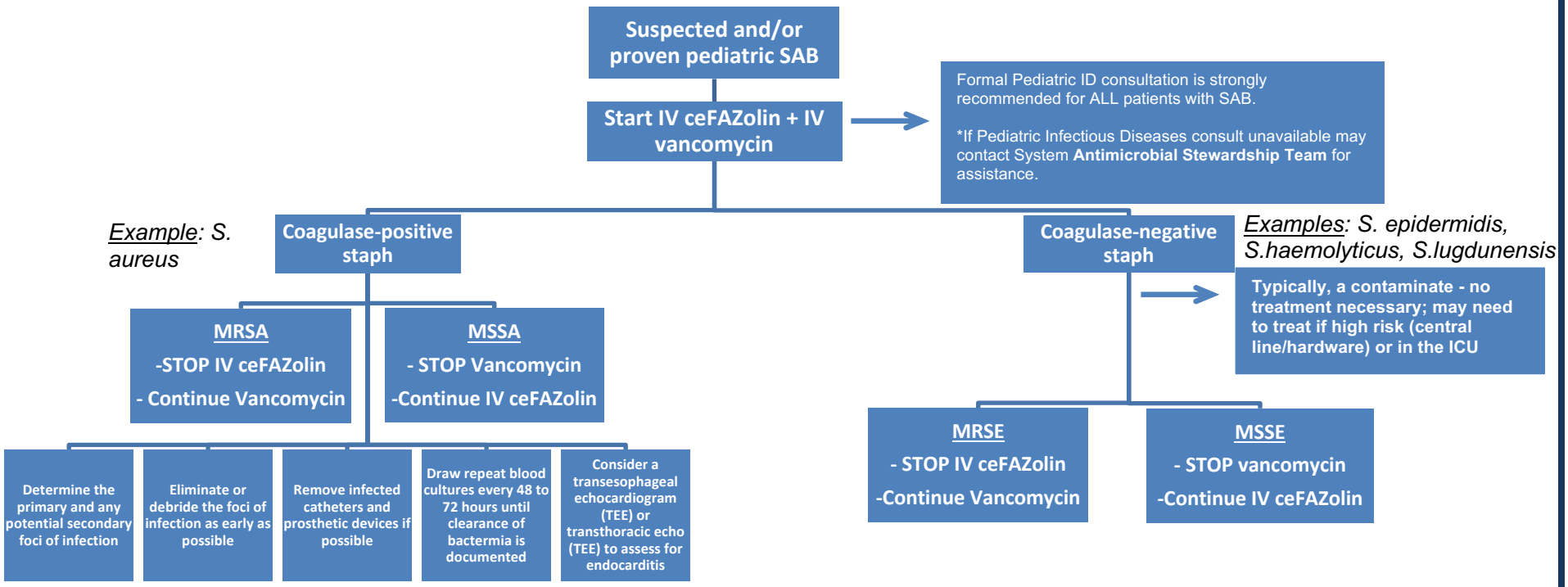
# Ochsner Health System
# Guidance for the Management of Gram-Positive Blood Cultures in Pediatric Patients

## Treatment Algorithm

This pathway applies to the use of antibiotics in suspected and/or proven pediatric staph aureus bacteremia (SAB).

The algorithm cannot apply to every clinical situation and should not replace clinical judgement.




Reviewed and Updated by: System Antimicrobial Stewardship Team
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| | Preferred agent[b] | Alternative agents[b] | Duration of Therapy & Considerations |
|---|---|---|---|
| **MRSA/MRSE** | Vancomycin IV<br>(Dosing per pharmacy) | Daptomycin IV[c,d]<br>1-6 years: 12 mg/kg q24h<br>7-11 years: 9 mg/kg q24h<br>≥12 years: 7 mg/kg q24h<br><br>Linezolid IV/PO<br><12 years: 10 mg/kg/dose q8h<br>≥12 years: 600 mg BID<br>(Max dose: 600 mg)<br><br>Ceftaroline IV[c]<br>15 mg/kg/dose q8h<br>(Max dose: 600 mg) | Duration (from 1st day of negative cultures):<br>• Uncomplicated bacteremia[a]: 7-14 days<br>• Complicated bacteremia: 4-6 weeks<br>  ○ For patients with endocarditis or osteomyelitis, treat for 6 weeks<br>  ○ Therapy can be stepped down to oral<br>• Adequate trial of vancomycin[e] and formal ID consultation is recommended prior to use of an alternative agent.<br>• PO linezolid may be considered as step down therapy in uncomplicated SAB if IV therapy is not ideal |
| **MSSA/MSSE** | CeFAZolin IV<br>50 mg/kg/dose q8h<br>(Max dose: 2,000 mg) | Oxacillin IV<br>50 mg/kg/dose q6h<br>(Max dose: 2,000 mg) | Duration (from 1st day of negative cultures):<br>• Uncomplicated bacteremia[a]: 7-14 days<br>• Complicated bacteremia: 4-6 weeks<br>  ○ For patients with endocarditis or osteomyelitis, treat for 6 weeks<br>  ○ Therapy can be stepped down to oral<br>• Studies have shown that treatment with vancomycin is associated with increased mortality risk compared to beta-lactam therapy even when therapy was altered after culture results identified MSSA. |

[a]Uncomplicated bacteremia is defined as exclusion of endocarditis; no implanted prostheses; negative follow-up blood cultures obtained 2-4 days after the initial set; defervescence within 72h of initiating effective therapy; and no evidence of metastatic sites of infection.
[b] Doses should be adjusted for renal function, as appropriate.
[c] Not preferred for CNS infection
[d] Not effective for respiratory infections
[e] Adequate vancomycin trial: 7 days of therapy with adequate vancomycin levels documented

## Clinical Considerations in the Management of Staphylococcus aureus Bacteremia

1) Recommended Therapy for *S. aureus* Bacteremia
   a) MSSA: Studies have shown that treatment with vancomycin is associated with increased mortality risk compared to beta-lactam therapy even when therapy was altered after culture results identified MSSA. Convenience of vancomycin dosing does not outweigh the potential benefits of beta-lactams in treatment of MSSA bacteremia.
      i) Preferred First -line: CeFAZolin
         (1) Safe in those with non-anaphylactic penicillin allergy
      ii) 2nd Line: Oxacillin
         (1) MSSA isolates are considered susceptible to other beta-lactams such as ampicillin/sulbactam, piperacillin/tazobactam, cefepime, ceftriaxone, ertapenem, and meropenem. There is a lack of clinical data supporting the use of these agents in *S. aureus* bacteremia,

but in mixed infections they are considered active and the addition of another agent such as vancomycin is unnecessary.

b) MRSA:
   i) Preferred First-line: Vancomycin.
   ii) 2nd Line: Daptomycin
   iii) Linezolid: May be considered in patients with uncomplicated SAB or as an option to complete therapy in patients where oral therapy is appropriate
   iv) Ceftaroline: May be considered for salvage therapy in patients with persistent bacteremia, despite adequate therapy.

      (a) Important note: Ceftaroline is considered a broad-spectrum antimicrobial as it offers MRSA coverage in addition to gram negative coverage similar to ceftriaxone. It should only be considered where necessary to help avoid the induction of antimicrobial resistance.

2) Considerations for additional antimicrobial agents
   a) The routine addition of agents such as rifampin or gentamicin is not recommended.
      i) Gentamicin use provides little clinical benefit and has been associated with increased nephrotoxicity even when only used for a short time.
      ii) Rifampin use is associated with increased drug interactions and toxicity, but it does have a role in infections where prosthetic devices are present such as prosthetic heart valves, pacemakers, or prosthetic joint.
         (1) Rifampin should not be added without the input of the infectious disease team.
         (2) Rifampin should **NEVER** be used alone as resistance rapidly develops.
         (3) Isolate MUST be sensitive to rifampin before use.

3) Document Blood Culture Clearance
   a) Positive repeat blood cultures are a predictor for endocarditis or metastatic infection and should prompt an in-depth investigation for these conditions.
   b) Continue to repeat blood culture no more frequently than every 48 hours until clearance is achieved.

4) Approach to Catheters and Prosthetic Devices
   a) *S. aureus* has many virulence factors which allow it to colonize and infect metal and plastic surfaces and catheters and other prosthetic devices are often infected by *S. aureus* without any clinical signs of infection.
   b) Any prosthetic device or intra-vascular catheter present at the time of SAB should be considered infected until that infection is ruled out.
      i) An attempt should be made to remove all prosthetic devices. In one study the retention of indwelling foreign bodies was associated with an 18-fold increase in the risk of *S. aureus* bacteremia relapse.
   c) Catheter management
      i) Short-term Catheters: All catheters present at the time of bacteremia should be removed immediately if possible.
      ii) Long-term Catheters: All catheters should be removed unless there are major contraindications (lack of alternative venous access, patient has significant bleeding diathesis, or quality of life issues take priority over the need for reinsertion of a new catheter at another site)
   d) Other prosthetic material
      i) Due to high rates of infection even when asymptomatic, any patient with persistent SAB should have all retained prosthetic material (prosthetic valve, prosthetic joint, pacemaker/ICD, etc.) removed if possible. In such cases Pediatric ID consultation is highly recommended. Removal is not always medically possible, and, in these cases, consideration should be given to the addition of rifampin

and/or long-term suppression.

5) Persistent *Staphylococcus aureus* Bacteremia
   a) It is not uncommon for SAB to persist for several days after the initiation of appropriate antibiotic therapy and defervescence of the patient (3-5 days).
      i) Metastatic foci and complications become more frequent in bacteremia lasting >3 days.
      ii) Failure to clear the bacteremia should prompt evaluation for metastatic foci of infection.
         (1) Diagnostics tests to consider include TEE, CT of any affected area, MRI of spine, tagged WBC scan, or PET/CT
         (2) Testing should be based upon symptoms and signs of infection.
      iii) Combination therapy may be considered until blood cultures are clear
         (1) **MRSA**: Daptomycin + Ceftaroline
         (2) **MSSA**: Ertapenem + CeFAZolin
      iv) Simplify to a single antimicrobial once blood cultures are clear, follow the guidance above for preferred options
      v) **A Pediatric Infectious Disease consult is strongly recommended.** Sites without onsite ID clinicians, may contact the system ID/ASP team for guidance

6) Infectious Disease Involvement
   a) Studies have found that patients with SAB benefit from the involvement of Pediatric ID specialists.
   b) Involvement of Pediatric ID *specialists* has been associated with improved adherence to standards of care, better use of diagnostic imaging, increased diagnosis of metastatic disease, longer treatment duration, and decreased mortality.
   c) Consider Pediatric ID consultation where available at the time of diagnosis of *S. aureus* bacteremia.

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