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Research Article

A STUDY OF NASAL CARRIAGE OF MRSA AMONG THE HEALTH CARE WORKERS OF A TERTIARY CARE HOSPITAL, BANGALORE

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ABSTRACT
Objective: The present study was conducted to evaluate the rate of nasal carriage of Methicillin Resistant *Staphylococcus aureus* among the health care workers working at our hospital with an aim to prevent the hospital acquired infections. *Background:* Methicillin resistant *Staphylococcus aureus* is now one of the commonest bacteria causing nosocomial infections. Approximately 25-30% of healthy people carry this organism on their skin or in their nose. Carriage of S. aureus in the nose appears to play akey role in epidemiology and pathogenesis of infection. Screening for MRSA carriers among this population is necessary for nosocomial infection control. Methicillin resistant *Staphylococcus aureus* is usually introduced into an institution by a colonised or infected patient or a healthcare worker. 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. *Methods:* A total of 157 nasal swabs were collected, sterile cotton swabs moistened with sterile saline were used for sample collection. Swabs were culture don to blood agar, and incubated at 37^0C for24 hrs. *Staphylococcus aureus* was identified by standard methods according to CLSI guidelines. Methicillin resistance was detected by using cefoxitin disc30µgm on Mueller Hinton agar with 4% Sodium Chloride (NaCl). *Results:* A total of 157 nasal swabs were collected from the health care workers of our hospital. Of the 157 swabs, 39(24.84%) strains of Staphylococcus aureus were isolated. Out of which 21(13.37%) strains were methicillin resistant *Staphylococcus aureus(MRSA)* and 18(11.46%) strains were methicillin sensitive *Staphylococcus aureus* (MSSA). *Conclusion:* Our study revealed that health care workers were the potential colonisers of methicillin resistant *Staphylococcus aureus*. These carriers may serve as reservoir and disseminator of MRSA, and should be treated with mupirocin 3 times daily for 5 days. So regular screening ofcarriers is required for the prevention of nosocomial infection.

Key Words: *Nasal Carriers, Mupirocin, Methicillin Resistant Staphylococcus Aureus (MRSA)*

INTRODUCTION
Methicillin-resistant *Staphylococcus aureus* (MRSA) has been recognized as an important nosocomial pathogen worldwide (Shenoy *et al.,* 2010). Methicillin resistant staphylococcus aureus strains were initially described in 1961 and emerged in the last decade as one of the most important nosocomial pathogens (PAC *et al.,* 1989). Infected and colonized patients provide the primary reservoir and transmission is mainly through hospital staff (McDonald *et al.,* 1997). Risk factors associated with MRSA bacteremia include the following: residence in an extended care facility, prior antibiotic exposure, insulin dependent diabetes, prolonged hospitalization, urinary catheterization, nasogastric tube placement, prior surgery and having an underlying disease (Doebbeling *et al.,* 1995).
The continuously high prevalence of methicillin-resistant staphylococci (MRS) throughout the world is a constant threat to public health, owing to the multiresistant characteristics of these bacteria (Brakstad and Maeland, 1997).
Approximately 25-30% of healthy people carry this organism on their skin or in their nose. Carriage of S. aureus in the nose appears to play akey role in epidemiology and pathogenesis of infection (Kluytmans *et al.,* 1997). Other sites of colonisation are wounds, tracheostomy sites and sputum of intubated patients (Walsh *et al.,* 1987). Rectal or perineal colonisation has been suggested as an important perhaps more difficult to eradicate reservoir of MRSA (Rimland and Roberson,1986).Colonization with *S aureus* or

MRSA is relatively common in both healthy and hospitalized individuals, most often involves the anterior nares and is frequently asymptomatic. Colonization increases risk of infection. Patient-to-patient transmission of MRSA within healthcare settings primarily occurs via carriage on the hands of healthcare workers (David and Henderson, 2006). Screening for MRSA carriers among this population is necessary for nosocomial infection control (Mathanraj *et al.,* 2009).

The use of mupirocin in eradicating mupirocin-susceptible strains from the nose is well established and in early studies, about 85% of nasal carriers were cleared, although relapse did occur. Clearance of nasal *S. aureus* with mupirocin in staff is associated with clearance of hand carriage, which may be important in control of outbreaks (Oxford Journals, 57).

MATERIALS AND METHODS

The study was conducted over a period of 3 months from October to December 2012 in the Department of Microbiology. A total of 157 nasal swabs were collected from health care workers working in departments like Intensive Care Units, Operation theatres, Surgery, Orthopaedics, Obstetrics and gynecology, paediatrics, ENT and ophthalmology.

Methods: Sterile cotton wool swabs moistened with sterile normal saline were used to collect the specimen from the anterior nares. The swabs were transported to the laboratory immediately and processed. Swabs were cultured on blood agar and then incubated at 37^0C for 24hrs. S. aureus was identified using standard methods based on colony morphology, gram stain, catalase test, Mannitol fermentation and coagulase test. Methicillin resistance was tested using Mueller- Hinton agar with 4% NaCl with Cefoxitin disc (30 micrograms) by Kirby-Bauer disc diffusion method. A zone size of$\geq$22 mm was considered sensitive and $\leq$ 21 was considered resistant (CLSI, 2012).

Repeat swabs were collected from the health care workers to detect the growth of methicillin resistant *Staphylococcus aureus* (MRSA) strains, after being treated with mupirocin ointment. The swabs were processed using standard methods.

RESULTS

A total of 157 nasal swabs were collected from the health care workers of our hospital. Of the 157 swabs, 39(24.84%) strains of Staphylococcus aureus were isolated. Out of which 21(13.37%) strains were methicillin resistant *Staphylococcus aureus (MRSA)* and 18(11.46%) strains were methicillin sensitive *Staphylococcus aureus* (MSSA).

Repeat swabs that were collected from methicillinresistant *Staphylococcus aureus* (MRSA) positive staff members after treatment with Mupirocin yielded no growth of staphylococcus aureus.

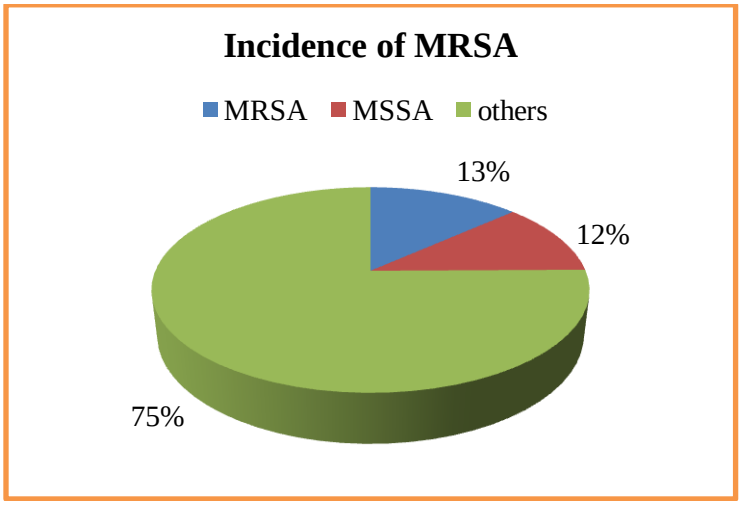
TABLE

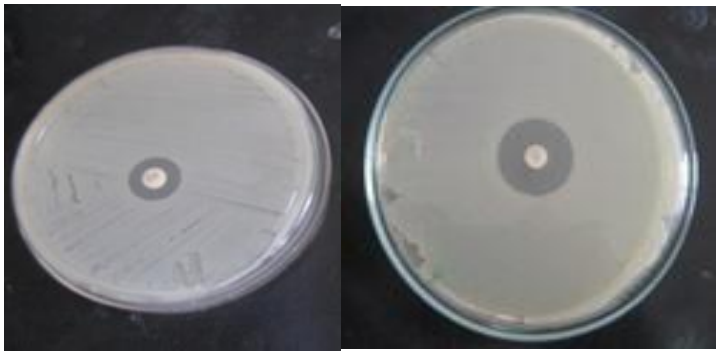
Total specimen	Staphylococcus aureus isolated	MRSA	MSSA
157	39(24.84%)	21(13.37%)	18(11.46%)

DISCUSSION

MRSA has been recognised as an important nosocomial pathogen worldwide because of the increased rate of multidrug resistant strains among the hospital acquired MRSA. Methicillin resistant *Staphylococcus aureus* colonisation precedes infection, anterior nares being the ecological niches of *Staphylcoccus aureus.*

Although *S. aureus* can be cultured from multiple sites of the skin and mucosal surfaces of carriers, the primary reservoir of staphylococci is thought to be the vestibulum nasi (anteriornares), i.e., the nostrils of the nose. Inside, this part of the nose is lined by a fully keratinized epidermis with hairs, sebaceous glands, and sweat glands.





MRSA (Zone of Inhibition- 13 mm) **MSSA (Zone of Inhibition-23 mm)**

Apparently, the staphylococcal cells flourish here in the relative absence of human defences and/or are capable of withstanding the local antibacterial defences. To adhere, bacterial cells need to establish firm interactions with human cell surfaces, to prevent their rapid elimination by physicochemical mechanisms. To establish successful colonization, it is thought that surface components of the staphylococcal cell interact with complementary components on the eukaryotic host cell membranes. Bacterial adherence may be nonspecifically mediated by physicochemical forces including hydrophobic interactions (Kluytmans *et al.*, 1997)

Methicillin resistance in staphylococci is determined by a gene-mec, composed of 50 kb or more of DNA found only in methicillin-resistant strains. mec contains mecA, the gene coding for penicillin-binding protein 2a (PBP 2a); mecI and mecR1, regulatory genes controlling mecA expression; and numerous other elements and resistance determinants. A distinctive feature of methicillin resistance is its heterogeneous expression (Clin Microbiol Rev, 1997). Methicillin resistance is phenol typically associated with the presence of the penicillin-binding protein 2a (PBP2a) which is not present in susceptible staphylococci. This protein has a low binding affinity for beta-lactam antibiotics (Brakstad and Maeland, 1997). Penicillin-binding proteins (PBP) are membrane-bound enzymes that catalyze the transpeptidation reaction that is necessary for cross-linkage of peptidoglycan chains. PBP2a substitutes for the other PBPs and, because of its low affinity for all β-lactam antibiotics, enables staphylococci to survive exposure to high concentrations of these agents. Thus, resistance to methicillin confers resistance to all β-lactam agents, including Cephalosporins (Lowy, 2003). Hospital Aquired-MRSA strains mainly harbour*SCCmec* types I, II and III and Community Acquired -MRSA types IV and V(Goetghebeur *et al.*, 2007).

The overall MRSA carriage rate in our study was 13.37% in the health care workers. This indicates that they are the potential colonisers and disseminators of MRSA in the hospital settings. The staffs that was positive for the growth of MRSA was advised to apply.

Mupirocin ointment to the anterior nares 3 times daily for 5 days. The staffs employed in a high dependency unit like ICU were refrained from the duty until they were cleared of nasal carriage.

The results of our study are comparable to a study conducted in 2011 (Kakhandki and Peerapur, 2012) where the incidence of MRSA among health care workers was 12.2%.

Mupirocin nasal ointment is presently the treatment of choice for decolonizing the anterior nares. Mupirocin apparently exerts its antimicrobial activity by reversibly inhibiting isoleucyl-transfer RNA, thereby inhibiting bacterial protein and RNA synthesis (Parenti, Hatfield and Leyden, 1987). It is effective in temporarily eradicating *S. aureus* from the nose. When mupirocin is applied to the nose twice daily for 5 consecutive days, it has been reported to result in elimination rates of 91% directly after therapy (Doebbeling *et al.,* 1993).

To conclude, Identification of the carrier and treating the carrier with mupirocin ointment is an important measure in preventing outbreaks of MRSA infection in hospitals.

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