

Editor's Note: Authors are invited to respond to Correspondence that cites their previously published work. Those responses appear after the related letter. In cases where there is no response, the author of the original article declined to respond or did not reply to our invitation.

Taking a Closer Look



Collection of Blood Cultures From Arterial Catheters and Venipuncture in the ICU

To the Editor:

I read with great interest the article published by Nakayama et al¹ in *CHEST* (July 2023) that compared the contamination rate of blood cultures obtained from arterial catheters and venipuncture in critically ill patients with suspected bloodstream infection. In this multicenter prospective diagnostic study, authors restricted the enrollment of patients to hospitals at which the ICU contamination rate was less than 3%. They concluded that the contamination proportion of blood cultures collected from arterial catheters was noninferior to that by venipuncture. Authors identified 41 of the 590 episodes (6.9%) had a true bacteremia, and only six of the 590 episodes (1%) were considered to be contamination (arterial catheter [0.3%] vs venipuncture [0.7%]).

In this study, the median length of ICU stay, at the time of blood culture collection, was 2.0 days (interquartile range, 1.0 to 4.0 days). In addition, the time from arterial catheter placement to blood culture collection was 0 to 4 days in most patients (84%), followed by 5 to 9 days and ≥ 10 days in 12% and 3.4% of patients, respectively. Given that the proportion of patients with ICU stay and dwelling time of the arterial catheter longer than 4 days were underrepresented in the current study, it would be concerning to apply the results of this study to all patients admitted to the ICU without taking into account the catheter use days and the associated increased risk of contamination with longer catheter indwelling time. A study by Khalifa et al² demonstrated that the risk factors for arterial catheter colonization increased in proportion to the duration of catheter use. Another limitation of the study is that 64% of patients were exposed to IV antibiotics within 5 days prior to blood culture collection, which has likely affected the rate of positive blood cultures. The prior use of

antibiotics might have influenced the power of the study because many patients with true bacteremia were missed, despite bloodstream infections that were suspected. Of interest, a study published by Komori et al³ demonstrated that the rate of bacteremia was 54.5% among patients admitted to the ICU with sepsis. Additionally, looking at the isolated pathogens with discordant results, coagulase-negative *Staphylococcus* species bacteria constitute the main organisms labeled as contaminant. It would have been informative to know if the *Staphylococcus* species were isolated in patients with catheters in place longer than 4 days. I believe there are some uncertainties in the study, including the actual rate of true bacteremia in these critically ill patients and the increase proportion of biofilm formation in patients with long catheter dwelling time.⁴ Moreover, the results of this study might not be applied to critically ill surgical patients.⁵ Therefore, health care practitioners should be more cautious in interpreting or generalizing the results of this study to patients admitted to ICU.

Changing the best clinical practice for blood culture collection in the ICU to obtain from arterial catheters remains an important clinical question. The study would have benefited from enhanced subset of patients with longer catheter dwelling time, including surgical and medical ICU from various institutions that follow the standard sterile measures, without taking into consideration the contamination proportion prior to enrollment to avoid a selection bias.

Alexandre E. Malek, MD
Shreveport, LA

AFFILIATIONS: From the Department of Medicine, Division of Infectious Diseases, Louisiana State University Health.

CORRESPONDENCE TO: Alexandre E. Malek, MD; email: alex.e.malek@gmail.com

Copyright © 2023 American College of Chest Physicians. Published by Elsevier Inc. All rights reserved.

DOI: <https://doi.org/10.1016/j.chest.2023.07.4223>

Financial/Nonfinancial Disclosures

None declared.

References

1. Nakayama I, Izawa J, Gibo K, et al. Contamination of blood cultures from arterial catheters and peripheral venipuncture in critically ill

patients: a prospective multicenter diagnostic study. *Chest*. 2023;164(1):90-100.

2. Khalifa R, Dahyot-Fizelier C, Laksiri L, et al. Indwelling time and risk of colonization of peripheral arterial catheters in critically ill patients. *Intensive Care Med*. 2008;34(10):1820-1826.
3. Komori A, Abe T, Kushimoto S, et al. Characteristics and outcomes of bacteremia among ICU-admitted patients with severe sepsis. *Sci Rep*. 2020;10(1):2983.
4. Passerini L, Lam K, Costerton JW, King EG. Biofilms on indwelling vascular catheters. *Crit Care Med*. 1992;20(5):665-673.
5. Martinez JA, DesJardin JA, Aronoff M, Supran S, Nasraway SA, Snyderman DR. Clinical utility of blood cultures drawn from central venous or arterial catheters in critically ill surgical patients. *Crit Care Med*. 2002;30(1):7-13.

Response



To the Editor:

We agree with Dr Malek that readers should not apply our study results blindly to all patients who are admitted to the ICU.¹ Contamination of arterial catheter-drawn blood samples is assumed to increase with the known risk factors for catheter tip colonization, such as femoral artery placement, long dwelling time, or placement in the ED.² The results should be applied with caution to populations in which these risk factors are more prevalent than that of the current study.

Among episodes judged as contamination in arterial catheter-drawn samples, the arterial catheter indwelling time was 3 days in an episode with *Staphylococcus capitis* and *S epidermidis* and 8 days with *Corynebacterium striatum*.

At this point, we disagree with the argument about critically ill surgical patients. The previous study cited in the letter indeed suggested that blood cultures drawn from arterial catheters and by venipuncture had comparable contamination proportions in surgical patients.³ We included 148 surgical patients (24.8% of participants) and demonstrated the noninferiority of blood cultures drawn from arterial catheters. Rather than the ICU admission category (eg, medical vs surgical), an assessment of the characteristics of each arterial catheter is important when applying our study results.

Prior exposure to antibiotics does not compromise the power of our investigation. The major determinants of blood culture contamination are the quality of blood collection procedures and indwelling catheter care.⁴ The history of antibiotics exposure does not affect them. Further, the sample size of this study was

determined by the contamination proportion and not influenced by the proportion of true bloodstream infection. In addition, the purpose of our study is to compare contamination proportions between arterial catheter-drawn samples and venipunctures and not to estimate the proportion of bacteremia among critically ill patients with sepsis.

We intended to compare contamination proportions under the standard aseptic techniques; thus, we restricted study participation to hospitals with a contamination proportion < 3%. If a facility does not meet the conventional performance standard, it would be more reasonable to ensure that the standard aseptic techniques are followed before implementing collection through arterial catheters.⁵ After the standard performance is achieved, a practice change that balances accurate diagnosis and the burden of collection could be considered.

Izumi Nakayama, MD, PhD
Yokohama, Japan

AFFILIATIONS: From the Department of Public Health, Yokohama City University School of Medicine.

CORRESPONDENCE TO: Izumi Nakayama, MD, PhD; email: nakayama.izu.vd@yokohama-cu.ac.jp

Copyright © 2023 American College of Chest Physicians. Published by Elsevier Inc. All rights reserved.

DOI: <https://doi.org/10.1016/j.chest.2023.08.010>

Financial/Nonfinancial Disclosures

See earlier cited article for author conflicts of interest.

References

1. Nakayama I, Izawa J, Gibo K, et al. Contamination of blood cultures from arterial catheters and peripheral venipuncture in critically ill patients: a prospective multicenter diagnostic study. *Chest*. 2023;164(1):90-100.
2. O'Horo JC, Maki DG, Krupp AE, Safdar N. Arterial catheters as a source of bloodstream infection: a systematic review and meta-analysis. *Crit Care Med*. 2014;42(6):1334-1339.
3. Martinez JA, DesJardin JA, Aronoff M, Supran S, Nasraway SA, Snyderman DR. Clinical utility of blood cultures drawn from central venous or arterial catheters in critically ill surgical patients. *Crit Care Med*. 2002;30(1):7-13.
4. Doern GV, Carroll KC, Diekema DJ, et al. Practical guidance for clinical microbiology laboratories: a comprehensive update on the problem of blood culture contamination and a discussion of methods for addressing the problem. *Clin Microbiol Rev*. 2019;33(1):e00009-19.
5. Garcia RA, Spitzer ED, Beaudry J, et al. Multidisciplinary team review of best practices for collection and handling of blood cultures to determine effective interventions for increasing the yield of true-positive bacteremias, reducing contamination, and eliminating false-positive central line-associated bloodstream infections. *Am J Infect Control*. 2015;43(11):1222-1237.