Optimal Surveillance Culture Sites for Detection of Methicillin-Resistant Staphylococcus aureus in Newborns

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We describe two outbreaks among newborns, one caused by community-associated methicillin-resistant Staphylococcus aureus (MRSA) and the other by hospital-associated MRSA. The umbilicus, rectum, and nares were tested for colonization. We found that no single body site had optimal sensitivity when tested alone. The combination of umbilical and nasal swabs achieved a sensitivity of >90%.

Outbreaks of infections caused by methicillin-resistant Staphylococcus aureus (MRSA) in the neonatal intensive-care unit (NICU) setting are well documented (7, 9, 13, 16–18, 22, 23, 26). To prevent transmission and to identify individuals who are at risk for developing infection, it is important to perform surveillance cultures (6, 15). Surveillance cultures may be taken from a range of body sites (1, 2, 4, 7, 12, 17, 22), and practices vary in this regard.

Few publications have addressed the sensitivities of surveillance cultures taken from different sites in neonates. Singh et al. reported results from two MRSA outbreaks in the NICU setting in which nasal cultures were paired with rectal or axillary (with or without umbilical) cultures during active surveillance efforts (24). The authors concluded that the use of nasal cultures alone would have detected 97% of colonized infants and would have resulted in significant cost savings. Interestingly, there were no positive umbilical cultures (24). Back et al. found that the addition of rectal swabs to nasal swabs in neonates in the NICU appeared to improve detection of MRSA-colonized infants, although this finding was not statistically significant (2). Of 28 infants colonized with MRSA who had paired nasal and rectal cultures, 16 infants were positive in both sites, three were positive only in the nares, and nine were positive only in the rectum ($P = 0.15$). Umbilical swabbing was not performed. Jerriigan et al. reported that the most common sites of MRSA colonization during an NICU outbreak were the nares (88%), umbilicus (56%), groin (50%), and axilla (31%) (11).

Community-associated MRSA (CA-MRSA) is increasingly recognized as a cause of serious infections in neonates (8), and outbreaks in the NICU have been reported (5, 20). More recently, an outbreak of CA-MRSA infections was reported among healthy newborns and maternity patients in a hospital setting (3). It is still not certain whether CA-MRSA strains colonize different body sites than hospital-acquired MRSA (HA-MRSA) strains.

Hospital no. 1 is a 430-bed community teaching hospital with over 5,000 babies delivered annually. The NICU is an advanced level II, 24-bed unit. In October 2004, there was a clonal outbreak of CA-MRSA (Canadian MRSA 10 or a USA300-related clone) among healthy newborns and their mothers. A smaller, related cluster emerged in January 2005. In an attempt to actively identify colonized and/or infected babies, mothers who had delivered during the outbreak period were advised to bring their newborns to the hospital. There, they were examined for signs of infection and tested for MRSA colonization in the nares, umbilicus, and rectum. The nasal and rectal swabs were premoistened with sterile saline. Both nares were sampled sequentially with a single swab. The majority of parents brought their infants to the hospital. The rest chose to see their primary-care physician and to have the culture results forwarded to the infection control team at the hospital.

Hospital no. 2, a 220-bed community teaching hospital with approximately 2,800 deliveries annually, experienced an almost simultaneous outbreak of MRSA in their level II special-care newborn nursery. Similar call-back clinics and screening procedures were undertaken. The clonal outbreak at hospital no. 2 was determined to have been caused by a common HA-MRSA strain (Canadian MRSA-2, or USA100 related).

Samples from hospital no. 1 were collected and transported in clear Amies gel with charcoal (Copan, Brescia, Italy) and inoculated onto mannitol-salt agar plates containing 2 mg/liter of oxacillin, while those from hospital no. 2 were collected and transported in clear Amies gel (Starplex Diagnostics Inc., Etobicoke, Ontario, Canada) and plated onto mannitol-salt agar plates containing 8 mg/liter of cefoxitin. S. aureus was identified in both laboratories by using Gram stain, catalase, and tube coagulase. Methicillin resistance was confirmed by latex agglutination for PBP 2a and by susceptibility testing by accepted methods (4).

At hospital no. 1, 542 neonates were screened. All had nasal and rectal swabs, and 530 had umbilical swabs collected. There were 37 neonates with MRSA identified, 25 colonized and 12 infected. Of the 25 colonized neonates, all had nasal swabs, 24 had rectal swabs, and 23 had umbilical swabs taken. The sensitivities for detection of MRSA colonization at the three sites...
TABLE 1. Detection of MRSA colonization by site in two unrelated hospital outbreaks among healthy newborns

<table>
<thead>
<tr>
<th>Outbreak*</th>
<th>Screening strategy</th>
<th>No. positive/no. of colonized infants tested</th>
<th>Sensitivity (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital no. 1 (USA300-related outbreak)</td>
<td>Nares only</td>
<td>17/25</td>
<td>68</td>
</tr>
<tr>
<td></td>
<td>Rectum only</td>
<td>5/24</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>Nares and umbilicus</td>
<td>23/23b</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Nares and rectum</td>
<td>17/24b</td>
<td>71</td>
</tr>
<tr>
<td>Hospital no. 2 (USA100-related outbreak)</td>
<td>Nares only</td>
<td>18/25</td>
<td>72</td>
</tr>
<tr>
<td></td>
<td>Umbilicus only</td>
<td>18/25</td>
<td>72</td>
</tr>
<tr>
<td></td>
<td>Rectum only</td>
<td>15/25</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>Nares and umbilicus</td>
<td>23/23b</td>
<td>92</td>
</tr>
<tr>
<td></td>
<td>Nares and rectum</td>
<td>21/25b</td>
<td>84</td>
</tr>
</tbody>
</table>

* A total of 25 colonized infants (nasal and/or rectum and/or umbilicus) were detected in each of the two hospital outbreaks.

b The number tested includes only those colonized infants tested at both sites.

colonizes the umbilical stump and readily spreads to the nose or other sites in neonates. Nasal colonization, however, may be more persistent than that of the umbilicus (7). This may help to explain the inconsistent findings of the various studies. The difference in the sensitivities of rectal swabs in the two outbreaks is interesting and may be related to hospital- and community-associated strains having predilections for different sites. It may also be due to the cefoxitin in the media used by the laboratory at hospital no. 2, as that antibiotic has been shown to improve the overall sensitivity and the suppression of normal flora in perineal specimens (19, 25). Differences in the swabbing techniques, the sensitivities of the screening plates used (21), inclusion of patients with clinical infections, and the age at the time of sampling may have contributed to this variability and may be areas of interest for future studies.

In conclusion, while it may be reasonable to limit routine surveillance cultures to the nares in the absence of an outbreak, we recommend pairing nasal swabs with umbilical swabs during outbreaks of either HA- or CA-MRSA to optimize detection of colonized newborns.

REFERENCES


