

# ضروریات کشت خون

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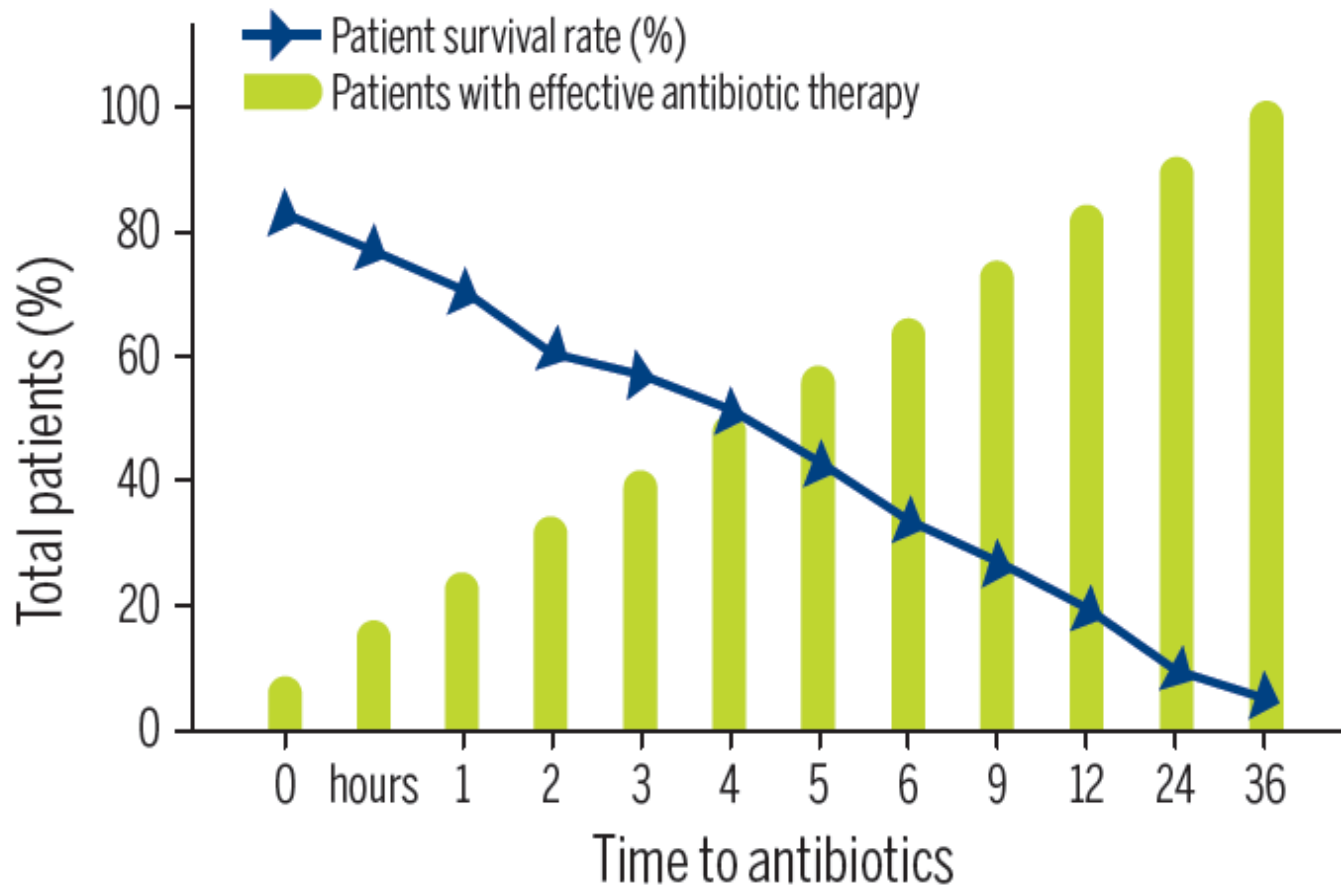
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# BLOOD CULTURE ESSENTIALS

- **1- What is a blood culture?**
- **2- Why are blood cultures important?**
- **3- When should a blood culture be performed?**
- **4 - What volume of blood should be collected?**
- **5- How many blood culture sets should be collected?**
- **6- Which media to use?**
- **7- Timing of blood cultures**
- **8 - How to collect blood cultures**
- **9- How many days of incubation are recommended?**
- **10- Is it a contaminant or a true pathogen?**

# Figure 1: Fast effective antimicrobial therapy increases survival chances

Adapted from Kumar A, et al. Crit Care Med. 2006;34(6):1589-96.<sup>15</sup>



# When should a blood culture be performed?

- Blood cultures should always be requested when a bloodstream infection or sepsis is suspected.

# Clinical symptoms in a patient which may lead to a suspicion of a bloodstream infection are:

- undetermined **fever** ( $\geq 38^{\circ}\text{C}$ ) or hypothermia ( $\leq 36^{\circ}\text{C}$ ), **shock, chills,**
- severe local infections (**meningitis, endocarditis, pneumonia, pyelonephritis, intra-abdominal suppuration...**).
- abnormally raised **heart rate**
- low or raised **blood pressure**
- raised **respiratory rate**

# Blood cultures should be collected:

- **as soon as possible** after the onset of clinical symptoms;
- ideally, prior to the administration of antimicrobial therapy.
- If the patient is already on antimicrobial therapy, recovery of micro-organisms may be increased by collecting the blood sample immediately before administering the next dose and by inoculating the blood into bottles containing specialized antimicrobial neutralization media.

# What volume of blood should be collected?

- The optimal recovery of bacteria and fungi from blood depends on culturing an adequate volume of blood.
- The collection of a sufficient quantity of blood improves the detection of pathogenic bacteria or fungi present in low quantities.
- This is essential when an endovascular infection (such as **endocarditis**) is suspected.

## Continued

- The **volume of blood** that is obtained for each blood culture set is the most significant variable in recovering micro-organisms from patients with bloodstream infections.



# Continued

- Blood culture bottles are designed to accommodate the recommended blood-to-broth ratio (**1:5 to 1:10**) with optimal blood volume.
- Commercial continuously monitoring blood culture systems may use a smaller blood-to-broth ratio (< 1:5) due to the addition of sodium polyanethole sulfonate (SPS) which inactivates inhibitory substances which are present in blood.

# Adults

- For an adult, the recommended volume of blood to be obtained per culture is **20 to 30 ml**.
- Since each set includes an aerobic and an anaerobic bottle, each bottle should be inoculated with approximately **10 ml** of blood. This volume is recommended to optimize pathogen recovery when the bacterial/fungal burden is less than **1 Colony Forming Unit (CFU) per ml of blood**, which is a common finding.

# Continued

- It is also generally recommended that two or three bottle sets (**two bottles per set**) are used per septic episode, meaning, for adults, 40 to 60 ml of blood collected from the patient for the 4 to 6 bottles, with 10 ml per bottle.
- For each additional milliliter of blood cultured, the yield of microorganisms recovered from adult blood increases in direct proportion up to 30 ml.
- This correlation is related to the relatively **low number of CFU /ml** of adult blood.

# Pediatric

- The recommended volume of blood to collect should be based on the **weight** of the patient, and **an aerobic** bottle should be used, unless an anaerobic infection is suspected. (**1:5 to 1:10**)

# حجم مناسب خون

Adapted from Kellogg *et al.* **Frequency of low-level bacteremia in children from birth to fifteen years of age.** *J Clin Microbiol.* 2000; 38:2181-2185.

Weight of patient		Patient's total blood volume (ml)	Recommended volume of blood for culture (ml)		Total volume for culture (ml)	% of patient's total blood volume
kg	lb		Culture no.1	Culture no.2		
≤1	≤2.2	50-99	2		2	4
1.1-2	2.2-4.4	100-200	2	2	4	4
2.1-12.7	4.5-27	>200	4	2	6	3
12.8-36.3	28-80	>800	10	10	20	2.5
>36.3	>80	>2,200	20-30	20-30	40-60	1.8-2.7

# Note

- from three blood culture sets (2 bottles per set), with a blood volume of 20 ml in each set (10 ml per bottle):
- 73.1% with the first set,
- 89.7% with the first two sets
- 98.3% with the first three sets.
- However, to achieve a detection rate of >99% of bloodstream infections, as many as four blood culture sets may be needed

# Note

- A **single blood culture** bottle or set **should never** be drawn from adult patients, since this practice will result in an inadequate volume of blood cultured and a substantial number of bacteremias may be missed

# How to collect blood cultures

- A properly collected sample, that is **free of contaminants**, is key to providing accurate and reliable blood culture results.
- It is recommended that blood cultures should be collected only by members of staff (**medical, nursing, phlebotomist or technician**) who have been **fully trained** and whose competence in blood culture collection has been assessed



# 10 Key Steps to Good Sample Collection

- 1- examine the bottles
- 2- Check the expiry date
- 3- Strictly follow the collection protocol
- 4- clearly and correctly labelled
- 5- an aerobic and an anaerobic bottle.
- 6- drawn from veins, not arteries
- 7- avoid drawing blood from a venous or arterial catheter

# 10 Key Steps to Good Sample Collection

- 8- Carefully disinfect the skin
- 9- Transport the inoculated bottles
- 10- All blood cultures should be documented

- **How many days of incubation are recommended?**

# contaminant or a true pathogen?

- A **false positive** is defined as growth of bacteria in the blood culture bottle that were not present in the patient's bloodstream, and were most likely introduced during sample collection.

# Contamination can come from a number of **sources**:

- 1- the patient's skin,
- 2- the equipment used to take the sample,
- 3- the hands of the person taking the blood sample,
- 4- the environment.

# common skin contaminants

- coagulase-negative staphylococci, up to 20% of cases,
- viridans- group streptococci,
- *Bacillus spp*,
- *Propionibacterium spp.*,
- *diphtheroids*,
- *Micrococcus spp.*

# Note

- **collection site information included with the blood culture request sent to the laboratory**

# Note

- Contamination rates can be most effectively reduced by strict compliance with **hand hygiene** rules and best practices for blood collection, particularly during the stages of skin antiseptics, venipuncture and sample transfer to blood culture bottles.



# Note

- not be possible to reduce the contamination rate below 2%
- The American Society for Microbiology and CLSI recommend targeting contamination rates not exceeding 3% of the total of collected sets.

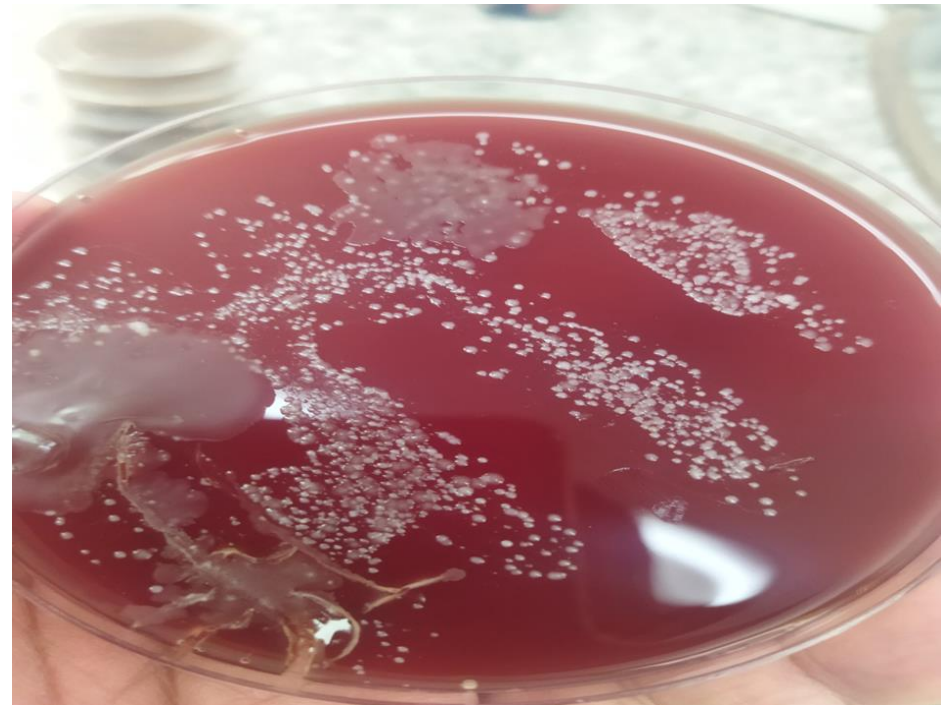
# Impact of contamination rates

- A contaminated blood culture can result in unnecessary antibiotic therapy, increased length of hospitalization and higher costs.

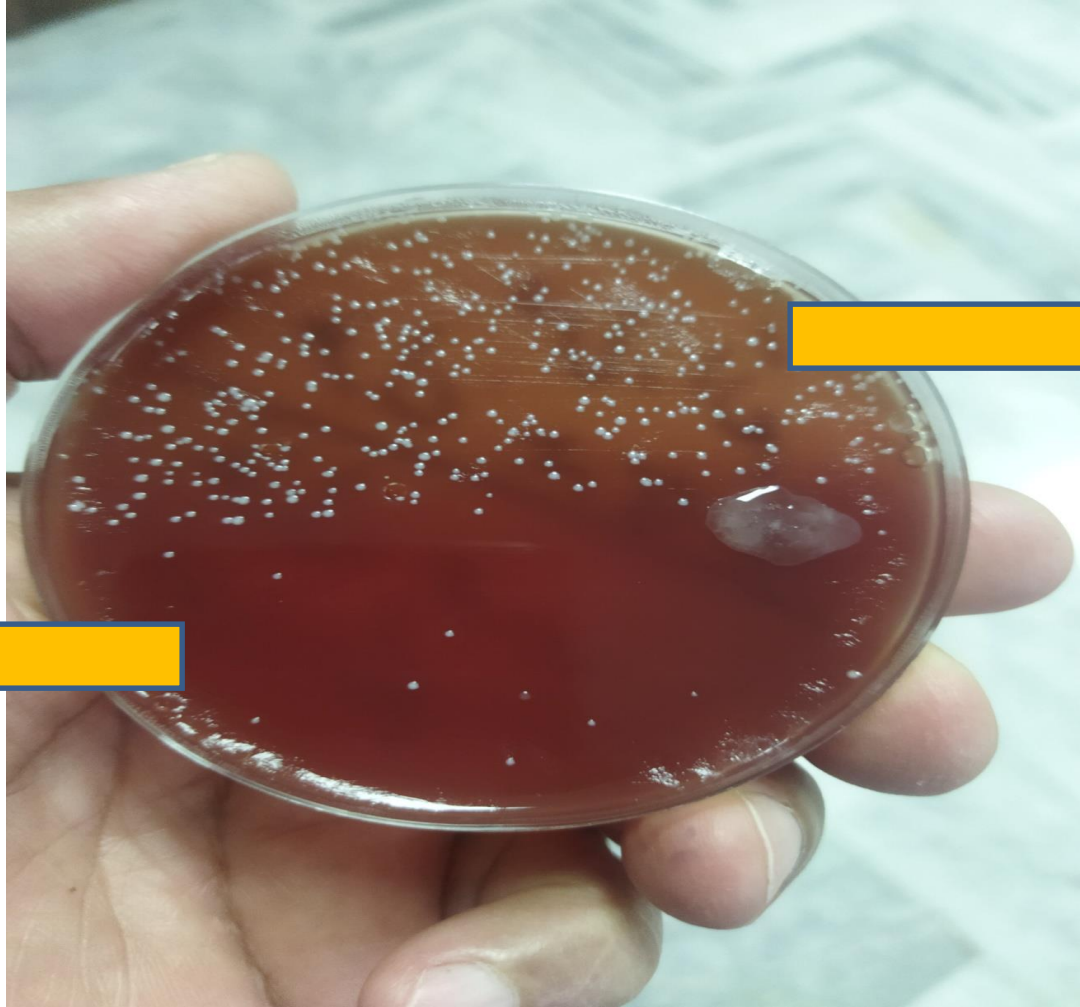
It has been found that each false positive result can lead to:

- Increased length of stay - on average 1 day.
- 39% increase in intravenous antibiotic charges.
- \$5,000 to \$8,720 additional charges.
- 20% increase in laboratory charges.
- 3 days longer on antibiotics

# کشت راندوم از دست پرسنل بیمارستان



# نقش الکل در ضد عفونی دست



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با تشکر از توجه شما