The antibiotic resistance pattern of community and hospital acquired \textit{Staphylococcus aureus} in children

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\textbf{ABSTRACT}

\textbf{Background and Objective}: Introduction and aims: \textit{Staphylococcus aureus} has been isolated from 20-45 percent of normal individuals. Studies have also reported various results for the resistance patterns and the rate of methicillin-resistant staphylococcus aureus (MRSA) carrier. This study aimed to assess the antibiotic pattern and the rate of \textit{S. aureus} carriage in children at the time of hospital admission and discharge in Kermanshah city, Iran.

\textbf{Methods}: During a cross-sectional study, 874 patients were included and sampled at two different times. First at the time of their admission into the hospital as community acquired isolates, and second at the time of their discharge as hospital acquired isolates. Two samples were collected from the nasal cavity of each patient and tested for \textit{S. aureus} and then the isolates were tested for antibiotic susceptibility using an E-test. If the result of the nasal culture was positive at the time of admission, they were excluded from sampling at the time of discharge.

\textbf{Results}: Of total 874 cases tested at the time of admission, 44 (5\%) had positive culture for \textit{S. aureus}, of which 3 isolates were MRSA. At the time of discharge, 56 (6.4\%), who were negative at the time of admission, became positive for \textit{S. aureus}, and 6 (10.6\%) of them were MRSA.

\textbf{Conclusions}: The presence of MRSA carriers among children is an important factor in the increase of hospital acquired infections with this pathogen. Given the high usage of antibiotics in our country and nasal colonization of children with MRSA, antibiotics should be used appropriately to prevent MRSA infections.

\textbf{Keywords}: \textit{Staphylococcus aureus}, Children, MRSA, Nasal carriers
Introduction

Staphylococcus aureus is a gram-positive bacterium that found in the nasal cavity or on the skin of 20-45% of people (1, 2). S. aureus is also an important hospital acquired pathogen. Despite antibiotic therapy, infections caused by this pathogen are increasing in hospitals (3-5). This bacterium is also an agent for community acquired infections such as; bacteremia, endocarditis, osteomyelitis, toxic shock syndrome and skin infections (7, 8).

Resistance of S. aureus to many antibiotics makes the treatment of its infections challenging (9, 10), as resistance to beta-lactam antibiotics due to beta-lactamase producing strains has emerged, and resistance to methicillin (MRSA) is also increasing (11-14). Some strains are resistant to several groups of antibiotics. Consequently, choosing an appropriate antibiotic for the treatment of S. aureus infections has become limited (15-17). A number of factors including; antibiotic usage, environmental conditions, population density and genetics, can affect bacterial resistance and nasal carriage from one area to another, therefore it is important to choose an appropriate antibiotic for the treatment of S. aureus infections as information on local resistance patterns is vital, particularly for empiric therapy (18, 19). Furthermore, most previous studies used a disc diffusion method for antibiotic susceptibility testing, but not a MIC or E-test. We studied the prevalence of S. aureus nasal carriage and antibiotic susceptibility in children at the time of their admission and discharge.

Materials and methods

In this study, 874 children who were admitted to the Imam Reza Hospital in Kermanshah, and stayed for at least 48 hours, were included. Patients who had a history of using antibiotics in the week before, or corticosteroids two weeks before admission, immunocompromised patients, hospital admission a month before the study admission, chronic systemic diseases such as: diabetes, renal failure or the presence of Staphylococcus infections, were all excluded from the study. Included patients were sampled by swab from both nasal cavities at the time of their admission and discharge. Hospital samples were put in transfer medium and taken to the Imam Reza Hospital’s laboratory. Samples were cultured on blood agar and incubated for 24-48 hours. Bacterial colonies were confirmed using; gram stain, catalase, coagulase, DNase and mannitol fermentation. The antibiotic susceptibility of the isolates was carried out using an E-test (Sweden, BioDisk) for oxacillin, erythromycin, clindamycin and cefazolin. Briefly, a bacterial suspension equal to the 0.5McFarland standard was prepared for each isolate and spread on Mueller-Hinton agar plates. After 15 minutes, the E-test strips were placed on plates and incubated for 24 hours. Growth inhibition areas were then observed and recorded, according to the manufacturer’s instructions. The results were analyzed and compared using statistical indices.

Results

Of the 874 children tested at the time of admission, 44 (5%) were nasal carriers for S. aureus and three were MRSA carriers. When the children were tested at the time of discharge, 56 (6.8%) patients who had been negative at the time of admission had become nasal carriers. Of this group, 6 patients were MRSA carriers. Overall, at the time of discharge 100
(11.4%) children were nasal carriers, of which 9 (1%) cases were MRSA carriers. The average length of the patients’ hospital admittance was 4.22 days. The difference between antibiotic resistance among community acquired and hospital acquired isolates was not statistically significant (p=0.411) (Figure 1).

Discussion

*S. aureus* is an important hospital pathogen and the results of previous researches have indicated that this pathogen can be found in various places inside hospitals and consequently transferred to patients. Situations such as inappropriate use of antibiotics and unhygienic conditions make this scenario worse (20, 21). The results of our study showed that hospital admission doubled the rate of *S. aureus* nasal carriers. Most importantly, the rate of MRSA carriers also doubled after hospital admission, which is a serious concern for hospital infection control. The results of this study were consistent with our previous study conducted in Kermanshah (22), but in that study we used a disk diffusion method. The rate of *S. aureus* nasal carriers has previously been reported from several parts of Iran. In one study on 333 individuals, 24% and 3% were *S. aureus* and MRSA carriers respectively.

This research also found 10% of isolates were resistant to erythromycin and 90% to cefotaxime (23). In another study on 200 hospital personnel, 45% of isolates were nasal carriers, and 16% MRSA carriers. In this study, 34%, 11.7% and 19%, were resistant to erythromycin, gentamicin and clindamycin, respectively (24). In a study on out-patients and in-patients, 15% of isolates were resistant to clindamycin, which is similar to our results (25, 26). Another study in Tehran in 2002 on antibiotic resistance of *S. aureus* found that 90.8%, 8.2%, 3.5%,
2.8% and 2.3% of cases were resistant to; penicillin, erythromycin, cephalazoline, clindamycin and gentamycin, respectively (27). In our study, although resistance to antibiotics in hospital acquired isolates was higher than community acquired isolates, it was not statistically significant. The rate of *S. aureus* nasal carriers has also been studied in various countries. For instance, in a study in Nepal on 112 people, including patients, hospital personnel and visitors, 12.5% were nasal carriers and 7.1% were MRSA carriers (28). In another study in Taiwan, carried out on 306 out-patient adults with a history of hemodialysis, 9.48% were MRSA carriers. This study also reported that nasal carriers had a shorter lifespan compared to non-carriers (29). In a research conducted in the USA on 500 patients, 9.2% were MRSA nasal carriers (30). Another study in the USA in 2004 on 758 patients in hospitals showed that 3.4% were MRSA carriers, the results of this study also indicated that the risk of infections among MRSA carriers was much greater than methicillin sensitive carriers. In this research, 37.5%, 25%, and 37.5% cases were resistant to; cephalaxin, gentamycin, and tetracycline, respectively (31). However, all isolates were sensitive to erythromycin. Compared with our study, resistance to cephalosporin was higher in their results, but resistance to erythromycin was lower than our results.

In conclusion, the presence of MRSA in the nasal cavities of children is one the main factors that increases hospital acquired infections with this pathogen. Given the high prescription rate of antibiotics in our country, as well as the sale of antibiotics as over-the-counter drugs and the rate of MRSA carriers, the use of appropriate antibiotics in hospitals is vitally important.

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### References


