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Study of nasal carriage of MRSA among the clinical staff and health care workers of a teaching hospital of Karnataka, India

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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 clinical staff and health careworkers working at our hospital with an aim to prevent the hospital acquired infections. *Background:* Methicillin resistant *Staphylococcus aureus* colonisation precedes infection, anterior nares being the ecological niches of *Staphylcoccus aureus*. Carriage of *Staphylococcus aureus* in the nose appears to play a key role in the epidemiology and pathogenesis of infection. 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 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 200 nasal swabs were collected, out of which 140 were from the nursing staff and 60 were from clinical staff. Sterile cotton swabs moistened with sterile saline were used for sample collection. Swabs were cultured on to blood agar, and mannitol salt agar, incubated at 37 ^{o}C for 24 hrs. *Staphylococcus aureus* was identified by standard methods according to CLSI guidelines. Methicillin resistance was detected by using cefoxitin disc 30µgm on Mueller Hinton agar with 4% NaCl. *Results:* Of the 200 samples screened 45 (43.6%) strains of Staphylococcus aureus were isolated, out of which 24 (12%) were. Methicillin resistant *Staphylococcus aureus* (MRSA) and 21 (10%) were methicillin sensitive *Staphylococcus aureus* (MSSA). The overall carriage rate of methicillin resistant *Staphylococcus aureus* in our study was 12% with the highest rate being seen among the nursing staff (12.2%) and clinical staff carriage rate was slightly less (11.7%) as compared to the nursing staff. *Conclusion:* Our study revealed that nursing staff were the potential colonisers of methicillin resistant *Staphylococcus aureus* when compared to clinical staff. 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 of carriers is required for the prevention of nosocomial infection.

Keywords: Nasal Carriers, Mupirocin, Methicillin resistant *Staphylococcus aureus* (MRSA).

Introduction

MRSA has become a major nosocomial pathogen in community hospitals, long term care facilities and tertiary care hospitals. MRSA colonisation precedes infection and the major reservoir being the anterior nares. MRSA is usually introduced into an institution by a colonised or infected patient or healthcareworker for the elimination of MRSA in carriers [1]. The increased use of this antibiotic has been accompanied by colonised or infected patient or a healthcare worker [2]. Colonisation may be either transient or persistent and may be at single or multiple body sites [3]. Carriage of S. aureus in the nose appears to play a key role in epidemiology and pathogenesis of infection [4]. Other sites of colonisation are wounds, tracheostomy sites, sputum of intubated patients [5]. Rectal or perineal colonisation has been suggested as an important perhaps more difficult to eradicate reservoir of MRSA [6]. Hospital workers have higher rates MRSA nasal colonisation than the general population [7]. Asymtomatically colonised patients and healthcare workers are the major source of MRSA in the hospital environment the latter being more commonly identified as links in the transmission of MRSA between the patients [8]. Screening for MRSA carriers among this population is necessary for nosocomial infection control [9]. Indiscriminate use of antibiotics, prolonged hospital stay, intravenous drug use, carriage of MRSA in nose, axilla, perineum are the important risk factors for the acquisition of MRSA infection [4]. The commonly used antibiotic for treatment of MRSA infection is Vancomycin or Linezolid while Mupirocin is

an effective topical antibiotic outbreaks of MRSA resistant to Mupirocin, although the frequency of resistance is still low [10].

Material and Methods

The study was conducted over a period of 3 months from January to March 2011 in the Department of Microbiology. A total of 200 nasal swabs were collected. 60 swabs were from clinical staff working in departments like Surgery (17), Orthopedics (17), Obstetrics and gynecology (17), Anaesthesia (9) while 140 swabs were from the nursing staff including the operation theatre staff.

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 mannitol salt 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 by Kirby-Bauer disc diffusion method. Plates were incubated at 37^0C for 24 hrs. A zone size of 23-29 mm was considered sensitive [11].

Repeat swabs were collected from the staff positive for the growth of methicillin resistant *Staphylococcus aureus* (MRSA) strains, after being treated with mupirocin ointment. The swabs were processed using standard methods.

Results

Total	Clinical Staff (Surgical)	Nursing staff
200	60	140

Clinical staff

Total specimen	S.Aureus isolated	MRSA	MSSA
60	12 (20%)	7(11.7%)	5 (8.3%)

Nursing staff

Total specimen	S.Aureus isolated	MRSA	MSSA
140	33 (23.6%)	17 (12.2%)	16 (11.4%)

A total of 200 nasal swabs were collected of which 140 were from the nursing staff and 60 were from the clinical staff. Of the 140 swabs (nursing staff), 33(23.6%) strains of Staphylococcus aureus were isolated. Out of which 17(12.2%) strains were methicillin resistant *Staphylococcus aureus* and 16(11.4%) strains were methicillin sensitive *Staphylococcus aureus* (MSSA).

Of the 60 swabs (clinical staff) 12(20%) strains of *Staphylococcus aureus* were isolated. Out of which 7(11.7%) were methicillin resistant *Staphylococcus aureus* and 5 (8.3%) were methicillin sensitive *Staphylococcus aureus* (MSSA). So of the 200 samples collected, 45(43.6%) strains of *Staphylococcus aureus* were isolated. Out of which 24(12%) were methicillin resistant *Staphylococcus aureus* MRSA) and 21(10.5%) were methicillin sensitive *Staphylococcus aureus* (MSSA). Repeat swabs that were collected from methicillin resistant *Staphylococcus aureus* (MRSA) positive staff members yielded no growth of Staphylococcus aureus.

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. Since 1990s many cases and outbreaks of infections caused by community acquired MRSA have been reported and are referred to as community associated MRSA (CAMRSA) [12]. CAMRSA infections also occur in immunocompetent persons without the MRSA risk factor [13].

"MRSA are those strains of *S. aureus* that express *mec*A or another mechanism of methicillin resistance, such as changes in affinity of penicillin binding proteins for oxacillin (modified *S. aureus* [MOD-SA]

strains)". **MRSA = *S. aureus* with *mec*A and/or oxacillin MIC >2 µg/ml** [14]. MRSA describes resistance to the penicillinase-resistant penicillin class of antibiotics which includes methicillin, oxacillin, nafcillin, cloxacillin, dicloxacillin. Methicillin resistance may be referred to as intrinsic to mean that the mechanism of resistance is chromosomally mediated. The mechanism of resistance is by alteration of penicillin binding protein on the surface of the bacterium resulting in a decrease in the affinity for the antibiotic. Intrinsic methicillin resistance due to altered penicillin binding protein i.e. PBP2a has been linked to the presence of a chromosomal gene ending within a region called mec. So all the strains of S. aureus that are highly resistant to methicillin produce an additional low affinity PBP2a encoded by the mecA gene. CAMRSA have a type IV Staphylococcal cassette chromosome mec (scc mec) genetic element that encodes for mecA gene [15].

The overall MRSA carriage rate in our study was 12% with the highest rate being seen among the nursing staff (12.2%). Carriage rate among the clinical staff was slightly less (11.7%), indicating that the nursing staff were the potential colonisers and disseminators of MRSA in the hospital settings. The staff who were positive for the growth of MRSA were advised to apply Mupirocin ointment to the anterior nares 3 times daily for 5 days. The staff employed in a high dependency unit like ICU were refrained from the duty until they were cleared of nasal carriage [16]. Mupirocin specifically binds to bacterial isoleucyl-t RNA synthetase (IRS) and inhibits protein synthesis [17].

The principal mode of MRSA transmission within an institution is from patient to patient via the transiently colonised hands of hospital personnel who acquire the organism after direct patient contact or after handling the contaminated materials [18-19]. Prevention of MRSA infection merits discussion as once introduced in a hospital, MRSA is very difficult to eradicate [20]. Nasal application of mupirocin at clinically effective concentrations may result in the presence of low levels of antibiotic in the pharynx, which could induce or select for the emergence of mupirocin resistant MRSA [21]. Other topical agents like Chlorohexidine and Naseptin have been less effective than mupirocin [16]. Recolonisation often occurs after the therapy is discontinued. It is possible that long term intermittent therapy with mupirocin may be more effective in suppressing or eradicating the MRSA colonisation, but whether this would lead to increasing problems with mupirocin resistance [22]. Identification of the carrier and treating the carrier with mupirocin ointment is an important measure in preventing outbreaks of MRSA infection in the hospitals.

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