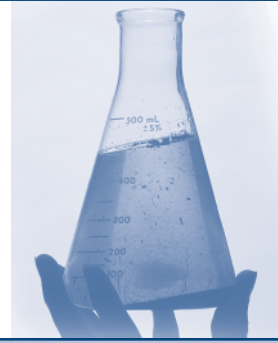


# LAB NOTES



## Blood Culture Contamination

Physicians rely heavily on blood culture results to diagnose and monitor febrile patients. Few results can have such a profound effect on patient care as an erroneous blood-culture report. Therefore, controlling the rate with which bacteria external to the patient contaminates blood culture is critical. Poor collection techniques can result in introducing organisms into blood-culture bottles and mislead physicians into thinking that patients have potentially life-threatening bacteremia when, in fact, they do not. The results of such misleading findings can be measured in both financial and human terms. Positive blood cultures, regardless of the source of the infection require physicians to act quickly. Doctors must decide if the culture results are consistent with the patient's condition and clinical symptoms or if the results reflect possible contamination.

According to the standards of the American Society for Microbiology, the rate of blood culture contamination should not exceed 3%.<sup>1</sup> If the rate is creeping beyond 3% it is an indication that blood cultures are not being collected with proper attention to aseptic technique.<sup>1</sup> Fortunately, indicators exist that can alert caregivers that the specimen might have been contaminated during collection or processing. These indicators include:

**Frequency:** Blood cultures that are legitimately positive (that is, contain growth from in vivo bacteria) typically have growth in every set collected. If sets of cultures collected demonstrate growth, it is probable that the patient has a rampant bacterial infection. Conversely, growth in only one of the bottles suggests contamination.<sup>1</sup>

**Gram-stain results:** Gram stains from positive cultures that demonstrate characteristics of normal skin flora should be suspect. (Ex. Gram-positive cocci in clusters indicates staphylococci.) Gram-stain morphology alone is not reason enough to dismiss the culture as contaminated because some normal flora can cause septicemia.<sup>1</sup>

**Elevated WBC count/abnormal differential:** Legitimately positive blood cultures are often accompanied by an elevated WBC and provide evidence that a cellular response to an infection is taking place. Additionally, a left shift in the differential (>10% bands) with or without an elevated WBC adds credibility to a positive blood culture. The absence of these indicators is a vote against a legitimately positive culture.<sup>1</sup>

**Multiple organisms isolated:** True septicemias are almost exclusively caused by an infection with a singular organism. Multiple-organism infections can occur; however, the presence of two or more organisms is usually the result of poor site preparation.<sup>1</sup>

**Patient symptoms:** Legitimately septic patients are constantly or occasionally febrile. The absence of a temperature in the presence of positive blood cultures raises questions about the validity of the culture results.<sup>1</sup>

**Time required for growth to become detectable:** Patients who are legitimately septic often demonstrate immediate growth in their blood-culture bottles. Assuming sufficient volumes of blood have been inoculated into the bottles, bacteria should multiply to detectable levels within 48 hours.<sup>2</sup> Growth that is slow indicates that only a miniscule number of organisms have been inoculated into the bottle, which is typical of collections contaminated from external sources.<sup>2</sup>

If the indicators (listed above) exist in combination, contamination is suggested. All of these factors should be reviewed carefully by the physician before treating the patient for septicemia.

Certain factors have a critical bearing on drawing a blood culture specimen. These factors include:

✓ **Personnel.** Appropriately trained personnel drawing blood cultures significantly reduces the contamination rates.

✓ **Site selection.** The location of the collection site has a significant impact on the potential for a culture to be contaminated. Draws from vascular-access devices, such as arterial lines, central venous catheters, and heparin locks have been shown to result in high contamination rates.<sup>3</sup> Because these ports pass through the skin and remain there for long periods of time, they are susceptible to bacterial colonization. Colonized bacteria multiply and accumulate in and around invasive ports, and can be pulled into blood specimens drawn from those sites. To confirm that a positive blood culture is caused by colonization, a second blood culture must be drawn at the same time by skin puncture and the results compared. A negative culture by venipuncture, in conjunction with a positive culture by line draw, confirms colonization, whereas positive cultures drawn from both sites confirm septicemia. If the culture collected by venipuncture is contaminated because of poor technique, then it becomes, necessary to compare the organisms isolated to determine if true septicemia exists.<sup>3</sup>

✓ **Site preparation.** A septic site preparation is the single most important factor in collecting uncontaminated blood cultures. Iodine-based antiseptics, used along with isopropyl alcohol, have become the industry standard for preparing puncture sites.<sup>3</sup>

✓ **Blood-collection volume.** Collecting inadequate volumes reduces the potential to harvest organisms causing septicemia. If the collection yields less than the minimum volume for both aerobic and anaerobic bottles, it is recommended to fill the aerobic bottle to maximum volume (preferred over dividing lesser amounts between the two bottles.)<sup>3</sup>

In conclusion, the human and financial costs associated with contaminated cultures can be significantly reduced by sufficiently educating healthcare professionals on the correct techniques for obtaining a specimen for a blood culture. Remember, quality starts with the collector.



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1. Medical Laboratory Observer, "Controlling blood culture contamination rates" by Dennis J. Ernest, MT (ASCP) March 2004-Vol. 36-No. 3 Pg 14-18
2. Bates D, Lee T. Rapid classification of positive blood culture: prospective validation of a multivariate algorithm. JAMA. 1992;267(4): 1962-1966.
3. Bates DW, Goldman L, Lee TH. Contaminant blood cultures and resources utilization: the true consequences of false-positive results. JAMA. 1991;265:365-369.