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GENERAL INFORMATION

PRACTICES TO BE OPTIMIZED AND HARMONIZED

- There are several concerns regarding blood cultures, such as:
 - The inappropriate clinical context for certain requests;
 - Improper prepping of the skin at the blood sampling site;
 - Inaccuracy in the volume of blood transferred into blood culture bottles;
 - The proportion of contaminated blood cultures;
 - The high frequency of follow-up blood cultures.
- The inappropriate use of blood cultures can have an impact on their diagnostic value, the management of patients and their care trajectory as well as resource utilization.

SCOPE OF THIS TOOL

- This tool is intended primarily for physicians and nurses and is aimed at optimizing and harmonizing blood culture practices by:
 - Guiding clinicians in their decision to order or not order blood cultures.
 - Promoting good blood sampling practices.
- This tool does not apply to post-transfusion context and does not describe the laboratory procedures or the management or the specific features of any of the conditions mentioned.
- While not a substitute for clinical judgment, this tool should promote responsible resource utilization and provide certain benefits for patients and the [environment](#).

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INITIAL BLOOD CULTURE REQUEST

→ **For blood cultures to be ordered in the appropriate clinical context**, the ordering decision should take into account the **entire clinical picture**, not just the presence of fever.

Blood cultures recommended

patient with clinical manifestations suggestive of a bacterial infection

 Children and Adults	 Children
• Neutropenic fever and chemotherapy • Fever of undetermined origin • Concern regarding: - An increased risk of infection, e.g., rigours, comorbidities, pregnancy and a severe deterioration in overall health; - Spread of a local infection with or without systemic manifestations. • Suspicion of: - Discitis - Infectious endocarditis due, or not, to an implantable cardiac device - Typhoid fever - Endovascular infection, including septic thrombophlebitis, vascular graft infection or vascular access device infection¹ - Necrotizing infection of the skin or soft tissues - Meningitis - Invasive meningococcal disease - Pneumonia where the severity of the lung involvement warrants hospitalization² - Sepsis, urosepsis or septic shock	• Fever: - And age < 2 months³ - And neutropenia – < 0.5 x 10⁹ neutrophils/l • Hemodynamic instability • Risk of maternal-fetal infection at birth • Suspicion of: - Retropharyngeal abscess - Suppurative cervical adenitis - Necrotizing enterocolitis - Osteoarticular infection (osteomyelitis or septic arthritis) - Mastoiditis

1 The risk factors for endovascular infection include a history of infectious endocarditis, acquired or congenital valvular heart disease, hereditary or congenital heart defect, and the presence of an implantable automatic defibrillator or a pacemaker, a vascular access device, a vascular shunt, a vascular graft or a prosthetic valve.

2 Blood cultures are generally not recommended if the admission is due to the patient's overall condition (e.g., advanced age or the presence of comorbidities) rather than the severity of the lung involvement.

3 In infants 2 to 3 months of age with a fever, blood cultures should not be ordered outright. Rather, the request should follow the assessment of the risk level for bacteremia.

→ **In other situations**, clinical judgment takes precedence and vigilance is key.



Given the importance of the blood culture result for determining the prognosis, **it is preferable to order blood cultures upon the least suspicion of bacteremia** rather than to hold off on the request or to not order any at all.



CAUTION REGARDING MULTIPLE REQUESTS

For patients who arrive from another department in the hospital or from another hospital, it is important to check if blood cultures have already been ordered and, if they have, when.

- In adults, a maximum of 6 blood culture bottles can be drawn within a 24-hour period.
- In children, the maximum number of blood culture bottles that can be drawn depends on their weight, but, in general, only one is drawn during a 24-hour period.

BLOOD DRAWS

→ **To maximize the diagnostic value of blood cultures**, special attention should be given to:

- Prepping the skin;
- The total volume of blood drawn.



In certain clinical situations, it may not be possible to meet all the requirements for a proper blood draw. In such case, clinical judgment should be used to strike a balance between good blood draw practices and the downsides for the patient.

BLOOD DRAW TIMING

→ Blood for blood cultures should be drawn:

- At any time after the appearance of signs and symptoms of bacterial infection. Waiting for the fever to spike is not necessary;
- Before blood is drawn for other tests;
- Before initiating antibiotic therapy, if the patient's clinical status so permits. The timely initiation of antibiotic therapy takes precedence over blood culture draws.



In the most urgent clinical situations, antibiotic therapy should be initiated as soon as possible and no later than 60 minutes after the clinical evaluation.

BLOOD DRAW STRATEGY

→ The blood draw strategy should be aimed at obtaining an optimal volume of blood based on weight.

- Single puncture, i.e., collecting blood to fill all the bottles with just one puncture – generally 4 bottles, including 2 for an aerobic culture – should be done in most situations.
- Multiple punctures, i.e., collecting blood to fill up to 2 bottles per puncture, should be preferred if there is suspicion of an endovascular infection, including infectious endocarditis or a vascular access device infection.
- In pediatric patients, since the quantity of blood that can be drawn is often limited by the small circulating blood volume, only one pediatric blood culture bottle (aerobic) is often drawn. However, depending on the child's weight, drawing more than one pediatric bottle or even one or more adult bottles may be indicated.
 - When 5 ml or more of blood is drawn, the volume should be divided equally between the two blood culture bottles.
 - Anaerobic culture bottles may be useful, especially in the following situations: intraabdominal infection, necrotizing enterocolitis, head and neck infection, immunocompromise, perianal and gynecological infections, bites, infant born to a mother with chorioamnionitis.

Guide to Blood Culture Draws¹

Weight (kg)	Optimal volume (ml)	Volume distribution per bottle (ml)				Type of bottle
		1	2	3	4	
≤ 1	1 - 2	1 - 2	-	-	-	Pediatric
> 1 to 4	2 - 4	2 - 4	-	-	-	
> 4 to 8	6	3	3	-	-	
> 8 to 12	8	4	4	-	-	
> 12 to 36 ²	20	10	10	-	-	Adult - aerobic and anaerobic
> 36	40	10	10	10	10	

¹ The total quantity of blood drawn is less than 5% of the patient's estimated total blood volume.

² Depending on the quantity of blood drawn from the child, consideration may be given to filling two pediatric bottles or one pediatric bottle (4 ml) and one adult bottle (10 ml).



A **single puncture** does not compromise blood culture performance, and it offers a number of advantages, such as a decreased risk of contamination and decreased nurse time. Furthermore, it is less unpleasant for the patient than multiple punctures.

If **multiple punctures** are performed, the blood draws should be done in immediate succession. An interval of 30 minutes between draws is no longer recommended.

OBTAINING SPECIMENS

→ For puncture purposes, **preference should be given to the peripheral veins.**

- Newly installed peripheral catheters (PiccLine and peripheral vascular access device [VAD]) can be used, utilizing a contact-free antiseptic technique.
- Central VADs should be used only when they are suspected of infection.



Consideration can be given to central VADs when the speed of execution and preservation of the vascular network are issues. In such case, this should be taken into account when interpreting the blood culture results.

When blood cultures are aimed at detecting a VAD infection, one blood sample should be taken from the VAD and another from a peripheral vein.

→ The skin should be disinfected twice to reduce the risk of contamination, the second time with 2% chlorhexidine diluted in 70% alcohol. For each disinfection, the drawer should:

- Rub the skin for 30 seconds;
- Allow the skin to dry for 30 seconds or as per the antiseptic used.



In children under the age of 2 months, the fragility of the skin necessitates the use of 0.5% chlorhexidine diluted in 70% alcohol.

In allergic individuals, disinfection with chlorhexidine should be replaced with two disinfections with 70% alcohol (3 disinfections in all).

→ For each puncture, the aerobic culture bottles should be drawn first.

→ Once the blood for blood cultures has been drawn, the bottles should be:

- Properly identified – collection site, date and actual time of collection, type of vascular access device, if applicable, and the requester's or designated person's contact information.
- Kept at room temperature and quickly sent to the laboratory.

INTERPRETATION OF RESULTS

- There are no criteria for interpreting blood culture results.
However, the combination of the following three elements is suggestive of contamination (false positive):
- Only one blood culture bottle in four is positive;
 - The pathogenic agent identified is part of the cutaneous flora;
 - No implanted medical device or foreign body.



If there is some uncertainty regarding the interpretation of the results, a microbiologist/infectious diseases specialist or an experienced colleague should be consulted.

CLARIFICATION OF RESULTS AND FOLLOW-UP ON BACTEREMIA ERADICATION

- For follow-up blood cultures to be ordered in the appropriate clinical context:
- The ordering decision should take the entire clinical picture into account;
 - The first request should be made 48 to 72 hours after initiating antibiotic therapy or upon receiving the results of the initial blood cultures if there is a concern about them;
 - Subsequent requests, if necessary, should be made after receiving the results of the previous blood cultures.

Follow-up blood cultures recommended

 Children and adults	 Children
• Confirming the eradication of the infection: - <i>S. aureus</i> or <i>S. lugdunensis</i> bacteremia; - Candidemia; - Infectious endocarditis due or not to an implantable cardiac device; - Endovascular infection. • Concern regarding: - The result of the initial blood cultures; - Persistence of bacteremia attributable to: ▫ No control of the primary site of infection (e.g., undrained abscess, primary site not identified); ▫ The progression of signs and symptoms or a deterioration in the patient's clinical status.	• Confirming the eradication of the infection: - Age < 2 months;¹ - Bacteremia caused by nontyphoidal <i>Salmonella</i>; - Osteoarticular infection (osteomyelitis or septic arthritis).

¹ In infants 2 to 3 months of age, follow-up blood cultures should not be ordered outright. Rather, the request should follow the assessment of the level of risk associated with persisting bacteremia.

- **In other situations**, clinical judgment takes precedence.

- Outside the situations indicated in the table above, follow-up blood cultures are generally not necessary when the patient's clinical status has improved with management.



Negative blood cultures should be confirmed with a new blood culture request in the context of bacteremia in a child under 2 months of age, *Staphylococcus aureus* bacteremia, or candidemia.



CAUTION REGARDING PERSISTENT BACTEREMIA

Negative blood cultures should be observed **72 hours** after antibiotic therapy is initiated. If not, a microbiologist/infectious diseases specialist or experienced colleague should be consulted.

REFERENCES

For the argument concerning the contents of this tool and for all the supporting references, see the [INESSS report](#) accompanying this tool.

APPENDIX



ENVIRONMENTAL ISSUES

- Blood cultures generate waste (e.g., single-use plastic) and consume electricity (e.g., incubator). In addition, the transporting of supplies and specimens, trips made by laboratory staff, the production of reports, and operating the hospital's laboratory are other factors that have an impact on the carbon footprint of blood cultures.
- Ensuring that blood culture requests are submitted in the appropriate clinical context is part of a broader view of responsibly using diagnostic tests and of an ecologically sustainable healthcare system.
- Responsible blood culture use can be fostered by following the recommendations in this tool. Separating blood cultures from the septic workup request would also be an avenue to explore.