



***In vitro* activity of mupirocin on *staphylococcal* nasal carriers
among health care providers of post operative surgical
ward in a tertiary care hospital**

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ABSTRACT

BACKGROUND

Methicillin-resistant *Staphylococcus aureus* (MRSA) has been associated with considerable morbidity and mortality and is an important public health issue. It is an opportunistic pathogen. The increasing resistance of this pathogen to various antibiotics complicates treatment of *S. aureus* infections. Effective measures to prevent *S aureus* infections are therefore urgently needed.

AIM

To evaluate the trend of mupirocin resistance in nasal colonisation of *Staphylococcus* in patients' attendants and health care workers of post operative surgical ward of a tertiary care hospital.

METHODS

Total of 66 health care providers were studied. Nasal swabs were collected and processed for bacterial culture and. Methicillin resistance was detected by disc diffusion method using ceftioxin (30mcg) disc & mupirocin sensitivity using mupirocin (5mcg) disc.

RESULTS

39(67.24%) of patients attendants had *Staphylococcus* carriage of which 94.87% were *S. aureus* . 9(24.33%) of *S. aureus* were MRSA. All health care worker had *S. aureus* colonisation of which 6 (75.00%) were MRSA. Overall 2(4.45%) *S. aureus* isolates from health care providers were resistant to mupirocin.

CONCLUSION

Regular surveillance to know carrier prevalence and effective infection control initiatives are needed to reduce the incidence of health care associated infections due to MRSA. Monitoring of mupirocin resistance is essential to device carrier eradication protocols.

Keywords: Cefoxitin, MRSA, Mupirocin, Nasal carriers.

INTRODUCTION

Staphylococcus aureus is one of the most prevalent and clinically significant pathogen, causing wide variety of infections ranging from mild skin and soft-tissue infections to serious life-threatening infections.[1] *S. aureus* accounts for 30% of surgical site infections (SSIs) in developed countries and even higher in developing countries. Most SSIs results from exogenous bacteria, some of which are carried in the nares and on hands of personnel who contact surgical patients.[2] Healthcare Workers (HCWs) constitute an

important reservoir of *S. aureus*, Healthy hospital personnel may carry pathogenic hospital strains in their nose and skin and may spread these pathogens to the community leading to more dreadful conditions.[3]

Methicillin-resistant *S. aureus* (MRSA) infections account for 40-60% of all nosocomial *S. aureus* infections in many centres across the world.[1] As a result of this drug-resistance issue, topical antibacterial agents and germicides have been the preferred intervention for MRSA eradication

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programs.[4]

Decolonising agents are chlorhexidine (2%), mupirocin, doxycycline, povidone-iodine (5%) and rifampin. Mupirocin has a unique mechanism of action in which it blocks protein synthesis in bacteria, a mechanism that is not shared with any other antibiotic; mupirocin has few problems of antibiotic cross-resistance. Mupirocin demonstrated the ability to eliminate 97% of *S. aureus* nasal carriage in health care workers within 24 hours of application.[5]

An aspect, which needs to be considered, is the potential role of carriage screening and decolonisation of HCW and patients attendants in preventing MRSA infections among hospitalized patients in our settings. MRSA screening is routinely employed in many countries world-wide and is thought to be helpful in limiting MRSA spread.[6] Currently, such studies are lacking in India, hence this study was undertaken to know the *in vitro* effect of mupirocin on nasal colonisers of *Staphylococcus* in health care providers of post operative surgical ward.

MATERIALS AND METHODS

This study was done in department of Microbiology, MMC&RI, Mysore. After taking informed consent from the patients' attendants and HCWs of post operative surgical ward, Samples from anterior nares were collected using sterile cotton swabs. Swabs were inoculated onto blood agar and MacConkey agar and *Staphylococcus* spp was identified as per standard protocols.[7] Antibiotic susceptibility testing was performed by Kirby-Bauer disc diffusion method according to

Clinical and Laboratory Standards Institute (CLSI) guidelines against amoxicillin, cefoxitin, ciprofloxacin, clindamycin, erythromycin, cotrimoxazole, gentamicin, linezolid, vancomycin.[8]

Methicillin resistance was detected by disc diffusion method using cefoxitin (30mcg) disc, mupirocin sensitivity using mupirocin (5mcg) disc.

RESULTS

Of 66 health care providers studied, 58 (87.8%) were patients' attendants (32 females, 26 males) and 8 (12.2%) were HCW (4 nursing staff, 2 group D workers & 2 doctors).

Among 58 patients attendants 39(67.24%) had *Staphylococcus* carriage; 37(94.87%) *S. aureus* and 2(5.13%) Coagulase negative *staphylococcus* (CONS). Of 37 *S. aureus*, 28(75.67%) were Methicillin sensitive *Staphylococcus aureus* (MSSA) and 9 (24.33%) were Methicillin resistant *Staphylococcus aureus* (MRSA). Out of 2 CONS isolated, one isolate was MRCONS. All health care workers were carriers of *S. aureus*, of which 6(75%) were MRSA. Overall 2(4.45%) *S. aureus* isolates from health care providers were resistant to mupirocin. 5.41% of *S. aureus* isolates from patient's attendants were resistant to mupirocin and none of the isolates from health care worker were resistant to mupirocin. Out of 2 CONS isolated, both were mupirocin sensitive.

Most of the MRSA strains were sensitive to vancomycin and linezolid and most of methicillin sensitive strains were sensitive to erythromycin, clindamycin, cotrimoxazole, vancomycin & linezolid.

Table: No. of mupirocin-sensitive and resistant isolates

Attendants(n=58)	HCWs (n=8)					
	Total Isolates	Mupirocin Sensitive	Mupirocin Resistant	Total Isolates	Mupirocin Sensitive	Mupirocin Resistant
<i>Staphylococcus</i> carriage	39(67.24%)	37(94.87%)	2(5.13%)	8(100%)	8(100%)	-
<i>Staphylococcus aureus</i>	37(94.87%)	35(94.59%)	2(5.41%)	8	8(100%)	-
i) MSSA	28(75.67%)	28(100%)	-	2(25%)	2(100%)	-
ii) MRSA	9(24.33%)	7(77.77%)	2(22.23%)	6(75%)	6(100%)	-

DISCUSSION

Nasal and extra nasal carriage of methicillin-resistant *S. aureus* (MRSA) is an essential step in invasive MRSA infections and plays a decisive role in the dissemination of these microorganisms.[9] With an emergence of MRSA even in the carrier,

eradication of carrier is of paramount importance in reducing hospital acquired infections. Mupirocin is the commonly used decolonising agent for MRSA and studies on mupirocin susceptibility on carrier strains are lacking. Rates of nasal carriage of *S. aureus* ranges from 16.8%-56.1 % among HCWs

and 40% of healthy individuals.[10,3] In our setting the predominant isolate from surgical wards is *Staphylococcus* spp, hence an attempt was made to know the carrier rate of *Staphylococcus* and their resistance to mupirocin among health care providers of surgical units.

Prolonged hospital stay, indiscriminate use of antibiotics, lack of awareness, receipt of antibiotics before coming to the hospital etc. are the possible predisposing factors of MRSA emergence.[11] In clean elective surgery in developed countries, the baseline rate for SSI is 1%–5% of which *S. aureus* accounts for 30%–50%.[4] MRSA has emerged as the ‘bug-bear’ of modern surgical practice.[12]

In our study, all health care workers 100% and 67.24% of patients’ attendants carried *Staphylococcus* in their anterior nares. 75% health care workers and 24.33% of the patients’ attendants carried MRSA. Studies from India have reported nasal carriage rate of *S. aureus* among hospital staff as 20.37%, among which MRSA was 45.5%.[3] A study from Kashmir reported 27.92% of *S. aureus* nasal carriage among healthy population.[1] The prevalence rates of *S. aureus* and methicillin-resistant *S. aureus* (MRSA) in the anterior nares in the United States population are 28.6% and 1.5%, respectively.[13] Study from Alzahra hospital, Dubai showed prevalence of *S. aureus* colonisation was 78.8% and the overall rate of MRSA was 60.5% in the 71 health care workers; with 76.7% MRSA colonisation.[14] A study from Karnataka reported overall MRSA carriage rate of 12% with the highest rate being seen among the nursing staff (12.2%).[15] Another study from India showed, the MRSA carriage was particularly high among the doctors (4%), followed by the nurses and the nursing orderlies (2% and 2%). The nasal carrier rate (8%) was higher than the hand carrier rate (2%).[16] In our study a very high rate of MRSA was noted among Health care workers which may be due to less number of subjects studied.

With the realization that MRSA spreads by direct physical contact, is not airborne and is also transmitted by indirect contact with towels, clothes, etc. prevention of infection is of prime importance. Surgical patients are at risk of infection if they are colonised with MRSA or if MRSA is inoculated into their surgical wound by contaminated hands or instruments including dressing scissors.[12] The nasal carriage of MRSA among HCWs has indicated the chances of transmission of the organism to the patients during patient-care.[3]

The topical antimicrobial mupirocin is recommended for the decolonisation of the nasal mucosa and of cutaneous lesions of patients or health professionals. This measure aims to limit the spread of this agent in the health services, and thereby to reduce the great clinical impact produced by it in hospital infections, especially those related to surgical procedures and vascular catheters.[17] Identification of the carrier and treating the carrier with mupirocin ointment is an important measure in preventing outbreaks of MRSA infection in hospitals. In our study 4.45% of *S. aureus* isolates from health care providers were resistant to mupirocin. In a study from Washington, of 302 MRSA isolates available for testing, 13.2% were resistant to mupirocin; with 8.6% having high level resistance (minimum inhibitory concentration, 512mcg/mL) and 4.6% having low level resistance (minimum inhibitory concentration, 8–256mcg/MI).[18] In our study 5mcg disc was used which indicates low level resistance.

When nose is treated topically with Mupirocin to eliminate nasal carriage, in most cases the organism also disappears from other areas of the body like groin, axilla, umbilicus, and hands.[19] It has been shown that the risk for SSI can be substantially reduced by eradicating *S. aureus* carriage.[20] The effect of any eradication or decolonisation strategy seems to last 90 days at most, most studies with prolonged follow-up have been of methicillin-susceptible *S. aureus* carriers. Recolonisation rates at 12 months after treatment have approached 50% and 75% for healthy health care workers and patients undergoing peritoneal dialysis, respectively.[4] It is possible that long term intermittent therapy with mupirocin may be more effective in suppressing or eradicating MRSA colonisation.[21]

Compliance with the sanitary and antibacterial guidelines by health professionals is the single most important factor in preventing nosocomial infections. Clearance of nasal *S. aureus* with mupirocin in staff is associated with clearance of hand carriage, which may be important in control of outbreaks.[4] Assessment of prevalence of mupirocin sensitivity can be utilized as an important epidemiological tool in institutions before the introduction of mupirocin decolonisation as a part of their infection control measures. Regular surveillance and effective infection control initiatives are desirable to reduce the incidence of health care associated infections due to MRSA and also emergence of mupirocin resistance.[22]

CONCLUSION

As all of the isolates in the study belonged to the subjects at post-operative and surgical wards, the vulnerability of the surgical wound infection with MRSA among the patients, following transmission from the healthcare providers, further complicates the treatment and recovery. In India, with an MRSA prevalence rate of 30-50% of all *S. aureus* clinical isolates, where multiple clones circulate at

any point of time, there is an urgent need for well controlled multicenter studies for MRSA carriage in patients and health-care providers. Formulation of screening and decolonisation strategies based on the carrier prevalence rates in the area will be of paramount importance in devising appropriate strategy for prevention and containment of such infections.

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