Prevalence of Nasal Carriage of Methicillin Resistant *Staphylococcus aureus* among Health Care Workers in a Tertiary Care Teaching Hospital in Maharashtra, India

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**ABSTRACT**

Methicillin-resistant *Staphylococcus aureus* (MRSA) is an important cause of hospital-acquired infections in many countries. Mainly healthcare workers (HCWs) are at risk for *Methicillin-resistant Staphylococcus aureus* carriage. A total of 100 healthcare workers (HCWs) were screened for carriage of MRSA. Nasal swabs collected from both anterior nares were transported to microbiology laboratory and inoculated on Mannitol salt agar plates. The plates were then incubated aerobically at 37°C for 24 hours and *S. aureus* was identified. The standard strains of *S. aureus* were screened for methicillin susceptibility by modified Kirby Bauer method by using cefoxitin discs (30µg) on Muller Hinton agar by using an inoculum density which was equivalent to Mcfarland’s 0.5 standard. Isolates which showed inhibition zone sizes of diameter ≤ 21 mm were identified as MRSA strains. MRSA ATCC 29213 and MSSA ATCC 33591 were used as control for antibiotic susceptibility tests. Overall carriage rate was 15%, with the highest rate in nursing staff (40%) while the lowest in Doctors (26.66%). Female gender was affected more with 66.66%. Health care workers can be a major source of MRSA in our hospital. There is a need for MRSA control policies in hospitals.

**Keywords**

Healthcare workers, Methicillin-resistant *Staphylococcus aureus*, MRSA carriage, Nasal carriage, *Staphylococcus aureus*

**Article Info**

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Introduction

*Staphylococcus aureus* is a human bacterial pathogen which leads to many infections, causing spread from patient to patient in hospital setups and other institutions. However, healthy individuals carry less risk of contracting invasive infections by this organism but can be carriers of this pathogen (Foster, 2004). *Staphylococcal* infections cause significant morbidity and mortality in community as well as hospital settings. Treating infections caused by *S. aureus* has become difficult since the development of MRSA (Kumar et al., 2011). In last two decades MRSA has become endemic worldwide (Fadeyi et al., 2010). MRSA has emerged as one of the commonest cause of
hospital acquired infection since its isolation and it continues to remain as a significant factor contributing to treatment failure (Shakya et al., 2010). MRSA is capable of causing serious manifestations like localized skin and wound infections and may also lead to life threatening infections. Potential reservoirs for MRSA are infected inpatients, hospital personnel and inanimate hospital environment. It can easily spread from one patient to another (Bala et al., 2010).

The main mode of MRSA transmission is from MRSA-colonized or infected patients to another by direct contact, through health care workers (Nour de San et al., 2007). Thus, patients may acquire MRSA from colonized HCWs (Hetty E.M. Blok et al., 2003). Similarly, healthcare providers are also exposed to patients with MRSA infection or are colonized in the course of their work (Akoua Koffi et al., 2004). Nasal carriage is a major risk factor for *Staphylococcus aureus* infection, especially for MRSA (Methicillin resistant *Staphylococcus aureus*. Wikipedia, the free encyclopedia, www.wikipedia.com). Anterior nares are the major reservoir of *S. aureus*. 20% of humans are persistent carriers, 60% are intermittent and 20% are noncarriers (González-Zorn et al., 2005).

Screening and eradication of MRSA from colonized healthcare workers have been recognized and recommended as an important part of a comprehensive infection control policy for MRSA (Fadeyi et al., 2010). It was with this background that this study was undertaken in our hospital mainly to screen health care workers for MRSA carriage.

**Materials and Methods**

This present prospective cross-sectional study was conducted at Department of Microbiology in a tertiary health care centre. A total of 100 subjects (31 doctors, 33 nursing staff and 36 ward attendants) were screened for MRSA after obtaining informed consent and approval by the institute ethical committee. Complete information about the participants was obtained in a proforma designed for this purpose, after getting their consent. Nasal swabs were collected from both anterior nares with sterile cotton swabs previously moistened with 2 to 3 drops of sterile normal saline. The samples were transported to microbiology laboratory and were processed within 2 hours.

These swabs were inoculated on Mannitol salt agar plates. The plates were then incubated aerobically at 37º C for 24 hours and examined for growth. Growth was identified as *S. aureus* by using standard procedures to study colony morphology, microscopic appearance on gram stained smears, catalase test, slide and tube coagulase test (Cheesbrough, 2009).

The standard strains of *S. aureus* were screened for methicillin susceptibility by modified Kirby Bauer method by using cefoxitin discs (30µg) on Muller Hinton agar by using an inoculum density which was equivalent to Mcfarland’s 0.5 standard. Isolates which showed inhibition zone sizes of diameter ≤ 21 mm were considered as MRSA strains (CLSI 2019). MRSA ATCC 29213 and MSSA ATCC 33591 were used as control for antibiotic susceptibility tests. The health care workers who were found to be colonized with MRSA were advised to apply 2 % Mupirocin ointment three times a day in their nares for 5 days. (Apurba S. Sastry and Deepashree, 2019).

**Results and Discussion**

A total of 100 healthcare workers, of different age groups and designations were screened for MRSA. Among them 35 were males and 65 were females. Out of which 31 were
4 doctors, 6 Nursing staff and 5 Ward attendants were found to be positive for MRSA. Out of which 3 HCWs had work experience of 1-5 years, 5 HCWs had work experience of 6-10 years and 11-15 years each and 1 HCW each were found to be positive for MRSA with work experience ranging from 21-30 years and 31-40 years respectively. Most frequently affected were Nursing staff i.e. 6 in number. Total 10 Female HCW and 5 Male HCW were reported MRSA positive (Table 3 and 4).

Colonization and infection by *S. aureus* are known to be significantly associated with infection among hospitalized patients. (Po-Liang Lu *et al.*, 2008).

In our study a total of 100 subjects with work experience range between 1-40 years were screened for MRSA carriage. Among them 35 (35%) were males and 65 (65%) were females. From these subjects 31 (31%) Doctors, 33 (33%) Nursing staff and 36 (36%) were Ward attendants. Among 100 health care workers screened, 15 were positive for MRSA at nasal sites, giving a carriage rate of 15%. Among the 35 of males screened 5(14.28%) were positive, compared to 65 females, 10 (15.38%) of them were positive. The distribution of MRSA carriage across cadre (presented Table 3) was 26.66% in Doctors, 40% in nursing staff and 33.33% in Ward attendants were colonized with MRSA (Table 4).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doctors</td>
<td>14</td>
<td>17</td>
<td>31</td>
</tr>
<tr>
<td>Nursing staff</td>
<td>03</td>
<td>30</td>
<td>33</td>
</tr>
<tr>
<td>Ward attendants</td>
<td>18</td>
<td>18</td>
<td>36</td>
</tr>
<tr>
<td>Total</td>
<td>35</td>
<td>65</td>
<td>100</td>
</tr>
</tbody>
</table>

### Table 1: Gender and Designation wise distribution of HCW

<table>
<thead>
<tr>
<th>Years of Experience in years</th>
<th>Doctors</th>
<th>Nursing staff</th>
<th>Ward attendants</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-1</td>
<td>02</td>
<td>03</td>
<td>01</td>
</tr>
<tr>
<td>1-5</td>
<td>11</td>
<td>10</td>
<td>01</td>
</tr>
<tr>
<td>6-10</td>
<td>10</td>
<td>06</td>
<td>04</td>
</tr>
<tr>
<td>11-15</td>
<td>03</td>
<td>06</td>
<td>09</td>
</tr>
<tr>
<td>16-20</td>
<td>01</td>
<td>02</td>
<td>08</td>
</tr>
<tr>
<td>21-30</td>
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<td>05</td>
<td>10</td>
</tr>
<tr>
<td>31-40</td>
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<td>01</td>
<td>03</td>
</tr>
<tr>
<td>Total</td>
<td>31</td>
<td>33</td>
<td>36</td>
</tr>
</tbody>
</table>

### Table 2: Work Experience wise distribution of HCW
The most frequent carriage site for *S. aureus* is anterior nares of the nose. *S. aureus* can also colonize other body sites such as skin, perineum, pharynx, vagina, axilla, and gastrointestinal tract of the human beings. (Wertheim HF., *et al.*, 2005) The reported prevalence of nasal carriage of MRSA among HCWs in hospital settings varies between 5.8% and 17.8%. (Eveillard *et al.*, 2004; Mulqueen *et al.*, 2007; Cesur *et al.*, 2004). In the present study, this carriage rate was 15% which is comparable to a study from Karnataka (India) from where the reported rates were 15%. (Kalyani *et al.*, 2012) However, studies from Nepal and another state of India (Assam) reported a comparatively lower prevalence (10% and 11.43%, respectively) (Shakya *et al.*, 2010; Rongpharpi *et al.*, 2013) Also low prevalence of MRSA (2.32% and 2%) has been observed in another study from Nepal and South India, respectively (Shrestha *et al.*, 2009; Vinodhkumaradithyaa *et al.*, 2009) This difference could be because of the variations in the geographic areas, institutions, hospital specialties, and settings within hospital where the studies were conducted. Disparity in carriage rate can be due to difference in the design of the study and methods used for detection of MRSA.

In the present study, higher proportion of MRSA carriage was observed among the nursing staff (40%) as compared to doctors and ward attendants. This is similar to the findings of Kalyani *et al.*, (2012).

The mechanism leading to MRSA nasal carriage is multifactorial and not properly understood, but higher carriage rate in nursing staff poses a big epidemiological challenge because nursing staff are the HCWs who have the highest frequency of contact with the patients and could probably be the reservoir of infection, thus responsible for continuance of the infection in the hospital environment.
Majority of the MRSA carriers of our study were females which is similar to the finding of Vijaya et al., (2011). In contrast, Mathanraj et al., and another review studies reported male sex as an important risk factor for MRSA colonization (Akoua Koffi et al., 2004; Wertheim et al., 2005; Mathanraj et al., 2009) However, the role of gender including that of sex hormones in MRSA carriage is controversial and needs further study.

Health care workers can be a major source of MRSA in our hospital. Active surveillance for MRSA should be carried out for health care workers who are epidemiologically linked to MRSA outbreak or who are working for long time in MRSA prevalent units. There is need for the development, adoption and enforcement of appropriate infection control policies in hospitals for effective MRSA control.

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