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Rectal culture screening for vancomycin-resistant enterococcus in chronic haemodialysis patients: false-negative rates and duration of colonisation

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SUMMARY

Infection or colonisation with vancomycin-resistant enterococci (VRE) is common in chronic haemodialysis (HD) patients. However, there is limited information on the duration of VRE colonisation or on the reliability of consecutive negative rectal cultures to determine the clearance of VRE in chronic HD patients. Chronic HD patients from whom VRE was isolated were examined retrospectively. Rectal cultures were collected more than three times, at least one week apart, between 1 June 2003 and 1 March 2010. The results of the sequential VRE cultures and patients' data were analysed. Among 812 patients from whom VRE was isolated, 89 were chronic HD patients and 92 had three consecutive negative cultures. It took 60.7 ± 183.9 and 111.4 ± 155.4 days to collect three consecutive negative cultures in the 83 non-chronic haemodialysis patients and nine chronic HD patients, respectively ($P = 0.011$). The independent risk factors for more than three negative sequential rectal cultures were glycopeptide usage [odds ratio (OR): 2.155; $P = 0.003$] and length of hospital stay (OR: 1.009; $P = 0.001$). After three consecutive negative rectal cultures, two of six chronic HD patients and 10 of 36 non-HD patients were culture positive again. In conclusion, a significant proportion of patients colonised with VRE cannot be detected by three-weekly rectal cultures, and the duration of VRE colonisation in chronic haemodialysis patients tends to be prolonged. These results may be contributing to the continued increase in the prevalence of VRE.

Introduction

Hospital-acquired vancomycin-resistant enterococcal (VRE) infections are increasingly common and difficult to treat.[1] Patients with VRE infections, as well as asymptomatically colonised patients, may serve as a reservoir for the transmission of VRE to other patients.[1] Because dialysis-dependent patients have extensive contact with the healthcare system, they are often in close proximity to other VRE reservoirs. In addition, these patients often receive repeated, prolonged courses of antibiotics, including vancomycin, and frequently have multiple comorbid conditions.[2] Therefore, patients with end-stage renal disease (ESRD) undergoing dialysis have an increased risk of acquiring VRE. A recent study reported that 17.8% of haemodialysis patients became colonised with VRE and had an incidence rate of one case per 9.8 patient-years of follow-up.[3] This high incidence of VRE suggests that practices within dialysis units may be a major driving force for the development and spread of VRE. Approximately 2–10% of VRE-colonised patients will develop infections, even though this rate may be as high as 30% among chronic immunocompromised patients, such as liver transplant recipients.[3,4] Since there is no effective antimicrobial therapy for VRE colonisation, strong efforts have been made to screen for VRE and isolate carriers when detected.[1] To prevent the spread of VRE, many guidelines recommend that healthcare providers use contact precautions during the care of colonised and infected patients until it can be demonstrated that they are no longer colonised.[5] Little is known about the persistence of VRE colonisation in patients with ESRD on

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haemodialysis treatment. This study examined the duration of VRE colonisation and the adequacy of consecutive negative follow-up rectal swab (RS) cultures to determine clearance in these patients.

Methods

Study design and population

Between 1 June 2003 and 1 March 2010, patients with VRE hospitalised at the 1088-bed Ajou University Hospital in Suwon, South Korea, were enrolled in this study. Ajou University Hospital has an average of 43 000 patient discharges per year. To follow the recommendations of the Centers for Disease Control and Prevention (CDC) on VRE, Ajou University Hospital uses private rooms and disposable gloves and gowns for the care of patients colonised with VRE, and has implemented follow-up rectal swab cultures at least a week apart.[6,7] A follow-up rectal culture was obtained on the first day following a patient being found to be culture-positive for VRE.

The inclusion criteria for this study were as follows: patients with VRE infection or colonisation identified by culture; and patients with more than three follow-up rectal cultures collected at least a week apart. Demographic information, VRE culture status, and information regarding antibiotic use were obtained from medical records. Information on cultures was collected from the date of the first known positive VRE culture through the date of the last available culture. Data on antibiotic use was collected for the two-week period before the initial VRE-positive culture was obtained.

Microbiology methods

Rectal samples were streaked on phenylethanol agar and CHROMagar™ VRE plates (Becton Dickinson, Sparks, MD, USA). The plates were incubated at 35 °C in ambient air and examined for growth at 24 and 48 h. From each plate, up to three colonies with the distinctive morphology of enterococci were subcultured to bile esculin azide agar (Becton Dickinson). The organisms were identified using the Vitek identification system (bioMérieux, Hazelwood, MO, USA), and the API Strep system (bioMérieux). Brain heart infusion agar containing 6 mg of vancomycin/mL was also inoculated, as described by the Clinical and Laboratory Standards Institute to enhance the detection of VRE. The minimum inhibitory concentrations of vancomycin and teicoplanin were determined using the E-test (AB Biodisk North America, Inc., Culver City, CA, USA); vancomycin-susceptible *Enterococcus faecalis* ATCC 29212 and vancomycin-resistant *E. faecalis* ATCC 51299 were used for quality control.

Analysis

The categorical variables were analysed using χ^2-test or Fisher's exact test. Continuous variables were analysed using *t*-test or Mann–Whitney test for non-parametric distributions. Logistic regression was used to calculate the odds ratio of the independent risk factors for VRE colonisation. All statistical analyses were performed using SPSS software (version 12.0; Chicago, IL, USA).

Results

During the study period (1 June 2003 to 1 March 2010), 812 out of 180 823 patients at Ajou University Hospital were VRE positive. There was no VRE outbreak among any hospital patients during this study period. Of the 812 positive patients, 453 had more than three follow-up rectal cultures one week apart. After two negative cultures, the next culture was negative in nine chronic HD patients and 83 non-chronic HD patients (Figure 1). Table I lists the demographic and clinical data for the patients who had at least three additional cultures. Compared to patients who were not on chronic HD, chronic HD patients were older ($P = 0.008$), more likely to have diabetes mellitus ($P = 0.002$), and more likely to have been treated with glycopeptides ($P < 0.001$) and less likely to be VRE positive on first follow-up rectal culture ($P < 0.001$). Table II shows that the chronic HD patients who were VRE negative on more than three consecutive rectal cultures were more likely to have been treated with glycopeptides ($P = 0.001$) and to have had a longer duration of glycopeptide therapy before becoming VRE positive ($P = 0.001$). Chronic HD patients were also likely to have a longer interval between the initial VRE-positive and three consecutive negative cultures ($P = 0.011$) with no significant difference in the number and length of time of the rectal cultures. Using logistic regression on all patients with more than three follow-up rectal cultures,

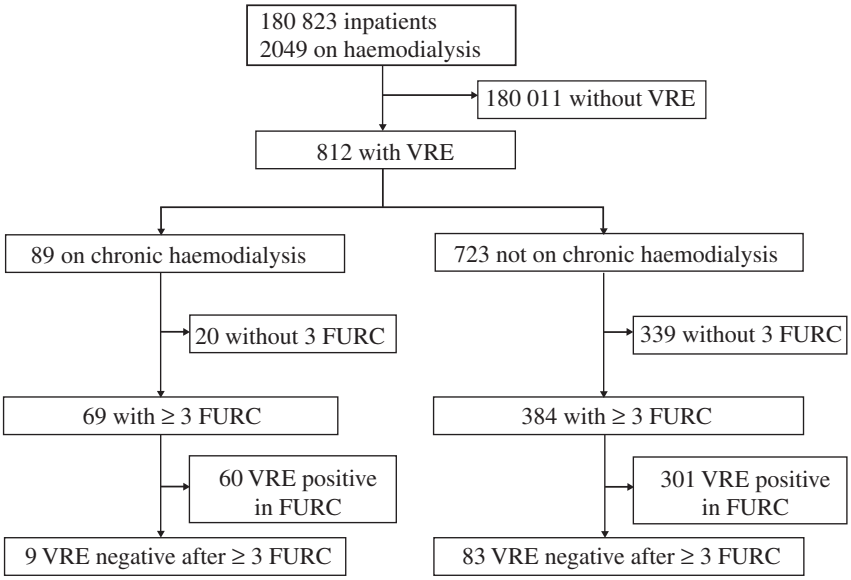

Figure 1. Number of patients in the study. VRE, vancomycin-resistant enterococci; FURC, follow-up rectal culture.