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ORIGINAL ARTICLE

Limited utility of blood cultures in the management of febrile outpatient kidney transplant recipients



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Abstract *Background/Purpose:* Blood cultures for patients suspected of having bacteremia are standard practice, although several studies demonstrate that blood cultures have limited utility because of a low true-positive rate and infrequent resultant changes in antibiotic treatment. However, most reports exclude immunocompromised patients such as transplant recipients. We assessed the utility of blood cultures in transplant recipients hospitalized for community-acquired infections and evaluated clinical characteristics to predict bacteremia. *Methods:* This retrospective study included 136 febrile cases in 97 kidney transplant recipients admitted to our hospital for whom blood cultures were performed between February 2001 and March 2013.

Results: Among the 136 cases, blood cultures were positive, contaminated, and negative in seven (5.1%) cases, 12 (8.8%) cases, and 117 cases (86.1%), respectively. All bacteria detected in the seven cases were sensitive to the initial empirical antibiotics. Antibiotic treatment was changed based on the blood culture results only in one case for which the coverage was narrowed. The white blood cell count and C-reactive protein level were significantly higher in the patients with bacteremia. The predictive model based on these two factors successfully identified the high-risk group with a sensitivity and specificity of 86% and 91%, respectively.

Conclusion: Among the outpatient kidney transplant recipients, positive blood cultures were uncommon and scarcely affected antibiotic therapy, especially in patients with upper respiratory tract or urinary tract infections. Therefore, it may be reasonable to perform blood

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cultures only for patients with marked leukocytosis and high C-reactive protein level, even among transplant recipients.

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Introduction

Transplant recipients are immunocompromised patients who receive several kinds of immunosuppressive drugs, which makes them susceptible to infection. Therefore, they are likely to require inpatient hospital care for the treatment of community-acquired infections during long-term post-transplantation follow up. Taking blood cultures of patients suspected of having bacteremia is the standard practice. Several guidelines recommend performing blood cultures for patients with community-acquired infections, especially pneumonia.^{1–4} However, no well-designed randomized studies actually support these recommendations. Furthermore, several studies demonstrate that blood cultures have limited utility because of the low true-positive rate and infrequent resultant changes in management.^{5–17} However, most of those reports exclude immunocompromised patients such as transplant recipients.^{6,7,12–14,18–20} Several studies describe the incidence of bacterial infections in febrile outpatient pediatric transplant recipients,^{21,22} although the actual utility of blood cultures for transplant recipients with community-acquired infections remains unknown.

Solid organ transplantation is a general treatment, and the number of transplant recipients is increasing. As a result, febrile transplant recipients are frequently examined in any emergency department. Since 1976, approximately 700 kidney transplantations have been performed in our hospital. Most transplant recipients have been followed at our outpatient department. During the long-term follow up of organ transplant recipients, community-acquired infections are a common and significant cause of patients requiring inpatient hospital care. Transplant recipients with infections were examined and treated in cooperation with a pulmonologist and infection control doctors in our hospital. Among kidney transplant recipients, the empiric therapy is penicillin and cephem antibiotics because of their safety and usability.

It is extremely important to know if and for whom blood cultures should be performed. Therefore, in this study, we assessed the utility of blood cultures for febrile outpatients who have received kidney transplants, and we created a predictive model to determine if the clinical characteristics of these patients influence the blood culture results.

Methods

Study population

We retrospectively identified 299 post-transplant patients who required inpatient hospital care and had at least one

blood culture drawn in our hospital between February 2001 and March 2013. Fever was defined as a body temperature of $\geq 38^{\circ}\text{C}$. We excluded patients for whom blood cultures were drawn 24 hours after the admission ($n = 155$) and patients who had a body temperature $< 38^{\circ}\text{C}$ ($n = 8$). One hundred and thirty-six febrile cases of community-acquired infections among 97 kidney transplant recipients were ultimately included. The local institutional internal review board approved this study.

Blood cultures and definitions

Among the included cases, all blood cultures were obtained from patients in the outpatient department or within the 1st day after hospital admission. The cultures were tested by the Oxoid Signal Blood Culture System (Oxoid, UK). The results of blood cultures were classified as “positive,” “negative,” or “contaminated.” Specimens were considered contaminated if bacteria from normal skin flora (e.g., *Staphylococcus epidermidis*) was detected and the experienced clinicians and infection control doctors evaluated the result as contamination. Contamination was considered a negative result. Pneumonia was defined as the presence of a new pulmonary infiltrate. Upper respiratory tract infection was defined as the presence of cough or sore throat without abnormal chest X-ray findings.

Immunosuppressive regimens

Maintenance immunosuppressive treatment consisted of one to three drugs such as prednisolone, a calcineurin inhibitor (e.g., tacrolimus or cyclosporine), and antimetabolic agents (e.g., mycophenolate mofetil, mizoribine, or azathioprine).²³

Statistical analysis

The statistical significance of normally distributed, skewed, and dichotomous data was determined by using the Student *t* test, Wilcoxon signed rank test, and Fisher's exact test, respectively. Primary analysis was performed to assess the positivity rates of blood cultures and resultant changes in antibiotic treatment. Secondary analysis was meanwhile performed to identify the group at high risk of bacteremia by comparing the characteristics of patients with and without bacteremia. Predictive discrimination for positive blood cultures was assessed by receiver-operating characteristic (ROC) curve analysis based on maximizing sensitivity and specificity. All analyses were performed using JMP Pro 11 (SAS Institute, Cary, NC, USA). The level of significance was set at $p < 0.05$.

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