

Practical tips for interpreting blood culture results

Exploring the time for blood culture results to be reported, interpreting whether a microorganism is a pathogen or a contaminant, and transitioning patients from intravenous to oral therapy.

Polina Novoseltseva, MSc, Eugene Y.H. Yeung, MD, MSc, FRCPC, FCCM, D(ABMM), DTM&H, CTH, CIC, LTC-CIP

Situations that would prompt a clinician to order blood cultures include suspected endocarditis, pyelonephritis, sepsis, and other serious infections.^{1,2} Blood culture results provide important clinical information, including identification of the causative organism and its antimicrobial susceptibility. These parameters are central to managing bloodstream infections.

To simplify the interpretation of blood culture results, we address common questions from clinicians, such as why antimicrobial susceptibility results are not available with the initial Gram stain, how to distinguish true infection from contamination, and why oral antibiotic options may not be reported. Using the laboratory workflow

shown in the **Figure**, we aim to help clinicians confidently incorporate blood culture results into clinical decision making.

Timing and interpretation of presumptive blood culture results

In a typical adult blood culture protocol, four blood culture bottles are collected from two venipuncture sites and placed in an automated incubator for up to 5 days [**Figure, step 1**].^{1,2} Although this remains standard practice, emerging evidence suggests that single-site venipuncture sampling may be sufficient in select settings.³ Most clinically significant bloodstream infections are detected in the first 24 to 48 hours, so cultures that remain negative beyond this point are substantially less likely to yield an infectious organism.^{1,4}

Clinically, this timeline helps frame risk. For instance, in patients whose clinical status is improving, negative cultures after 48 hours suggest a lower likelihood of a true bloodstream infection. However, when clinical suspicion remains high—such as in the presence of ongoing fever, hemodynamic instability, or sepsis—empiric antibiotic treatment may be initiated while awaiting blood culture results.

Within 1 hour of a blood culture returning a positive result, the laboratory releases the Gram stain to the ordering clinician. In many cases, the presumptive organism is also identified, using direct matrix-assisted laser desorption/ionization time-of-flight (MALDI-TOF) mass spectrometry

[**Figure, step 2**]. When confidence thresholds are met, a presumptive identification (e.g., “presumptive *Staphylococcus aureus*”) is released.^{1,5} When thresholds are not met, only the Gram stain result is reported, and identification is deferred until final testing [**Figure, step 3**].

In practical terms, clinicians can expect to receive Gram stain results, with or without presumptive organism identification, within 1 to 2 days of sample submission. At this stage, antimicrobial susceptibility data are not yet available. However, empiric antibiotics may still be selected by combining the Gram stain and presumptive organism identification with antimicrobial susceptibility tables from local laboratories and hospitals. When only Gram stain results are available, published analyses of local epidemiology and susceptibility patterns may inform initial treatment decisions [**Table 1**]. **Table 1** is based on outpatient blood culture data, which represent a subset of bloodstream infections, because blood cultures are more commonly obtained in hospitalized patients with severe illness. For example, analyses of regional bloodstream infections in British Columbia demonstrate that, among Gram-negative organisms, *Escherichia coli* predominated on Vancouver Island, whereas in the Lower Mainland, *Salmonella* species were more common than *E. coli*.⁶

Definitive organism identification and antimicrobial susceptibility testing take

Ms Novoseltseva is a medical student at the University of British Columbia. She holds an MSc in chemistry from Queen's University in Kingston, Ontario, and worked as an associate medicinal chemist in the pharmaceutical industry prior to entering medical school.

Dr Yeung has worked as a medical microbiologist at LifeLabs, a community pharmacist, and a clinical assistant professor in the University of British Columbia Faculty of Pharmaceutical Sciences and Faculty of Medicine and Simon Fraser University's Stephens Family School of Medicine.

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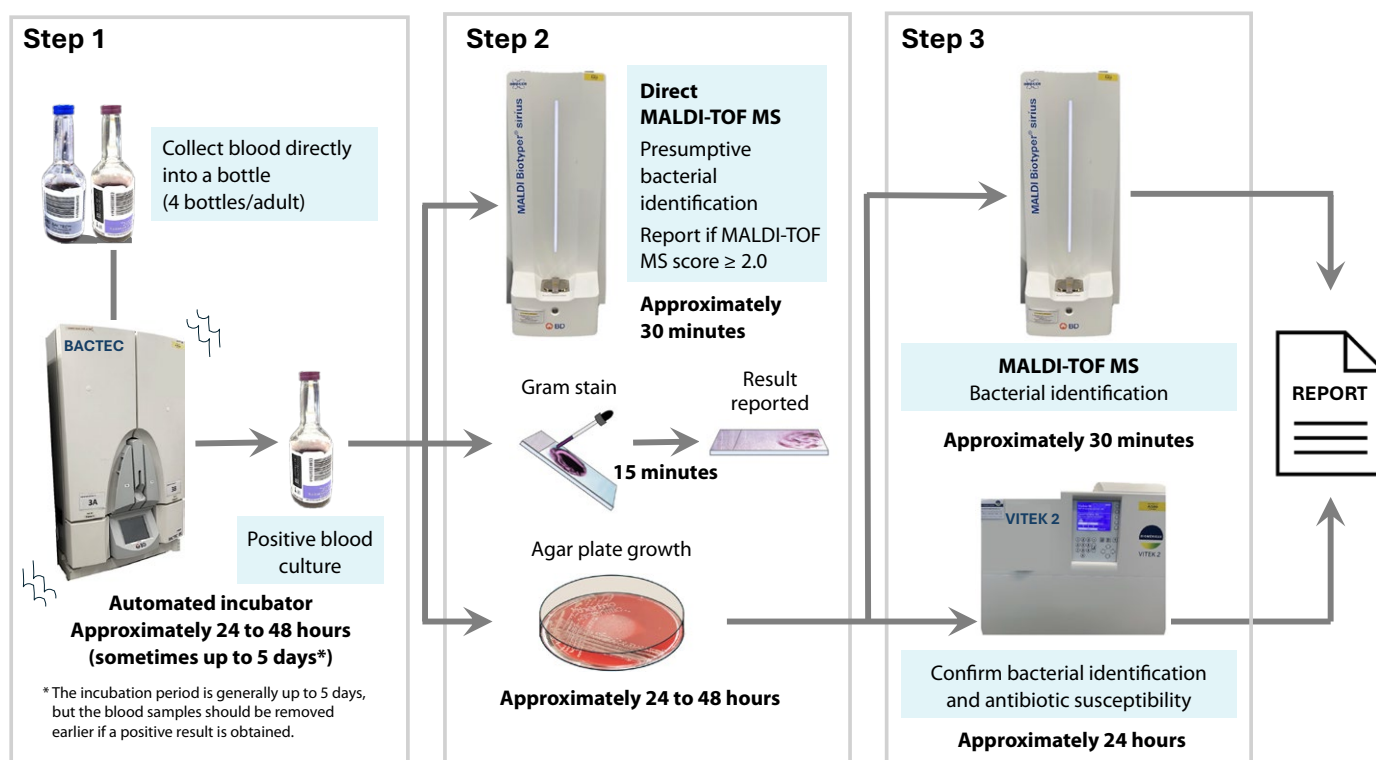


FIGURE. Adult blood culture typical laboratory protocol and workflow. Gram stain and presumptive identification results (from direct MALDI-TOF MS) are released at step 2, with final organism identification and antimicrobial susceptibility testing released at step 3.

MALDI-TOF MS = matrix-assisted laser desorption/ionization time-of-flight mass spectrometry.

longer, as they require subculture to obtain isolated bacterial colonies. This process typically adds another 24 to 48 hours to the testing timeline [Figure, step 3].² As a result, antimicrobial susceptibilities are typically available 3 to 4 days after submitting a patient's sample.

Anticipating this timeline, clinicians can plan follow-up monitoring of the changes in a patient's clinical status. Once available, the antimicrobial susceptibility can be used to confirm, narrow, or adjust initially selected empiric therapy. Ultimately, the ordering clinician is responsible for reviewing results, notifying patients, and ensuring appropriate follow-up.⁷

Distinguishing true infection from contamination

Interpreting preliminary blood culture results requires careful consideration of both the identified organism and the clinical context. Certain organisms are more

likely to be contaminants, while others are more often associated with true bloodstream infections.⁸ Organisms commonly considered to be contaminants—particularly when isolated from only one of four bottles—include *Cutibacterium acnes*, *Bacillus* species, *Corynebacterium* species, and coagulase-negative staphylococci such as *Staphylococcus epidermidis*.² In most clinical situations, these do not require antibiotic therapy. However, they may represent true infection in patients with intravascular

catheters, prosthetic joints or valves, or other implanted devices.

In contrast, isolation of organisms such as *Staphylococcus aureus*, beta-hemolytic streptococci such as *Streptococcus pyogenes* and *Streptococcus agalactiae*, *Streptococcus pneumoniae*, Enterobacteriaceae species such as *E. coli* and *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, organisms from the *Bacteroides fragilis* group, and *Candida* species should generally be considered clinically significant, even when detected

TABLE 1. Frequently encountered Gram-positive and Gram-negative organisms based on the LifeLabs outpatient blood culture data.⁶

Gram-positive	Gram-negative
Viridans group streptococci	<i>Salmonella</i> species
<i>Staphylococcus epidermidis</i>	<i>Escherichia coli</i>
<i>Staphylococcus aureus</i>	<i>Klebsiella pneumoniae</i>
<i>Enterococcus faecalis</i>	<i>Serratia marcescens</i>
<i>Staphylococcus lugdunensis</i>	<i>Enterobacter</i> species

TABLE 2. Common probable pathogens and contaminants identified in outpatient blood cultures based on LifeLabs data.⁶

Common probable pathogens	Common probable contaminants*
<i>Staphylococcus aureus</i>	<i>Staphylococcus</i> species other than <i>Staphylococcus aureus</i>
<i>Salmonella</i> species	Viridans group streptococci
<i>Escherichia coli</i>	<i>Bacillus</i> species
<i>Klebsiella pneumoniae</i>	<i>Micrococcus</i> species
<i>Serratia marcescens</i>	<i>Corynebacterium</i> species
<i>Enterobacter</i> species	<i>Cutibacterium acnes</i>

* If isolated from only one of four blood culture bottles.

in a single blood culture bottle [Table 2]. These organisms are rarely contaminants and should prompt urgent initiation of intravenous antimicrobial therapy.^{1,2}

The patient’s clinical presentation can be used as a consistency check. For example, complicated pyelonephritis that begins with urinary tract symptoms supports a urinary source, where Enterobacteriaceae species, most commonly *E. coli*, would be expected. In contrast, detection of organisms not typically associated with the presenting syndrome, such as *Streptococcus pneumoniae* or *Streptococcus pyogenes* in a presumed urinary source, should prompt consideration of an alternative focus of infection and escalation of care when appropriate.

Transitioning from intravenous to oral therapy

Bloodstream infections generally require initial intravenous antimicrobial therapy. Once the infection is clinically controlled, patients may transition to oral antibiotics to complete therapy, provided specific criteria are met. These criteria include demonstrated susceptibility to an oral agent, hemodynamic stability, adequate source control, and reliable gastrointestinal absorption.¹

The step-down from intravenous to oral therapy is an important component of antimicrobial stewardship that reduces the burden of prolonged intravenous access and catheter-related complications.^{9,10} However, because initial management of bloodstream infections is typically intravenous, oral options are often not reported

in antimicrobial susceptibility results unless specifically requested from the microbiology laboratory. Treatment decisions ultimately rest with the ordering clinician and often involve collaboration with infectious diseases and microbiology teams.⁷

Conclusions

Managing bloodstream infections relies on understanding blood culture processing timelines and results. Early interpretation of the Gram stain and presumptive identification of the organism help differentiate contamination from true infection and guide initial therapy. Final test results help identify the pathogens and potentially effective antibiotics. When combined with the patient’s clinical condition and local epidemiology, these results help the care team quickly choose the most appropriate antimicrobial therapy. ■

Competing interests

Ms Novoseltseva has no competing interests to declare. Dr Yeung has been paid to work as a physician, pharmacist, microbiologist, and clinical assistant professor. Opinions expressed are solely his own and do not represent the views of his employers.

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