COMMUNITY-ACQUIRED METHICILLIN-RESISTANT *STAPHYLOCOCCUS AUREUS* INFECTIONS IN A SOUTH INDIAN CITY

BVS Krishna, Asha B Patil and MR Chandrasekhar

Department of Microbiology, Karnataka Institute of Medical Sciences, Hubli, Karnataka, India

Abstract. There are increasing numbers of reports of community-acquired *Staphylococcus aureus* being resistant to methicillin. The present study was undertaken as no such reports are available for the developing nations. In a prospective study, between June to December 2001, at the Karnataka Institute of Medical Sciences, Hubli, Karnataka, India, methicillin-resistant *S. aureus* (MRSA) isolates were tested for clindamycin-susceptibility, a surrogate marker for community-acquired strains. Patients with clindamycin-susceptible isolates were interviewed to determine if they had acquired them in the community and also to identify any risk factors. Of the 116 patients with *S. aureus* infection, 18.1% had infection with methicillin-resistant strains. Clindamycin-susceptible MRSA accounted for 61.9% of cases. Among these, 46.1% patients were confirmed to have acquired the MRSA from the community, based on inclusion criteria. The community-acquired MRSA were susceptible to multiple antibiotics, as compared to nosocomial isolates. Except for one patient with diabetes mellitus, no other patient had any known risk factor for acquiring MRSA. As significant numbers of MRSA infections are being acquired from the community, treatment options for *S. aureus* infections may need to be reviewed. Effective infection control programs for the community should be considered to prevent the spread of these infections.

INTRODUCTION

Methicillin-resistant *Staphylococcus aureus* (MRSA) as a cause of nosocomial sepsis has become an increasing concern with more than 50% of the hospital *S. aureus* isolates resistant to methicillin (Lowy, 1998). As these nosocomial MRSA are resistant to multiple antibiotics (Moreno *et al*, 1995); infections caused by them are difficult to treat, resulting in high morbidity and mortality. Although community-acquired *S. aureus* infections are common, recent reports suggest that they may increasingly be caused by MRSA strains (Moreno *et al*, 1995; Adcock *et al*, 1998; Frank *et al*, 1999; Gorak *et al*, 1999). Community-acquired MRSA appears to be a new emerging pathogen. There is considerable concern that community-acquired MRSA would cause infections difficult to treat in the outpatient setting and would markedly increase the need for vancomycin therapy (Suntharam *et al*, 2001). Interestingly, community-acquired MRSA isolates uniquely differ from nosocomial MRSA isolates by being generally susceptible to multiple antimicrobial agents other than β lactams (Udo *et al*, 1993; Adcock *et al*, 1998; Suntharam *et al*, 2001). Clindamycin susceptibility has been shown to have a very significant correlation with community-acquired MRSA (Frank *et al*, 1999), and has been used as a surrogate marker for its detection (Suntharam *et al*, 2001).

The published reports of community-acquired MRSA are all from the developed nations. No such data are available from the developing regions of the world. In the present study, we assessed the number of MRSA infections acquired in the community (that may occur) in the population served by our hospital, at Hubli City in Karnataka State, India.

MATERIAL AND METHODS

Study design

Karnataka Institute of Medical Sciences is a 950-bed tertiary care teaching facility serving the population of 6 northern districts of the state of

Correspondence: Dr BVS Krishna, Department of Microbiology, Karnataka Institute of Medical Sciences Hubli – 580 022, Karnataka, India.
Tel: +91-0836-2278 606

Karnataka, India.

In this prospective study, all MRSA isolates obtained during the 7-month period from June to December 2001, were included. The MRSA that were susceptible to clindamycin were further investigated. Patients were interviewed directly to collect both inpatient and outpatient information. Their medical records were also reviewed. Patients were considered to harbor community-acquired MRSA if they had no contact with a healthcare facility within the preceding two years and if the sample was obtained within 72 hours after hospital admission. Outpatients were also included if they had no contact with a healthcare facility in the preceding two years. Nosocomial isolates were defined according to standard criteria (Centers for Disease Control and Prevention, 1999).

Laboratory procedures

Samples were obtained from various cases such as abscesses, boils, wound discharge, and ear discharge, and processed according to standard procedures. *S. aureus* was identified by colonial morphology, catalase test, tube coagulase test, mannitol fermentation and oxidation fermentation test (Forbes *et al*, 1998). Antibiotic susceptibility was tested for penicillin, erythromycin, gentamicin, netilmicin, amikacin, tetracycline, cotrimoxazole, clindamycin, ciprofloxacin, and ofloxacin (Hi-Media, Mumbai) by disc diffusion method on Muller-Hinton agar, according to National Committee for Clinical Laboratory Standards guidelines (2000). Methicillin resistance was also detected by disc diffusion method using 1 μg oxacillin disc (Hi-Media, Mumbai) on 4% NaCl Muller-Hinton agar incubated at 35ºC for 24 hours (National Committee for Clinical Laboratory Standards, 2000).

RESULTS

During the study period, *S. aureus* was isolated from 116 patients, of which 21 (18.1%) were MRSA. Thirteen (61.9%) of these MRSA were clindamycin-susceptible. Nine (69.2%) were isolated from pus samples, and 4 (30.8%) from ear discharge. Based on the inclusion criteria, 6 (28.6%) patients with MRSA infection or 46.1% patients with clindamycin-susceptible MRSA infections were confirmed to have community-acquired infections. Three of these patients, who were confirmed to have acquired MRSA infection from the community, presented with chronic suppurative otitis media; one each presented with boil, infected wound (wound in the left thigh due to domestic injury) and ischiorectal abscess. Except for the patient with ischiorectal abscess, who had diabetes mellitus, no patient had any predisposing factor for MRSA infection. While the two patients with wound and ischiorectal abscess were inpatients, the other four were treated as outpatients.

The antibiotic susceptibility pattern showed that the nosocomial MRSA were multidrug-resistant, while the community-acquired MRSA were susceptible to most antibiotics, except the β lactams and co-trimoxazole (Table 1).

Table 1
Antibiotic susceptibility pattern of *Staphylococcus aureus.*

Organism	No. of isolates	% Susceptible									
		P	E	G	Nt	Ak	Cf	Of	T	Co	Cd
CA-MRSA	6	0	50	83	100	100	67	100	50	17	100
Nosocomial MRSA	15	0	0	25	63	75	13	63	0	0	50
MSSA	95	8	85	100	100	100	80	100	67	58	83

CA–MRSA – Community-acquired methicillin-resistant *Staphylococcus aureus.*
MSSA – Methicillin sensitive *Staphylococcus aureus.*
P – Penicillin, E – Erythromycin, G – Gentamicin, Nt – Netilmicin.
Ak – Amikacin, Cf – Ciprofloxacin, Of – Ofloxacin.
T – Tetracycline, Co – Co-trimoxazole, Cd – Clindamycin.

DISCUSSION

Community-acquired MRSA accounted for 28.6% of the total MRSA isolated during the study period. Several authors have described a high incidence of methicillin resistance among *S. aureus* isolated from community-acquired infections (Moreno *et al*, 1995; Adcock *et al*, 1998; Frank *et al*, 1999; Gorak *et al*, 1999). Several other studies failed to detect significant numbers of true community-acquired MRSA infections (Shopsin *et al*, 2000; Suntharam *et al*, 2001).

The reasons for the increasing incidence of MRSA in the community-acquired infections could be multifactorial. One study suggests that MRSA carriage continues outside the hospital (Hicks *et al*, 1991). Even if a hospitalization/ health care facility contact in the remote past was when the colonization first occurred, long-term carriers can ultimately become reservoirs for the organisms in the community. However, it has been observed that community-acquired MRSA isolates differ from nosocomial isolates in both antimicrobial susceptibility and molecular typing patterns (Moreno *et al*, 1995). Thus, these organisms may not simply be hospital strains that have been transferred into the community (Suntharam *et al*, 2001). Selection pressure due to overuse of antibiotics could have led to the emergence of methicillin-resistant strains of *S. aureus* in the community. The increased use of antibiotics has been documented to increase the incidence of MRSA (Udo *et al*, 1993; Adcock *et al*, 1998). One such study reported an increased incidence of MRSA in a child daycare center resulting from increased use of antibiotics, providing evidence that MRSA could have become established in the community, as was observed with penicillin-resistant *S. aureus* in the 1950s (Adcock *et al*, 1998).

Community-acquired MRSA was isolated from patients with no known risk factors for MRSA infection, except for one case with diabetes mellitus in this study. A few other studies could also not identify any predisposing risk factors for community-acquired MRSA infection (Moreno *et al*, 1995; Gorak *et al*,1999). Most of our patients are of lower socioeconomic stratus and are inherently subject to overcrowding, lower living standards, and overuse or inappropriate use of antimicrobial agents, which could have caused increased methicillin resistance among community-acquired *S. aureus*. Similar inferences have been made by other authors (Maguire *et al*, 1996; Gorak *et al*,1999). However, the establishment of MRSA in the community could occur among patients with demographic and underlying disease factors that are indistinguishable from those of patients with methicillin-sensitive *S. aureus* infection (Moreno *et al*, 1995).

This study used strict criteria to define a MRSA isolate as community-acquired. The isolates obtained from samples collected within 72 hours of hospitalization for inpatients, or any isolate obtained from an outpatient, was considered as community-acquired when both inpatients and outpatients were confirmed not to have had any hospitalization or health care facility contact within the previous 2-year period. The 2-year hospital contact criterion was used because MRSA colonization has been shown to persist for a long time after hospitalization (Sanford *et al*, 1994).

The present study also found that community-acquired MRSA are susceptible to most antibiotics, compared with nosocomial isolates, as described by many reports (Udo *et al*, 1993; Moreno *et al*, 1995; Adcock *et al*, 1998; Gorak *et al*, 1999). Community-acquired MRSA typically are clindamycin-susceptible (Frank *et al*, 1999; Suntharam *et al*, 2001), and hence clindamycin susceptibility was used as a surrogate marker to screen for community-acquired MRSA in the study. This approach should exclude the vast majority of nosocomial isolates resistant to clindamycin (Suntharam *et al*, 2001). Clindamycin susceptibility is not a highly specific marker (Suntharam *et al*, 2001), since only 46.1% of the clindamycin-susceptible isolates were confirmed to have been acquired from the community.

All the community-acquired MRSA infections were managed effectively without increased morbidity or the use of specific anti-MRSA treatment. However, in future, 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 (Moreno *et al*, 1995).

S. aureus infections suspected to have been acquired from the community, due to their reducing methicillin susceptibility, may need MRSA isolation and infection control procedures. Infections due to such community organisms spreading or displacing known nosocomial pathogens in the hospital environment are a potential threat to already burdened hospital infection control programs. Effective interventional strategies need to be developed to prevent such situations. Such control programs are also to be extended to the communities where the incidence of MRSA is increasing. Rational antimicrobial drug prescription policies, not only for the hospitals, but for all community-acquired infections, is the baseline of any such intervention modality, along with efficient microbiological surveillance to detect drug resistance among pathogens. The problems of poverty, overcrowding, poor hygiene, and illiteracy inherent to the developing nations should be addressed, if any community-based interventional programs are to succeed.

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