LABORATORY DIAGNOSIS OF BLOODSTREAM INFECTIONS

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Summarised from: A Guide to Utilization of the Microbiology Laboratory for Diagnosis of Infectious Diseases: 2018 Update by the Infectious Diseases Society of America and the American Society for Microbiology.

The diagnosis of bloodstream infections (BSIs) is an essential function of the clinical microbiology laboratory. Conventional blood culture methods provide positive results within 48 hours for the vast majority of aetiologic agents of BSIs. Incubation for > 5 days rarely is required with modern automated continuous-monitoring blood culture systems and media in current use. This includes recovery of historically fastidious organisms such as *Brucella* species (spp) and HACEK (*Haemophilus*, *Aggregatibacter, Cardiobacterium, Eikenella*, and *Kingella*) bacteria. A blood culture set is defined as all the blood culture bottles inoculated from a single venepuncture or intravascular catheter draw. The volume of blood inoculated into a blood culture set is the most important variable in the isolation of micro-organisms in patients with BSIs.

Table 1. Summary of diagnostic methods for bloodstream infections

Aetiologic Agents	Diagnostic Procedures	Optimum Specimens	Transport Issues
Staphylococcus spp *Streptococcus* spp *Enterococcus* spp *Listeria monocytogenes* Enterobacteriaceae *Pseudomonas* spp *Acinetobacter* spp HACEK bacteria *Brucella* spp Anaerobic bacteria	Adults: 2 – 4 blood culture sets per septic episode	20 – 30 mL of blood per culture set in adults injected into at least 2 blood culture bottles	Inoculated culture bottles should be transported to the laboratory ASAP at room temperature. Organisms will usually survive in inoculated culture bottles, even if not incubated immediately
	Infants & children: ≥ 2 blood culture sets Blood volume depends on the child's weight (see Table 2)		
NOTE: Most ***Candida* spp** grow very well in standard blood culture broths, unless the patient has been on antifungal therapy			

Table 2. Recommended volumes of blood for culture in paediatric patients

Weight of patient (kg)	Total patient blood volume (mL)	Recommended volume of blood for culture (mL)		Total volume for culture (mL)	% of total blood volume
		Culture set No. 1	Culture set No. 2		
< 1	50 – 99	2	-	2	4
1.1 - 2	100 – 200	2	2	4	4
2.1 - 12.7	> 200	4	2	6	3
12.8 - 36.3	> 800	10	10	20	2.5
> 36.3	> 2200	20 - 30	20 - 30	40 - 60	1.8 - 2.7

Infection associated with intravascular catheters, including central lines

There is no microbiological gold standard for diagnosing ivi catheter-associated bloodstream infection. The major criteria include documented bacteraemia, and exclusion of other potential primary foci of bloodstream infection. Numerous techniques for catheter cultures have been described. At best they may provide supporting evidence of catheter-associated bloodstream infection; in practice, they all have pitfalls that make interpretation problematic. Some investigators have concluded that catheter tip cultures have such poor predictive value that they should not be performed. The clinical significance of a positive culture of an ivi catheter tip in the absence of bacteraemia is unknown.

Key points for the laboratory diagnosis of bacteraemia/fungaemia

- The volume of blood collected, not timing, is key to optimal recovery of pathogens.
- In critical situations, two or more blood culture sets can be obtained sequentially over a short time interval (minutes), after which empiric antimicrobial therapy can be initiated. In less urgent situations, blood culture sets should be obtained over several hours, or more. Each set should be drawn from a different peripheral site.
- Disinfect the venepuncture site with chlorhexidine gluconate or 2% tincture of iodine in adults and children > 2 months old. At least 30 seconds of contact time is needed for both chlorhexidine and tincture of iodine to exert an antiseptic effect. Chlorhexidine is NOT recommended for use in children < 2 months of age; in this patient group povidone-iodine followed by alcohol is preferred.
- Draw blood for culture before initiating antimicrobial therapy.
- Catheter-drawn blood cultures have a higher risk of contamination (false positives) than peripheral venepuncture-drawn blood cultures.
- Do not submit catheter tips for culture without an accompanying blood culture obtained by venepuncture.
- Never refrigerate blood prior to incubation.

The impact of proper specimen handling and management on patient care is immense. It is the key to accurate laboratory diagnosis; it directly affects patient care, length of stay and outcome; it influences therapeutic decisions; it impacts hospital infection control practices and antibiotic stewardship; it effects hospital and laboratory costs, and it drives laboratory efficiency.

Enhancing the quality of the specimen is everyone's responsibility. Therefore communication between the physicians, nurses, and laboratory staff should be encouraged. It must be open with no punitive motive or consequences. Clinicians and other medical personnel should consult the laboratory to ensure that selection, collection, transport, and storage of specimens are managed properly.

Reference:

- Miller JM, et al. A Guide to Utilization of the Microbiology Laboratory for Diagnosis of Infectious Diseases: 2018 Update by the Infectious Diseases Society of America and the American Society for Microbiology. Clin Infect Dis 2018 Jun 28. doi: 10.1093/cid/ciy381. [Epub ahead of print]

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