

Original Research Article

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A Prospective Study Estimating the Mupirocin Resistance in Health Care Providers with MRSA Nasal Carriage in a Tertiary Care Hospital in Rural South India

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ABSTRACT

This study was conducted to estimate the prevalence of nasal carriage of Methicillin resistant *Staphylococcus aureus* (MRSA) and its Mupirocin resistance in health care providers (HCPs). Sterile swabs from the anterior nares of the HCPs were collected and then transported to the Microbiology laboratory for processing. The *Staphylococcus aureus* (*S.aureus*) isolates were tested for Methicillin resistance on Mueller Hinton agar using Cefoxitin disc (30ug) by Kirby Bauer disc diffusion method. A zone of ≤ 21 mm was considered as MRSA. All the MRSA isolates were tested for Mupirocin resistance by Epsilometer test (E-test) using Mupirocin E-strips. A total of 186 swabs from the anterior nares were collected from HCPs, out of which 18 were positive for *S. aureus*. Among the 18 isolates 10 were Methicillin sensitive *S. aureus* (MSSA) and 8 were MRSA. The nursing staff had the highest prevalence of MRSA (50%). None of the staff from the critical areas or treating doctors were MRSA colonisers. All the MRSA isolates were Mupirocin sensitive. The repeat swabs taken from MRSA positive group after 1 week of Mupirocin therapy were all negative for *S. aureus*. The HCPs with nasal colonisation of MRSA are potential source for health care associated infections. Mupirocin is used currently as a decolonising agent for MRSA. Therefore monitoring the emergence of Mupirocin resistance as well as ongoing training classes on infection control practices like hand hygiene and standard precautions are mandatory for prevention and control of infections.

Keywords

MRSA, Mupirocin resistance, Health care provider, Nasal swab, Decolonisation, Infection control

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Introduction

Staphylococcus aureus (*S. aureus*) and its resistant form Methicillin-resistant *S.aureus* (MRSA) is now one of the most prevalent and clinically significant pathogen causing health care associated infections. Nasal carriage of *S. aureus* among health care providers (HCPs) plays a key role in the epidemiology and

pathogenesis of such infections (Pai *et al.*, 2010). Colonised or infected HCPs may serve as reservoir and disseminator of MRSA not only to the hospitalised patients but also to the community at large (Thilakvathy *et al.*, 2015). Mupirocin is a topical Glycopeptide antibiotic agent that specifically binds to bacterial isoleucyl-tRNA synthetase (IRS) and inhibits protein synthesis. The increase use of

Mupirocin to treat Staphylococcal infections and colonisation has led to the emergence of resistant strains. Mupirocin resistance is categorised into two types: Low-level or intermediate resistance (MupL or MupI), with minimum inhibitory concentration (MICs) of 8-256 µg/ml, and high-level resistance (MupH), with MICs \geq 512 µg/ml (Kaur and Narayan, 2014). Various studies have suggested that MupL nasal isolates can be controlled with Mupirocin therapy. Whereas, high-level resistant strains are frequently associated with failure of decolonization (Hudson, 1994; Agarwal *et al.*, 2015).

Resistance of MRSA to Mupirocin is an emerging infection control problem which could mean potential loss of the major treatment option for controlling MRSA. Therefore this study was conducted to estimate the prevalence of nasal carriage of MRSA and its mupirocin resistance in HCPs in a rural area.

Materials and Methods

This prospective study was carried out by collecting nasal swabs from HCPs comprising of doctors, nurses, lab technologists and house-keeping staff working in Akash Hospital, Devanahalli Bangalore Rural from February to June 2017. Ethical clearance from the Institutional Ethical committee was obtained before the commencement of the study. Informed written consent was taken from all the staff who participated in the study. Health care providers who refused to give informed consent for the study and those with history of upper respiratory tract infection, recent nasal surgery, use of nasal medication, or antibiotic therapy were excluded from the study.

Sterile cotton swabs moistened with sterile normal saline were used to collect the specimen by simply rotating the swabs gently

five times in both the nares. The swabs were transported immediately to the Microbiology laboratory for processing and cultured on mannitol salt agar and incubated at 37°C for 24 hrs. Based on the colony morphology (yellow colour mannitol fermenting colonies), Gram stain, catalase test and coagulase test, preliminary identification of *S. aureus* was made (Winn *et al.*, 2006). Methicillin resistance was tested in Mueller Hinton agar using Cefoxitin disc (30ug), Himedia[®], by Kirby Bauer disc diffusion method. A zone of \leq 21mm was considered as MRSA. All the MRSA isolates were then tested for Mupirocin resistance by Epsilometer test (E-test) using Mupirocin E-strip, Himedia[®]. Isolates with Minimum inhibitory concentration (MICs) \geq 512 µg/ml were considered as high-level resistant (MupH), those with MICs 8–256 µg/ml were considered as low-level resistant (MupL), and with \leq 4 µg/ml were considered as Mupirocin sensitive as per Clinical and Laboratory Standards Institute guidelines 2016.

All the HCPs who were positive for MRSA were treated with 2% Mupirocin ointment twice daily for 5 days and were instructed to adopt strict hand hygiene and standard precautions during their routine work.

A repeat swab from the anterior nares was collected after a week to ensure decolonisation (Siegel *et al.*, 2006). The data was analysed using SPSS version 22 and the Chi-square test was determined to check the statistical association between two categorical variables. A p value $<$ 0.05 was considered statistically significant.

Results and Discussion

A total of 186 swabs from the anterior nares were collected from the HCPs (Figure 1), out of which 18 (9.68%) were positive for *S. aureus*. Among the 18 isolates 10 (5.38%) were Methicillin sensitive *S. aureus* (MSSA)

and 8 (4.30%) were MRSA (Table 1). The 10 MSSA were isolated from 4 nurses, 3 doctors (surgeons), 2 housekeeping staff and 1 technologist. The 8 MRSA were isolated from 4 nurses, 2 technologists and 2 housekeeping staff (Table 2). None of the MRSA isolates were from the staff in the critical areas or treating doctors. Mupirocin E-test was done on MRSA isolates (all had a MIC \leq 4 μ g/ml) and all 8 were Mupirocin sensitive. The repeat swabs taken after 1 week of Mupirocin therapy were negative for *S. aureus*. There was no statistically significant association ($p>0.05$) between nasal colonisation and

gender as well as MRSA colonisation and various professional groups (Table 1 and 2).

In our study the nasal carriage of *S. aureus* was 9.68% out of which MRSA carriage was only 4.30%. Both of which were similar to the study conducted by Thilakavathy *et al.*, (2015) and Goyal *et al.*, (2002). The highest prevalence was among the nurses from the wards (50%) followed by housekeeping staff (25%) and technologist (25%) which was similar to the study conducted by Thilakavathy *et al.*, (2015), Kaur and Narayan (2014) and Agarwal *et al.*, (2015).

Table.1 Positive isolates and their Mupirocin susceptibility (N=186)

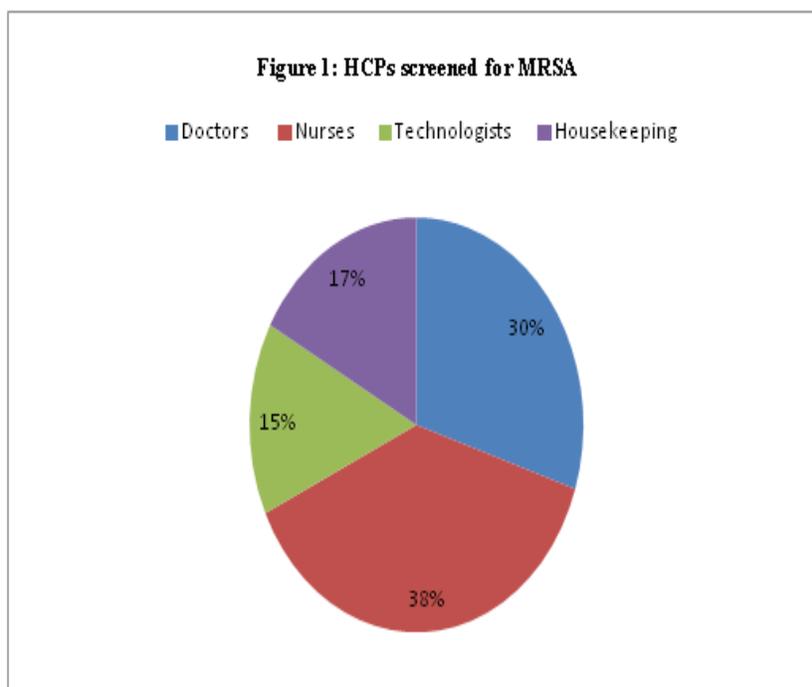
Isolates	Male	Female	Total	P Value	Mupirocin susceptibility
MSSA	3(1.61%)	7(3.76%)	10(5.38%)	p>0.05*	Sensitive
MRSA	2(1.07%)	6(3.22%)	8 (4.30%)		
Total no of <i>S.aureus</i> isolated	5(2.68%)	13(6.98%)	18(9.68%)		

*Chi-square- Association between Gender and Colonisation

Table.2 Distribution of MRSA among HCPs and their respective departments (N=186)

Professional group	MRSA	P value	Distribution
	8 (4.30%)		
Doctors	0	p>0.05*	-
Nurses	4 (2.15%)		2-medicine ward, 1-obstetric ward 1-paediatrics ward
Technologists	2 (1.075%)		1-blood bank, 1- phlebotomy
Housekeeping staff	2 (1.075%)		1- medicine ward 1- causality

*Chi-square- Association between Profession and MRSA Colonisation



The *S. aureus* and MRSA colonisation rate is much less compared to other studies (Kaur and Narayan, 2014; Agarwal *et al.*, 2015; Mathanraj *et al.*, 2009) in India which could be because of the low local prevalence of MRSA in rural area, which was estimated to be only 5.03% (MRSA infection rate) in a recent study conducted by Thomas *et al.*, (2016) in the same hospital in 2015-2016. The prevalence was probably more in nurses from the wards as they are the personnel closely associated with infected patients. Most of them that is 3 student nurses, 1 technologist and 1 housekeeping staff who were MRSA colonisers had not undergone our induction classes on infection control practices.

All the 8 MRSA were Mupirocin sensitive which was similar to study conducted by Kaur and Narayan (2014), Thilakavathy *et al.*, (2015), and Oommen *et al.*, (2010).

Health care providers with nasal colonisation of MRSA are potential source of health care associated infections. Our hospital being a new hospital there is regular entry of new staff, therefore routine screening and

decolonisation should be made mandatory to prevent the spread of infection. Mupirocin is currently used as a decolonising agent, especially for the anterior nares. Hence the estimation of Mupirocin resistance is very important so that an alternative option like chlorhexidine can be introduced if its resistant. Induction classes before the new staff start work and thereafter ongoing training classes on infection control practices like hand hygiene and standard precautions should be conducted as a measure to curb the spread of infection.

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