

MRSA- Nasal Carriage among Paramedical Staff in a Tertiary Care Hospital, Khammam, India

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Abstract

Introduction: *Staphylococcus aureus* and its resistant form Methicillin-Resistant *Staphylococcus aureus* (MRSA), is the most common hospital-acquired infection. The major sources of MRSA are asymptomatic patients and health-care workers (HCW's). The HCW's are identified as link for transmission between patients. The aim of the present study was to detect the carrier rate of *Staphylococcus aureus* in the anterior nares and to know the prevalence of carriers of MRSA in HCW's. Further to evaluate the effect of mupirocin for decolonization in MRSA carriers.

Methodology: A prospective cross-sectional study was conducted at Dept. of Microbiology, Mamata General Hospital from May 2017 to July 2017 after obtaining institutional ethical committee clearance and informed consent from participants. Paramedical staff (nurses, ward boys, OT staff, lab technicians) involved in the management of patients in were included.

Results: Out of 98, 21 (21.42%) were *S. aureus*, 15 (19%) were sterile, 30 (37.9%) were normal commensals, 13 (16.5%) were coagulase negative *Staphylococcus aureus*, 5 (6.3%) showed mixed growth. Out of 21, 5 (5.1%) carriers were MRSA positive. All MRSA carriers were successfully decolonized by Mupirocin topical ointment.

Conclusion: The present study, conclude that regular screening of carriers and awareness regarding the precautionary measures among HCW's can reduce MRSA outbreaks.

Keywords: MRSA; *Staphylococcus aureus*; Mupirocin; Health-Care Workers

Introduction

Staphylococcus aureus is considered as the second most cause of Nosocomial infection. It is widespread in nature and skin, mucous membrane of human beings is normal habitats. Human skin is colonized largely by CONS (Coagulase Negative *Staphylococcus*) followed by *S. aureus* to lesser extent [1]. In general staphylococcus multiply in the nose, on the skin and also survive outside the body for some time. The skin, perineum, pharynx, GIT, vagina and axillae are the extra nasal sites colonised by *S. aureus* [2]. *S. aureus* causes wide variety of infections which ranges from mild cutaneous and soft -tissue infections to life threatening infections [3]. *S. aureus* and MRSA is one of the

most common Nosocomial pathogens accounting 40 - 60% of isolates which not only causes increased morbidity and mortality but also increase the duration of hospital stay and cost [4].

Healthcare workers (HCWs) serve as sources of cross contamination of Hospital acquired MRSA (HA-MRSA) and Community Acquired MRSA (CA-MRSA), who are at interface between the hospital and the community. It has been observed that asymptotically colonized patients and health care workers act as the major sources of MRSA in the hospital environment. MRSA nasal carriage rate among the HCWs world-wide assessed an estimate of around 10 - 40% [5]. They serve as the link between hospitals, long-term care facilities, nursing homes on one hand and the community on the other hand [6]. There are evidences for the increased carriage of MRSA among hospital personnel due to the potential risks of being colonized by *S. aureus* and also by other pathogens [7].

Severe underlying illness, prolonged hospital stay, exposure to broad spectrum antimicrobials, presence of invasive devices and also frequent contact with health care personnel are the risk factors for colonization of MRSA [8].

Colonization is an important risk factor for subsequent infections to themselves and to others. Approximately 20% of healthy adults are persistent nasal carriers of MRSA and 60% of them harbour the organism who play the major role in the epidemiology and pathogenesis of infection [9,10]. Patient to patient transmission of MRSA within the healthcare settings mostly occurs by the carriage of the resistant pathogen on the hands of healthcare workers [11]. Screening of MRSA carriers among HCWs is necessary to control nosocomial infections. Identification of the hospital personnel who are colonized with MRSA and observing other precautions like hand hygiene would be helpful in reducing the transmission and control the spread of MRSA infections [12].

This has formed the basis of our study and it is necessary to screen healthy carriers of MRSA among hospital personnel, which is a potential risk factor in the nosocomial spread and transmission when the same carriers are exposed to the hospital settings and to control the spread in different ICUs.

Aims and Objectives

1. To detect the carrier rate of *S. aureus* in the anterior nares of HCW's.
2. To know the prevalence of carriers of MRSA among HCWs.
3. To know the effect of mupirocin for decolonization in MRSA carriers.

Methodology

Study Design: A prospective cross-sectional study was conducted at the Department of Microbiology, Mamata General Hospital from May 2017 to July 2017 after obtaining institutional ethical committee clearance and informed consent from participants.

Inclusion Criteria: All paramedical staff (nurses, ward boys or staff, lab technicians) involved in the patient care was included in the study.

Exclusion Criteria: The staffs under antibiotic therapy were excluded. Doctors were excluded in the study.

Study Procedure: A total of 98 nasal swabs were collected from 98 individual HCW irrespective of departments. The age, sex, occupation, time of work, duration of work, prior hospitalization, any skin infections and any infections or chronic illness and other relevant information was obtained in a proforma which is designed for the study. Two Pre-moistened sterile cotton swabs were used to collect each of the specimens from anterior nares. The swab was introduced 2 - 3 cm in the nasal cavity and rotated 4 - 5 times both clockwise and anticlockwise. The swabs were then immediately transported to the Microbiology laboratory for further processing. Specimens were

inoculated onto Mannitol salt agar (MSA) and incubated at 37°C for 48h. Mannitol fermenting colonies that were yellow were selected and sub-cultured on Nutrient agar (NA). Colonies on NA were subjected to Gram's staining, catalase test and coagulase test. Gram positive cocci that were catalase positive and coagulase positive were identified as *S. aureus*.

Detection of MRSA: It was done on Mueller-Hinton Agar by using 30 µg cefoxitin disc. An inhibition zone diameter of > 22 mm was considered as susceptible and < 21 mm will be considered as resistant according to CLSI guidelines 2018.

Decolonization with Mupirocin: All the carriers of MRSA were advised to consult a physician and treated with Mupirocin topical ointment twice daily for 5 days. Post- decolonization nasal swabs were taken after one week of treatment. Culture negative carriers were documented as decolonized.

Study assessment/Statistics: All findings were analysed statistically by using relevant tests and formulas.

Results

A total of 98 nasal swabs were collected from 98 individual HCWs irrespective of departments. Among 98, 29 were males and 69 were females. Out of 98, the maximum HCWS belong to age group of 26 - 30 years. Among these, the majority (37.75%) of samples were collected from nursing staff who play the major role in the patient care in the hospital. Others (midwives, lab technicians, to assistants, sweepers, ward boys) constitute 62.7% (Table 1). Among 98 samples, 21 were found to be positive for *S. aureus* nasal carriage. Among 21, 8 were nursing staff and remaining 13 were others (Table 2). Out of 21 *S. aureus* nasal carriage, 5 were found to be positive for MRSA

Factor	Group	Number of Samples
Sex	Males	29
	Females	69
Age	20 - 25	24
	26 - 30	36
	31 - 35	29
	36 - 40	09
Profession	Nursing staff	37
	ANM/GNM	29
	Lab technicians	14
	Ward boys/Sweepers	10
	OT Assistants	8

Table 1: Socio-demographic distribution of study groups.

ANM: Auxiliary Nurse Midwife; GNM: General Nursing and Midwifery

Study group	<i>S. aureus</i> +ve	<i>S. aureus</i> -Ve	P value
Nursing staff (n = 37)	8 (8.16%)	29 (29.6%)	0.9711
ANM/GNM (n = 29)	6 (6.12%)	23 (23.5%)	0.9879
Lab technicians (n = 14)	2 (2.04%)	12 (12.25%)	0.4817
Ward boys/Sweepers (n = 10)	4 (4.08%)	6 (6.12%)	0.0398
OT Assistants (n = 8)	1 (1.02%)	7 (7.14%)	0.3526
Total (n = 98)	21 (21.4%)	77 (78.6%)	

Table 2: Distribution of *S. aureus* nasal carriage among different groups of Healthcare workers.

Study group	No. of <i>S. aureus</i> (n = 21)	No. of MRSA (n = 98)	No. of MSSA (n = 98)	P Value
Nursing staff	8	3	5	0.2461
ANM/GNM	6	1	5	0.6241
Lab technicians	2	1	1	0.3638
Ward boys/Sweepers	4s	0	4	0.2149
OT Assistants	1	0	1	0.5687
Total	21 (21.42%)	5 (5.1%)	16 (16.32%)	

Table 3: Distribution of MRSA and MSSA among different groups of HCWs.

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

Study group	No. of MRSA (n = 5)	No. of MupRSA
Nursing staff	3	0
ANM/GNM	1	0
Lab technicians	1	0
Ward boys/Sweepers	0	0
OT Assistants	0	0
Total	5	0

Table 4: Mupirocin sensitivity of MRSA.

MupRSA: Mupirocin-Resistant *staphylococcus aureus*

and remaining 16 showed MSSA (Table 3). Among 5 MRSA carriers, 3 were nursing staff and 2 were others. Among 3 nursing staff, 1 HCW belongs to emergency ward. This shows the nursing staff were greatly exposed to nosocomial pathogens and act as the vectors between patients and their colleagues. After the treatment of these MRSA carriers with Mupirocin ointment as directed, all the 5 carriers responded to the treatment and were culture negative after the treatment (Table 4).

Discussion

Staphylococcus aureus and its resistant form Methicillin-Resistant *Staphylococcus aureus* (MRSA), is the most common hospital-acquired infection. The present study showed 21.42% of *S. aureus* nasal carriage among HCW’s which is ranging between the studies conducted by Thilakavathy, *et al.* (15.6%) [13] and Loveleena Agarwal, *et al.* (48%) [14]. It is reported that *S. aureus* nasal carriage among HCW’s worldwide ranges from 16.8% - 56.1% [15,16]. The *S. aureus* nasal carriage is the most important reservoir of infection among HCW’s who are colonized with the pathogen and may transmit the infection to other HCWs and also in the community.

The present study showed 5.1% of MRSA nasal carriage among HCW’s which is ranging between the studies by Thilakavathy, *et al.* (3.2%) [13], Loveleena Agarwal, *et al.* (14%) [14], Rongpharpi SR (11.43%) [17], Kannan Sridharan., *et al.* (11.3%) [18] and Mathanraj, *et al.* (8.5%) [19]. Reports showed that MRSA nasal carriage ranges between 5.8% - 17.8% world-wide [20]. Nepal has reported lowest prevalence of MRSA carriage [21]. The difference in prevalence rates of *S. aureus* and MRSA in various hospital settings worldwide could be due to the difference in the local prevalence rates, laboratory variations in detection methods as well as the effectiveness of control

measures in the hospital settings.

The present study reported highest MRSA nasal carriage among nursing staff (8.10%). This could be explained by poor knowledge regarding hand hygiene, precautionary measures, infection control policies. A study conducted by Shibabaw and co-workers have reported the high carriage (21.2%) among nursing staff could be due to frequent contact with the patient [22].

Colonization of MRSA is an important risk factor for subsequent infection, hence decolonization procedures are essential along with standard precautions to decrease the transmission rate of infection in the hospital. Nasal formulation Mupirocin, topical antibiotic interferes with the protein synthesis, is recommended for decolonization of MRSA nasal carriage. The prevalence of MupRSA ranges from 0.5% in Nigeria to 14.6% in India [23,24]. In the present study, post-decolonization screening for MRSA was done after 1 week of application of mupirocin ointment twice daily for 5 days. All the MRSA carriers (5.1%) were followed up which showed culture negative for MRSA and documented as decolonized.

In the present study, 1 (2.70%) HCW among nursing staff from emergency ward was found to be positive for MRSA nasal carriage. MRSA among HCWs at emergency ward indicates introduction of CA-MRSA into hospital setting, however, typing of the strain has to be done for confirmation. In emergency ward, the patients may be infected, high-patient load along with the attendants and direct contact with the patient may be one of the causes for spreading CA-MRSA infections. This may lead to colonization of MRSA among HCWs working in emergency unit [25]. Some studies reported that MRSA colonized HCW's were allowed to work without restrictions with strict emphasis on hand hygiene and precautionary measures. But in some studies, the HCW's were allowed to work only in dedicated MRSA areas or where MRSA was present [26,27]. Some studies reported that the colonized or infected HCW's were temporarily restrained from patient care for some period until follow-up cultures were negative and documented as decolonized [28].

In one study by Davis and colleagues, observed that 19% of patients colonized with MRSA at the time of admission, and 25% who became colonized during hospitalization developed MRSA infection, compared to patients colonized with MSSA on admission [29]. Hence it is necessary to screen for MRSA among patients in outpatient departments, wards, and ICUs and also necessary to screen for MRSA carriage in anterior nares, hands and web spaces of HCWs who involve in the patient care to reduce the transmission between patients in the hospital setting. Vonberg, *et al.* indicated that screening of HCWs for MRSA nasal carriage should be performed before starting work duties to reduce the detection of transient, short-term MRSA carriage that may occur during a work shift [30].

Conclusion

Health-care workers are the potential colonizers of MRSA and may serve as reservoirs and disseminators of the pathogen. In our study, majority of the HCWs are in the age group of 26 - 30 years and females are predominant. In our study, nurses are the major colonizers for MRSA followed by ward boys and lab-technicians. Hand- hygiene is the most important way to control MRSA infection. As the HCW's are the leading cause of transmission of MRSA from patient-to- patient, regular screening, and treatment of HCW's should be done in the hospital. Mupirocin helps in decolonizing MRSA from nasal carriage. Our study revealed that local application of Mupirocin decolonized MRSA nasal carrier state. In addition to decolonization and treatment of HCW's, awareness should be brought to the personnel by conducting educational programmes regarding standard precautionary measures.

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