

NEWSLETTER

Best Practices in Blood Culture Collection

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Catheter drawn cultures, right or wrong?



Best practice in blood culture has always emphasized on withdrawing blood sample from direct venipuncture site instead of from catheter to reduce contamination rate. Contamination of blood cultures causes diagnostic confusion and sometimes leads to unnecessary use of antimicrobial agents. In this newsletter, we would like to look into the evidences showing that catheter-drawn blood cultures are more likely to be contaminated.

Everts *et al* 2001 assessed the risk of contamination by undertaking a 2-year retrospective study involving 1,408 matched pairs of simultaneous catheter-drawn and venipuncture blood cultures. The samples collected from both sites were from the same patient within a 20-min time span. Blood for culture was inoculated into media for processing in a Bactec 9240 or BacT/ALERT automated blood culture system and incubated either until microbial growth was

detected or for 5 days.¹

The study had showed that higher rate of contamination of cultures collected by intravascular catheter was statistically significant ($P = 0.001$ by the chi-squared test). Contamination rates for individual intravascular catheter types were as follows: Implantable ports was 7 of 166 (4.2%); subcutaneous tunneled and cuffed central venous catheters was 21 of 767 (2.7%); non-cuffed, nontunneled central venous catheters was 16 of 245 (6.5%); unspecified central venous catheters was 0 of 31; peripherally inserted central venous catheters was 3 of 57 (5.3%); and arterial catheters was 7 of 142 (4.9%).¹

The contaminating microorganisms isolated from catheter-drawn samples were more diverse (included 33 coagulase-negative staphylococci, 6 diphtheroids, 5 viridans group and nonhemolytic streptococci, 4 enterococci, 2 *Staphylococcus aureus* isolates and 1 isolate each of *Micrococcus sp.*, *Lactobacillus sp.*, *Propionibacterium sp.*, *Escherichia coli*, *Clostridium perfringens*, *Veillonella sp.*, *Bacteroides sp.*, mixed gram-positive bacteria, and *Candida sp.*) than those isolated from venipuncture samples (included 21 coagulase-negative staphylococci, 2 isolates of *Micrococcus sp.*, and 1 isolate each of *Propionibacterium sp.*, *Bacillus sp.*, *Peptostreptococcus sp.*, and *Clostridium*

septicum).¹

Stohl *et al* 2011 compared the blood culture results taken at central venous catheter (CVC), at arterial line insertion, and from peripheral venipuncture. Results of 14,589 blood cultures, including 2,736 (19%) CVC, 1,513 (10%) arterial line, and 10,340 (71%) peripheral cultures taken over 5.5 years in two ICUs (general and medical) were analyzed. The study showed that CVC cultures were contaminated more frequently than arterial line or peripheral cultures (225/2,736 [8%] CVC, 48/1,513 [3%] arterial line, and 378/10,340 [4%] peripheral cultures [$P < 0.001$ for CVC versus peripheral and CVC versus arterial line cultures]). Besides, true pathogens were found more frequently in CVC insertion cultures (334/2,736 [12%] CVC, 155/1,513 [10%] arterial line, and

795/10,340 [8%] peripheral cultures [$P < 0.001$ for CVC versus peripheral cultures; $P = 0.055$ for CVC versus arterial line cultures; $P < 0.001$ for peripheral versus arterial line cultures]). Contamination and true-positive rates were similar for culture sets from the two ICUs for each given culture source. Although strict aseptic techniques and sterility has been taken extra precaution during central line insertion, the blood cultures taken from this site were still showing higher contamination rate than those taken either from peripheral or arterial line.²



Diagnosis of Catheter-Related Sepsis in ICU using Differential Quantitative Blood Cultures



Quilici *et al* 1997 studied over a period of 2 years with a sample pool size of 283 central venous catheters (CVC) inserted in 190 adult patients, to compare differential blood cultures and quantitative catheter tip cultures for the diagnosis of catheter-related sepsis. Generally when a patient in the ICU becomes febrile, infection of CVC is suspected and catheter is removed. In this study, immediately before removal of the central venous catheters, blood cultures were performed with blood drawn simultaneously from the catheter and the peripheral vein (this technique is termed as differential blood culture). After removal, quantitative catheter culture was performed according to the Brun-Buisson modified Cleri technique. Results showed that fifty-five quantitative catheter cultures were positive. They were classified as contaminated ($n = 18$), colonized ($n=23$), or infected ($n = 14$). Differential blood cultures correctly identified 13 infections. With a catheter/peripheral cfu ratio of 8, differential blood cultures had a sensitivity of 92.8% and a specificity of 98.8%. When the catheters were

removed because of suspected infection, differential blood cultures had a sensitivity of 92.8% and a specificity of 100%. In summary, differential blood culture can be employed as an effective technique in diagnosis of catheter-related sepsis in patients in the intensive care unit.³

Conclusion:

All studies have shown that catheter-drawn blood cultures are more prone to contamination as compared to the blood culture taken from peripheral venipuncture site. It is highly recommended that catheter-drawn sample is only taken when direct venipuncture is not possible or safe.



Reference:

1. Everts RJ, Vinson EN, Adholla PO and Reller LB. 2001. Contamination of Catheter-Drawn Blood Cultures. *Journal of Clinical Microbiology*. 39;3393-3394.
2. Stohl S, Benenson S, Sviri S, Avidan A, Block C, Sprung CL and Levin PD. 2011. Blood cultures at central line insertion in the intensive care unit; Comparison with peripheral venepuncture. *JCM*. 2011, 49(7)2398-2403.
3. Quilici N, Audibert G, Conroy MC, Bollaert PE, Guillemin F, Welfringer P, Garric J, Weber M and Laxenaire M-C. Differential quantitative blood cultures in the diagnosis of catheter-related sepsis in intensive care units. *Clin. Inf. Dis*. 1997;25:1066-70.