ANMC Adult Rapid Blood Pathogen Identification Panel Guideline

(Last Updated: 12/2019)

ANMC utilizes an FDA approved test called the Blood Pathogen Panel (BPP) performed on the BioFire BCID instrument. The test uses polymerase chain reaction (PCR) to amplify DNA targets from 3 groups of pathogens (gram positive bacteria, gram negative bacteria and yeast). It is performed directly following a positive blood culture and allows rapid identification of 21 different pathogens (**Table 1**). It also detects genes responsible for vancomycin-resistant *Enterococci*, methicillin-resistant *Staphylococci* and one of the genes responsible for carbapenem-resistant *Enterobacteriaceae*. In addition to detecting multiple species-specific assays, the panel also contains 4 genus specific assays (*Enterococcus*, *Staphylococcus*, *Streptococcus* and *Enterobacteriaceae*) that allows detection of pathogens for which there are no specific targets. A comprehensive list of all pathogens detected by BCID can be found in **Table 3**.

Table 1: List of Pathogens/Resistance Genes Detected by Blood Pathogen Panel

Gram-Positive Bacteria	Gram-Negative Bacteria	Yeast	Resistance Markers
Enterococcus species	*Acinetobacter baumannii*	*Candida albicans*	*mecA* = methicillin (oxacillin) resistance
Listeria monocytogenes	*Enterobacteriaceae family*	*Candida glabrata*	*vanA/B* = vancomycin resistance
Staphylococcous species	*Enterobacter cloacae* complex	*Candida krusei*	*kpc* = carbapenem resistance
Staphylococcus aureus	*Escherichia coli*	*Candida parapsilosis*	
Streptococcus species	*Klebsiella oxytoca*	*Candida tropicalis*	
Streptococcus agalactiae	*Klebsiella pneumoniae*		
Streptococcus pneumonia	*Proteus species*		
Streptococcus pyogenes	*Serratia marcescens*		
	Haemophilus influenzae		
	Neisseria meningitidis		
	Pseudomonas aeruginosa		

Immediately following a positive blood culture, the ANMC microbiology lab performs the BPP. The results from the panel (pathogen identification) are typically available within 2 hours. It is important to note, that this test is NOT a standalone test. Blood samples with bacterial growth are still cultured and proper MIC testing is performed. The rapid reporting of pathogen identification allows for early escalation or de-escalation of antimicrobials to the most appropriate therapy while waiting for susceptibilities. A list of recommended antimicrobial treatment choices are outlined in **Table 2**.

The ANMC Antimicrobial Stewardship Program (ASP) developed these recommendations based upon the institutional antibiogram and national guidelines issued by the Infectious Diseases Society of America (IDSA). Relevant local susceptibility data is provided for gram-negative pathogens if activity for the antimicrobial is available. When both blood culture gram-stain and BPP results are available, current antimicrobial therapy should be evaluated in light of the clinical picture and adjusted to the most appropriate regimen. Additionally, when full susceptibility results become available therapy should again be evaluated and adjusted to the most appropriate narrow spectrum agent. It is important to note that certain infections are often polymicrobial in nature. In most cases, isolation of a single pathogen from the BPP should warrant narrowing of antimicrobial therapy, but should never result in over-narrowing. An example would be in complicated intra-abdominal infections where anaerobes are frequently present and therapy against these pathogens should generally be included until definitive cultures of the site of infection are available. Providers must use clinical judgment on a case-by-case basis.

Table 2: Blood Pathogen Panel Results and Recommended Empiric Therapy

The table below contains interpretations of BPP data and recommended empiric antibiotic therapy for treating blood stream infections (BSIs) at ANMC. When the clinical picture and judgement dictates, patients who respond to narrow spectrum therapy do not always need to be escalated, even if this guideline recommends a broader spectrum agent. Similarly, patients who continue to deteriorate or are not clinically responding despite appropriate empirical antimicrobial therapy may require broader coverage. Allergies, organ dysfunction and history of multi-drug resistant organisms (MDROs) should always be considered prior to selecting empiric antimicrobial therapy. Data on susceptibility for the various gram-negative pathogens is derived from the 2018 institutional antibiogram.

Gram Positive Organisms				
Pathogen Detected		**Preferred Empiric Therapy**	**Alternative Therapy**	**Comments/Considerations** (Susceptibility data from 2018)
Enterococcus species	*Van A/B* Negative	Ampicillin 2g IV q4h	Vancomycin (per pharmacy)	
	Van A/B Positive (VRE)	Linezolid 600mg IV/PO q12h	Daptomycin	
Staphylococcus aureus	*mecA* Negative (MSSA)	Cefazolin 2g IV q8h	Nafcillin	Repeat Blood cultures (BCx) and formal ID consult recommended Daptomycin should not be utilized when pneumonia is the primary source of infection
	mecA Positive (MRSA)	Vancomycin (per pharmacy)	Daptomycin	
Staphylococcus species (not *S. aureus)*	1 of 2 Positive	Probable contaminant. Consider withholding therapy. Do <u>not</u> need to routinely repeat BCx		In severely ill or immunocompromised patients consider starting/continuing therapy until more definitive results are available
	2 of 2 Positive *mecA Negative*	Cefazolin 2g IV q8h	Nafcillin	Consider ID consult. Call microbiology if mecA gene information is needed for determination of treatment for *Staphylococcus species* bacteremia (not aureus).
	2 of 2 Positive *mecA* Positive	Vancomycin (per pharmacy)	Linezolid	
Streptococcus pyogenes (Group A, Beta hemolytic Strep) and ***Streptococcus agalactiae*** (Group B, Beta hemolytic Strep)		Ampicillin 2g IV q4h <u>*or*</u> Cefazolin 2g IV q8h	Vancomycin (per pharmacy)	Beta-hemolytic strep are routinely susceptible to penicillin
Streptococcus pneumoniae	Pneumonia	Ampicillin 2g IV q4h	Cefazolin Ceftriaxone	Continue vancomycin in patients with suspected CNS infection until susceptibilities are available
	CNS Infection	Vancomycin (per pharmacy) + Ceftriaxone 2g IV q12h		
Streptococcus species (NOT Group A, NOT Group B, NOT *pneumonia*e)	1 of 2 Positive	Possible contaminant, if no other source of infection, consider discussing with ID provider.		In severely ill or immunocompromised patients consider starting/continuing therapy until more definitive results are available
	2 of 2 Positive	Ceftriaxone 2g IV q24h	Vancomycin (per pharmacy)	
Listeria monocytogenes		Ampicillin 2g IV q4h	TMP/SMX in patients with severe beta-lactam allergy	Consider ID consult. GPR will not be run on BCID automatically due to large number of GPR being probable contaminants. Please discuss with microbiology staff if concern for *Listeria* is present.

Gram Negative Organisms			
Pathogen Detected	**Preferred Empiric Therapy**	**Alternative Therapy**	**Comments/Considerations** (Susceptibility data from 2018)
Acinetobacter baumannii	Meropenem 500mg IV q6h		Consider ID consult.
Escherichia coli	Ceftriaxone 2g IV q24h	Cefepime Piperacillin/Tazobactam Levofloxacin	Ceftriaxone: 95% susceptible Pip/Tazo: 98% susceptible Levofloxacin: 85% susceptible
Klebsiella pneumoniae	Ceftriaxone 2g IV q24h	Cefepime Piperacillin/Tazobactam Levofloxacin	Ceftriaxone: 98% susceptible Pip/Tazo: 98% susceptible Levofloxacin: 97% susceptible
Klebsiella oxytoca	Ceftriaxone 2g IV q24h	Cefepime Piperacillin/Tazobactam Levofloxacin	Ceftriaxone: 98% susceptible Pip/Tazo: 98% susceptible Levofloxacin: 98% susceptible
Serratia marcescens*	Cefepime 2g IV q8h (extended infusion over 4 hours)	Levofloxacin Meropenem	
Enterobacter cloacae*	Cefepime 2g IV q8h (extended infusion over 4 hours)	Levofloxacin Meropenem	Cefepime: 99% susceptible Levofloxacin: 100% susceptible Meropenem: 100% susceptible
***Proteus* species**	Ceftriaxone 2g IV q24h	Cefepime Piperacillin/Tazobactam Levofloxacin	Ceftriaxone: 100% susceptible Pip/Tazo: 100% susceptible Levofloxacin: 92% susceptible
Enterobacteriaceae* family ONLY	Cefepime 2g IV q8h (extended infusion over 4 hours)	Levofloxacin Meropenem	See list of potential pathogens in **Table 3** Contact microbiology, ID or Antimicrobial Stewardship with questions concerning *Enterobacteriaceae* sp NOT BCID panel
Pseudomonas aeruginosa	Cefepime 2g IV q8h (extended infusion over 4 hours)	Piperacillin/Tazobactam Ciprofloxacin	Cefepime: 92% susceptible Pip/Tazo: 94% susceptible Ciprofloxacin: 93% susceptible
Neisseria meningitidis	Ceftriaxone 2g IV q12h		*N. meningitidis* is associated with CNS infection. Rule out meningitis. Consider ID consult.
Haemophilus influenza	Ampicillin/sulbactam 3g IV q6h *or* Ceftriaxone 2g IV q24h		De-escalate to ampicillin if beta-lactamase negative

*AmpC chromosomal and inducible organisms may develop resistance during prolonged therapy with third-generation cephalosporins. Therefore, isolates that are initially susceptible may become resistant within three to four days after initiation of therapy.

Yeast Organisms		
Pathogen Detected	**Preferred Empiric Therapy**	**Comments/Considerations**
Candida albicans	Fluconazole 800mg IV loading dose followed by 400mg IV q24h	Consider ID consult.
Candida glabrata	Micafungin 100mg IV q24h	
Candida krusei	Micafungin 100mg IV q24h	
Candida parapsilosis	Fluconazole 800mg IV loading dose followed by 400mg IV q24h	
Candida tropicalis	Micafungin 100mg IV q24h	

Table 3: Pathogens Detected by Blood Pathogen Panel

Genus Specific Assay	Pathogens Detected by BPP		Pathogens Not Detected By BPP
Enterococcus species	• *E. faecium* • *E. faecalis* • *E. avium* • *E. casseliflavus* • *E. durans*	• *E. gallinarum* • *E. hirae* • *E. dispar* (reduced sensitivity) • *E. saccharolyticus* (reduced sensitivity)	• *E. raffinosus*
Staphylococcus species	• *S. aureus* • *S. caprae* • *S. cohnii* • *S. epidermidis* • *S. haemolyticus* • *S. hominis* • *S. lugdunensis*	• *S. xylosus* • *S. capitis* (reduced sensitivity) • *S. pasteuri* (reduced sensitivity) • *S. saprophyticus* (reduced sensitivity) • *S. simulans* (reduced sensitivity) • *S. warneri* (reduced sensitivity)	• *S. auricularis* • *S. carnosus* • *S. lentus* • *S. pettenkoferi* • *S. pseudointermedius* • *S. schleiferi* • *S. sciuri*
Streptococcus species	• *S. anginosus* • *S. bovis* • *S. constellatus* • *S. dysgalactiae* • *S. equinus* • *S. gallolyticus* • *S. gordonii* • *S. intermedius*	• *S. mitis* • *S. mutans* • *S. oralis* • *S. parasanguinis* • *S. pseudopneumoniae* • *S. salivarius* • *S. sanguinis*	
Enterobacteriaceae family	• *Cedeceae spp.* • *Citrobacter spp.* • *Cronobacter spp.* • *Enterobacter spp.* • *Escherichia spp.* • *Klebsiella spp.* • *Kluyvera spp.* • *Leclercia adecarboxylata* • *Proteus spp.* • *Raoultella spp.* • *Salmonella spp.* • *Shigella spp.*	• *Serratia marcescens* • *Serratia ficaria* • *Serratia entomophila* • *Yokenella regensbergei* • *Edwardsiella* spp. (reduced sensitivity) • *Enterobacter gergoviae* (reduced sensitivity) • *Hafnia alvei* (reduced sensitivity) • *Pantoea* spp. (reduced sensitivity) • *Salmonella bongori* (reduced sensitivity) • *Serratia fonticola* (reduced sensitivity) • *Serratia odorifera* (reduced sensitivity) • Serratia rubidaeae (reduced sensitivity)	• *Morganella morganii* • *Providencia spp.* • *Rahnella spp* • *Serratia liquefaciens* • *Serratia plymuthica* • *Tatumella ptyseos* • *Yersinia enterocolitica*

References:

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3. Bookstaver PB, Nimmich EB, Smith III TJ, et al. Cumulative Effect of an Antimicrobial Stewardship and Rapid Diagnostic Testing Bundle on Early Streamlining of Antimicrobial Therapy in Gram-Negative Bloodstream Infections. AAC 2017;61(9):e00189-17