Community-Acquired Methicillin-Resistant *Staphylococcus aureus* in Hospitalized Adults and Children without Known Risk Factors

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Community-acquired methicillin-resistant *Staphylococcus aureus* (MRSA) infections are not commonly recognized in healthy patients without predisposing risk. We performed a retrospective study of patients hospitalized with community-acquired MRSA infections from 1992 to 1996 in Honolulu to determine if community-acquired MRSA infections occurred in patients without known risk. Patients hospitalized within the previous 6 months or transferred from other hospitals or nursing homes were excluded. Epidemiological and clinical data were obtained from an inpatient chart review. Ten (71%) of 14 patients with community-acquired MRSA infection had no discernible characteristics of MRSA infections. Thirteen (93%) patients had skin or soft-tissue infections and one patient had MRSA pneumonia. Isolates from patients with MRSA infection were more likely to be susceptible to ciprofloxacin ($P = 0.05$), clindamycin ($P = 0.03$), and erythromycin ($P = 0.01$) than were those from MRSA-colonized patients. In our population, the majority of community-acquired MRSA infections occurred in previously healthy individuals without characteristics suggestive of MRSA transmission.

Methicillin-resistant *Staphylococcus aureus* (MRSA) infections became clinically important in the United States in the 1960s [1]. These infections were hospital-acquired and frequently involved patients in intensive care units and nursing homes.

In 1980 the first community-acquired MRSA infections in this country were reported [2]. Risk factors for community-acquired MRSA infection included recent hospitalization, admission from another hospital, nursing home residence, intravenous drug use, prior antimicrobial use, and underlying illnesses such as cardiovascular and pulmonary disease, diabetes, malignancy, and chronic skin diseases [3–9].

See editorial response by Kak and Levine on pages 801–2.

Few investigators in the United States and other countries have reported community-acquired MRSA infections in healthy persons without known characteristics of MRSA infection [3, 10–13]. We reviewed the demographics and clinical features of patients admitted to our facility who had community-acquired MRSA infection or colonization and studied the antimicrobial susceptibility of these isolates as well.

**Methods**

Tripler Army Medical Center is a 420-bed primary-through-tertiary-care hospital located in Honolulu. Our patient population included active-duty personnel and their families, military retirees, Veterans Administration beneficiaries, Pacific Islanders, and other patients eligible for care in a federal facility. We reviewed laboratory records concerning all *S. aureus* isolates, including methicillin-susceptible and methicillin-resistant isolates. We then reviewed the medical records of all patients with community-acquired MRSA isolates who were admitted to our hospital from 1992 to 1996. A case was considered community-acquired if MRSA was isolated from cultures performed within 48 hours after admission to our hospital. We excluded those patients who were hospitalized within the previous 6 months, transferred from other hospitals, or residents of nursing homes or other long-term-care facilities.

Inpatient records were reviewed for residency status; travel history; admitting service; history of alcohol, tobacco, and intravenous drug use; family member or close contact with pyoderma; previous antimicrobial therapy; initial and definitive antimicrobial therapy; surgical intervention; site of culture; and antimicrobial susceptibilities. Medical records were also reviewed for underlying health problems, including diabetes mellitus; ischemic or decubitus skin ulcers; chronic respiratory disease; skin disease; preexisting renal failure, including mode of dialysis; malignancy; vascular disease; HIV disease; liver disease; and indwelling catheter or prosthetic device present on...
admission. MRSA infections were categorized according to published guidelines of the Centers for Disease Control and Prevention [14, 15]. Patients with MRSA isolates not associated with a clinical infection were considered colonized.

Susceptibility testing of *S. aureus* isolates was performed with the Vitek system (bioMérieux Vitek, Hazelwood, MO) in the microbiology section at Tripler Army Medical Center (Honolulu). The isolates were identified by coagulase testing and confirmed with the Vitek system. Each *S. aureus* isolate was inoculated into a gram-positive-susceptibility MIC card containing 1% sodium chloride and placed into the Vitek instrument for incubation and reading. An isolate was further evaluated by disk-diffusion testing when the Vitek testing revealed that it was resistant to oxacillin. Disk-diffusion testing was performed as recommended by the National Committee for Clinical Laboratory Standards [16]. Categorical data were compared with a two-tailed Fisher’s exact test or Mantel-Haenszel \( \chi^2 \) test.

### Results

Thirty-eight patients with community-acquired MRSA were admitted to the hospital during the study period. Twenty-four patients met the criteria for inclusion in our study. Fourteen patients (58%) were clinically infected with MRSA; the remaining 10 patients had no clinical infection and were considered colonized with MRSA.

The characteristics of MRSA-infected patients are depicted in table 1. Eight male and six female patients were identified. The mean age was 23 years, and six patients (43%) were \( \leq \) 18 years of age. Ten patients (71%) had no risk factors or underlying health problems typical of MRSA infections. Ten patients (71%) were residents of Hawaii. Three patients were native to American Samoa, and one patient was native to the Marshall Islands. These four patients were referred to our hospital for consultation and further care and satisfied our inclusion criteria. None were identified as health-care workers or intravenous drug users. Nine (64%) of the 14 patients were either military personnel or families of military personnel.

<table>
<thead>
<tr>
<th>Patient no./residence</th>
<th>Age (y)/sex</th>
<th>Potential risk factor for MRSA infection</th>
<th>Isolate source</th>
<th>Initial therapy on admission</th>
<th>Definitive antimicrobial therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/Hawaii</td>
<td>38/F</td>
<td>None</td>
<td>Facial abscess</td>
<td>Clindamycin; I+D</td>
<td>Ciprofloxacin</td>
</tr>
<tr>
<td>2/Hawaii</td>
<td>27/M</td>
<td>None</td>
<td>Leg abscess</td>
<td>Nafcillin; I+D</td>
<td>Vancomycin</td>
</tr>
<tr>
<td>3/American Samoa</td>
<td>15/F</td>
<td>Meningitis at age 5 y; VP shunt</td>
<td>Infected VP shunt, abdominal wound</td>
<td>Cefazolin; removal of VP shunt; surgical debridement</td>
<td>Vancomycin</td>
</tr>
<tr>
<td>4/Hawaii</td>
<td>24/F</td>
<td>None</td>
<td>Axillary abscess</td>
<td>Nafcillin; I+D</td>
<td>None</td>
</tr>
<tr>
<td>5/Hawaii</td>
<td>20/M</td>
<td>None</td>
<td>Arm abscess</td>
<td>Nafcillin; I+D</td>
<td>None</td>
</tr>
<tr>
<td>6/Hawaii</td>
<td>17/M</td>
<td>None</td>
<td>Facial abscess</td>
<td>Nafcillin; I+D</td>
<td>Ciprofloxacin</td>
</tr>
<tr>
<td>7/Marshall Islands</td>
<td>16/M</td>
<td>RHD, AVR/MVR at age 11 y</td>
<td>Infected pacer wire, chest-wall abscess</td>
<td>Cefazolin; I+D; removal of pacer wire</td>
<td>None</td>
</tr>
<tr>
<td>8/Hawaii</td>
<td>27/F</td>
<td>IDDM</td>
<td>Perirectal abscess</td>
<td>Cefazolin; I+D</td>
<td>None</td>
</tr>
<tr>
<td>9/Hawaii</td>
<td>3/F</td>
<td>None</td>
<td>Arm abscess</td>
<td>Nafcillin, rifampin</td>
<td>Vancomycin</td>
</tr>
<tr>
<td>10/Hawaii</td>
<td>34/M</td>
<td>None</td>
<td>Leg abscess</td>
<td>Cephalexin</td>
<td>Vancomycin</td>
</tr>
<tr>
<td>11/American Samoa</td>
<td>10 mo/M</td>
<td>None</td>
<td>Lung abscess</td>
<td>Cefuroxime, gentamicin; chest tube drainage</td>
<td>Vancomycin</td>
</tr>
<tr>
<td>12/American Samoa</td>
<td>17/F</td>
<td>None</td>
<td>Breast abscess</td>
<td>Nafcillin, clindamycin; I+D</td>
<td>None</td>
</tr>
<tr>
<td>13/Hawaii</td>
<td>28/M</td>
<td>None</td>
<td>Arm wound</td>
<td>Cephalexin; surgical debridement</td>
<td>None</td>
</tr>
<tr>
<td>14/Hawaii</td>
<td>44/M</td>
<td>Alcoholic liver disease*</td>
<td>Leg abscess</td>
<td>Amoxicillin and clavulanate; I+D</td>
<td>TMP-SMZ</td>
</tr>
</tbody>
</table>

* Presumed on the basis of chart review.

NOTE. AVR = aortic valve replacement; I+D = incision and drainage; IDDM = insulin-dependent diabetes mellitus; MVR = mitral valve replacement; RHD = rheumatic heart disease; TMP-SMZ = trimethoprim-sulfamethoxazole; VP = ventriculoperitoneal.
S. aureus. Subsequent definitive antimicrobial therapy included administration of vancomycin (5 patients), ciprofloxacin (2 patients), and trimethoprim-sulfamethoxazole (1 patient). Six infections resolved with surgical intervention but no definitive antimicrobial therapy for MRSA. There were no deaths or serious long-term complications. Six patients (43%) were hospitalized for >5 days.

When isolates from infected patients were compared with those from colonized patients, the former were more likely to be susceptible to ciprofloxacin (93% vs. 60%; \( P = .05 \)), clindamycin (100% vs. 70%; \( P = .03 \)), and erythromycin (86% vs. 30%; \( P = .01 \)). There were no significant statistical differences noted between the two groups with respect to susceptibility to tetracycline (100% vs. 70%) and trimethoprim-sulfamethoxazole (100% vs. 90%). No isolates had reduced susceptibility to vancomycin.

Discussion

We demonstrated community-acquired MRSA infections in previously healthy young adults as well as in children without known risk factors for MRSA infection. Four (29%) of 14 patients were referred from clinics outside of the United States. The majority of our patients’ community-acquired infections resolved with surgical intervention (six with effective antimicrobial therapy and six without effective antimicrobial therapy). It is not clear from the medical records why definitive therapy was withheld. Two infections resolved with effective antimicrobial therapy only.

A recent retrospective study of children at the University of Chicago Children’s Hospital also documented community-acquired MRSA infections in children with no identified predisposing risk [10]. Skin and soft-tissue infections were the most common sites of culture for MRSA in our study and in prior investigations [3, 6–13, 17]. Community-acquired MRSA from infected patients were susceptible to a greater number of antimicrobials than MRSA isolates from colonized patients. Seven (70%) of our 10 colonized patients had underlying diseases that may have required frequent visits to a health-care facility and an increased chance of exposure to more-resistant hospital MRSA strains. These increased susceptibility patterns among community-acquired MRSA strains is consistent with other investigations [10–13, 17–19].

Differences between our study and other reports may be related to our unique patient population. Our hospital is primarily a military facility, and our patient population tends to be young and healthy. This may account for a shortened hospital stay and resolution of many infections with surgical intervention but no definitive MRSA antimicrobial therapy.

The results of the Chicago study and our study in Honolulu suggest a change in the epidemiology of community-acquired MRSA in two diverse locations in the United States [10]. In both cities, community-acquired MRSA infections requiring hospitalization occurred in healthy young persons without appreciable risk factors for MRSA acquisition.

A limitation of our investigation was its retrospective design. We do not know how many of our infected patients had prior visits to outpatient clinics or family members’ with risk factors typical of MRSA. This is especially true for those patients native to American Samoa or the Marshall Islands. These patients are from lower socioeconomic classes and inherently are subjected to overcrowding, lower living standards, and overuse or inappropriate use of antimicrobials. This overrepresentation may reflect increased MRSA in their native countries. Two prior reports make similar implications regarding the aboriginal populations of Australia and Canada [12, 13].

The majority of infections were effectively managed without increased morbidity or prolonged hospital stay. However, if community-acquired MRSA infections continue to increase, it may be prudent to consider empirical antimicrobial therapy against MRSA causing community-acquired staphylococcal infections, particularly in patients with serious infections. Surgical intervention or removal of infected foreign devices is an important adjunct to antimicrobial therapy.

Isolation precautions for MRSA should be considered for suspected community-acquired S. aureus infections, pending laboratory identification of the species of isolates. Prospective studies are needed to define the epidemiology of MRSA infections in both outpatient and inpatient populations and to reassess empirical antimicrobial therapy for staphylococcal infections.

References


