

Methicillin-resistant *Staphylococcus aureus* Carriage among the Health Care Workers in a Tertiary Care Hospital

MALINI J., SHRUTI A. HARLE, PADMAVATHY M., UMAPATHY B.L., NAVANEETH B.V., KEERTHI MANNAN J., GIRISH M.S.

ABSTRACT

Background: Methicillin-resistant *Staphylococcus aureus* (MRSA) nosocomial infection outbreaks and prevalence among various populations have been well reported in the literature, particularly with respect to the developed and the developing countries. The hospital personnel tend to have higher colonization of MRSA than the general population. The personnel with MRSA colonization are the sources of dissemination of the organisms, both in the hospital and the community.

Aim: The present study was conducted to assess the carriage rate of MRSA among health care workers (HCWs).

Design: A hospital based prospective study.

Place and Duration: Department of Microbiology, ESIC-MC-PGIMS, Rajajinagar, Bangalore, from October 2010 to April 2011.

Materials and Methods: A total of 150 HCWs who were involved in the management of critically ill patients [in the intensive care unit (adult), all surgical specialties, post-operative surgical wards, major OT and minor OT] were screened for MRSA by collecting their nasal swabs, throat swabs and swabs from the webs of their fingers. *Staphylococcus aureus* was identified by the standard methods. Antibiotic susceptibility was performed according to the Kirby-Bauer disc diffusion method. MRSA was identified by using a cefoxitin 30 mcg disc and it was interpreted according to the Clinical Laboratory Standards Institute guidelines. All the carriers which were identified were decolonized with Mupirocin (Supirocin ointment 2% Glen mark), local application twice a

day for ten days, and subsequently, they were checked for the decolonized state.

Statistical analysis: The findings were statistically analyzed by using the Chi-square test.

Results: Of the 150 HCWs who were screened, 15 (10%) had MRSA either in the nose or on the hand. The nasal carriage of MRSA was higher (8%) than the hand carriage (2%) and none had throat carriage as compared to the Methicillin sensitive *Staphylococcus aureus* carriage rate in the nose and on the hand 3.4% and 0.6% respectively, which was statistically significant ($p < 0.05$). Doctors, nurses and nursing orderlies were the predominant carriers (4%, 2%, and 2%, respectively). The antibiogram of the MRSA isolates revealed the highest resistance to penicillin and amoxycylav (93% each). The sensitivity to erythromycin, gentamicin, amikacin, ciprofloxacin and cotrimoxazole was variable (53%-73%). All the MRSA isolates were sensitive to vancomycin. Thirteen (86.6 %) carriers were successfully decolonized with the local application of Mupirocin. However, two of the carriers did not take part in the further studies.

Conclusion: The MRSA carriage rate among the HCWs in our hospital was high, particularly among the doctors and nurses. Screening and decolonization may be effective in decreasing the MRSA carriage rate among the HCWs. Standard infection control precautions should be employed in the professional practice to minimize either the carriage or the transmission rate.

Key Words: Methicillin resistant *Staphylococcus aureus*, Methicillin sensitive *Staphylococcus aureus*, Health-care workers, Colonization and decolonization

INTRODUCTION

Methicillin Resistant *Staphylococcus aureus* (MRSA) has become endemic worldwide within the past two decades. There are both the hospital acquired MRSA and the community acquired MRSA strains and infections [1]. Asymptomatically colonized patients and health care workers (HCW) are the major sources of MRSA in the hospital environment, with the latter being more commonly identified as the link in the transmission of MRSA between the patients [2]. The role of the MRSA carriers in the transmission of this pathogen is critical. Such carriers may transmit the organism to another person through direct contact, usually through colonized hands and aerosolization following sneezing. Therefore, HCWs who are at the interface between the hospital and the community may serve as the agents of the cross-transmission of the hospital acquired MRSA and the community acquired MRSA [1].

Nonetheless, the nosocomial transmissions of MRSA from and through health care givers to the hospitalized patients have been documented and these may be greater than was previously thought [3].

The knowledge of the MRSA prevalence and the current antimicrobial profile is necessary for the selection of the appropriate antimicrobial empirical treatment for these infections [4].

Similarly, the screening and eradication of MRSA from the colonized HCWs have been recognized and recommended as an important part of a comprehensive infection control policy for this organism. The hospital infection control staff need to limit the spread of MRSA for several reasons. There have recently been reports on the strains of MRSA that had an intermediate resistance to vancomycin. This is an important concern since the already limited treatment options for serious MRSA infections may become more limited due to the

increase in resistance to vancomycin. Limiting the transmission of MRSA might reduce the potential for these strains to spread [5].

This study was therefore aimed at establishing the carriage rate of MRSA among the HCWs in the critical care units. The outcome may be useful for formulating an MRSA control policy and an infection control policy for our hospital.

MATERIALS AND METHODS

This prospective study was conducted between October 2010 and April 2011.

Inclusion criteria: All the HCWs who were involved in the management of critically ill patients [in the intensive care unit (adult), all surgical specialties, postoperative surgical wards, major Operation Theatre (OT) and minor OT] were recruited into the study after obtaining their informed consent.

This study was approved by the ethical review committee of the hospital.

Exclusion criteria: Hospitalization within the previous one year and the use of antibiotics within one week of collection of the swabs.

The age, sex, work category, time of employment, duration of working in the critical care unit, prior hospitalization, current skin infection/other illness and other relevant information about the participants were obtained in a proforma which was designed for this purpose. By using pre-moistened sterile cotton swabs, specimens were collected from the anterior nares, throat, palms and web spaces (taken after at least 30 min of the last hand wash) of the HCWs [5]. The specimens were inoculated onto appropriate media and *Staphylococcus aureus* was identified as per the recommended procedures [6]. The in-vitro antibiotic susceptibility test of all the isolates of *Staphylococcus aureus* was performed by using the Kirby-Bauer disc diffusion method [7]. The antibiotics which were used were penicillin (10U), amoxycylav (20/10mcg), erythromycin (15mcg), gentamicin (10mcg), amikacin (30mcg), ciprofloxacin (5mcg), cotrimoxazole (1.25/23.75mcg), vancomycin (30mcg) and tetracycline (30mcg). The zone diameters were interpreted according to the Clinical Laboratory Standards Institute (CLSI) guidelines. *Staphylococcus aureus* was further screened for Methicillin resistance by the Kirby-Bauer method by using cefoxitin (30 mcg) discs according to the CLSI guidelines [8].

All the MRSA carriers were subjected to decolonization with Mupirocin (supirocin ointment 2% Glenmark), local application twice a day for 10 days and subsequently, the swabs were collected to check for the status of the carrier state.

Statistical analysis: The findings were statistically analyzed by using the Chi-square test.

RESULTS

Out of the 150 HCWs who were screened for MRSA, 84 (56%) were females and 66 (44%) were males. Nurses 47(31%), nursing orderlies 40(27%) and doctors 36(24%) constituted a majority of the HCWs who were screened [Table /Fig-1].

Twenty one (14%) *Staphylococcus aureus* strains were isolated in all, of which 15 (10%) were MRSA.

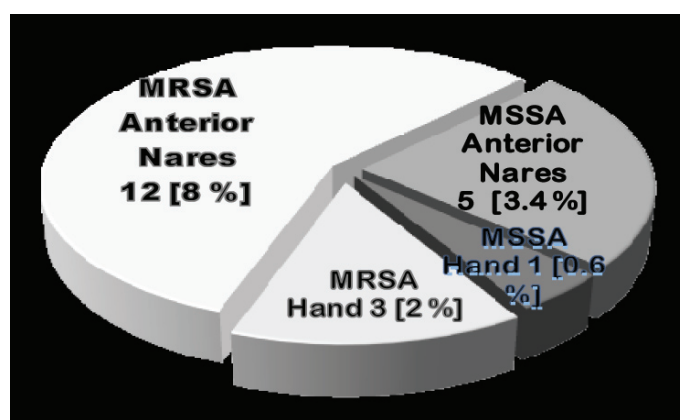
The proportion of HCWs with the nasal carriage of MRSA was higher (8%) than that on the hand (2%) and none had throat carriage as compared to Methicillin sensitive *Staphylococcus aureus* (MSSA) with nasal and hand carriage (3.4% and 0.6% respectively) (P< 0.05) [Table /Fig-2].

The highest carriage rate was seen in doctors (4%), followed by nurses and nursing orderlies (2% and 2% respectively) [Table/ Fig-3].

Thirteen (86.6 %) carriers were successfully decolonized with the local application of Mupirocin. However, two of the carriers did not take part in the further studies.

Category	Frequency (%)	Male (%)	Female (%)
Staff nurse	47 (31)	7 (15)	40 (85)
Nursing orderly	40 (27)	22 (55)	18 (45)
Doctors	36 (24)	25 (69)	11 (31)
House keeping	19 (13)	6 (32)	13 (68)
Operation theatre and Central Sterile supply department technician	08 (5)	6 (75)	2 (25)
Total	150	66 (44)	84 (56)

[Table/Fig-1]: Health care workers screened for Methicillin Resistant *Staphylococcus aureus*

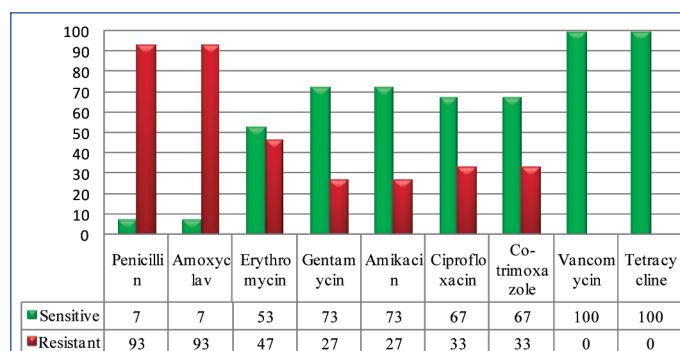


[Table/Fig-2]: Site Distribution of *Staphylococcus aureus* isolates

MRSA- Methicillin Resistant *Staphylococcus aureus*
MSSA- Methicillin Sensitive *Staphylococcus aureus*

Category	No. sampled (n=150)	Number positive (Carriage rate %)
Doctors	36	6 (4%)
Staff nurse	47	3 (2%)
Nursing orderly	40	3 (2%)
Operation theatre and Central Sterile supply department technician	8	2 (1.3%)
House keeping	19	1 (0.6%)
Total	150	15(10%)

[Table/Fig-3]: Distribution of Methicillin resistant *Staphylococcus aureus* carriers among the health care workers



[Table/Fig-4]: Antibiotic Susceptibility of Methicillin Resistant *Staphylococcus aureus* isolates

The antibiogram of MRSA revealed the highest resistance to penicillin and amoxycylav (93%) each, with no resistance to vancomycin and tetracycline. The sensitivity to erythromycin, gentamicin, amikacin, ciprofloxacin and cotrimoxazole was variable (53%-73%) [Table/Fig-4].

DISCUSSION

It is necessary to detect the MRSA carriers among the apparently healthy hospital personnel, particularly those working in the critical care areas. These individuals act as a potential source of infection to their patients, resulting in their extended stay in the hospital. This can be controlled by the regular screening of the HCWs and by taking the appropriate preventive measures. In our study, MRSA colonization was found in 10 % of the HCWs. This was in agreement with the internationally reported range of the MRSA carriage (5.8 to 17.8%) among the HCWs in the hospital setting [9].

The prevalence of MRSA varies between institutions and geographic areas. The differences in the design of the study such as the sample size and the method of MRSA detection may account for the disparity in the carriage rate. In our study, the MRSA carriage was particularly high among the doctors (4%), followed by the nurses and the nursing orderlies (2% and 2%) [Table/Fig-3]. The nasal carrier rate (8%) was higher than the hand carrier rate (2%) [Table/Fig-2].

This should be seen as a great challenge because doctors and nurses are the HCWs who have the highest frequency of contact with the patients and those who mostly transmit the MRSA. This underscores the necessity for a preventive intervention in the hospital, more importantly, as one study have shown the nosocomial spread of an MRSA strain which was harboured in the nose of a nurse in two different newborn nurseries [5]. Further, the advantage of eradicating the MRSA carriage by the hospital staff and in the institution with effective hospital control policies, is the prevention of its transmission to the family members of the patients and others in the community.

Mupirocin is the most frequently evaluated topical agent. It is labelled for use in patients who are aged 12 years and older and in health care workers to reduce the infection risk and the transmission of the infection during institutional outbreaks. Mupirocin is the topical antibiotic of choice for the decolonization of MRSA, as it is very effective for this use [10]. In our study, thirteen (86.6 %) carriers were successfully decolonized with the local application of Mupirocin. However, two of the carriers did not take part in the further studies.

CONCLUSION

To assess the prevalence of MRSA among the HCWs, it is important to determine preventive measures for the hospital infections. There is a need for a greater awareness among the health professionals regarding the standard precautionary measures which are aimed at the prevention of acquisition of pathogens, especially when considering multi-drug resistance and the potential for the transmission of nosocomial infections from the HCWs who are colonized by MRSA to their patients. Although the use of Mupirocin may have a beneficial role in some patients and in the HCWs in controlling the MRSA infection, the use of additional infection prevention practices is very important and it cannot be understated.

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AUTHOR(S):

1. Dr. Malini J.
2. Dr. Shruti A. Harle
3. Dr. Padmavathy M.
4. Dr. Umamathy B.L.
5. Dr. Navaneeth B.V.
6. Dr. Keerthi Mannan J.
7. Dr. Girish M.S.

PARTICULARS OF CONTRIBUTORS:

1. Asst Prof, Microbiology, ESIC-MC-PGIMSR, Bangalore.
2. Asst Prof, Microbiology, ESIC-MC-PGIMSR, Bangalore.
3. Asst Prof, Microbiology, ESIC-MC-PGIMSR, Bangalore.
4. Professor, Microbiology, ESIC-MC-PGIMSR, Bangalore.
5. Professor and HOD, Microbiology, ESIC-MC-PGIMSR, Bangalore.

6. Specialist, Dermatology, ESIC-MC-PGIMSR, Bangalore.
7. Specialist, Dermatology, ESIC-MC-PGIMSR, Bangalore.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Malini J. MBBD, MD
Assistant Professor, Dept of Microbiology
ESIC-MC-PGIMSR, Rajajinagar.
Bangalore-560010
Phone: 09448847852
E-mail: drsha13@hotmail.com

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