Development and Implementation of a Gram-positive Treatment Algorithm for Bloodstream Infections Identified by a Gram-positive Nucleic Acid Microarray Assay

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ABSTRACT

Background: bloodstream infections are a major cause of morbidity and mortality in the United States, with a mortality rate of up to 40%. The rapid identification of causative organisms and initiation of appropriate antimicrobial therapy is a key predictor of mortality. Routine blood culture techniques can take up to 2-3 days for identification and susceptibility of causative organisms. The Nanosphere Verigene® Gram-positive blood culture assay (BC-GP) is a rapid method of identifying the pathogenic bacteria and three genetic markers of antibiotic resistance.

Methods: A retrospective chart review was conducted at the University of Minnesota Medical Center, Fairview from October 2014 until December 2014. Patients identified with a positive Gram-positive bloodstream infection by BC-GP were screened for inclusion. Patients were excluded if they had a negative blood culture and were admitted to the hospital. Patients were included if they were <18 years of age, pregnant, or opted out of research. Results: A total of 96 blood culture positive with Gram-positive cocci or bacilli by Gram stain were analyzed by BC-GP. The organisms identified by the BC-GP assay were Staphylococcus aureus 37.5%, Staphylococcus epidermidis 18.75%, Enterococcus faecalis 5.4%, and Strep. pneumoniae 3.1%. Three genotypic markers were determined: mecaA, mecC and vanA. When compared with routine culture results, BC-GP organism identification and resistance genes were concordant 63.7%, 97.5% and 92.8% respectively. The mean time to BC-GP was 3.8 hours shorter than traditional identification and 53.8 hours shorter than susceptibility.

Conclusions: the BC-GP assay provides rapid identification of Gram-positive bloodstream infections. In order to improve utilization of BC-GP results and decrease broad-spectrum antibiotics use, a treatment algorithm was developed and made available to the medical staff.

BACKGROUND

• bloodstream infections (BSI) are a major cause of morbidity and mortality (up to 40%)
• the rapid identification of causative organisms and initiation of appropriate antimicrobial therapy is a key predictor of mortality
• traditional blood culture techniques can take up to 2-3 days for identification and susceptibility of causative organisms
• the Nanosphere Verigene® Gram-positive blood culture assay (BC-GP) is a rapid method of identifying the pathogenic bacteria and three genetic markers of antibiotic resistance

• the target includes Staphylococcus spp., Staphylococcus spp., Listeria spp., S. aures, S. epidermidis, S. pneumonia, S. pyogenes, S. agalactiae, S. endocardii, Enterococcus faecalis, and E. faecium
• the three resistance genes are meca encoding for methicillin resistance in Staphylococcus, and vanA and vanC encoding for vancomycin resistance in Enterococcus
• Methodology for rapid organism and susceptibility detection in vitro is in accordance with current antibiotic stewardship intervention have demonstrated improved time to appropriate antibiotics, decreased broad-spectrum antibiotics, decreased length of stay and decreased overall cost.