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Comparison of BD GeneOhm Methicillin-Resistant *Staphylococcus aureus* (MRSA) PCR versus the CHROMagar MRSA Assay for Screening Patients for the Presence of MRSA Strains▽

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We compared the BD GeneOhm methicillin-resistant *Staphylococcus aureus* (MRSA) real-time PCR assay with the CHROMagar MRSA assay for the detection of MRSA in 286 nasal surveillance specimens. Compared with the CHROMagar MRSA assay, PCR had sensitivity, specificity, positive predictive value, and negative predictive values of 100%, 98.6%, 95.8%, and 100%, respectively. The mean PCR turnaround time was 14.5 h.

To rapidly detect methicillin-resistant *Staphylococcus aureus* (MRSA) nasal colonization in patients, clinical microbiology laboratories must choose between PCR methods and selective-agar-based methods. Several chromogenic and differential MRSA selective agars have been shown to yield results within 18 to 24 h (4, 5, 7, 8, 11, 13). In contrast, PCR methods can yield results in 2 to 3 hours. We compared the CHROMagar MRSA (C-MRSA) agar assay (BD Diagnostics, Sparks, MD) with the BD GeneOhm MRSA real-time PCR system (BD Diagnostics, Sparks, MD), formerly called IDI-MRSA, which has been found to be a sensitive and specific method for the detection of MRSA (1, 2, 3, 6, 8, 9, 10, 14, 15, 16).

The study was conducted at a 450-bed, university-affiliated teaching hospital. Nasal swab specimens were obtained from 286 patients admitted to the surgical and medical intensive care units and a hematology-oncology ward.

Using a single Starswab II (Starplex Scientific, Inc., Canada), one nares specimen per patient was inoculated onto C-MRSA agar between 6 a.m. and 11 p.m., and the swab was refrigerated until PCR assays were run. C-MRSA plates were incubated at 36°C overnight and examined for the presence of mauve-colored colonies, both at the beginning and at the end of the day shift. Mauve-colored colonies with typical colony morphology and a positive Staphaurex (Remel, Lenexa, KS) coagulase test were classified as MRSA (5). Negative C-MRSA plates were incubated for an additional 24 h and reexamined for the presence of MRSA at the beginning of the next day shift.

The PCR assay was performed once daily, following the manufacturer's recommendations. Brain heart infusion broth (BD Diagnostics, Sparks, MD) was added to all PCR-positive broths, and the broths were incubated overnight and subcultured onto C-MRSA agar to evaluate the performance of the PCR assay. Testing of unresolved specimens was repeated, following the manufacturer's recommended freeze-thaw procedure. A "false-positive" PCR result was defined as a positive PCR assay performed on a nasal swab that yielded no growth of MRSA on C-MRSA agar and the failure of MRSA to grow from broth subculture of the PCR tube. Turnaround times were recorded prospectively for both the C-MRSA and the PCR assay.

Dichotomous variables were compared by using McNemar's test. Continuous variables were compared by using a paired-sample *t* test or Wilcoxon test (SSPS, Chicago, IL).

A total of 286 nasal swab specimens were tested by using the C-MRSA and PCR assays. Sixty-three (22%) specimens were positive for MRSA on C-MRSA agar. In contrast, 72 (25.2%) were positive for MRSA by the PCR method. Sixty-nine (24.1%) were considered true-positive results and three (1%) were classified as false-positive results by the PCR method. Another three specimens were initially unresolved by PCR, but were negative after repeat testing using the freeze-thaw procedure. After excluding the three false-positive results from the analysis, the 9.5%-higher yield obtained by the PCR method was statistically significant (McNemar's test; $P = 0.04$) All six of the specimens positive by PCR but negative on C-MRSA agar were newly identified MRSA carriers, none of whom had subsequent clinical cultures positive for MRSA. Compared to the C-MRSA agar assay, the PCR method had a sensitivity of 100%, specificity of 98.6%, positive predictive value of 95.8%, and negative predictive value of 100%.

The mean and median turnaround times for the PCR assay were significantly shorter than those for the C-MRSA agar assay (Table 1). The cost for a negative culture on C-MRSA agar was $6.71 versus $7.52 for a positive culture with a confirmatory coagulase test. Technician time was 1.5 min for negative cultures and 2 min for positive cultures. The cost per test for PCR assays was $25.50, and technician time varied from 5 to 9 min.

We found that 53/63 (84%) specimens positive for MRSA on C-MRSA agar were detected within 24 h, a finding similar to that reported by Flayhart et al. (5). The advantages of C-MRSA agar over nonselective agars include the short incubation time required to detect MRSA, the minimal technician time required for reading plates, and the lack of the need for susceptibility tests.

The PCR method was significantly more sensitive than the

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TABLE 1. Mean and median turnaround times for PCR and C-MRSA agar

No. of specimens with result by both methods	Turnaround time (h) for:		*P* value
	PCR	C-MRSA agar	
63 positive			
Mean	13.1	19.8	<0.001
Median	13.0	19.5	0.013
214 negative			
Mean	14.9	40.7	<0.001
Median	16.5	42.0	<0.001

C-MRSA agar assay, detecting 9.5% more patients colonized with MRSA. Exact comparison of the PCR performance results in the present study to those observed in other studies of the BD GeneOhm MRSA PCR assay is problematic, since we used the C-MRSA agar formulation distributed by BD Diagnostics, whereas previous studies used other chromogenic media or nonchromogenic selective media (1, 2, 8, 10, 12, 14, 16). In the present study, the PCR assay had a sensitivity of 100%, slightly higher than that reported in other studies in which nasal swab specimens were directly inoculated onto agar (range, 90% to 98.5%) (1, 8, 10, 14–16) and similar to (100%) or greater than in four other studies in which agar-based cultures included a broth enrichment step (range, 81% to 92%) (1, 2, 9, 12, 15). While broth enrichment cultures have the advantage of increasing sensitivity by as much as 2% to 23% (1, 12, 15), they require more technician time and an additional one to three days before results are available (2, 3).

Batch-processing of PCR assays once daily in the present study yielded average turnaround times of 13 h for PCR-positive specimens and 15 h for PCR-negative specimens, which compares favorably with the average turnaround time of 19 h reported by others (2).

Our study has several limitations. Since we did not use nonselective agar, we were unable to determine if the few false-positive results yielded by PCR were due to methicillin-susceptible *S. aureus* isolates with a residual SCC*mec* right-extremity fragment following the deletion of a chromosomal segment containing *mecA* (6). Omitting the use of enrichment broth and inoculating only selective-agar medium for the growth of MRSA may have slightly overestimated the sensitivity of the PCR method.

In conclusion, C-MRSA agar detects a majority of cases of MRSA nasal colonization in patients in less than 24 h and is easy to use. Compared to C-MRSA agar, the BD GeneOhm MRSA PCR assay was more sensitive, provided significantly faster turnaround times, and resulted in more-prompt isolation of MRSA-colonized patients. Further studies are warranted to determine if the greater costs of PCR assays are offset by cost savings from reduced transmission of MRSA.

J. M. Boyce has received speaker honoraria from BD GeneOhm.

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