

Invasive community-acquired *Staphylococcus aureus* among pediatric population of Eastern Iran

Mohammadsaeed Sasan¹, Nahid Donyadide¹, Emran Askari^{2*}, Mahboobeh Naderi-Nasab³

¹Department of Pediatrics, Mashhad University of Medical Sciences, Mashhad, Iran. ²Students Research Committee, Mashhad University of Medical Sciences, Mashhad, Iran. ³Department of Microbiology, Central Laboratory, Imam Reza Teaching Hospital, Mashhad University of Medical Sciences, Mashhad, Iran.

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ABSTRACT

Background and Objective: Community-acquired methicillin-resistant *Staphylococcus aureus* (CA-MRSA) is increasingly reported worldwide. We aimed to determine the frequency of invasive CA-MRSA in children admitted to the pediatric wards of Imam Reza and Ghaem hospitals of Mashhad, Iran.

Materials and Methods: In this retrospective study, data regarding *S. aureus* isolates from pediatric patients' sterile body sites (i.e. blood, joint, bone and lymph node aspiration) were retrieved in a time period from March 2006 to March 2012. Disc diffusion data was analyzed to determine the resistance pattern of the isolates, and differentiation between community-acquired and nosocomial *S. aureus* was done according to CDC guidelines.

Results: Twenty three invasive community-acquired *S. aureus* isolates from sterile body sites were identified, of which seventeen (74%) were CA-MRSA. The CA-MRSA isolates showed high frequency of resistance to non- β -lactam antibiotics (71% to erythromycin, 53% to co-trimoxazole, 44% to gentamicin and 36% to ciprofloxacin).

Conclusion: In this study, the majority of invasive community-acquired *S. aureus* isolates were found to be CA-MRSA. Therefore, we recommend that primary treatment should be with antibiotics such as clindamycin, vancomycin, linezolid or daptomycin for any invasive infection suspected to be caused by *S. aureus* in these two hospitals.

Keywords: *Staphylococcus aureus*, methicillin resistance, community-acquired infections, child

INTRODUCTION

Staphylococcus aureus is a well-adapted human/zoonotic colonizer which can also cause a wide range of diseases and its treatment is becoming more difficult because of increasing rates of drug resistance both in hospital and community settings. Community-acquired methicillin-resistant *S. aureus* (CA-MRSA) has been a subject of interest in the last decade. Traditionally, the risk factors for CA-

MRSA are chronic illness, history of recurrent use of antibiotics and intravenous drug abuse. Moreover, new risk factors such as attendance in military service and day care centers, homosexuality, tattooing, contact sports, sharing soaps and towels, having pets and age ≤ 2 years have been proposed, yet several patients with CA-MRSA infections do not have any recognized risk factor for methicillin resistance (1-6).

In addition to epidemiological differences, CA-MRSA and hospital-acquired methicillin-resistant *S. aureus* (HA-MRSA) differ in antibiotic resistance pattern. CA-MRSA clones are usually resistant only to β -lactams and erythromycin and are usually susceptible to co-trimoxazole, clindamycin and fluoroquinolones (1, 2, 5, 7). From a molecular perspective, HA-MRSA strains usually carry

* Corresponding author: Emran Askari

Address: Mashhad Medical Microbiology Student Research Group, Mashhad University of Medical Sciences, Mashhad, Iran.

Tel: +98-936-5317744

E-mail: AskariE871@mums.ac.ir

Table 1. Clinical manifestations of invasive community-acquired *S. aureus* infections in this study.

Clinical manifestations	CA-MRSA	CA-MSSA
Osteomyelitis	6	1
Septic arthritis	7	0
Sepsis	4	3
Lymphadenitis	1	2
Cellulitis	1	1
Total*	19	7

* Three patients had two manifestations; one with osteomyelitis and septic arthritis, one with cellulitis and osteomyelitis and one with cellulitis and lymphadenitis.

CA-MRSA = Community-Acquired Methicillin Resistant *Staphylococcus aureus*

CA-MSSA = Community-Acquired Methicillin Susceptible *Staphylococcus aureus*

staphylococcal cassette chromosome *mec* (SCC*mec*) types I-III while CA-MRSA strains carry SCC*mec* types IV or V (1, 4, 5, 8).

The aim of this study was to determine the frequency of invasive CA-MRSA in children admitted to the pediatric wards of Imam Reza and Ghaem teaching hospitals.

MATERIALS AND METHODS

In this retrospective observational study, data of *S. aureus*-positive cultures from sterile body sites (i.e. blood, bone puncture, joint fluid and lymph node aspiration) was gathered from microbiology laboratory files from March 20th 2006 to March 19th 2012. All the samples were from pediatric wards of Imam Reza and Ghaem hospitals. Disc diffusion data was analyzed. The community or hospital origin of *S. aureus* infection was determined by hospital files and telephone communication with the patients' parents according to the CDC criteria (1, 6).

RESULTS

During this 6-year period, 23 invasive community-acquired *S. aureus* cultures were recovered from pediatric patients (8 girls and 15 boys). Isolates were from blood (n = 15), synovial fluid (n = 2), bone puncture (n = 3) and lymph node aspiration (n = 3). Seventeen isolates (74%) were resistant to methicillin. Septic arthritis, osteomyelitis and sepsis were the most common clinical manifestations. (Table 1)

The resistance rate for erythromycin, cotrimoxazole, ciprofloxacin, tetracycline, and gentamicin was 71%, 53%, 36%, 50% and 44% for CA-MRSA and 0%, 0%, 20%, 50%, 33% for community-acquired methicillin susceptible *S. aureus*, respectively.

DISCUSSION

Invasive staphylococcal infections like osteomyelitis, septic arthritis and pneumonia are common causes of admission to pediatric wards. Most physicians treat these infections with cloxacillin, cefazolin or cephalothin. However, based on our daily clinical observations, there is a high incidence of CA-MRSA in our institutions. This research confirms that the rate of methicillin resistance among invasive community-acquired isolates has been very high (74%) in pediatric patients during the past six years.

There is a high difference in the prevalence of CA-MRSA in different geographic areas. For example in the US, CA-MRSA prevalence varies between 15% in North Eastern states up to 72% in Southern states (3). In Middle East countries, the prevalence of CA-MRSA is 62% in Saudi Arabia (9) and 52% in Turkey (10), 11% in south of India (11), and 74% in Taiwan, (12) which is close to our estimation in this study.

CA-MRSA was more common in boys in our study (male/female ratio = 2). This ratio was 3 in a Saudi Arabian study (13). Also in a study of the NICU of Texas Children Hospital, most subjects (65 of 89) were male (14). Sex difference in our study can be explained by considering the fact that bone and joint infections are more common in boys (15).

Resistance of CA-MRSA to non- β -lactam antibiotics like co-trimoxazole and ciprofloxacin has been reported 0% and 10.7% in the US and 11% and 10% in Saudi Arabia, respectively (8, 9). In this study, high rate of resistance to co-trimoxazole and ciprofloxacin was observed among our invasive CA-MRSA isolates. Interestingly, multidrug resistant CA-MRSA has been recently reported from other Asian countries (16).

CONCLUSION

The rate of CA-MRSA in our community is very high and similar to Asian CA-MRSA clones which are also resistant to co-trimoxazole and ciprofloxacin. Although further epidemiological and molecular investigations are needed to confirm the results of this study, we recommend that in these two hospitals, for invasive community-acquired *S. aureus* infections treatment should be started with drugs like clindamycin, vancomycin, linezolid or daptomycin.

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