World Journal of Medical Sciences 9 (2): 109-112, 2013
ISSN 1817-3055

DOI: 10.5829/idosi.wjms.2013.9.2.7648

Prevalence of Methicillin-Resistant *Staphylococcus aureus* Nasal Carriage in Children Admitted to Shahidbeheshti Hospital

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Abstract: *Staphylococcus aureus (S. aureus)* is the leading cause of hospital stays and a dangerous, challenging micro-organism when it comes to treatment. Methicilin Resistant *S. aureus* (MRSA) have different degrees of resistance to a wide range of antibiotics other than beta-lactam antibiotics. This study mainly was designed in order to determine the prevalence of *S. aureus* colonization and MRSA rate in the children admitted to Shahidbeheshtihospital between 2011-2012. It also assesses the resistance rate of MRSA to different antibiotics. Antimicrobial susceptibility was evaluated by the Kirby-Bauer disk diffusion method and oxacillin disk was used to show methicillin resistance. From cultures of 403 children admitted to Shahidbeheshtihospital, 49.1% were colonized with *S. aureus*and 68.6% were MRSA. The MRSA resistant rate obtained 53%, 87.2%, 80.8%, 56.5%, 16.1%, 17.1, 20.7%, 74.2% and 0.005% for Clindamycin, Erythromycin, Clarithromycin, Tetracycline, Rifampin, TMP-SMZ, Gentamicin, Ciprofloxacin and Vancomycin disks, respectively. The prevalence of *S. aureus* colonization in anterior nares is high and the strategies and policies for eradication of this colonization may be helpful.

Key words: *Staphylococcus aureus* · Methicillin-Resistant *Staphylococcus aureus* · Vancomycin Resistance

INTRODUCTION

Staphylococcus aureus (S. aureus) is a part of normal bacterial flora of the skin and mucosal surfaces of the respiratory tract of 20-90% of normal population [1, 2]. It is the leading cause of hospital stays and a dangerous, challenging micro-organism when it comes to treatment [2]. It may cause devastating, lethal conditions like osteomyelitis, septicemia and endocarditis [3].

Multidrug resistance has become prevalent among different kinds of bacterial strains due to the haphazard use of antibiotics in the treatment of infections [4-7]. Most *S. aureus* infections assume to come from nasal carriage, because the moist squamous epithelium of the anterior nares is the place for colonization of *S. aureus*. Eradication of *S. aureus* from the anterior nares has been proven to affect reducing *S. aureus* infections [8]. Methicilin Resistant *S. aureus* (MRSA) have different degrees of resistance to a wide range of antibiotics other than beta-lactam antibiotics [9]. Increasing rates of MRSA may result from unwise use of antibiotics in treatment of *S. aureus* infections in hospital and inevitable transition of MRSA strains to community [10].

On the other hand MRSA infections are recurrent ones and have recurrent rate of 15% among adults [11] and 12-28% among children [12, 13]. MRSA colonization may lead to infection and there are some reports that 38% of individuals with colonized MRSA, develop skin or soft tissue infection in 8-10 weeks [14].

This study mainly designed in order to determine the prevalence of *S. aureus* colonization and MRSA rate in the children admitted to Shahidbeheshtihospital between 2011-2012. It also assesses the resistance rate of MRSA to different antibiotics.

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MATERIALS AND METHODS

This study is a prospective cohort one that was conducted in the Shahidbeheshtihospital, a central teaching hospital in Kashan, Iran and patients admitted in pediatric ward and orally consent were entered in our study.

From all of the patients, specimens were taken from both anterior nares with rayon swabs for culture. The swabs were plated directly onto sheep's blood agar 5% plates, which were incubated at 35°C with 5% CO_2 for 48hours. *S. aureus*was identified systematically [15].

Antimicrobial susceptibility was evaluated by the Kirby-Bauer disk diffusion method in guide lines of Clinical and Laboratory Standards Institute [16].

Oxacillin disk was used to show methicillin resistance of *S. aureus*isolates and *S. aureus*ATCC 25923 was used as a control strain.

RESULTS

From cultures of 403 children admitted to Shahidbeheshti Hospital during the study period, 198 (49.1%) were colonized with *S. aureus*. One hundred thirty six out of these 198 cultures (68.6%) were MRSA. Antibiotic susceptibility of these MRSA isolates is shown in Table 1. The isolate that was vancomycin resistant was resistant to all tested antibiotics.

Table 1: Antibiotic susceptibility of MRSA isolates

Antibiotic	Antimicrobial resistance of MRSA isolates n (%)
Clindamycin	105 (53)
Erythromycin	173 (87.3)
Clarithromycin	160 (80.8)
Tetracycline	112 (56.5)
Rifampin	32 (16.1)
TMP-SMZ	34 (17.1)
Gentamicin	41 (20.7)
Ciprofloxacin	147 (74.2)
Vancomycin	1 (0.005)

DISCUSSION

*S. aureus*is a human pathogen which primarily colonizes thenose. In the past few decades, methicillin-resistant strainshave come to predominate in both health care-associated and community-associated *S. aureus* infections. *S. aureus*colonization increase the risk of infection and recurrent nature of the following disease [16], MRSA-colonized patients are also at increased risk of developing a MRSA infection, but data are limited of children in the previous studies.

Thus, the prevalence of 49.1% of colonization of the *S. aureus* strain in our study is quite important. This rate is higher than 36.4% rate of a study conducted in America [17]. The rate of MRSA infection in our study was 68.6% while the rate in the named study was 25.2% [17]. This may be the cause of wide antibiotic use in our center.

Another study in Texas showed 36% rate of *S. aureus* colonization and 61% MRSA [18]. The resultsof that study were in accordance with the results of our study. In a study conducted in Taiwan [19], these rates were 32% and 25% for *S. aureus*and MRSA colonization. These rates are much lower than our results and show lesser colonization of MRSA strains in that population.

These rate results are much lower in China, where Fan *et al*. [20] stated the rate of *S. aureus* and MRSA colonization as 18.4% and 1.1%. But MRSA rate is usually reported higher than this rate, as a major study in England reported it 47% [21].

The MRSA resistant rate obtained 53%, 87.2%, 80.8%, 56.5%, 16.1%, 17.1, 20.7%, 74.2% and 0.005% for Clindamycin, Erythromycin, Clarithromycin, Tetracycline, Rifampin, TMP-SMZ, Gentamicin, Ciprofloxacin and Vancomycin disks, respectively. The authors conducted a study in 2013 on diabetic patients and the results were 36.8%, 81.9%, 65.5%, 43.4%, 19.6%, 28.6%, 15.5%, 71.3% and 1.6% respectively [8]. These results are in accordance with each other regarding Rifampin, TMP-SMZ, Gentamicin, Ciprofloxacin and Vancomycin but results of the current study are higher in Clindamycin, Erythromycin, Clarithromycin and Tetracycline. These may show the prevalent use of Clindamycin, Erythromycin, Clarithromycin and Tetracycline in children in our center.

There is onevancomycin resistant *S. aureus*(VRSA) isolate in our study. This isolate was resistant to all discs used in this study. The first clinical VRSAwas reported in 2002 in USA [22]. In Iran the first VRSA was detected in 2007 [23]. A VRSA reported from diabetic foot ulcer in 2012 [24]. In a study in Tabriz, Iran that has been done on 64 S. *aureus*isolates from nasal carriages in 2011, the prevalence of MRSA and VRSA was 5.3 and 0.33 % [25]. Emerging VRSA strains should be considered important because this antibiotic is one of the last line therapies that is effective on many infections.

We could not apply molecular strain typing of MRSA that may help better understanding of MRSA epidemiology and this may be one of our limitations.

CONCLUSION

The prevalence of *S. aureus* colonization in anterior nares is high and strategies and policies for eradication of this colonization may be helpful in this region. It may be of a great importance when we think of high rate of MRSA among isolates of *S. aureus*, where they have high resistance rate to a wide range of antibiotics. Presence of a VRSA isolate in our study should ring a warning bell in controlling MRSA in Iran.

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