Staphylococcus aureus Nasal Carriage and Its Antibiotic Resistance Profiles in Tibetan School Children in Southwest China

JJ Deng, GG Xiao, Y Zhu, W Zhou, CM Wan

Abstract

Objectives: To describe the Staphylococcus aureus (S. aureus) nasal carriage as well as its antibiotic resistance patterns among Tibetan healthy school children in Songpan County in Southwest China.

Methods: Nasal swabs of both anterior nares were collected from healthy school children. The identification of S. aureus was based on the colony morphology, biochemical tests and the results of Slidex Staph Plus kit. The antibiotic resistance profiles of the isolates were determined according to standard methods. Isolated strains were tested with the polymerase chain reaction assays to detect the mecA gene.

Results: 673 Tibetan healthy children were included in this study, and S. aureus was detected in 16 of 673 nasal samples (2.4%). The resistance of isolated strains to penicillin, erythromycin, clindamycin, and gentamicin was 87.5% (14/16), 56.2% (9/16), 12.5% (2/16), and 18.8% (3/16), respectively. No strains were resistant to cefoxitin or vancomycin, and mecA gene was not detected within these isolates.

Conclusion: The methicillin-sensitive S. aureus (MSSA) as well as methicillin-resistant S. aureus (MRSA) nasal carriage rate seemed to be very low among healthy school children in the Tibet Plateau.

Key words

Antibiotic resistance; Child; Nasal carriage; Staphylococcus aureus

Introduction

Staphylococcus aureus (S. aureus) is a known coloniser in humans, and the anterior nares are the most common colonisation site. S. aureus is also a frequent cause of clinically important infections ranging in severity from superficial skin and soft-tissue abscesses to invasive disease and even death. Colonising strains are often similar to those isolates from the infected tissue. Furthermore, the emergence of community acquired methicillin-resistant S. aureus (MRSA) has become an important challenge for the treatment of staphylococcal infections due to its high virulence and emerging antibiotic resistance of this kind of S. aureus. Nasal carriage of S. aureus has been regarded as being associated with the infections caused by S. aureus in the host. A better understanding of the prevalence of nasal carriage of S. aureus could be helpful for devising appropriate measurements to control diseases caused by this organism. The objectives of this study were to investigate the prevalence of nasal carriage of S. aureus among Tibetan healthy children and to determine the antibiotic resistance profiles of these isolates.

Materials and Methods

This study was conducted between September and October 2008 in Songpan County at altitude between 2700 and 3000
Staphylococcus aureus in Tibetan School Children

Six hundred and seventy-three Tibetan healthy children including 390 (57.9%) boys and 283 (42.1%) girls participated in the study. There were 245 (36.4%), 277 (41.2%) and 151 (22.4%) children in the age group of 7-13, 13-15 and 15-18 years, respectively. S. aureus strains were isolated from 16 (2.4%) children including 9 boys and 7 girls without significant difference with regard to sex (p=0.889). Of the 16 S. aureus strains, 7 strains (43.7%) was isolated from children between 7 and 13 years of age, 5 (31.3%) from children between 13 and 15 years of age, and 4 (25.0%) from children between 15 and 18 years of age. The antibiotic resistance profiles of the isolated S. aureus strains are shown in Table 1. No isolated strains were resistant to vancomycin or cefoxitin, suggesting no MRSA strain was detected. Inducible clindamycin resistance (positive D test) was found in 2 out of the 9 erythromycin-resistant isolates. No meCA gene was detected among the isolated S. aureus strains.

Discussion

Colonisation by S. aureus is considered to be associated with the S. aureus infections in human body. And studies of the carriage of S. aureus can be of great importance. A few studies have investigated the carriage rate of S. aureus in the child population in the community of the low-altitude regions of mainland China, suggesting that the overall carriage rate of S. aureus was about 18% and MRSA accounted for about 6% of the isolated S. aureus strains. However, data about the carriage rate of S. aureus in the child population on the highland of China are scarce.

Table 1  Antibiotic resistance profiles of the isolated S. aureus strains (n=16)

<table>
<thead>
<tr>
<th>Antibiotics</th>
<th>S (%)</th>
<th>I (%)</th>
<th>R (%)</th>
</tr>
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<tbody>
<tr>
<td>Penicillin</td>
<td>2 (12.5)</td>
<td>0 (0.0)</td>
<td>14 (87.5)</td>
</tr>
<tr>
<td>Erythromycin</td>
<td>5 (31.3)</td>
<td>2 (12.5)</td>
<td>9 (56.2)</td>
</tr>
<tr>
<td>Clindamycin</td>
<td>11 (68.8)</td>
<td>3 (18.7)</td>
<td>2 (12.5)</td>
</tr>
<tr>
<td>Gentamicin</td>
<td>13 (81.3)</td>
<td>0 (0.0)</td>
<td>3 (18.7)</td>
</tr>
<tr>
<td>Cefoxitin</td>
<td>16 (100.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Vancomycin</td>
<td>16 (100.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
</tbody>
</table>

S, susceptible; I, intermediate; R, resistant
This study aimed to assess the prevalence of nasal carriage of *S. aureus* within healthy children living in the Tibet Plateau and the antibiotic resistance profiles of these isolated strains. To our knowledge, this is the first study reported in this specific population in this region.

Our study showed that the nasal carriage rate of *S. aureus* among Tibetan healthy children was 2.4%. This rate was fairly low compared with previously reported rate of 30% among healthy persons. Two studies performed among school children aged from 5 to 15 years old reported the *S. aureus* carriage rate of 16.1% and 52.3%, respectively. Another study found the *S. aureus* carriage rate of 31.1% among healthy children aged between 5 and 20 years old. Our team assessed the prevalence of *S. aureus* nasal carriage within healthy school children aged between 7 and 18 years old. The extremely low *S. aureus* carriage rate in this specific population seems to be related to the highland environment where these people live in. As children from areas of better economic status such as Chengdu could get better medical care and receive antibiotic therapy frequently, the low carriage rate within the Tibetan children may also be associated with the socioeconomic status and possibly the race of people. Nonetheless, this relationship needs further determination.

The resistance of the isolated *S. aureus* strains to some antibiotics often used in the empirical treatment of *S. aureus* infections was slightly higher than that reported in some other studies, whereas no isolates were found resistant to cefoxitin or vancomycin. It seemed that although the nasal carriage rate of *S. aureus* in this study population was low, once the *S. aureus* strains were isolated, these strains might be highly resistant to some antibiotics usually used in the clinical situation. In this situation, some other antibiotics such as cefoxitin and vancomycin may be used. However, compared with our study in Chengdu, the resistance of the isolated strains to the antibiotics assessed in this study was relatively lower, which may result from the low level of antibiotic consumption. As the number of the isolated *S. aureus* strains is very limited in this study, further studies are needed to determine the antibiotic resistance profiles of this kind of organism more precisely in this region.

No MRSA strains were detected in this study, in agreement with the results of detection of *mecA* gene which allowed the *S. aureus* strains to be resistant to antibiotics such as oxacillin. Two studies conducted among school children aged between 5 and 15 years old reported the nasal carriage rate of MRSA of 0.5% and 3.9%, respectively. One study conducted among school children aged between 7 and 18 years old in Chengdu by our team found that the prevalence of MRSA was about 6%. The results of this study indicated that the prevalence of MRSA in the community of this region was still extremely low. Although there's few data about the prevalence of MRSA among pediatric patients in the hospital of this area, a few reports showed that the isolation rate of MRSA in adult patients of Tibetan highland was lower than that of other low altitude areas of mainland China. What's more, we found no *mecA* gene in these isolated *S. aureus* strains, which is different from the results of other studies previously reported. The low carriage rate of MRSA in this population may be related to the fact that antibiotics are not commonly used in these people and the specific environment. But as the number of participants in this study is limited, the prevalence of MRSA in this region needs to be further determined.

**Conclusion**

This is a preliminary study which showed that the *S. aureus* and MRSA nasal carriage rate seemed to be still low among healthy school children in the Tibet Plateau. However, as there's only a small group of participants included in this study, larger studies are needed to further determine the carriage rate of *S. aureus* among this population. Further studies can be performed to investigate why the nasal carriage of *S. aureus* is lower among this population than that from other parts of the world, which may provide new ways to reduce *S. aureus* nasal carriage in order to control the *S. aureus* infections.

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**Declaration of Interest**

None
References