Comparison of Rectal and Perirectal Swabs for Detection of Colonization with Vancomycin-Resistant Enterococci

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Patients whose gastrointestinal tracts are colonized with vancomycin-resistant enterococci (VRE) may serve as a reservoir for nosocomial transmission. We compared the sensitivities and concordance of several methods used to detect VRE colonization. Eighty-two paired rectal and perirectal swabs were obtained from 13 patients over a 9-day period. The sensitivity of both rectal and perirectal swabs was 79%. There was 100% concordance of culture results between simultaneously obtained rectal and perirectal swabs, and the quantities of growth were similar by these two methods of detection. Our data suggest that rectal and perirectal swabs are equally sensitive for the detection of VRE colonization.

Over the past decade enterococci have emerged as the second most common nosocomial pathogen (8). Data from the National Nosocomial Infection Surveillance System documented an overall increase in vancomycin-resistant enterococci (VRE) from 0.3% of enterococcal isolates in 1989 to 7.9% in 1993 (3). This trend was most pronounced in intensive care units and at large university-affiliated hospitals. Outbreaks of infections with VRE in a variety of settings have been well described (1, 2, 6, 7, 10).

The first VRE isolate at our institution was identified in a blood culture specimen in July 1992, and since that time VRE have become endemic in several inpatient wards. A surveillance program has been instituted in these high-prevalence wards as part of our infection control program. Patients in these wards have weekly rectal swabs screened for VRE. Our surveillance and precaution policy is consistent with recommendations recently published by the Centers for Disease Control and Prevention (5). However, infection control programs based on surveillance cultures can be effective only if the cultures are sensitive for detection of the organism.

While data exist concerning the sensitivity of surveillance cultures for colonization with methicillin-resistant *Staphylococcus aureus* (9), the sensitivity of rectal swab cultures for the detection of colonization with VRE is not known, yet this is a commonly used method. Similarly, the usefulness of perirectal swabs, which are safer to perform on neutropenic patients and may be more acceptable to all patients, is unknown. This information is critical in formulating infection control policies, developing strategies for surveillance for VRE, and determining when a particular patient may be removed from precautions. We performed a study to determine the sensitivities of rectal and perirectal swabs for the detection of VRE and to evaluate the concordance of results from simultaneously obtained rectal swabs, perirectal swabs, and stool cultures.

(Some of the data contained in this report was presented at the 95th General Meeting of the American Society for Microbiology in May 1995 [11]).

Patients and methods. All patients enrolled gave verbal consent to participate in this study. In order to obtain approximately even numbers of patients with and without VRE colonization, we enrolled only patients whose colonization status was previously known via surveillance cultures. We also attempted to enroll only patients who would likely remain hospitalized during the entire duration of the study. On day 1, rectal swabs were obtained from all patients and stool cultures were requested. The combined results of these initial cultures determined whether the patient was placed into group A (positive for VRE) or group B (negative for VRE). Simultaneous rectal and perirectal swabs collected by the same investigator were then obtained on days 3, 4, 8, and 9. Repeat stool cultures were also requested during this 9-day period.

Specimens had patient identifiers removed and were streaked by the semiquantitative four quadrant method onto colistin-nalidixic acid plates (Becton Dickinson, Cockeysville, Md.) to assess the normal flora and campylobacter plates (Becton Dickinson, Cockeysville, Md.) containing 10 μg of vancomycin per ml to screen for VRE. Stool cultures were submitted in sterile containers and were directly plated with sterile swabs. After 24 and 48 h of incubation at 37°C, VRE were identified by Gram stain, the rapid bile esculin test, and the pyroglutamyl-β-naphthylamide test (4). The quantitation of VRE growth on the plates was defined in a standard fashion: 1+ represents growth only in the first quadrant streaked and so on up to a maximum of 4+ growth, when colonies were present in all four quadrants of the agar plate.

Definitions. Sensitivity was defined as the percentage of positive swabs obtained after day 1 from the patients in group A. Specificity was defined as the percentage of negative swabs obtained after day 1 from group B. Concordance between the results of rectal and perirectal swabs was defined as the percentage of simultaneously obtained swabs which yielded identical culture results.

Results. Thirteen patients were enrolled in the study; on day 3, five were placed in group A and eight were placed in group B on the basis of the results of the rectal swabs and stool cultures obtained on day 1. During the study, one patient in group B died after day 3, but all other patients had adequate follow-up. Table 1 shows the results of all swabs obtained during the study period. Overall, there were 41 sets of simul-

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TABLE 1. Results of cultures for VRE

Patient	1		3		4		8		9	
	S	R	R	P	R	P	R	P	R	P
1	−	+	−	−	−	−	−	−	−	−
2	NA	+	+	+	NA	NA	+	+	+	+
3	NA	+	+	+	+	+	+	+	+	+
4	NA	+	+	+	+	+	+	+	+	+
5	+	+	+	+	+	+	+	+	+	+
6	NA	−	−	−	NA	NA	−	−	NA	NA
7	−	−	−	−	−	−	−	−	−	−
8	−	−	NA	NA	−	−	NA	NA	−	−
9	−	−	−	−	−	−	Dis	Dis	Dis	Dis
10	−	−	−	NA	−	−	−	−	−	−
11	−	−	−	−	−	−	+	+	+	+
12	−	−	−	−	−	−	−	−	+	+
13	NA	−	−	−	D	D	D	D	D	D

[a] S, stool culture; R, rectal swab; P, perirectal swab; NA, not available; Dis, discharged; D, deceased.

TABLE 2. Quantitations of VRE growth on all 19 simultaneously positive rectal and perirectal swabs by the semiquantitative four quadrant method[a]

Rectal swab result	No. of paired sets with perirectal swab result			
	1+	2+	3+	4+
1+	5	0	0	0
2+	1	1	0	0
3+	0	2	2	1
4+	0	2	1	4

[a] Agar plates showing VRE growth in one quadrant (1+) occurred with five sets of paired rectal and perirectal swabs. Rectal data are read vertically; perirectal data are read horizontally.

taneously obtained rectal and perirectal swabs collected between days 3 and 9 of the study period. Eleven stool cultures were also received from seven patients on days when swabs were obtained (data not shown). Among the eight patients in group B, two (patients 11 and 12) acquired VRE during the study period. One of the five patients in group A became VRE negative during the study period. No clinically apparent infections with VRE occurred in any of the patients during the study period.

A sensitivity of 79% (15 of 19) for both rectal and perirectal swabs was calculated. The specificities of rectal and perirectal swabs were 87 (20 of 23) and 86% (19 of 22), respectively. The positive predictive value of both rectal and perirectal swabs was 83% (15 of 18). The negative predictive values of rectal and perirectal swabs were 83.3 (20 of 24) and 82.6% (19 of 23), respectively. There was a 100% concordance of the results of 41 pairs of simultaneously obtained rectal and perirectal swabs, and there was a 91% concordance between 11 stool cultures and rectal or perirectal swabs obtained on the same day. One stool culture was negative, while the rectal swab was positive. The quantitations of VRE growth were similar from the simultaneously obtained rectal and perirectal swabs (Table 2).

Discussion. Our data suggest that rectal and perirectal swabs are a sensitive, specific, and reproducible means of surveillance. This is important, because if the sensitivity is low, then there will be many false negatives and the prevalence of colonization will be underestimated. Hence, the spread of VRE might continue because of unrecognized cases, making surveillance ineffective. If the sensitivity of surveillance cultures is high, then most colonized patients will be identified and infection control measures are more likely to be effective.

A limitation of our study is the small sample size, which was dictated by the number of VRE patients hospitalized and eligible for our study. However, a total of 82 swabs were obtained from these 13 patients. We believe the sensitivity and specificity calculated by our method are probably underestimates because we used strict definitions. The swabs from patients who converted from positive to negative and vice versa do not appear to be false positives or false negatives. If patient 1 had tested negative from the initial rectal swab, then the sensitivity of both rectal and perirectal swabs would have been 100%. We do not believe that this patient's sample represented a false positive since, prior to the study, he was known to have been

colonized with VRE; rather, it appears that colonization, if still present, was no longer detectable after the first day of this study. The two patients who acquired VRE during the study had risk factors known to predispose them to VRE, including prior treatment with vancomycin and cephalosporins.

Perhaps the most significant finding of our study was the 100% concordance between the results of simultaneously obtained rectal and perirectal swabs. The sensitivities and specificities calculated with rectal swabs are somewhat problematic in that the "gold standard" was the combined results of the initial rectal swabs and stool cultures, yet not all patients had stool cultures. However, if rectal swabs are considered the gold standard, then the sensitivity of perirectal swabs was 100%. The data on quantity of growth shown in Table 2 also supports a hypothesis that perirectal swabs have a sensitivity similar to that of rectal swabs. This has direct clinical applicability in two settings: with patients who refuse a rectal swab but would allow a perirectal swab and with neutropenic patients for whom an internal rectal swab may be contraindicated. We have encountered both of these scenarios at our institution. Because we were unable to obtain stool cultures from all patients, we could not determine whether stool cultures are more sensitive than rectal or perirectal swabs.

In conclusion, highly sensitive and specific surveillance for gastrointestinal colonization with VRE can be achieved with either rectal or perirectal swabs. These findings are important because the Centers for Disease Control and Prevention have recommended that surveillance programs be initiated at hospitals where VRE has been identified (5). Further areas which require study include whether surveillance culturing programs are efficacious in preventing cross-transmission of VRE in hospital settings and whether such programs are cost effective.

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