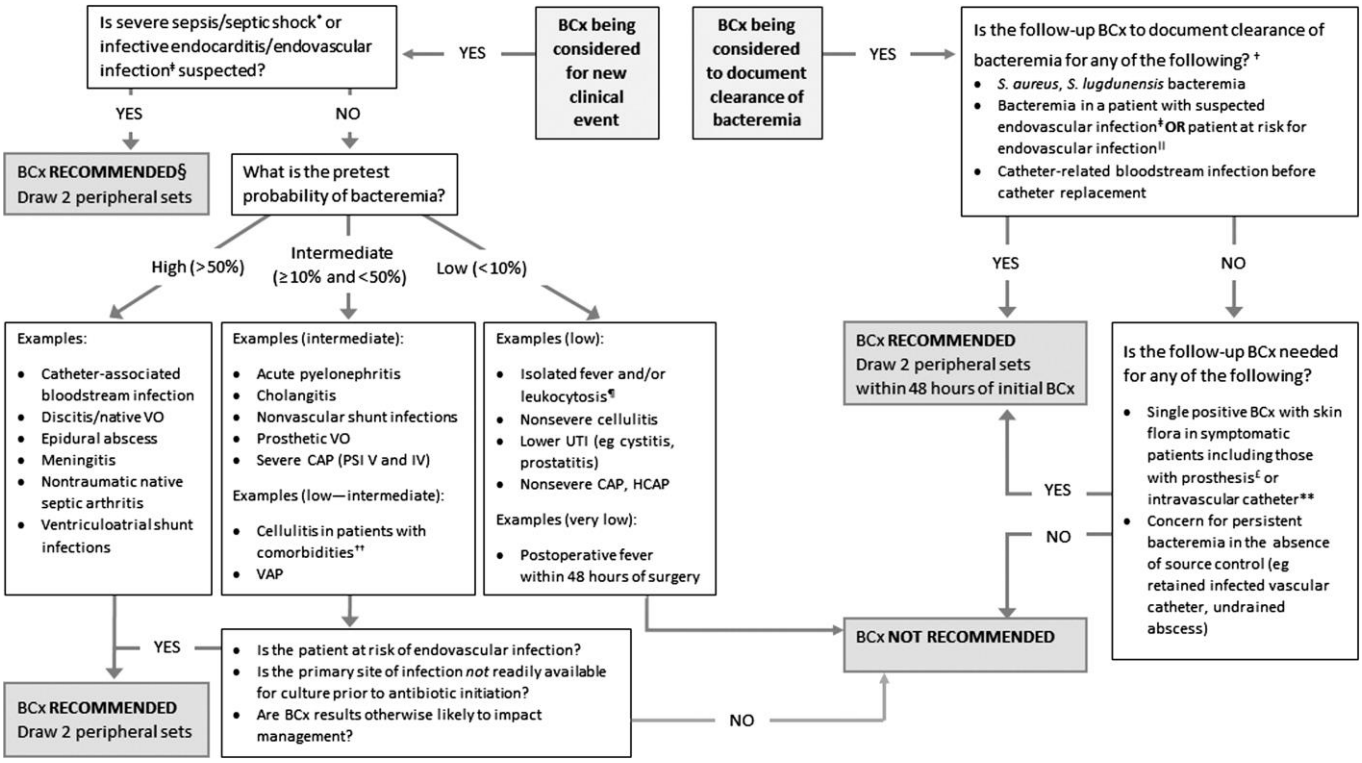
Blood Culture Guideline for Non-Severely Immunocompromised Adult Patients

Summary Algorithm (adapted from Fabre *Clin Infect Dis* 2020).



Algorithm for bacterial blood cultures recommendations in nonneutropenic patients. **The algorithm is not a substitute for clinical judgment.** *Blood culture (BCx) required by US Centers for Medicare and Medicaid Services severe sepsis criteria of the Severe Sepsis and Septic Shock Early Management Bundle. †BCx positive for *Candida* species require routine follow-up blood culture (FUBCx). ‡Septic thrombophlebitis, infected endovascular thrombi, implantable cardioverter defibrillator (ICD)/pacemaker lead infections, intravascular catheter infections, and vascular graft infections. §Consider > 2 sets for suspected endocarditis. ||Patients at risk of endovascular infection: ICD/pacemaker, vascular graft, prosthetic valves and prosthetic material used for cardiac valve repair, history of infective endocarditis, valvulopathy in heart transplant recipient, unrepaired congenital heart disease, repaired congenital heart disease with residual shunt or valvular regurgitation, or within the first 6 months postrepair. ¶Before ordering BCx, assess the patient's clinical history and perform a physical examination to identify infectious and noninfectious sources for the isolated fever episode and review the potential benefit added by BCx. £Prosthesis: joint or intravascular prosthesis. **Routine additional FUBCx for a single BCx with skin flora (eg, coagulase-negative staphylococci) in an immunocompetent patient are not necessary unless bacteremia is suspected or a prosthesis is present. ††Cellulitis in patients with comorbidities: immunocompromised hosts or those at risk of poor outcomes from sequelae from missed *Staphylococcus aureus* bacteremia. Abbreviations: BCx, blood culture; CAP, community-acquired pneumonia; HCAP, healthcare-associated pneumonia; PSI, Pneumonia Severity Index; *S. aureus*, *Staphylococcus aureus*; *S. lugdunensis*, *Staphylococcus lugdunensis*; UTI, urinary tract infection; VAP, ventilator-associated pneumonia; VO, vertebral osteomyelitis.
From Fabre et al. Clin Infect Dis 2020; 71: 1339

Background

Blood cultures (BCx) are the gold standard for diagnosing bloodstream infections. However, most BCx obtained in routine clinical practice are negative (~90%). 30-50% of BCx that are positive recover organisms that are contaminants are associated with unintended

consequences such as unnecessary antibiotic use (especially vancomycin), additional testing, diagnostic delays due to anchoring bias, longer hospital stays, increased “central line associated bloodstream infections” despite not being a true bloodstream infection, and increased healthcare costs. The low rates of BCx positivity are associated with testing patients with low pretest probabilities for a bloodstream infection. This document provides guidance on when to obtain BCx.

New Clinical Events

BCx should be obtained based on the pre-test probability of detecting a bloodstream infection and the likelihood that it will impact on subsequent clinical decision making. Also, BCx should be obtained in persons with suspected severe sepsis or septic shock as part of the CMS Sepsis Early Management Bundle (SEP-1).

Patients should be assessed for hemodynamic stability and evaluated for potential sources of infection.

Listed below are conditions in which BCx in adult patients who are not severely immunocompromised are recommended versus not recommended:

BCx Recommended	BCx **NOT** Recommended

• Severe sepsis/septic shock
• Suspected infective endocarditis/endovascular infection
• Syndromes with a high (>50%) pretest probability of a bloodstream infection
  ○ Catheter-associated bloodstream infection
  ○ Discitis/native vertebral osteomyelitis
  ○ Epidural abscess
  ○ Meningitis
  ○ Native joint septic arthritis
  ○ Ventriculo-atrial shunt infection
• Syndromes with an intermediate (≥10%-50%) pretest probability of a bloodstream infection
  ○ Pyelonephritis
  ○ Cholangitis
  ○ Non-vascular shunt infections
  ○ Prosthetic vertebral osteomyelitis
  ○ Severe pneumonia
  ○ Severe cellulitis or skin and skin structure infections with severe comorbidities (i.e. necrotizing infection, end stage renal or liver disease)
	• Syndromes with a low (<10%) pretest probability of a bloodstream infec
	  ○ Non-severe cellulitis/skin and skin structure infection
	  ○ Lower urinary tract infection
	  ○ Non-severe community acquired pneumonia
	  ○ Non-severe diabetes-related foot infection
	  ○ Colitis
	  ○ Aspiration pneumonitis
	  ○ Uncomplicated cholecystitis, diverticulitis, or pancreatitis
	• Fever or isolated leukocytosis explained by a noninfectious cause (i.e. d trauma, venous thromboembolism)
	• Isolated fever and/or leukocytosis without other findings
	• Post-operative fever within 48 hours of surgery
	• Persistent fever or leukocytosis in patients with negative BCx in the pas without new localizing signs of infection
	• Surveillance blood cultures in patients without suspicion of bacteremia central line placement)

Always draw **two sets of peripheral BCx** (4 bottles, 8-10cc per bottle). Every effort should be made to draw the BCx *prior* to initiating or escalating antibiotic therapy as this can decrease the yield.

Follow-up Blood Cultures for Surveillance/Documentation of Clearance of Bacteremia

Most patients do not need follow-up BCx.

Follow-up blood cultures are recommended in the following situations:

Follow-up BCx Recommended	Follow-up BCs **NOT** Recommended

• All bacteremia/fungemia due to
  ○ *Staphylococcus aureus*
  ○ *Staphylococcus lugdunensis*
  ○ *Candida spp.* (including *Torulopsis glabrata*)
• All cases with suspected endovascular infection
  ○ Infective endocarditis
  ○ Septic thrombophlebitis
  ○ Implantable cardioverter defibrillator (ICD)/pacemaker lead infections
  ○ LVAD line infections
  ○ Vascular graft infections
• Cases in patients at risk for endovascular infection, particularly with gram positive bacteremia
  ○ ICD/pacemaker
  ○ Vascular grafts
  ○ Prosthetic cardiac valves
  ○ History of infective endocarditis
  ○ Valvulopathy in heart transplant recipient
  ○ Endovascular thrombi
• Infected prosthetic device that is retained
• Concern for persistent bacteremia due to lack of clinical improvement after 48 hours of effective therapy
	• Single positive BCx with skin flora (i.e. coagulase negative *Staphylococci*, *Micrococcus*, viridans group *Streptococci*, *Corynebacterium spp., Bacillus spp.*)
	• Clinically stable patients with persistent fever or leukocytosis with two sets of negative BCx within the last 72 hours (except for *S.aureus* or *Candida* bloodstream infections)
	• Uncomplicated gram-negative bacteremia from a non-endovascular source (i.e. urine, abdominal)
	• Uncomplicated streptococcal bacteremia, especially *S.pneumoniae*, viridans group Streptococci, and beta-hemolytic Streptococci (i.e. *S. pyogenes*)
	  ○ Uncomplicated: clinical improvement without concerns for an uncontrolled source, endocarditis, or endovascular infection

Follow-up BCs **may be considered** in the following conditions

• Pathogen based
  ○ *Enterococcus spp.* With 2+ positive BCx
  ○ Streptococcal species other than *S.pneumoniae* and beta-hemolytic Streptococci (i.e. *S. pyogenes*) as these are potential pathogens for infective endocarditis
  ○ HACEK organisms (*Haemophilus aphrophilus, Actinobacillus actinomycetemcomitans, Cardiobacterium hominis, Eikenella corrodens, Kingella kingae*)
• Syndrome based
  ○ Suspected epidural abscess or vertebral discitis/osteomyelitis
  ○ Bacteremia of unclear source

When follow-up BCx are obtained, they should be spaced at least 48 hours after the initial BCx.

Fungal Blood Cultures

The utility of fungal BCx is limited and should be reserved for select patients with a high clinical suspicion a disseminated fungal infection. The utility of fungal BCx depends on the specific pathogen.

Routine blood cultures can detect common yeasts such as *Candida* spp., *Cryptococcus* spp., and *Fusarium* spp. For the latter, use of the Cryptococcus serum antigen should also be considered for faster detection.

Some fungal pathogens such as Histoplasma, Coccidioides, and Blastomyces are detected by fungal cultures but the time to detection is slower compared to other testing methodologies (i.e. Histoplasma serum/urine antigen). Aspergillus spp. and Mucorales spp. are rarely found on fungal cultures and are better detected using serologic studies (i.e. Aspergillus galactomannan) or biopsy with tissue culture.

Infectious Diseases consultation is recommended to help guide diagnostic testing in persons suspected of a disseminated fungal infection.

Acid Fast Bacilli (AFB) Blood Cultures

The utility of AFB BCx is very limited and can be considered for patients with a strong clinical concern for disseminated Mycobacterial infections (i.e. *Mycobacterium avium* complex in a person with advanced HIV infection). AFB will not be detected with routine BCx; a separate

order and collection device is used for AFB BCx. Infectious Diseases consultation is recommended in persons with a strong concern for a Mycobacterial infection.

References

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