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Sensitivities of Nasal and Rectal Swabs for Detection of Methicillin-Resistant *Staphylococcus aureus* Colonization in an Active Surveillance Program▽

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All medical and high-risk surgical patients were screened for methicillin-resistant *Staphylococcus aureus* colonization over 3.5 years. The sensitivities of nasal and rectal swabs were 68% and 62%, respectively. Naris and open-skin-site swabs detected 467 (74%) of 627 adult carriers identified. Rectal swabs detected an additional 160 (26%) carriers.

Active surveillance for patients colonized with methicillin-resistant *Staphylococcus aureus* (MRSA) is recommended to prevent MRSA infections in health care settings (1, 8, 16, 18, 25). The sensitivity of patient screening for MRSA colonization is partially dependent on the body sites sampled. The nose and open skin areas (i.e., wounds and device exit sites) are considered the most important sites for colonization (7, 8, 16–18, 21, 22). Studies suggest that a substantial proportion of colonized patients will be missed if only these anatomic sites are sampled (7, 12, 13, 19, 23). However, these studies were based on small numbers, often included children and/or healthy, nonadmitted adults, and used outdated or unclear culture methods and therefore may not be generalizable to current culture-based screening programs among adult patients.

Gastrointestinal carriage of MRSA may occur in the absence of nasal carriage and may increase the risk of transmission (3–5, 9, 13, 19). Previously, gastrointestinal site swabs have demonstrated low sensitivity, but these studies included small numbers of colonized patients, producing estimates with large confidence intervals (CIs) (7, 11, 17, 19, 21). In addition, laboratory methods used to detect MRSA from gastrointestinal specimens have since improved (24). We analyzed data collected prospectively for our active surveillance program from January 2004 to June 2007 to determine the relative sensitivities of nasal, rectal, and open-skin-site swabs alone and in combination for detecting MRSA colonization in adults.

North York General Hospital is a 430-bed community teaching hospital with 28,000 admissions annually. All patients admitted for medicine, admitted surgical patients with hospital-associated MRSA risk factors, and exposed roommates are screened for MRSA colonization. Periodic prevalence screens are conducted on units where transmission has recently occurred. Regular audits indicated greater than 90% compliance with admission screening requirements over the study period.

Nurses used premoistened swabs to collect specimens from the anterior nares, rectum, and device exit sites and a maximum of two wounds. Swabs were placed in Amies gel with charcoal and inoculated on mannitol-salt agar with 4 mg/liter oxacillin (MSA-OX; January 2004 to July 2005), mannitol-salt agar with 8 mg/liter cefoxitin (MSA-FOX; August 2005 to January 2006), or a selective, chromogenic medium (MRSA-Select; Bio-Rad Laboratories, Marnes-la-Coquette, February 2006 to June 2007) for culture. MSA-OX and MSA-FOX plates were incubated in ambient air at 35°C overnight (18 h), and MRSA-Select plates were incubated overnight (24 h) at 35 to 37°C. MRSA isolates were confirmed using standard methods, including Pastorex Staph Plus agglutination (Bio-Rad, Hercules, CA), tube coagulase (Remel, Lenexa, KS), and PBP2a agglutination (Denka, Seiken, Tokyo, Japan) and susceptibility testing in accordance with Clinical and Laboratory Standards Institute standards (6).

We conducted descriptive analysis of all screening data and determined the relative sensitivities of body site specimens for detecting MRSA in patients ≥18 years of age. Only the first set of screening swabs from each colonized patient in which any specimen was culture positive for MRSA was included. We defined colonized patients as those with a culture-positive specimen from any body site and considered this the gold standard. The sensitivity of a given body site (or combination of body sites) equaled the number of patients who were culture positive at the site(s) divided by the total number of colonized patients who were sampled at the site(s). We used Statistical Analysis System version 9.1 (SAS Institute Inc., Cary, NC), the chi-square test for difference in proportions, and exact binomial confidence limits.

We screened 23,404 unique individuals, and 666 (2.8%) were positive at one or more sites, including 39 pediatric patients. We conducted 43,409 screen events. We collected 43,144 nasal and 42,851 rectal swabs, of which 1.7% and 1.6% were culture positive, respectively. Of 5,881 open-skin-site specimens tested, 5.2% were positive. Among adult colonized patients, the sensitivity of nasal swabs was higher than that of rectal swabs for detecting MRSA carriage ($P = 0.03$) (Table 1). For MRSA-Select, the sensitivity of rectal swabs increased to

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TABLE 1. Sensitivities of body sites for detection of MRSA among adult colonized patients identified by a culture-based active surveillance program from January 2004 to June 2007

Body site(s) sampled	No. of colonized patients tested (n = 627)	No. of positive patients	% Sensitivity (95% CI)
Nares	616	419	68 (64–72)
Open skin areas[a]	121	88	73 (64–80)
Rectum	616	382	62 (58–66)
Nares and rectum[b]	612	586	96 (94–97)

[a] Wounds and device exit sites.
[b] Only patients sampled at both sites were included in the denominator, and patients positive at either site were included in the numerator.

TABLE 2. Sensitivities of body sites for detection of MRSA among adult colonized patients identified by an active surveillance program using different culture media from January 2004 to June 2007

Body site(s) sampled	% Sensitivity (95% CI)		
	MSA-OX (January 2004 to July 2005)	MSA-FOX (August 2005 to January 2006)	MRSA-Select (February 2006 to June 2007)
Nares	67 (61–73)	64 (53–74)	70 (65–76)
Open skin areas[a]	74 (59–85)	75 (51–90)	71 (56–82)
Rectum	59 (53–65)	55 (44–65)	67 (61–72)
Nares and rectum[b]	95 (91–97)	94 (86–98)	97 (94–98)

[a] Wounds and device exit sites.
[b] Only patients sampled at both sites were included in the denominator, and patients positive at either site were included in the numerator.

67% from 59% when MSA-OX was used (P = 0.05), but the sensitivities of nasal and open-skin-site swabs did not change significantly (Table 2). Overall, 160 (26%; 95% CI, 22% to 29%) colonized patients were positive on the rectal swab only, leading to a 34% relative increase in detection by the addition of these swabs. The age and sex distributions of patients and antimicrobial susceptibility profiles of isolates from patients with only rectal carriage were similar to those for patients with nasal carriage only.

Active surveillance using only specimens from the anterior nares and open skin areas to screen for MRSA colonization will detect fewer than 75% of carriers. Previous estimates of the sensitivity of gastrointestinal site swabs were significantly lower than those reported here (7, 11, 17, 19, 21). This may be explained by the enhanced sensitivity and specificity of new culture media for detecting MRSA in gastrointestinal specimens and the wide CIs around earlier estimates due to small numbers (24). Similar findings have been reported in smaller studies using both culture and molecular methods (7, 12, 13, 19, 26). Using a sensitive PCR assay, Zhang et al. reported similar findings with nasal swabs alone missing 24% of positive patients, and addition of rectal swabs significantly enhanced sensitivity (26).

Further studies are required to determine the optimal combination of anatomic sites for MRSA screening strategies in adults. Throat swabs may be comparable to rectal swabs in sensitivity and incremental yield when added to nasal-based screening strategies, but there are no comprehensive studies comparing these sites by using current culture or molecular methods (12, 13, 20). The relative risks of transmission from different colonized body sites are also unknown, although patients with gastrointestinal carriage of MRSA have been noted to contaminate their environment (4). Consideration should also be given to circulating strains of MRSA, as the USA300/Canadian MRSA-10 strain may have an increased ability to survive on skin (2, 10, 14, 15). Health care facilities may need to adapt screening strategies accordingly.

Specimens other than nasal and open-skin-site swabs have been omitted from screening strategies for cost savings, and current recommendations do not emphasize their importance (8, 16–18, 21). This study describes the largest series published to date reporting the incremental yield of testing rectal swabs to detect MRSA carriage. The findings confirm that nasal swabs alone are insufficient to detect all MRSA carriers. Health care facilities should consider the addition of rectal swabs to active surveillance programs to significantly enhance screening sensitivity. Studies evaluating the effect and cost-effectiveness of active surveillance should consider the patient body sites tested and the potential contributions of undetected carriers to MRSA transmission.

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