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Letter to the Editor

Is it useful to culture the intravascular catheter tip for management of central line-associated bloodstream infections?

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Introduction

Intravascular catheter tip culture (TC) has been used as a reference standard in order to identify central venous catheters (CVCs) as the source of bloodstream infections, as recommended by Maki et al. in 1977.[1] Recently, several concerns have been raised regarding the clinical utility of catheter TC for diagnosing catheter-related bloodstream infections (CRBSI). The overculturing the catheter tip in cases with low pre-test probabilities of infection may lead to poor positive predictive values (23%–55%) and increased costs.[2,3] Poor predictive value in catheter TC can lead to unnecessary antibiotic treatments, the development of antibiotic resistance, and reimbursement penalties for potentially false positive CRBSIs.[3] However, some argue that catheter TC can be clinically useful because a positive result indicates that the infection source has been removed, potentially allowing for a shorter duration of antimicrobial therapy. We have evaluated the effect of intravascular catheter TC on the management and outcomes of central line-associated bloodstream infections (CLABSIs).

Methods

We conducted a retrospective chart review of all adult patients (≥18 years) with CLABSIs, defined as the recovery of a pathogen from a blood culture (or from two blood cultures in cases of skin contamination) in a patient who had a CVC within 48 hours before the onset of a bloodstream infection (BSI), with no other identifiable source of infection.[4] The decision to perform catheter TCs for removed CVC was at the physicians' discretion. The Institutional Review Board of Kyung Hee University Hospital approved this study (2021-09-041) and the requirement for informed consent was waived because of the retrospective nature of the study.

Clinical outcomes were compared between the catheter TC-positive and TC-negative groups using the following measures: microbiological failure, 30-day mortality, and complicated infection. Microbiological failure was defined as persistent bacteremia/candidemia beyond 72 h after CVC removal or the relapse of bacteremia/candidemia within 30 days of the index blood culture. Complicated infection was defined as the presence of infective endocarditis, septic thrombophlebitis, endophthalmitis or metastatic infection within 12 weeks of an initially positive blood culture result. Cases with removal of CVC >2 days after the onset of bacteremia/candidemia were classified as having delayed CVC removal.

Results

During the study, of the 476 CLABSI episodes, catheter TC results were available for 361 cases and unavailable for 115 (Table S1). Among the 361 results, 233 (64.5%) were positive, and 122 (33.8%) were negative. Six catheter TCs (1.7%) grew different pathogens than those isolated from the blood cultures (Table S2). Empiric antimicrobial agents were modified based on blood culture results in 119 cases (33.0%) and based on TC results in 9 cases (2.5%). Factors associated with TC positivity are shown in Table 1. In this analysis, we classified the six discrepant TC results as negative TCs. In a multivariate logistic regression analysis, independent factors associated with negative TC results included a Charlson Comorbidity Index (CCI) score of ≥4 (OR 2.25; $P = 0.002$), neutropenia (OR 7.77; $P = 0.003$), chlorhexidine–silver sulfadiazine-impregnated CVCs (OR 2.59 compared with standard CVC; $P < 0.001$), and delayed CVC removal (OR 1.97; $P = 0.008$).

The median duration of the antimicrobial therapy did not differ between TC-positive and TC-negative cases in CLABSI due to *S. aureus* (13 vs. 20 days; $P = 0.61$), coagulase-negative staphylococci (10 vs. 9 days; $P = 0.81$), *Enterococcus* species (9 vs. 8 days; $P = 0.81$), gram-negative bacilli (5 vs. 11 days; $P = 0.50$), and *Candida* species (14 vs. 15 days; $P = 0.49$). Clinical outcomes were found to be similar between the TC-positive and TC-negative groups, including the rates of microbiological failure (17.2% vs. 10.2%; $P = 0.10$), 30-day mortality (21.6% vs. 22.7%; $P = 0.91$), and complicated infection (6.4% vs. 6.2%; $P = 0.99$).

Discussion

In this study, the TC positivity rate was 64.5% for all the CLABSI episodes. This rate further decreased in patients with a CCI score of ≥4, those with neutropenia, those with antiseptic-impregnated CVCs, and when CVCs were removed with delays of ≥2 days. In most cases, modification of antimicrobial therapy was based on blood culture results rather than TC results. A recent study showed that antibiotic modifications were made in only 2% (2 out of 88) of cases with positive TCs.[5] Previous studies have suggested that the duration of antimicrobial therapy for uncomplicated CLABSI due to *S. aureus,* coagulase-negative staphylococci, and

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Table 1. Comparison of clinical characteristics of patients with CLABSI based on positive and negative catheter tip cultures

Characteristic	Negative tip culture(n = 128)	Positive tip culture(n = 233)	P value [a]
Age, years	70 (58–78)	68 (57–75)	0.35
Male gender	61 (47.7)	120 (51.5)	0.56
BMI, kg/m2	23 (20–27)	23 (21–26)	0.82
Underlying diseases			
Cerebrovascular accident	56 (43.8)	96 (41.2)	0.72
Diabetes mellitus	47 (36.7)	69 (29.6)	0.21
Solid tumor	33 (25.8)	68 (29.2)	0.57
Hematologic malignancy	13 (10.2)	10 (4.3)	0.05
End stage renal disease	2 (1.6)	18 (7.7)	0.03
Liver cirrhosis	10 (7.8)	8 (3.4)	0.12
Charlson comorbidity index score	3 (2–5)	2 (1–4)	0.001
Underlying conditions			
Hospital stay until onset of CLABSI, days	22 (11–46)	24 (17–57)	0.20
ICU stay at onset of bacteremia, days	49 (38.3)	55 (23.6)	0.005
Previous surgery[b]	29 (22.7)	48 (20.6)	0.75
Previous chemotherapy[b]	13 (10.2)	15 (6.4)	0.29
Previous immunosuppressant use[b]	10 (7.8)	3 (1.3)	0.002
Neutropenia at onset of bacteremia	10 (7.8)	3 (1.3)	0.002
Organism			
Staphylococcus aureus	11 (8.6)	44 (18.9)	0.01
Coagulase-negative staphylococci	55 (43.0)	65 (27.9)	0.005
Enterococcus species	6 (4.7)	6 (2.6)	0.36
Gram-negative bacilli	14 (10.9)	21 (9.0)	0.69
Candida species	41 (32.0)	94 (40.3)	0.15
Other	1 (0.8)	3 (1.3)	0.99
CVC			
CVC dwell time, days	13 (7–21)	17 (11–27)	0.004
Long-term catheterization (≥30 days)	20 (15.6)	47 (20.2)	0.36
Tunneled CVC	13 (10.2)	26 (11.2)	0.91
CHSS-impregnated CVC	90 (70.3)	128 (54.9)	0.006
Subclavian vein	102 (79.7)	186 (79.8)	0.99
Internal jugular vein	25 (19.5)	44 (18.9)	0.99
Femoral vein	1 (0.8)	2 (0.9)	0.99
Peripheral vein	0	1 (0.4)	0.99
Delayed CVC removal (>2 days)	62 (48.4)	76 (32.6)	0.004
Effective antibiotics before CVC removal[c]	86 (67.6)	127 (54.5)	0.03
Management			
Antibiotic modification based on blood culture results	43 (34.4)	76 (32.6)	0.82
Antibiotic modification based on tip culture results	9 (3.9)	0	0.03
Duration of antibiotic therapy			
S. aureus ($n = 55$)	13 (11–22)	20 (10–22)	0.61
Coagulase-negative staphylococci ($n = 120$)	10 (5–13)	9 (4–14)	0.81
Enterococcus species ($n = 12$)	9 (1–16)	8 (0–13)	0.81
Gram-negative bacilli ($n = 35$)	5 (0–20)	11 (9–14)	0.50

(*Continued*)

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Table 1. (*Continued*)

Characteristic	Negative tip culture(n = 128)	Positive tip culture(n = 233)	P value [a]
Candida species (*n* = 135)	14 (11–19)	15 (12–21)	0.49
Outcome			
Microbiological failure	13 (10.2)	40 (17.2)	0.10
Persistent bacteremia or candidemia	10 (7.8)	36 (15.5)	0.06
Relapsed bacteremia or candidemia	3 (2.3)	7 (3.0)	0.99
30-day mortality	29 (22.7)	50 (21.6)	0.91
Complicated infection	8 (6.2)	15 (6.4)	0.99

The data are presented as no. (%) of patients or median (interquartile range), unless otherwise indicated.
Abbreviations: BMI, body mass index; CHSS, chlorhexidine–silver sulfadiazine; CLABSI, central line-associated bloodstream infection; CVC, central venous catheter; ICU, intensive care unit.
[a]Categorical variables were compared using either the chi-squared test or Fisher's exact test, while continuous variables were compared using the Mann–Whitney U-test.
[b]Within 1 month before the onset of CLABSI.
[c]Defined as receiving at least one *in vitro* active antibiotic for at least 24 h.

gram-negative bacteria may be shortened if the CVC is removed.[6–8] Our data indicated that the duration of antimicrobial therapy, according to the causative pathogens, did not differ between the positive and negative TC groups. In addition, a more useful approach for length of treatment decisions appears to ensure that blood cultures are cleared within 72 hours.[9] A prospective cohort study of 724 *S. aureus* bacteremia revealed that the strongest predictor of complicated infection was a positive follow-up blood culture result at 48 to 96 hours.[10] In this study, outcomes including microbiological clearance, mortality, and complicated infection did not differ between the positive and negative catheter TC groups. This study has several limitations. First, our inclusion criteria—specifically, selecting CLABSI cases with available TC results—and the differences in patient characteristics between cases with and without TC (Table S1) may have influenced the study results. Second, the sample size was too small to provide sufficient statistical power for analyzing differences in the duration of pathogen-specific therapy. Based on our findings, catheter TC results do not seem to influence patient management and outcomes in patients with CLABSI.

Supplementary material. To view supplementary material for this article, please visit https://doi.org/10.1017/ice.2025.10215

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Competing interests. The authors report no conflict of interest.

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