Bacteremia – *Staphylococcus aureus*

BACKGROUND

- Gram positive cocci in clusters associated with infections of virtually every organ system
- *Staphylococcus aureus* in the blood is **never** considered a contaminant
- Identification in the blood should prompt immediate workup for **source** and metastatic foci
- Hardware in particular predisposes patients to dissemination, and in patients with SAB, all hardware should be carefully evaluated for involvement in infection
- Note that pyelonephritis is an **exceedingly** rare cause of *Staphylococcus aureus* bacteremia, and when present in the urine and blood, *Staphylococcus aureus* has almost always seeded **from** the blood **to** the urine. Similarly, *Staphylococcus aureus* is a very uncommon cause of community-acquired pneumonia. Patients presenting with pulmonary findings should be evaluated for endocarditis with septic emboli or heart failure.
- Endocarditis estimated 14-25%
- Mortality as high as 27% in cohort studies
- Sustained *Staphylococcus aureus* bacteremia is suggestive of a deep focus of infection and ultimately a source control problem, not antibiotic failure in most cases.

INITIAL MANAGEMENT

Empiric Therapy

Infectious Source	Empiric Therapy
Monomicrobial	vancomycin IV *For more severely ill patients or high burden of infection:* vancomycin IV **AND** cloxacillin 2 g IV q4h **OR** vancomycin IV **AND** cefazolin 2 g IV q8h
Polymicrobial	**ADD** vancomycin to underlying regimen

Doses may require adjustment for renal insufficiency

For vancomycin dosing, refer to "Vancomycin Dosing and Therapeutic Monitoring" in ASP Handbook

- ✓ Admit patient to hospital
- ✓ Repeat blood cultures x 2 sets immediately when blood cultures return positive, then q48h until clear
  - At least **one set** of blood cultures should be from peripheral veins
- ✓ Identify the source of infection and control the source where applicable
- ✓ TTE remains recommended for all patients with *Staphylococcus aureus* bacteremia regardless of time to blood culture clearance
- ✓ TEE recommended for most patients with community-onset bacteremia, and for all patients with indwelling cardiac hardware
- ✓ Remove or exchange any hardware that can feasibly be removed or exchanged (central venous catheters, etc)
- ✓ Central venous catheters that are exchanged while the patient is bacteremic should be **replaced** when blood cultures are clear x48h to reduce risk of recurrence
- ✓ Infectious Diseases consultation

METASTATIC COMPLICATIONS

- *Staphylococcus aureus* can seed from the blood to any organ system including brain, eye, bone, joint, lung/pleura, intraabdominal cavity, liver, spleen, artery/endothelium, etc
- Any new localizing/focal symptoms in patients with SAB should be taken seriously and evaluated closely, consideration should be given to prompt imaging
- Hardware not involved in the initial infection that cannot be easily removed or exchanged should be monitored closely for signs of seeding

Organ System	Signs of Seeding	Management
CNS	Confusion, altered mentation, headache, vision changes, protracted vomiting	STAT CT head with contrast or CTA Consult Neurosurgery if cerebral abscess or aneurysm
Vertebrae/Cauda Equina	Saddle numbness, bladder or bowel dysfunction, decreased perineal sensation	STAT MR spine (OR CT spine* if MR not available) Consult Neurosurgery if vertebral OM and neurological deficits/mass effect
Eye	Decreased visual acuity, acute onset eye pain, eyelid edema, intraocular inflammation	Consult Ophthalmology
Artery (Mycotic Aneurysm)	Fever, low back pain, pulsatile mass + abdo pain (abdominal) vs chest pain (thoracic); headache, seizure, altered sensorium, hemiparesis (intracranial)	STAT CTA of affected area Consult Vascular if mycotic aneurysm
Liver, Abdomen	Abdominal pain, abnormal liver enzymes	CT Abdomen/Pelvis
Hardware	New pain to site, overlying erythema, loosening of hardware	Variable depending on hardware type & location
Joint	Joint effusion, redness, warmth, tenderness. Decreased range of motion, decreased weight bearing	Arthrocentesis U/S or CT joint
Bone	Draining ulcer or sinus tract. Pain, decreased range of motion, decreased weight bearing	CT or MRI** of involved area

*CT scan cannot rule out epidural abscess/cauda equina (inadequate sensitivity).
**MRI is more sensitive for diagnosis of OM where possible, but not available at all FHA sites.

DURATION OF THERAPY: UNCOMPLICATED VS COMPLICATED SAB

- Patients with **uncomplicated** *Staphylococcus aureus* bacteremia necessitate a minimum of 24d of IV therapy from first negative blood cultures
- Patients with **complicated** *Staphylococcus aureus* bacteremia necessitate a minimum of 28d of IV therapy from first negative blood cultures
- Community-onset *Staphylococcus aureus* bacteremia and those of unclear origin are more likely to be complicated.

Uncomplicated (ALL of the following criteria)	Complicated (ANY of the following criteria)
Defervescence within 72h of initial culture	Failure to defervesce by 72h of initial culture
Blood cultures clear within 72h of initial culture	Failure to clear blood cultures by 72h of initial culture
No evidence of metastatic infection or deep source	Evidence of metastatic infection or deep source
No indwelling intravascular prosthetic device	Indwelling intravascular prosthetic device
No evidence of endocarditis via echocardiography	Evidence of endocarditis via echocardiography
Intravascular catheter source removed within 5d	Intravascular catheter source not removed within 5d

DIRECTED THERAPY:

MSSA bacteremia (MSSAB)

Infection	Targeted Therapy	Minimum duration from negative blood cultures
Uncomplicated MSSAB	1. Cloxacillin 2 g IV q4h 2. Cefazolin 2 g IV q8h	2 weeks
Complicated MSSAB *without* identified OM or IE		4 weeks
Complicated MSSAB **with** OM or IE		6 weeks

- Vancomycin monotherapy outside of the empiric therapy window is associated with **higher mortality** for MSSA bacteremia than cloxacillin or cefazolin
- For patients transferred to outpatient antibiotic therapy for bone and joint infections, ceftriaxone 2 g IV q24h can be considered once blood cultures are clear. Use of ceftriaxone in other settings has very limited data.

MRSA bacteremia (MRSAB)

Infection	Targeted Therapy	Minimum duration from negative blood cultures
Uncomplicated MRSAB	1. Vancomycin *If confirmed allergy or severe intolerance to vancomycin:* 2. Daptomycin 6 mg/kg IV q24h*	2 weeks
Complicated MRSAB		4 weeks
Complicated MRSAB **with** OM or IE		6 weeks
MRSAB fails to clear **after 7d** of vancomycin*	Daptomycin 10 mg/kg IV q24h*	6 weeks

***With ID or AMS consultation, when susceptibility to daptomycin has been confirmed with medical microbiology

- Daptomycin is not effective for primary *Staphylococcus aureus* pneumonia as it is inactived by pulmonary surfactant.
- There is conflicting evidence on whether elevated vancomycin minimum inhibitory concentration (MIC of 1.5 or 2 mg/L) increases the risk of treatment failure using vancomycin. Obtain ID or AMS consultation, especially if persistent bacteremia or poor clinical response.

Role of Rifampin in Hardware Infections

- Initiating rifampin in patients with pacemakers, prosthetic joints, or other hardware infections is **only recommended** once blood cultures have **cleared**