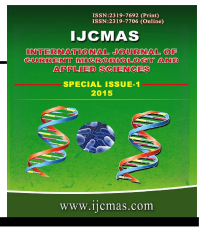
International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Special Issue-1 (2015) pp. 59-64**
http://www.ijcmas.com



Original Research Article

To Determine the Prevalence of Intranasal Carriage of MRSA in Children, Antibiotic Susceptibility Pattern and Risk Factors Associated with Acquiring Nosocomial Intranasal Carriage

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Keywords

S. aureus, MRSA, nasal colonization, nosocomial, antibiotic

A B S T R A C T

Nasal carriage of *Staphylococcus aureus* has been identified as a risk factor for community as well as hospital acquired infections in children. These children have the potential to cause spread of infection in the community. This study was thereby undertaken to determine the prevalence, antibiotic sensitivity pattern and risk factors associated with nasal MRSA carriage at a tertiary care hospital. Nasal swabs soaked in sterile saline were collected from 50 consecutive children, who were admitted as pediatric inpatients. Two samples were collected from each patient, one at the time of admission and the other at the time of discharge. Samples were transported and processed in the lab for the growth of MRSA. Positive isolates were subjected to antimicrobial susceptibility tests by Dick Diffusion method according to CLSI guidelines. Patient's particulars and associated risk factors were recorded in the predesigned Performa. Out of 50 samples analyzed, 19 (38%) revealed growth of MRSA. There was significant increase in colonization rate with increasing age and the duration of hospital stay. Sex and nutritional status were not found to be significant risk factors for acquiring nasal carriage. All the isolates were sensitive to Vancomycin whereas sensitivity to Amikacin and Gentamycin was weaker in the second samples, sent at the time of discharge. The prevalence of intranasal MRSA is high in children which increases with advancement in age and exposure to any health care setting. This calls for strict control measures and better awareness programs to curtail the spread of this potentially lethal organism, which can be effectively controlled by a simple measure of washing of hands.

Introduction

Methicillin Resistant *Staphylococcus aureus* (MRSA), once confined to health care facilities has now emerged as an important pathogen for community outbreaks. World over, it has been recognized as a cause of both superficial as well as deep tissue infections (Moellering, 2006). *Staph. aureus* developed resistance to penicillin in the 1940's and later to Methicillin in 60's (Chatterjee et al., 2009). Increasing trend of MRSA has been recorded all over the world and at all ages. Strains isolated from the infected tissues have been demonstrated to be similar to those found colonized at body surface (Klutmans et al., 1997). Apart from resistance to methicillin, vancomycin resistant and vancomycin indeterminate strains have also emerged as lethal pathogens (Asadullah et al., 2003; Himartshu et al., 1997). Nasal carriage of MRSA has been proven to be a significant risk factor for community as well as nosocomial infections at all age groups (Oguzkaya-Artan et al., 2008; Klutmans et al., 1997; Saxena et al., 2003). Its prevalence among children in India has been reported to be as high as 5.3% (Saxena et al., 2003). Anterior nares have been reported to be the commonest site of colonization as compared to finger webs and skin (Khan et al., 2013). Even asymptomatic carriage is common and about 20% of healthy population has nasal colonization which is a major risk factor for both local as well as systemic infections (Weidenmaier et al., 2012). Such carriers can be a source of transmission of infection to other children. Moreover nosocomial colonization can pose a serious threat to the community as hospital acquired MRSA are often resistant to the commonly prescribed antibiotics. The present study was there by undertaken to determine the prevalence of nasal carriage MRSA, its antibiotic sensitivity pattern and the risk factors for acquiring nasal colonization during the hospital stay.

Materials and Methods

The study was conducted in the Department of Pediatrics, Jawahar Lal Nehru Medical College, Aligarh Muslim University. Fifty consecutive children admitted in the Pediatric ward for various indications were included. Informed consent was obtained from the parents and patients (where feasible) prior to participation. The predesigned Performa which included patient's particulars, socioeconomic status, anthropometric indices and risk factors for colonization like prior recent hospitalization and antibiotic usage in the past 4 weeks, was filled and recorded. Specimens were collected with nasal swabs soaked in sterile saline, rotated in the vestibule of each nare. Two samples were collected from each patient, one at the time of admission (MRSA I), which represented community acquired MRSA and second at the time of discharge (MRSA II), which indicated nosocomial colonization. The samples were transported within an hour of collection, maintaining cold chain and cultured on 5-10% sheep blood agar in the Microbiology lab at our hospital for the growth of MRSA. Positive isolates were subjected to antimicrobial sensitivity by Kirby-Baeur diffusion method as described by Clinical Laboratory Standard Institute (CLSI) guidelines.

Statistical analysis

Statistical analysis was done with chi-square test and a 'p' value of less than 0.05 was taken as significant.

Result and Discussion

Out of 50 samples, 38% (19) revealed growth of MRSA, a figure which is quiet

high as compared to a study in Chandigarh by Chatterjee *et al.* (2009) which reported a prevalence of 3.89%. Similarly other studies in USA and India have demonstrated a much lower prevalence rate ranging from 1–5.3% (Mainous et al., 2006; Beam and Buckley, 2006). The high rate in our study could possibly be due to the fact that children in our study belonged to lower socioeconomic strata and lacked awareness about simple preventive measures like hand washing. This high rate is comparable to prevalence seen in studies by Tabbarai *et al.* (34.8%) and Soltani et al. (35.9%) (Tabbarai et al., 2001; Soltani et al., 2014). Of the second samples sent on discharge, 16 samples showed growth of MRSA, out of which there were 3 children who had the initial sample as positive too. Thus, 13 children who were initially negative acquired nasal carriage during the hospital stay. 16 children who tested positive for nasal MRSA subsequently became negative on second cultures. This could be due to the antibiotic therapy that the children received as a part of the treatment during the hospital stay.

Risk factors

Gender

Table 1 shows sex distribution of both the groups, but the difference was not found to be statistically significant (p value> 0.05). Some studies have noted male gender as a risk factor for acquiring nasal colonization (Soltani et al., 2014).

Nutritional status

Subjects were categorized according to their nutritional status in accordance with the classification of the malnourished by IAP. Nutritional status was not found to be significantly associated with either community or nosocomial colonization (Table 2).

Age

For our estimation, patients were divided into 3 age groups: 5 years, 5–10 years and 10 years. Table 3 shows prevalence of both community as well as nosocomial MRSA nasal carriage which was noted to increase significantly with age (p value< 0.05) with highest prevalence amongst 5–10 years age-group.

Duration of stay in the hospital

An increasing trend of acquiring nasal colonization was observed with increasing duration hospitalization but it was not found to be statistically significant (Table 4). To the authors best knowledge, none of the previous studies have tested the effect of nutritional status, age and duration of hospital stay on nasal carriage.

Exposure to health care facility has been reported to cause an increase in colonization rate (Saxena et al., 2003) but incidentally none of the subjects in our study group had history of recent exposure to any health care facility and other risk factors like antibiotic usage in the last 4 weeks, so influence of these risk factors could not be tested.

Antibiotic susceptibility testing

All the positive isolates were subjected to antibiotic sensitivity tests by disk diffusion method (CLSI, 2007). Out of 50 samples collected on admission (MRSA I), 19 were positive for MRSA. All 19 of these were sensitive to vancomycin, 17 to amikacin (89.4%) and 12 to gentamycin (63.1%), 6 to cephazolin, 4 to erythromycin, 2 to ciprofloxacin and only 1 was sensitive to clindamycin (Table 5).

The 100% sensitivity to vancomycin has been reported from other studies in Korea,

Taiwan and India (Ko et al., 2008; Huang et al., 2007; Pathak et al., 2010) but in a study by Soltani et al. (2014) vancomycin sensitivity was found to be relatively low - 87.9%. In our study sensitivity to gentamycin was found in 63.1% and to clindamycin in a single isolate, whereas in a study in Chandigarh, it was found to be 12.5% and 6.3% respectively. All the isolates in this study were sensitive to ciprofloxacin as compared to only 2 in our study (Chatterjee et al., 2009).

Out of 50 second samples (MRSA II) sent at the time of discharge, 13 were positive for MRSA. All the positive isolates which were representative of hospital acquired infection were sensitive to vancomycin (100%) but sensitivity to amikacin and gentamycin was found to be lower (69.2 and 46.1% respectively) as compared to the first cohort of isolates. Sensitivity to clindamycin was found to be similar as compared to first isolates.

Table.1 Gender distribution of positive cases

	MALE	FEMALE	P value
MRSA I(n=19)	11	8	>0.05
MRSA II(n=13)	9	4	>0.05

Table.2 Nutritional status of positive cases

	Normally nourished	PEM 1	PEM 2	PEM3	PEM4	P value
MRSA I (n=19)	8	5	2	1	3	>0.05
MRSA II (n=13)	6	5	0	2	0	>0.05

Table.3 Age distribution of positive cases

Age (years)	5	5-10	10	P value
MRSA I n=19	3	12	4	<0.05
MRSA II n=13	1	8	4	<0.05

Table.4 Duration of hospital stay and risk of MRSA

Duration of hospital stay(hours)	48	48-72	72	P value
MRSA II n=13	1	3	9	>0.05

Table.5 Antibiotic sensitivity pattern of positive isolates

	ANTIBIOTIC SENSITIVITY n(%)	
	MRSA I n=19	MRSA II n=13
Vancomycin	19(100)	13(100)
Amikacin	17(89.4)	9(69.2)
Gentamycin	12(63.1)	6(46.1)
Oxacillin	5	1
Clindamycin	1	1
Ciprofloxacin	2	2

This indicates that hospital acquired MRSA is relatively more resistant to commonly prescribed antibiotics and thus judicious use of antibiotics when suspecting this organism is warranted. This also calls for better awareness and preventive measures like simple hand washing to prevent the spread of hospital acquired nasal MRSA to the community.

Prevalence of nasal MRSA is fairly common in our community and risk of acquiring nasal colonization increased with age and duration of stay in the hospital in our study. This calls for strict infection control measures and awareness program to curtail the spread of nosocomial infections. Emphasis should be laid on proper hand washing technique, a measure which has been demonstrated to be the cheapest and most efficient method to prevent inter-patient transmission.

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