IMPROVING THE DIAGNOSIS OF PEDIATRIC BLOOD STREAM INFECTIONS IN A PATIENT CENTERED MICROBIOLOGY LABORATORY

Daniel A. Keesler (Judy A. Daly)
Department of Pathology

Background
More than a million adults and children in the US develop bloodstream infections every year and it is estimated that up to 50 percent die. Rapid diagnosis and appropriate antimicrobial treatment have proven critical in reducing morbidity and mortality. Traditional culture methods require 12-24 hours to identify an organism after blood culture positivity, significantly delaying optimization of antimicrobial therapy. At Primary Children’s Hospital (PCH) we have developed an algorithm for the rapid identification of organisms causing pediatric bloodstream infections using both the AdvanDx QuickFISH™ and the BioFire Diagnostics’ FilmArray® Blood Culture Identification (BCID) Panel.

Methods
Blood cultures (BCX) at PCH are performed using the BACTEC™ automated blood culture system. Positive BCX are processed immediately for Gram stain (GS). For aerobic bottles, BCID testing is set up simultaneously. Since BCID is not FDA approved for anaerobic bottles QuickFISH™ is used on anaerobic bottles for which GS identifies Gram-positive cocci (GPC) in clusters (likely Staphylococcus spp.) or GPC in chains (likely Enterococcus or Streptococcus spp.). If BCID identifies Enterococcus spp. the sample is tested with QuickFISH™ to differentiate Enterococcus faecalis. Results of GS, BCID or QuickFISH™ are reported immediately to clinicians and to the PCH antimicrobial stewardship team. For this study, times from positivity to GS read, and times to report were recorded for all positive BCX. Data was prospectively collected from Dec. 2013 to June 2014. A two-year report (Jan. 2008 thru Dec. 2009) of all positive BCX identities at PCH was used for data analysis.

Results
71 positive blood cultures were analyzed during the study period. Data was collected for 71 GS, 15 QuickFISH™ runs, and 30 BCID panels. The average turnaround time for GS was 23.51 minutes (SD=12.07 min., n=71), for QuickFISH™, following a GS, was 40.33 minutes (SD=7.58 min., n=15) and BCID was 86.00 minutes (SD=18.26 min., n=30). Utilizing QuickFISH™ and BCID in collaboration, PCH is able to identify 91% (2528/2778) of positive BCX organisms and report them as critical values for both aerobic and anaerobic blood culture bottles. This algorithm can enable clinicians to provide rapid, targeted antimicrobial therapy for septic patients.
Blood Culture Timeline

**Timeline (minutes)**
- **0**
- **20**
- **40**
- **60**
- **80**
- **100**

**BLOOD DRAWN**
- Bottles placed in BACTEC TM Bottle
- Positive Anaerobic Bottle
- Gram stain set up
- BCID set up and Gram stain set up
- QuickFISH TM set up (when indicated)
- QuickFISH TM result
- Subculture to plates
- BCID result
- Subculture to plates

**INCUBATION**
- Transport aerobic bottle
- Antimicrobial stewardship
- FilmArray BCID identifies:
  - Gram positive: *Enterococcus, Listeria monocytoigenes, Staphylococcus, Streptococcus agalacae, Streptococcus pneumoniae, Streptococcus pyogenes*
  - Gram negative: *Acinetobacter baumannii, Haemophilus influenzae, Neisseria meningitidis, Pseudomonas aeruginosa, Enterobacteriaceae, Enterobacter cloacae, Escherichia coli, Klebsiella oxytoca, Klebsiella pneumoniae, Proteus, Serratia marcescens*
- Fungi: *Candida albicans, Candida glabrata, Candida krusei, Candida parapsilosis, Candida tropicalis*
- An bio c Resistance Genes: *KPCI carbapenem resistant, mecA methicillin resistant, vanA/vanB vancomycin resistant*

**If** Enterococcus is set up QuickFISH TM to identify
- Enterococcus faecalis or non-faecalis

**24-48 Hours for Culture Growth**

*U of Utah and IMH*