NASAL CARRIAGE OF STAPHYLOCOCCUS AUREUS WITH SPECIAL EMPHASIS ON METHICILLIN-RESISTANT STAPHYLOCOCCUS AUREUS AMONG STUDENTS OF A SOUTH INDIAN MEDICAL COLLEGE - PREVALENCE AND ANTIBIOMGRAM PATTERN

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INTRODUCTION

Staphylococcus aureus remains an important human pathogen responsible for health-care and community-associated infections, which also behaves as a commensal in healthy individuals, adopting the anterior nares as its ecological niche. Although primary S. aureus infections are not common, a great deal of the virulence of this organism occurs through cross-infection by spread from patient to patient in hospitals and other institutional settings. In contrast, healthy individuals have a small risk of contracting an invasive infection caused by S. aureus, but they can be carriers of the organism [1]. It is well known that nasal colonization constitutes a risk factor for subsequent severe infection but it also can be the source of transmission of this bacterium to other susceptible individuals [2]. Asymptomatic carriage of S. aureus in healthy individuals has been shown to have a high prevalence, especially in children, young adults, and health-care workers [3]. The incidence of community-acquired and hospital-acquired S. aureus infections has been rising with increasing emergence of drug-resistant strains called methicillin-resistant S. aureus (MRSA) [4]. MRSA is an established pathogen in most health care facilities. Previously limited to hospitals, MRSA infections have been increasingly reported in the community [5,6]. A recent meta-analysis of 27 studies of the prevalence of community-acquired-MRSA among hospital patients that used clinical specimens, as opposed to surveillance cultures conducted at the time of admission, yielded a prevalence of MRSA of 30.2% [7]. A variety of studies have examined community prevalence of nasal carriage of S. aureus in diverse subpopulations such as adult outpatients, health-care workers, college students, and injection drug users [8,9]. These are issues that may be very useful to clinicians when trying to decide the likelihood that a given patient has a staphylococcal infection and, if so, whether antibiotic coverage should be provided for resistant strains [5]. Exposure to microbes is an inherent risk of working in patient care settings. In view of its increasing incidence in the general population, acquisition of MRSA is a special concern for health-care workers [10]. Medical students represent an important portion of the healthcare personnel, and they are in frequent contact with patients. Thus, they are at risk of being colonized with different pathogens including S. aureus and of spreading them to susceptible patients. Different studies around the world have evaluated nasal carriage rates of S. aureus in medical students. Some of these studies reported that nasal carriage rates of S. aureus increased with greater exposure of students to the hospital environment [11-13]. No in detail study has analyzed whether this patient exposure creates a risk of MRSA carriage for Indian medical students. The aim and objective of the study was to evaluate the prevalence of nasal carriage of S. aureus, MRSA in particular, antibiotic susceptibility pattern and to correlate the risk factors for the carriage status among the 2nd year medical students of our institution.

METHODS

The proposed study was conducted in the Microbiology Diagnostic Laboratory of Kasturba Medical College, Mangalore. This was a type of cross-sectional study. All consenting students of 2nd year MBBS, the third term were randomly recruited into the study. The study proposal was submitted to the ethical review committee of the institution for approval. The age, sex, lifestyle, current skin infection/other illnesses and another relevant information about the participants was obtained.

ABSTRACT

Objective: There is paucity of information on carriage of Staphylococcus aureus and Methicillin Resistant S.aureus from developing nations including the medical students who could be the potential transmitters. Present study was aimed at establishing the prevalence and antibiogram pattern of S. aureus with special emphasis on MRSA among II year MBBS students of Kasturba Medical College, Mangalore.

Methods: A total of 148 students were participated in this study. Swabs taken from both anterior nares were processed, and the growth of S. aureus was confirmed by standard procedure. Further categorization of S. aureus into MRSA was done using cefoxitin disc diffusion method, along with the antibiogram to other common drugs.

Results: The number of strains of S. aureus isolated from our 148 participants was 78 with a percentage rate of 52.7. Of the 78 isolates of S. aureus, 9 (11.5%) were MRSA. The overall MRSA carriage rate was 6.1%.

Conclusion: The S. aureus and MRSA carriage rates recorded in this study were significantly higher when compared with other reported studies. It was observed that risk factors like use of antibiotics in past 6 months and snoring were found to be statistically significant in nasal carriage status of S. aureus. Out of nine MRSA carriers, six were found to be having the parents who were busy clinicians by occupation and the close contact with them could be the prime factor in the acquisition of MRSA carriage status.

Keywords: Staphylococcus aureus, MRSA, Nasal carriage, Medical students.
in a pro forma designed for the said purpose. A total of 148 students were participated in this study. Swabs of both anterior nares of consenting persons were taken with a sterile swab stick moistened with sterile physiological saline. Processing of the samples was done immediately within 2 hrs after collection. In the case of delay, more than 2 hrs the swabs were stored at 4°C for maximum 24 hrs. The swabs were inoculated onto manitol salt agar (MSA), and the inoculated MSA was incubated at 37°C for 18-24 hrs. The growth of the organism was identified as S. aureus using standard tests such as colony morphology, gram stain, catalase test, and coagulase test [13]. The isolated strains of S. aureus were screened for methicillin resistance by modified Kirby-Bauer method using cefoxitin (30 µg) disc on Mueller-Hinton agar (MHA) [14]. The MHA on which cefoxitin was placed was incubated aerobically at 37°C for 18 hrs. Isolates with inhibition zone diameter ≤21 mm around cefoxitin disc were considered MRSA strains [15]. Screening for vancomycin susceptibility was also done by the modified Kirby-Bauer method using vancomycin disc (30 µg) on MHA incubated at 37°C for 24 hrs. Further confirmation of vancomycin susceptibility was done by minimum inhibitory concentration (MIC) estimation using vancomycin E-test strips. Antibiotic sensitivity to all S. aureus isolates against other antibiotics such as amoxicillin/clavulanic acid, cotrimoxazole, ciprofloxacin, ceftriaxone, erythromycin, gentamicin, linezolid, penicillin, and teicoplanin were determined by modified Kirby-Bauer method. All inoculum on MHA was 4-6 hrs growth of pure isolates in Muller Hinton broth, with density equivalent to 0.5 McFarland turbidity standard. S. aureus ATCC 25923, MRSA ATCC 29213, MSSA ATCC 33591 were used as control. All antibiotic discs and the vancomycin E-test strips were procured from HiMedia Laboratories Pvt. Limited, India. Antibiotic sensitivity testing and result interpretation was done according to CLSI Guidelines [16].

**Statistical analysis**

Results were compiled and tabulated, and all data were subjected to the Statistical Package Social Sciences SPSS version 17.0. The results were presented in the form of tables and graphs. Associations of different factors were done using Chi-square test. p<0.05 was considered as significant.

**RESULTS AND DISCUSSION**

A total of 148 students of II MBBS, age range 19-22 years were screened for MRSA. 63 (42.6%) were males and 85 (57.4%) females (Table 1). The types of organisms isolated from the anterior nares of the participants have been shown in Table 2. S. aureus was predominant (52.7%) followed by coagulase-negative Staphylococcus (28.4%). Out of 148, 78 students were positive for nasal carriage of S. aureus giving a carriage rate of 52.7%. Nine out of 78 isolates of S. aureus were MRSA giving a percentage of 11.5. Overall, MRSA nasal carriage rate was 6.1%. Nasal carriage rate and again with zero percentage of MRSA [19]. Yet another study from Thailand disclosed 29.68% of S. aureus nasal carriage rate and again with zero percentage of MRSA [19]. Whereas the outcome of two more studies from pre-clinical students of Duhok University and Saudi Arabia were 9.2%; 18.7% of S. aureus nasal carriage rate [18]. The percentage of 11.5. The overall MRSA carriage rate was 6.1%.

The swabs of the participants have been shown in Fig. 1. The antibiotic susceptibility pattern of MRSA isolates has been shown in Fig. 2. 92% of the isolates of S. aureus were resistant to penicillin, whereas resistance to amoxiclav and erythromycin were 15.4% and 54%, respectively. The nine isolates of MRSA showed sensitivity of 100% to vancomycin, linezolid, ceftriaxone, gentamicin, and teicoplanin. All the nine isolates of MRSA were resistant to penicillin, erythromycin, and amoxiclav. Further MIC to vancomycin in all the nine isolates of MRSA was found to be <2 µg/ml by E-test. The repeat samples obtained from the participants confirmed that they were MRSA and expressed the same pattern of antibiotic susceptibility. MSA found to be very useful for the quick identification of S. aureus.

**DISCUSSION**

Nasal carriage of S. aureus among II year MBBS students of Kasturba Medical College, Mangalore, according to the result of this study was 52.7%. Out of 78 isolates of S. aureus, nine were MRSA positive with the percentage of 11.5. The overall MRSA carriage rate was 6.1%. The S. aureus and MRSA carriage rates recorded in this study were significantly higher when compared with other reported studies. Different studies around the world have evaluated nasal carriage rates of S. aureus and MRSA in pre-clinical medical students. One of the studies from India by involving pre-clinical students of Malaysian base revealed nasal carriage rate of 23.7% of S. aureus and no MRSA [18]. Yet another study from Thailand disclosed 29.68% of S. aureus nasal carriage rate and again with zero percentage of MRSA [19]. Whereas the outcome of two more studies from pre-clinical students of Duhok University and Saudi Arabia were 9.2%; 18.7% of S. aureus and 4.6%; 6.7% of MRSA respectively [20,21]. It was observed that risk factors like use of antibiotics in past 6 months and snoring were found to be

**Table 1: Gender wise distribution of participants, carriage status of S. aureus and MRSA**

| Gender    | Number of participants (%) | S. aureus carriers (%) | MRSA carriers (%) |
|-----------|----------------------------|------------------------|-------------------|
| Male      | 63 (42.6)                  | 33 (42.3)              | 3 (3.3)           |
| Female    | 85 (57.4)                  | 45 (57.7)              | 6 (6.6)           |
| Total     | 148                        | 78 (52.7)              | 9 (6.1)           |

MRSA: Methicillin-resistant Staphylococcus aureus, S. aureus: Staphylococcus aureus

**Table 2: Nature of organisms isolated from anterior nares**

| S. No. | Organisms isolated | Frequency (%) |
|--------|--------------------|---------------|
| 1      | S. aureus          | 78 (52.70)    |
| 2      | CONS               | 42 (28.3)     |
| 3      | Diphtheroids       | 9 (6.10)      |
| 4      | No growth          | 19 (12.83)    |

S. aureus: Staphylococcus aureus, CONS: Coagulase negative Staphylococcus

**Fig. 1: Antibiotic susceptibility profile of Staphylococcus aureus isolates**
Among nasal carriage in a student community: infections [26]. Another shortcoming for this: An antibiotic had used antibiotics in the past 6 months and infection. JAMA swab culture to check the efficacy of treatment in the eradication of those MRSA carriers after taking their consent and repeat the nasal reduction in effectiveness [27]. It is recommended to educate and treat antibiotic is the increasing trend in resistance and the subsequent nosocomial common within several months [25]. Furthermore, clinical studies the bacterium from the nose over a few weeks, and nasal relapses are MRSA [24]. The limitation is, this antibiotic is only effective at removing certain groups of patients and health-care workers colonized with recommend the use of mupirocin for nasal decolonization in tried with topical and oral antibiotics. The international guidelines remain essential to control the spread of MRSA [22,23]. Eradication transmission; thus emphasizing that good hand hygiene practices more likely act as vectors and not as the main sources of MRSA. There are published evidence pointing out that health-care workers with mupirocin and further screened for MRSA carriage status to treat them. Aiming at 0% carriage rate these students may be treated sensitive to vancomycin, teicoplanin, linezolid it will not be difficult to the patients or other individuals. Since all the strains of MRSA were sensitive to vancomycin, teicoplanin, linezolid it will not be difficult to treat them. Aiming at 0% carriage rate these patients may be treated with mupirocin and further screened for MRSA carriage status to check the efficacy of treatment.

There are published evidence pointing out that health-care workers more likely act as vectors and not as the main sources of MRSA transmission; thus emphasizing that good hand hygiene practices remain essential to control the spread of MRSA [22,23]. Eradication of MRSA colonization from patients and healthy carriers has been tried with topical and oral antibiotics. The international guidelines recommend the use of mupirocin for nasal decolonization in certain groups of patients and health-care workers colonized with MRSA [24]. The limitation is, this antibiotic is only effective at removing the bacterium from the nose over a few weeks, and nasal relapses are common within several months [25]. Furthermore, clinical studies have found little or no efficacy of mupirocin treatment in preventing nosocomial S. aureus infections [26]. Another shortcoming for this antibiotic is the increasing trend in resistance and the subsequent reduction in effectiveness [27]. It is recommended to educate and treat those MRSA carriers after taking their consent and repeat the nasal swab culture to check the efficacy of treatment in the eradication of MRSA carriage status. However, periodic screening for MRSA should be an on-going practice in medical student population.

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