

METHICILLIN-RESISTANT *STAPHYLOCOCCUS AUREUS* CARRIAGE AMONG HEALTH-CARE PROFESSIONALS OF A TERTIARY CARE HOSPITALLATHA T¹, ANIL K BHAT^{2*}, MANJUNATHA HANDE H², CHIRANJAY MUKHOPADYAY³, ELSA SANATOMBI DEVI⁴,
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ABSTRACT

Objective: The aim of this study was to find the prevalence of methicillin-resistant *Staphylococcus aureus* (MRSA) carrier status in anterior nares and hands of health-care professionals working in orthopedic wards of a tertiary care hospital and to decolonize them to reduce spread of MRSA to their patients.

Methods: The study was conducted in a super specialty, tertiary care teaching hospital. The samples were collected from anterior nares, palm, web spaces, and fingertips of 140 health-care professionals (48 doctors, 74 nurses, and 18 technicians) working in orthopedic wards using sterile pre-moistened swabs. MRSA carrier status was identified by Kirby-Bauer disc diffusion method.

Result: Most (76.4%) of the health-care professionals were <30 years of age and 51% were male. MRSA in anterior nares of doctors was 4.3%, nurses 1.4%, and technicians 0.7% and none had MRSA in their hands. Methicillin-sensitive *Staphylococcus aureus* (MSSA) growth was more among nurses (nurses - 5.7%, doctors - 2.1%, and technicians - 1.4%) in anterior nares. In addition, 1.4% nurses' hands were colonized with MSSA. Both MRSA and MSSA carriers were decolonized effectively and repeat sampling showed no growth.

Conclusion: Health-care professionals have a greater chance of transmitting MRSA to patients and orthopedic patients are more susceptible for infection. Although MRSA carrier status was not very high among orthopedic health-care professionals compared to previous studies, it cannot be ignored. Nasal mupirocin and bath with chlorhexidine soap were effective in decolonization. Periodic screening and treatment of colonizers would help in elimination of MRSA carriage.

Keywords: Health-care professionals, Methicillin-resistant *Staphylococcus aureus* (MRSA), colonization, Orthopedics.

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INTRODUCTION

Staphylococcus aureus, a Gram-positive cocci has been recognized since long to cause both localized and systemic infections. Mortality due to *S. aureus* was estimated to be 90% in the pre-antibiotic era [1]. β -lactam antibiotics were introduced to combat *S. aureus* and soon found to be resistant [2]. Therefore, methicillin was introduced in 1959 to treat resistant *Staphylococcus*. However, methicillin-resistant *S. aureus* (MRSA) was detected in 1961 in the UK which spread to every continent [3]. Today, MRSA strains resistant to commonly used antibiotics such as aminoglycosides and lincosamides have also emerged [4]. MRSA is an important nosocomial pathogen worldwide, accounting for 20–80% of nosocomial infections in different health-care setup [1].

MRSA causes a variety of infections to humans from insignificant skin diseases to life-threatening infections [5]. Indeed, it is the most important cause of surgical site infection in both tertiary and community hospitals [6,7].

Asymptomatic carriers, both patients and health-care workers, constitute important MRSA reservoirs in the hospitals [8-10], and the prevalence of MRSA carriage rate is known to be high among health-care professionals [11]. MRSA carrier status is not homogenous and may vary from 1.8 to 25% among health-care workers in various hospital settings [8,12].

MRSA colonization is predominantly present in the nose and skin of 30% people [13]. Other areas of colonization include armpit, groin, perineum, and throat [14-17]. Colonized bacteria may not cause disease. However, damage or injury to the skin can lead to serious infection [15-17]. MRSA can be isolated from the samples of pus, urine, sputum, body fluids, etc. [18].

Since the asymptomatic carriers of health-care workers transmit MRSA infection to their patients [19] identifying such carrier status helps the hospitals to bring down the infection rate. Although there is some data on MRSA colonization among health-care professionals, in general, no studies are available on screening of health-care professional exclusively working in orthopedic setups in India. As orthopedic patients are at high risk of acquiring MRSA infection, health-care professionals working in these wards need to be screened. Therefore, the present study is conducted with an objective to find the carrier status of health-care professionals working in orthopedic wards and to decolonize them.

METHODS

This study was conducted in orthopedic department of a tertiary care, multispecialty, teaching hospital having more than 2000 beds. Orthopedic department has five wards, two operation rooms and an intensive care unit with a total of 185 beds. Health-care professionals who were involved in care of orthopedic patients and volunteered

for the study were tested for carrier status. A total of 140 health-care professionals comprising of doctors, nurses, and technicians were included in the study. Ethical committee clearance was done and also written informed consent was obtained from the study participants. Health-care professionals with signs of respiratory infection were excluded from the study.

Sample collection

The specimens were collected from both anterior nares, palm, web space, and fingertips using sterile pre-moistened cotton swab with transport tube. Three swabs were collected from each health-care professionals including one from right anterior nares, another from left anterior nares and the third from palm, web space, and fingertips. Nasal swabs were collected by rotating the pre-moistened swab for minimum of 3 s in both the nostrils. Hand specimen was obtained by gently rolling the pre-moistened swab over both the palms, web spaces, and fingertips. Hand swabs were not collected immediately after the handwash, and a minimum of 45 min gap was present between hand wash and specimen collection. The specimens were transported to microbiology laboratory soon after the collection, and the sample processing was started within 60 min of collection.

Sample processing and detection of MRSA

All swabs were inoculated on 5% sheep blood agar and mannitol salt agar and incubated at 37°C for 24 h. After inoculation, growth was identified as *S. aureus* on the basis of colony morphology, Gram-stain, catalase, and dimethyl sulfoxide test. All confirmed *S. aureus* isolates were further tested for detection of methicillin-resistance by Kirby-Bauer disc diffusion method using cefoxitin 30 µg discs [20].

Statistical analysis

The data were recorded and tabulated using SPSS 16.0 version.

RESULTS

In the present study, 140 health-care professionals working in orthopedic wards were included. Majority 72 (51%) were males, and more than three-fourth of them (107) were <30 years of age. Majority 67 (47.9%) were nurses (Table 1).

The growth of methicillin-sensitive *S. aureus* (MSSA) and MRSA in anterior nares and hands is given in Table 2. The presence of MRSA

Table 1: Age and designation of health-care professionals n=140

Sample characteristics	Frequency (%)
Age in years	
20–30	107 (76.4)
31–40	12 (8.6)
41–50	16 (11.4)
50–58	5 (3.6)
Designation	
HA/ANMs	7 (5.0)
Staff nurses	67 (47.9)
Doctors	48 (34.2)
Technicians	18 (12.9)
Gender	
Male	72 (51.4)
Female	68 (48.6)

HA: Hospital auxiliary staff, ANM: Auxiliary nurse midwife

was more among doctors (4.3%) compared to others. Nurses had more MSSA (5.7%) in anterior nares. Although 1.4% nurses had MSSA grown in their hand, none had grown MRSA.

Nine health-care professionals were MRSA carriers and 13 were MSSA carriers. Both MRSA and MSSA carriers were treated with nasal mupirocin for 7 days and daily shower with chlorhexidine soap for 7 days. All the carriers were screened again after 10 days of completion of the treatment. There were no growths in the repeat sample which shows successful decolonization.

DISCUSSION

Exposure to infection is an inherent risk of contracting varied infections among health-care professionals. Health-care workers serve as a reservoir, vector or victim of MRSA transmission [21]. This should be seen as a great challenge because doctors and nurses have the highest frequency of contact with patients and may transmit MRSA more frequently. Therefore, screening and decolonizing the health-care professional becomes significant in reducing MRSA infection. One hundred and forty health-care professionals are screened in this study. Among them, 52.9% were nurses, 34.2% were doctors, and 12.9% technicians and 51% were male and 49% were female. The similar gender distribution (male – 54% and female – 46%) of health-care professionals was noted in the previous study [22].

A meta-analysis published in 2008 with 127 studies which involved screening of 33,318 health-care workers for MRSA carrier status around the world showed a prevalence of 4.6% [21]. There are no meta-analysis or systematic reviews published in the recent years on screening of MRSA colonization among health-care professionals. However, there are many studies reporting varied rates of MRSA carrier status ranging from 0 to 48% (Table 3). In this study, the MRSA carrier status was 6.4% and that of MSSA was 9.2%.

The risk of MRSA colonization in anterior nares (8%) is more common than in hand (2%) [23]. Likewise, the current study has detected 6.4% of MRSA colonization in the anterior nares and no growth of MRSA in the hands. MRSA carriage was particularly high among the doctors (4%), followed by the nurses (2%) and the nursing orderlies (2%) [23], and the similar trend is documented in our study showing more MRSA among doctors (4.3%), followed by nurses (1.4%) and technicians (0.7%). MSSA was higher among nurses (5.7%) compared to doctors (2.1%) and technicians (1.4%).

MRSA infection increases the morbidity, mortality, and health-care costs and also may result in inappropriate and delayed antibiotic therapy [31-33]. Adding to these problems, MRSA-infected patients have a great risk of getting recurrent infection [34]. The duration of hospital stay increases with MRSA infection, and it triples among orthopedic surgery patients [35]. Hence, prevention of MRSA infection in orthopedic ward is critical.

Mupirocin is widely used as pre-operative prophylaxis and for the treatment of nasal carriers. Mupirocin-resistant MRSA are documented in India [17]. Yet, this study did not notice any mupirocin-resistant MRSA and hence is used for nasal decolonization. The newer plant based therapeutic agent such as *Casuarina junghuhniana* root can also be used in treating different strains of *S. aureus* infections [36]. Axilla

Table 2: Screening result of health-care professionals n=140

Test Result	Right anterior nares		Left anterior nares		Hand, web space, and fingertip	
	MSSA f (%)	MRSA f (%)	MSSA f (%)	MRSA f (%)	MSSA f (%)	MRSA f (%)
Doctors	3 (2.1)	6 (4.3)	3 (2.1)	6 (4.3)	0 (0)	0 (0)
Nurses	8 (5.7)	2 (1.4)	8 (5.7)	2 (1.4)	2 (1.4)	0 (0)
Technicians	2 (1.4)	1 (0.7)	2 (1.4)	1 (0.7)	0 (0)	0 (0)

MSSA: Methicillin-sensitive *Staphylococcus aureus*, f: Frequency, MRSA: Methicillin-resistant *Staphylococcus aureus*

Table 3: Screening of health-care professionals for MRSA in the previous studies

Author and year	Sample	Location of screening	Carrier status (%)	
			MSSA	MRSA
Goyal et al., 2002 [23]	150 health-care workers	Anterior nares and hand	3.3	3.3
Santhosh et al., 2007 [24]	157 pre-clinical medical students	Anterior nares	23.7	0
Vinodhkumaradithyaa et al. 2009 [25]	100 surgical staff	Anterior nares	13	15.4
Malini et al., 2012 [26]	150 health-care workers (doctors, nurses, technicians, nursing students, housekeeping, and others)	Anterior nares, throat, palm, and web spaces	10	14
Radhakrishna, 2013 [27]	200 health-care workers of ICU	Anterior nares	17.5	2.5
Renushri, 2014 [28]	119 nursing students	Nasal, throat, and web space swabs	18.2	11.8
Sharma, 2014 [29]	30 health-care professionals	Anterior nares	13.3	6.6
Agarwal, 2015 [22]	200 health-care workers (doctors, nurses, technicians, nursing students, housekeeping, and others)	Anterior nares swab	14	48
Radhakrishna et al., 2016 [30]	148 medical students	Anterior nares	52.7	6.1
Present study	140 health-care professionals (orthopedic department)	Anterior nares, palm, web spaces, and fingertips	9.2	6.4

MRSA: Methicillin-resistant *Staphylococcus aureus*, ICU: Intensive care unit, MSSA: Methicillin-sensitive *Staphylococcus aureus*

and perennial sampling were not done as nasal colonization is proven to be predominant compared to other areas of colonization [6,9]. Nonetheless, all MRSA colonizers of the present study were prescribed to shower with chlorhexidine soap for a week. The MRSA carriers were re-screened to confirm the success of their treatment.

CONCLUSION

Detecting the MRSA carriers among the apparently healthy health-care provider is crucial as they act as a potential source of infection to their patients resulting in their extended stay in the hospital and increased health-care cost. In spite of having an effectively functioning Hospital Infection Control Committee as well as prepared policies, MRSA carrier rate was 6.4%. This signifies the necessity for further measures to eradicate colonization among health-care professionals. Periodic systematic screening of all health-care professionals and decolonization may help in eliminating the burden of MRSA carrier status and spread of infection.

AUTHORS' CONTRIBUTION

All the authors have substantially contributed throughout the project and in preparing the article.

CONFLICTS OF INTEREST

No conflicts of interests.

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