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Identification and Eradication of Methicillin-Resistant *Staphylococcus aureus* Colonization in the Neonatal Intensive Care Unit: Results of a National Survey

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Abstract

We surveyed SHEA members to assess practice in identifying and eradicating MRSA colonization in the NICU. Although most respondents (86%) screened patients for MRSA colonization, variation existed in number of anatomic sites screened, and the use of admission cultures, empiric isolation and MRSA decolonization. Evidence-based MRSA prevention strategies are needed.

Keywords

methicillin-resistance; *Staphylococcus aureus*; neonatal intensive care unit; epidemiology; prevention; surveillance

INTRODUCTION

Methicillin-resistant *Staphylococcus aureus* (MRSA) is an important healthcare-associated pathogen in hospitalized neonates. MRSA outbreaks are frequently reported in neonatal intensive care units (NICU), and the incidence of late-onset MRSA infections in the United States's NICUs increased 300% from 1995 to 2004.[1] As the community and hospital prevalence of MRSA rises [2, 3], eradicating MRSA from NICUs becomes more challenging. Because MRSA colonized neonates have a high likelihood of subsequent MRSA infection [4], preventing MRSA transmission in the NICU is essential.

Strategies to control MRSA outbreaks in the NICU include hand hygiene, cohorting and isolation, periodic surveillance cultures, and screening healthcare workers.[5] However, as

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MRSA becomes endemic in many NICUs, the optimal approach to the management of MRSA in the NICU remains unclear. The objectives of this study were to assess current practice in identifying MRSA carriers and eradicating MRSA colonization in hospitalized neonates in the NICU.

MATERIALS AND METHODS

The Society for Healthcare Epidemiology of America (SHEA) represents more than 1,650 practitioners from 58 countries. Between March and June 2009, SHEA included in its monthly e-newsletter a link to a survey asking members to help assess the current practice of MRSA screening and decolonization in high risk neonates. In June 2009, SHEA sent a direct email to its members requesting participation in this survey. A similar email was distributed to members of SHEA's Pediatric Special Interest Group.

The survey asked participants about their institution's approach to 1) screening NICU patients for MRSA colonization, and 2) decolonizing NICU patients with MRSA. To ensure that multiple responses were not included from the same hospital, those participants that did not list their hospital affiliation were excluded, and only the first complete response from each hospital was included. Comparisons were made using Pearson's χ^2 test and Fisher's exact test, with a 2-tailed *P* value of <0.05 using Stata version 10.0 (Stata Corp., College Station, TX). The Johns Hopkins institutional review board approved this study.

RESULTS

Overall, 180 SHEA members responded to the survey. Excluded responses included those from members outside the United States (n=21), those that did not list a hospital affiliation (n=22), responses from already represented United States hospitals (n=39), those from hospitals that did not have a NICU (n=5), and those that only listed demographic characteristics (n=2). The final analysis included 91 participants from unique United States hospitals in 35 different states, representing all geographic regions. Of the respondents, 16 (18%) were pediatric infectious diseases physicians, 24 (26%) were adult infectious diseases physicians, 35 (38%) were hospital epidemiologists, and 31 (34%) were Infection Control Practitioners. Twenty-five percent of respondents were affiliated with free-standing children's hospitals, and 90% of NICUs admit patients referred from other hospitals. Most participants (87%) had an MRSA infected child in their NICU in the previous 12 months.

Seventy-eight participants (86%) reported that their NICUs screened patients for MRSA colonization in their NICU [see Table 1]. Screening programs included admission cultures and periodic point prevalence screens (n=43, 55%), admission cultures only (n=22, 28%), periodic point prevalence screens (n=12, 15%), or admission and discharge cultures and periodic point prevalence screens (n=1, 1%). Thirty-seven participants (47%) cultured multiple anatomic sites when performing screening cultures; 38 (49%) cultured nares alone, and 34 (44%) cultured nares and at least one additional anatomic location. MRSA selective agar was the most common laboratory method reported for identifying MRSA (54%), followed by PCR (31%) and traditional culture (12%).

Of the participants, 66 (73%) screened patients at the time of NICU admission. Those who screened on admission cultured all admissions (65%), only admissions transferred from other hospitals (32%), and those infants with a maternal history of MRSA (3%). Participants from free-standing children's hospitals and those from hospitals with pediatric beds were equally likely to have screened patients for MRSA at the time of NICU admission (74% and 72%, respectively; P=0.55). NICUs that did and did not accept transfers from outside hospitals did not differ in their likelihood of performing admission MRSA surveillance cultures (73% and

67%, respectively; P=0.70). Of the participants that screened patients at the time of NICU admission, 23 (35%) placed patients in isolation pending admission screening culture results. Free-standing children's hospitals were more likely than other hospitals to empirically isolate patients pending culture results (59% versus 28%, P=0.04).

Of eligible respondents, 34 (37%) attempted decolonization of MRSA carriers [see Table 2]. Twenty-one percent decolonized all MRSA carriers, 12% decolonized select patients, and 4% (n=4) decolonized only MRSA infected infants. Of those that attempted decolonization, 100% (n=34) used mupirocin, 35% (n=12) used a topical antiseptic bath, and 9% (n=3) used systemic antibiotics.

DISCUSSION

Despite widespread awareness of the morbidity and mortality of MRSA in hospitalized patients, strategies to identify and eradicate MRSA colonization remain heterogeneous across institutions. Most NICUs encounter MRSA infected neonates, but there is a varied approach to screening for MRSA, testing multiple anatomic sites for MRSA colonization, placing patients in isolation pending admission screening culture results, and decolonizing MRSA carriers.

Most MRSA control guidelines do not account for the NICU's unique patients and environment. In 2006, consensus recommendations were formulated for the management of outbreaks of MRSA infections in NICUs [5] which included strategies similar to SHEA's guidelines for preventing MRSA transmission in acute care hospitals. However, as MRSA becomes increasingly common, even endemic, in hospitals and NICUs, we found a varied approach to identify and eradicate MRSA colonization in NICUs nationwide.

Most participants in our survey screened patients to identify MRSA colonized infants. Interestingly, of those that screen at time of NICU admission, 65% screen all admissions. Although some studies suggest possible maternal to child transmission of MRSA during vaginal birth [6], the utility of screening newborns of any gestation is unknown. Some states, including Illinois, mandate screening all patients admitted to the ICU for MRSA colonization which may confound why some NICUs screen all patients on admission.

Previous guidelines for MRSA outbreak management in NICUs recommended nares cultures alone to detect MRSA carriers.[5] Interestingly, 47% of our participants cultured multiple anatomic sites when screening for MRSA. As MRSA epidemiology changes and more is learned about the ecologic niche of MRSA [7], more data are needed to guide optimal strategies to identify MRSA carriers.

Active surveillance culturing for MRSA carriers in combination with isolation and decolonization can reduce MRSA transmission and MRSA infection rates.[8–10] The impact of MRSA decolonization in multifaceted MRSA control strategies is difficult to quantify.[9] We found that only one-third of participants attempt decolonization of MRSA carriers, and decolonization regimens were varied. More data are needed on the benefit of decolonizing high risk MRSA carriers in the NICU.

This study's main limitation was a poor survey response. It is unknown what percentage of SHEA members are involved in NICU management decisions. We disseminated the survey to the entire membership, hoping to reach more than the 148 members of SHEA's Pediatric Special Interest Group. Despite the low response, we elicited tremendous variability in the approach to MRSA colonized neonates.

Varied strategies to identify and eradicate MRSA colonization in the NICU should stimulate collaborative research studies to generate evidence from which best practice recommendations can be made. Future studies should focus on the cost-benefit of admission surveillance cultures in the NICU and empiric patient isolation, optimal anatomic sites to identify MRSA carriers, the role of decolonization, and the most appropriate decolonization regimens.

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Table 1

Approach to Screening for MRSA in Neonatal Intensive Care Units

Participants that screen for MRSA in the NICU, number (% of participants)	78 (86%)
Screening cultures performed:	
At time of admission	66 (85%)
Periodic point prevalence screens	56 (72%)
Discharge	1 (1%)
Anatomic Sites Tested	
Nares	72 (92%)
Umbilicus	27 (35%)
Rectum	14 (18%)
Axilla	14 (18%)
Groin	9 (12%)
Oropharynx	2 (3%)

Values reported as number (% of those that screen for MRSA) unless otherwise stated

Table 2

Approach to MRSA Decolonization in Neonatal Intensive Care Units

Participants that attempt decolonization of MRSA colonized or infected neonates, number (% of participants)	34 (37%)
Decolonization regimens include[a]	
Mupirocin alone	19 (56%)
Mupirocin and a topical antiseptic bath	11 (32%)
Mupirocin and systemic antibiotic	2 (6%)
Mupirocin, a topical antiseptic bath, and systemic antibiotics	1 (3%)

Values reported as number (% of those that attempt decolonization) unless otherwise stated.

[a] One participant did not specify a decolonization regimen.