™ BC identified E. coli, K. pneumoniae, and P. aeruginosa in 70/100 (100%) of bottles growing these organisms.
• MALDI-TOF MS and Gram-Negative QuickFISH BC had 100% correlation.
• These three organisms only accounted for 69% (70/101) of the total isolates.

• Gram-Negative QuickFISH™ BC is negative for all samples (31/101, 31%) not containing E. coli, K. pneumoniae, and P. aeruginosa.

• No cross-reactivity with the other bacterial species encountered.
• Overall, there is a very good correlation between MALDI-TOF MS, Gram-Negative QuickFISH™ BC, and standard-of-care methods.

• Standard of care includes automated direct-from-positive-blood-culture analysis by either BD Phoenix or bioMérieux VITEK® II subculture to solid media, and identification and susceptibility testing by standard methods.

DISCUSSION

• Direct analysis of positive blood cultures by MALDI-TOF MS provides a very high percentage of correct organism identifications.
• Identification of individual species in mixed cultures is currently a limitation of this method, however.

• Gram-Negative QuickFISH™ BC very accurately identifies E. coli, K. pneumoniae, and P. aeruginosa.
• No cross-reactivity with the other bacterial species encountered.
• Overall, these methods correctly identified the majority of Gram-negative bacilli encountered in the positive blood cultures.

• Although the results of this study demonstrate the utility of these methods for direct-from-blood-culture testing, evaluations of these products should be done on an individual laboratory basis.

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REFERENCES