Nasal carriage of *Staphylococcus aureus* among Basra Medical students

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Abstract

*Staphylococcus aureus* strains are becoming a major causes of nosocomial and community acquired infections specially those strains associated with antibiotic resistance. Nasal colonization of *S. aureus* is seen in patients and healthy individuals. This study was done to screen the nasal carriage rate of *S. aureus* among medical students (1\textsuperscript{st}, 2\textsuperscript{nd}, 4\textsuperscript{th}, 5\textsuperscript{th} and 6\textsuperscript{th} year). The highest colonization rate (42.23\%) of *S.aureus* revealed in the 4\textsuperscript{th}, 5\textsuperscript{th} and 6\textsuperscript{th} year students. However the nasal carriage of *S. aureus* of 1st and 2nd year students was 18.6\% (p<0.001). In addition nasal carriage was shown to be higher in male than female students (p<0.05). Antibiotic sensitivity pattern of *S.aureus* against 10 types of antibiotics had been reported.

**Key wards:** *Staphylococcus aureus*, nasal carriage , Basra medical college
Introduction

*Staphylococcus aureus* is one of the most common human pathogen causing nosocomial and community-acquired infections (Santosh *et al.*, 2007). Nosocomial infections due to *Staphylococcus aureus* have become an increasing problem over the last four decades (Stubbs *et al.*, 1994).

The infections caused by *S. aureus* have clinical range from minor skin infections to severe life threatening infections such as toxic shock syndrome and septicaemia (Lowy, 1998).

The anterior nares have been shown to be the main reservoir of *S. aureus* in both adults and children (Collery, 2008). Colonization may be either transient or persistent and may be at single or multiple body sites (Pathak *et al.*, 2010).

Carriage of *S. aureus* in the nose appears to play a key role in epidemiology and pathogenesis of infection (Kakhandki & Peerapur, 2012). Other sites of colonization are wounds, tracheostomy sites, sputum of intubated patients. (Kakhandki & Peerapur, 2012)

The spread of colonization occur especially in close contact areas like schools, pre-schools or households probably by the contaminated hands and from surfaces (Citak, 2011; Pathak *et al.*, 2010) where it can survive for months.

The prevalence of nasal carriage varies widely ranging from 20 to 65% in both patients and healthy population (Citak, 2011).

Healthy individuals could become carriers of the organism and have a small risk of contracting an invasive infection due to *S. aureus* (Santosh *et al.*, 2007).

Nasal carriage of *S. aureus* acts as endogenous reservoir for clinical infections in the colonized individual but also as a source of...
cross-colonization for community spread. *S. aureus* nasal colonization can be an indicator of high risk for subsequent infection (Citak, 2011).

The present study was conducted to determine if the exposure to hospital environments affected nasal carriage of *S. aureus* among Basrah Medical students.

**Materials and Methods:**

One hundred of Basra Medical College students (Iraq) were included in this study. First and second year of medical students were included in group 1. While fourth, fifth and sixth year students were included in group 2.

Student with any nasal problems (infection and allergy) were not included in this study.

**Sampling and bacteriological investigation:**

Sterile cotton swabs moisted with sterile normal saline were used in specimens collection. Samples were collected by repeatedly swabbing circularly both anterior nares with sterile cotton-tipped moistened swabs. Then samples were inoculated and streaked immediately on: Mannitol salt agar (MSA) (Himedia) & Blood agar (Himedia) plates for isolation and identification of the bacteria. The plates were incubated aerobically at 35°C for up to 72 h. Mannitolfermenting yellow or gold colonies and/or ß- haemolytic or typical colonies on blood agar was Gram stained and further screened for diagnosis of bacteria. Further identification of the isolate were done by colonial morphology, catalase, and tube coagulase test. (Murray 2003; Forbes *et al.*, 2007)

Antibiotic sensitivity was determined by Kirby Bauer method (Forbes *et al.*, 2007) by using Mueller-Hinton agar. Antibiotics tested were (ug): penicillin (10), cloxacilin (5), vancomycin (30), trimethoprim (5), gentamicin (10), ciprofloxacin
(10), amoxicillin (20), cefixime (5), cephotaxime (30) and amikacin (30)
Results were read after 24 h of incubation at 37°C.

**Statistical Analysis:**

Statistical Package for Social Science (SPSS) version 17 was used to analyze the data. Chi-square (X²) test and was used to assess the significance of differences between groups. P value less than 0.05 was considered as statistically significant and P value less than 0.01 considered as highly significant.

**Results**

Out of 100 samples that examined, 43 (86%) of Group 1 students and 45 (90%) of Group 2 students showed positive bacterial growth (Table-1). Nasal carriage of *S.aureus* was shown in all student as in Table-2.

It has been found that *S.aureus* recovered from the Group 2 students in 42.23, which was statistically higher (P<0.001) than that from Group 1 students (18.6%).

On other hand, *S.epidermidis* appeared significantly higher in Group 1 students than those in the second group (P<0.001).

Nasal carriage rate of *S.aureus* among Group 1 students has been differ significantly between males and females.

Out of 35 females of Group 1 students, 30 (85.7%) carried *S.aureus*, while out of 15 males, 13 (86.6%) was revealed *S.aureus* (Table-3).

Similarly, out of 30 females of Group 2 students, 25 (83%) carried *S.aureus*. While all male in this group (100%) showed *S.aureus* nasal carriage. Both results were significantly differed (P<0.005, P<0.001 respectively) (Table-4).

The pattern of antibiotic sensitivity of 10 isolates of
**S.aureus** showed variable effect against 10 types of antibiotic discs by measuring the diameter of inhibition zone on Muller-Hinton agar (Table-5).

All **S.aureus** isolates showed high sensitivity (100%) towards gentamicin, vancomycin, amikacin and ciprofloxacin. On the other hand S aureus isolates observed very low sensitivity percentage to cloxacillin, cefixime and cephotaxime (20%, 20%, 40%) respectively.

**Table 1. Frequency of positive cultures among groups**

<table>
<thead>
<tr>
<th>Study groups</th>
<th>*Positive culture</th>
<th>Negative culture</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>43 (86%)</td>
<td>7 (14%)</td>
<td>50</td>
</tr>
<tr>
<td>Group 2</td>
<td>45 (90%)</td>
<td>5 (10%)</td>
<td>50</td>
</tr>
<tr>
<td>Total</td>
<td>88</td>
<td>12</td>
<td>100</td>
</tr>
</tbody>
</table>

\[ df=1 \quad P>0.05 \]

*No statistical difference between various parameters* \( P>0.05 \).

**Table -2 Frequency of S. aureus among studied groups**

<table>
<thead>
<tr>
<th>Study groups</th>
<th><strong>S.aureus</strong></th>
<th><strong>S.epidermidis</strong></th>
<th>Mixed</th>
<th>*Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>8 (18.6%)</td>
<td>35 (81.4%)</td>
<td>0 (0.0)</td>
<td>43 (48.86%)</td>
</tr>
<tr>
<td>Group 2</td>
<td>19 (42.23%)</td>
<td>17 (37.78%)</td>
<td>9 (20%)</td>
<td>45 (51%)</td>
</tr>
<tr>
<td>Total</td>
<td>27 (30.68%)</td>
<td>52 (59.09%)</td>
<td>9 (10.23%)</td>
<td>88 (100%)</td>
</tr>
</tbody>
</table>

\[ df=1 \quad P<0.001 \]

*High statistical difference between various groups and various bacterial types* \( P<0.001 \).
Table -3 Nasal carriage of *S. aureus* among Group 1 according to sex differences

<table>
<thead>
<tr>
<th>Sex</th>
<th>Positive</th>
<th>Negative</th>
<th>*Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>30 (85.71%)</td>
<td>5 (14.29%)</td>
<td>35 (70%)</td>
</tr>
<tr>
<td>Male</td>
<td>13 (86.67%)</td>
<td>2 (13.34%)</td>
<td>15 (30%)</td>
</tr>
<tr>
<td>Total</td>
<td>43 (86%)</td>
<td>7 (14%)</td>
<td>50 (100%)</td>
</tr>
</tbody>
</table>

*df=1 P≤0.001*

*High statistical difference between male and female (P≤0.001).*

Table -4 Nasal carriage of *S. aureus* among Group 2 according to sex differences

<table>
<thead>
<tr>
<th>Gender</th>
<th>Positive</th>
<th>Negative</th>
<th>*Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>25 (83.34%)</td>
<td>5 (16.67%)</td>
<td>30 (60%)</td>
</tr>
<tr>
<td>Male</td>
<td>20 (100%)</td>
<td>0 (0.00%)</td>
<td>20 (40%)</td>
</tr>
<tr>
<td>Total</td>
<td>45</td>
<td>5</td>
<td>50</td>
</tr>
</tbody>
</table>

*df=1 P≤0.005*

*Nasal carriage of *S. aureus* in group 2 found to be statistically differ between male and female(P≤0.005).*
Table-5 Antibiotic susceptibility of *S.aureus* isolates

<table>
<thead>
<tr>
<th>Antibiotic types</th>
<th>Conc.</th>
<th>Inhibition zone range</th>
<th>Sensitive isolate No.(%)</th>
<th>Resistant isolate No.(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Penicillin</td>
<td>10 μg</td>
<td>17-24mm</td>
<td>8 (80%)</td>
<td>2 (20%)</td>
</tr>
<tr>
<td>Amoxicillin</td>
<td>20μg</td>
<td>16-22mm</td>
<td>8 (80%)</td>
<td>2 (20%)</td>
</tr>
<tr>
<td>Cloxacillin</td>
<td>5μg</td>
<td>10-13mm</td>
<td>2 (20%)</td>
<td>8 (80%)</td>
</tr>
<tr>
<td>Trimethoprim</td>
<td>5μg</td>
<td>12-18mm</td>
<td>6 (60%)</td>
<td>4 (40%)</td>
</tr>
<tr>
<td>Gentamicin</td>
<td>30μg</td>
<td>12-19mm</td>
<td>10 (100%)</td>
<td>0</td>
</tr>
<tr>
<td>Vancomycin</td>
<td>30μg</td>
<td>10-18mm</td>
<td>10 (100%)</td>
<td>0</td>
</tr>
<tr>
<td>Cephotaxime</td>
<td>30μg</td>
<td>12-13mm</td>
<td>4 (40%)</td>
<td>6 (60%)</td>
</tr>
<tr>
<td>Amikacin</td>
<td>30μg</td>
<td>19-24mm</td>
<td>10 (100%)</td>
<td>0</td>
</tr>
<tr>
<td>Ciprofloxacin</td>
<td>10μg</td>
<td>22-30mm</td>
<td>10 (100%)</td>
<td>0</td>
</tr>
<tr>
<td>Cifixime</td>
<td>5μg</td>
<td>10-12mm</td>
<td>2 (20%)</td>
<td>8 (80%)</td>
</tr>
</tbody>
</table>
Discussion:

Medical students can become colonized with various pathogens and can propagated these bacteria to other contacts (including healthy individuals or patients (Chambers 2001; Mulligan et al, 1993).

In this study, the student of 4th 5th and 6th year been colonized with bacteria more than 1st and 2nd year students. Beside that from this high percent of growth (90%) S.aureus has been estimated to colonize the nasal passages of those students significantly higher than S.epidermidis, this might be resulted from that the second group had more than five sessions in the hospital which lead to prolong contact with the patients and medical staff in the hospitals. This finding was in agreement with that study of Reva Balci etal, 2009.

A high nasal carriage rate of S.aureus difference was determined in male than female in all student(Tables 3 &4).These difference might be occurred regarding the females behavior in cleaning their face. Also the variation could be associated with oestrogen levels (Winkler et al, 1990).

The pattern of antibiotic sensitivity of S.aureus isolates reported levels of resistance against cloxacillin, cifaxime, Cephotaxime (table-5).The emergence of antibiotic resistant bacteria constitutes a major problem in antibiotic therapy. This could be attributed to unrestricted use of antibiotics in a particular environment (Onwubiko & Sadiq, 2011). Actually high level antibiotic abuse arising from self-medication which is often associated with inadequate dosage.

Hence, the nasal carriage of S.aureus should be Prevented to
overcome the transmission of resistance strains.

Stubbs et al (1994) and Foster (2004) had been demonstrated that the individual with harmless *S.aureus* could become carrier.

The interaction and exposure to hospital environments could cause major brisk in transmitting to hospital patients & spreading nosocomial infection.

So, wearing masking, sterilization of hands and object before and after entering of students to the hospitals besides protection measure of the hospitals at all could be helpful in elimination both cross-infection &increasing the carriage rate of *S.aureus*.

In conclusion the students of 4\textsuperscript{th} 5\textsuperscript{th} and 6\textsuperscript{th} year had been colonized with bacteria more than 1\textsuperscript{st} and 2\textsuperscript{nd} year students. Also *S.aureus* has been estimated to colonize the nasal passages of those students significantly higher than *S. epidermidis*. The pattern of antibiotic sensitivity of *S. aureus* isolates reported levels of resistance against Cloxacillin, Cifixime & Cephotaxime.
References


الحمل الجرثومي الأنفي للمكورات العنقودية الذهبية لدى طلبة كلية طب البصرة

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الخلاصه

تعتبر سلالات المكورات العنقودية الذهبية من الاسباب الرئيسية لعدوى المستشفيات وعذوى المجتمع المكتسبة وخاصة تلك السلالات المقاومة للمضادات الحيوية. إن الحمل الجرثومي لهذه المكورات الذهبية سجل لدى كل من المرضى و الاشخاص الاصحاح. اجريت هذه الدراسة لتحديد معدلات الحمل الجرثومي لدى طلبة كلية طب البصرة (المرحلة الولى والثانية والرابعة والخامسة والسادسة). أعلى معدل لللاستعمار الجرثومي (42.23%) وجدت في طلبة المرحلة الرابعة والخامسة والسادسة. كما ظهر الحمل الجرثومي لطلبة المرحلتين الأولى والثانية بنسبة 18.6% (p<0.001). بالإضافة إلى ذلك فان الحمل الجرثومي ظهر أكثر في أنوف الطلبة الذكور من الإناث (p<0.05). اجري اختبار الحساسية الدوائية باستخدام عشرة أنواع من المضادات الحيوية لتحديد حساسية أنواع المكورات العنقودية المعزولة من انوف الطلبة.