TREATMENT GUIDELINE FOR ADULT PATIENTS WITH BACTEREMIA

Purpose:

This guideline is intended to help guide antimicrobial therapy for adult patients (defined as patients admitted to adult service lines) following the results of Gram Stain, Organism identification (with or without Biofire™ molecular resistance results) and antimicrobial susceptibilities. Deviation from the recommendations in this guideline may be required for patients with concomitant infections, history of resistant pathogens, or with antimicrobial allergies or intolerance.

How to use this guideline:

For patients with ONLY Gram stain results available, refer to the left column (labeled Gram Stain) for treatment recommendations.

For patients with organism identification results available, refer to the middle column (labeled Species Identification) for treatment recommendations.

For patients with antimicrobial susceptibility results available, refer to the right column (labeled Susceptibilities) for treatment recommendations.
Gram Stain

Yeast
- Micafungin
- Consult ID

If suspicion for Cryptococcus or Histoplasmosis (fungemia in setting of pneumonia or meningitis in immunocompromised patient), call infectious diseases consult service

Species Identification

All Candida species: Continue Micafungin
- See Candidemia Guideline. Therapy should not be de-escalated until guideline criteria are met. ID consult is strongly recommended.
- If concern for urinary, ocular, endocarditis or CNS infection, alternative therapy may be needed. Immediately consult ID for treatment recommendations

If Candida auris identified immediately consult ID for treatment recommendations.

Susceptibilities

C. albicans, C. parapsilosis, C. tropicalis, C. dublinensis and C. lusitaniae: Consider de-escalation to fluconazole for clinically stable patients with clearance of blood cultures and fluconazole susceptibility
- Otherwise Micafungin

C. glabrata with fluconazole MIC ≤ 8 (SDD): Consider de-escalation to fluconazole for clinically stable patients with clearance of blood cultures
- Otherwise Micafungin

Cryptococcus spp.:
- Liposomal amphotericin B (Ambisome™) + flucytosine.
- Consult ID

Cryptococcus spp.:
- Fluconazole may be appropriate for step down therapy when criteria is met in conjunction with ID consult recommendations

Histoplasma:
- Liposomal amphotericin B (Ambisome™)
- Consult ID

Histoplasma
- Step down therapy may be appropriate when clinical stable in conjunction with ID consult recommendations
**Gram Stain**

- Gram-positive cocci in clusters: Vancomycin

**Species Identification**

- **S. aureus or S. lugdunensis and MecA/C + MREJ negative:**
  - Cefazolin if no suspicion for endocarditis, CNS infection
  - Oxacillin if endocarditis or CNS infection is suspected

- **S. aureus or S. lugdunensis and MecA/C + MREJ positive or MecA/C + MREJ not performed:**
  - Vancomycin OR Daptomycin (if no pulmonary involvement)

  **Consult ID**

  Consider discontinuing adjunctive gram-negative therapy between 48-72 hours if cultures are negative for gram-negative pathogens, except for patients with intra-

**Single positive culture for Coagulase-negative Staphylococcus or S. epidermidis in suspected infection of prosthetic material, neutropenia, or in hemodynamically unstable patients:**

- **S. epidermidis and mecA/C Negative:**
  - Cefazolin

- **S. epidermidis and mecA Positive OR coagulase negative Staphylococcus:**
  - Vancomycin

  For patients who do not meet the above criteria, a single positive culture for Coagulase-negative Staphylococcus or S. epidermidis may represent contamination, assess for possible source of infection and hold antibiotics if clinically stable

**Susceptibilities**

- **S. aureus or S. lugdunensis sensitive to methicillin:**
  - Cefazolin OR oxacillin

- **S. aureus or S. lugdunensis CNS infection sensitive to methicillin:**
  - Oxacillin

- **S. aureus or S. lugdunensis intermediate or resistant to methicillin:**
  - Vancomycin OR Daptomycin (if no pulmonary involvement)

Antibiotic susceptibilities are only performed when Coag-negative Staph or S. epidermidis grow from 2 or more bottles.

If growth from 1 blood culture bottle, assess for possible source of infection, repeat blood cultures, and hold antibiotics if clinically stable

- **Coagulase-negative Staph or Staph epidermidis sensitive to methicillin:**
  - Cefazolin

- **Coagulase-negative Staph or Staph epidermidis meningitis sensitive to methicillin:**
  - Oxacillin

- **Coagulase-negative Staph or Staph epidermidis intermediate or resistant to methicillin:**
  - Vancomycin
**Gram-positive cocci in chains or pairs:**
- Vancomycin

**Hem-onc, SICU, Solid organ transplant:**
- Linezolid

**BMT with ANC>1,000:**
- Linezolid

**BMT with ANC<1,000:**
- Daptomycin

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**E. faecalis and VanA/VanB Negative:**
- Ampicillin
  (consider piperacillin/tazobactam as alternative for intra-abdominal infections)
- Vancomycin if penicillin allergy

**E. faecalis and VanA/VanB Positive:**
- Ampicillin (consider piperacillin/tazobactam as alternative for intra-abdominal infections)
- Linezolid if penicillin allergy
  (Daptomycin for BMT patients with ANC<1,000)

**E. faecium, and VanA/VanB negative:**
- Vancomycin

**E. faecium, and VanA/VanB Positive:**
- Linezolid
  (Daptomycin for BMT patients with ANC<1,000)

**E. casseliflavus, E. gallinarium:**
- Linezolid
  (Daptomycin for BMT patients with ANC<1,000)

**Other Enterococcus Species:**
- Vancomycin

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**Strep. pneumoniae, Strep. anginosus or Strep. species:**
- Non-meningitis: Ceftriaxone
- Meningitis: Ceftriaxone and Vancomycin
- Endocarditis, CNS infection or febrile neutropenia:
  - Vancomycin

**Strep. agalactiae or Strep. pyogenes:**
- Penicillin or Ampicillin

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**Penicillin-based antibiotics should be first line therapy for all Enterococcus species if sensitive:**
- Ampicillin
  (Consider ampicillin/sulbactam or piperacillin/tazobactam for intra-abdominal infections)

**Patients with penicillin allergy or ampicillin-resistant Enterococcus:**
- Vancomycin

**Patients with vancomycin allergy or vancomycin-resistant Enterococcus:**
- Linezolid
  (Daptomycin for BMT patients with ANC<1,000)

**Patients with suspected endocarditis will likely require combination therapy and ID consult is strongly recommended**

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**Penicillin-based antibiotics should be first line therapy for all Streptococcus species infections, except meningitis or brain abscess, if sensitive:**
- Penicillin or Ampicillin
*Gram-negative bacilli: Piperacillin-tazobactam or Cefepime (add metronidazole for intra-abdominal infections)

*Evaluate if patient has history of resistance to piperacillin-tazobactam or cefepime with prior year, and modify therapy accordingly

E. coli, Klebsiella pneumoniae, K. oxytoca Proteus, Serratia, Morganella, Salmonella, Enterobacterales:

No CTX-M, KPC, IMP, VIM, NDM, OXA detected:
Cefepime or Piperacillin-tazobactam

**CTX-M positive:**
Meropenem

**KPC positive:**
Meropenem/Vaborbactam

**IMP, VIM or NDM positive:**
Ceftazidime/avibactam plus Aztreonam

**OXA positive:**
Ceftazidime/avibactam

Enterobacter cloacae complex, Citrobacter freundii, Klebsiella aerogenes

No CTX-M, KPC, IMP, VIM, NDM, OXA detected:
Cefepime

**CTX-M positive:**
High-dose meropenem

**KPC positive:**
Meropenem/Vaborbactam

**IMP, VIM or NDM positive:**
Ceftazidime/avibactam plus Aztreonam \ OR cefiderocol

**OXA positive:**
Ceftazidime/avibactam

Narrow antibiotic selection based on susceptibility results, clinical status, concomitant infections.

- **Narrow-spectrum antibiotics are preferred if no resistance or allergies. These include ampicillin, penicillin, ampicillin/sulbactam, cefazolin and cefuroxime.**

- **ID consult is strongly encouraged for patients with infections from organisms with KPC, IMP, VIM, NDM, or OXA resistance genes**

- **Enterobacter cloacae, Citrobacter freundii, and Klebsiella aerogenes frequently have an inducible beta-lactamase resistance gene (AmpC), which can confer resistance to penicillin, ampicillin, ampicillin/sulbactam, and 1st-3rd generation cephalosporins. Cefepime should be first-line therapy if susceptible.**

- **Citrobacter koseri is not associated with having AmpC gene, and narrow spectrum antibiotics should be prescribed if susceptible**
**Pseudomonas aeruginosa**

- **No IMP, VIM, NDM detected:** Cefepime or Piperacillin-tazobactam. Consider empiric double coverage with tobramycin

- **IMP, VIM or NDM positive:** Cefiderocol plus tobramycin until susceptibilities result

- **CTX-M, KPC, or OXA positive:** Contact infectious diseases – unusual genotype

**Acinetobacter baumannii**

- **No IMP, VIM, NDM, OXA detected:** High-dose meropenem plus minocycline until susceptibilities result

- **IMP, VIM or NDM positive:** Cefiderocol plus minocycline until susceptibilities result

- **CTX-M, KPC positive:** Contact infectious diseases – unusual genotype

**Narrow antibiotic selection based on susceptibility results, clinical status, concomitant infections.**

- If Pseudomonas isolate is resistant to cefepime, piperacillin-tazobactam, meropenem, imipenem, aztreonam, levofloxacin and ciprofloxacin, request ceftolozane-tazobactam, ceftazidime-avibactam and meropenem-vaborbactam susceptibilities from microbiology lab (phone number 6-6831)

- Double coverage of *Pseudomonas* is not indicated after susceptibilities are available, unless isolate is resistant to all beta-lactam antibiotics, cystic fibrosis patient, or decompensating on susceptible antibiotics

**Narrow antibiotic selection based on susceptibility results, clinical status, concomitant infections.**

- There is no evidence double coverage of Acinetobacter improves outcomes. The decision to double cover should be made based on source of bacteremia, severity of infection, and patient's medical history

- Consider definitive combination therapy for carbapenem-resistant *A. baumannii* based on susceptibility information and infectious diseases consultation

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*Gram-negative bacilli: Piperacillin-tazobactam or Cefepime (add metronidazole for intra-abdominal infections)*

*Evaluate if patient has history of resistance to piperacillin-tazobactam or cefepime, and modify therapy accordingly*
*Gram-negative bacilli: Piperacillin-tazobactam or Cefepime
* Evaluate if patient has history of resistance to piperacillin-tazobactam or cefepime, and modify therapy accordingly

Gram-positive rod
Most likely the result of skin flora contamination of blood culture
Consider treatment in HD unstable, prosthetic material with suspected infection, BMT, Neutropenia: Vancomycin
If concern for Listeria: Ampicillin

Achromobacter:
Piperacillin-tazobactam
PCN allergy: meropenem
(Avoid cefepime unless susceptibility is verified)

Stenotrophomonas:
Trimethoprim-sulfamethoxazole
Sulfa allergy: Levofloxacin + minocycline OR ceftazidime-avibactam PLUS aztreonam

Bacillus, lactobacillus and Corynebacterium spp. are possible contaminants: consider treatment in hemodynamically unstable, prosthetic material with suspected infection, BMT, Neutropenia

Bacillus or Corynebacterium spp.: Vancomycin
Lactobacillus: Piperacillin/tazobactam
Listeria: Ampicillin

Patients with multiple positive sets of blood cultures are more likely true infection. Consider ID consult.

Narrow antibiotic selection based on susceptibility results, clinical status, concomitant infections.
- Achromobacter is frequently multi-drug resistant, and ID consult is encouraged to guide appropriate management of these infections
- Trimethoprim-sulfamethoxazole should be dosed 10 mg/kg/day in 2-4 divided doses for patients with good renal function when treating Stenotrophomonas bacteremia
- Piperacillin-tazobactam and cefepime do not have activity against Stenotrophomonas

Narrow antibiotic selection based on susceptibility results, clinical status, concomitant infections.
- Susceptibilities will not be routinely performed by the microbiology lab. Please call to request susceptibilities if strong suspicion for infection