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Prevalence of Community Acquired Nasal Carriage of Methicillin Resistant Staphylococcus Aureus and its Antibiotic Senstivity Pattern in Children in A Tertiary Care Centre

KEYWORDS: Nasal carriage, Staphylococcus aureus, antimicrobial susceptibility.

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ABSTRACT

BACKGROUND

Staphylococcus aureus is a common cause of serious Community associated and health care-associated infections as there is increased prevalence of both in recent decades. The spread of staphylococcal infections among children in the community have been attributed to the nasal carriage of the organism. Risk of Invasive Staphylococcus aureus infections are increased manifold in the children with nasal colonization of the organism. Hence, this study was undertaken to estimate the prevalence of Staphylococcus aureus colonization in healthy children and its antimicrobial susceptibility pattern.

MATERIALS AND METHODS

This study was carried out among 80 healthy children between the age group of 5 to 12 years who attended the pediatric out -patient department. Nasal swab sample was collected and processed by streak plate method on blood agar plates, cultured for Staphylococcus aureus. All positive cultures were then tested for pattern of antibiotic sensitivity.

RESULTS

Results recorded, maximum growth recorded between the age group of 5 to 7 years. The prevalence of nasal carriage of MSSA nasal carriage was 10% (8/80), among which MRSA was 1.25%(1/80). Antibiotic sensitivity pattern showed that, most MSSA isolates were sensitive to cephalexin, cloxacillin and ampicillin, gentamycin but resistant to common antibiotics like ampicillin and erythromycin. The only identified MRSA strain was sensitive to vancomycin, clindamycin, linezolid and ciprofloxacin.

CONCLUSION

The overall prevalence of nasal carriage of CA-MRSA in this setting though not in alarming rate, poses a major threat requiring regular screening to prevent further infections and strategies to interrupt transmission should be implemented.

INTRODUCTION

Staphylococcus aureus (MSSA), is an ubiquitous organism colonizing the skin and mucus membranes of normal healthy children causing wide spectrum of infections ranging from skin and soft tissue infections to Pneumonia and septicemia (1). Recently, the prevalence of community-acquired methicillin-resistant Staphylococcus aureus (CA-MRSA) infections has increased even among healthy children (2,3,4). Colonization rates of MRSA in the Indian community have been reported to range from 0 to 9.2 per cent (5).

The anterior nares of the nose is the most frequent carriage site for S. aureus (6). Nasal colonization of MRSA has been correlated with increased risk for acquiring invasive disease (7). Contaminated hands most commonly cause the colonization of the nares, as there is a strong correlation between hand and nasal carriage of MRSA (8,9). Colonization of the organism can occur in close contact areas like schools, pre-schools or households and is attributed to the contaminated hands and surfaces, where the organism can survive for months (7,10).

Nasal carriers serve as "cloud" individuals dispersing S. aureus into the environment during rhinitis (11). Over time, three patterns of carriage can be distinguished. Approximately 20% of individuals almost always carry one type of strain and are called persistent carriers. A large proportion of the population (60%) harbor S. aureus intermittently, and the strains change with varying frequency. Such persons are called intermittent carriers. Finally, a minority of people (20%) almost never carry S. aureus and are called non-carriers (20%). Persistent carriage is more common in children than in adults (12,13). The reasons for these differences in colonization patterns are unknown (7).

Though the epidemiology of CA-MRSA colonization and infection in other countries have been extensively studied, there is limited data on the extent of CA-MRSA colonization in India. With antimicrobial resistance being more common and India's population crossing over 1 billion and growing, microbial milieu demands for close surveillance. Hence, this study was undertaken to determine the prevalence of CA-MRSA nasal colonization, and antimicrobial susceptibility characteristics among isolates were studied.

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MATERIALS AND METHODS

This study was a prospective observational design carried out in the Pediatric outpatient department at Sri Ramachandra Medical Centre (SRMC) and Hospital, Chennai for a period of one year, with sample size being 80 children between the age group of 5 to 12 years. Those children who were not on recent antibiotic therapy, with no respiratory illness and parents willing to consent were included in the study. Children who were inpatients, had recent antibiotic therapy, respiratory illness or skin and soft tissue infections were excluded from the study. The study was approved by the ethics committee of SRMC.

Samples were obtained from the left and right anterior nares of each participant using a sterile swab, pre-moistened with sterile water. The swab was inserted into each nostril, rotated for 5 seconds, and placed immediately into the tube. The collected sample was then cultured in blood agar media and specimens with positive culture were assessed by Kirby Bauer method to common antibiotics like penicillins, cephalosporins, macrolides and aminoglycosides. Interpretation of results were done using Clinical Laboratory Standard Institute guidelines (CLSI). Known quantity of bacteria (Staphylococcus aureus) was grown on agar plates in the presence of thin wafers containing relevant antibiotics. If the bacteria were susceptible to a particular antibiotic, an area of clearing surrounds the wafer where bacteria were incapable of growing (called a zone of inhibition). Children with culture positive results were treated with local mupirocin ointment. The collected data was analysed with SPSS 16.0 version.

The data was described by descriptive statistics, frequency analysis an percentage analysis method. Significant difference between the bivariate samples for independent groups was analysed by Mann-Whitney U test and the significance in categorical data was analysed by Chi-Square test . In both the above statistical tools, the probability value of $P \leq 0.05$ was considered as significant.

RESULTS

Among the 80 pediatric (n=80) patients enrolled in the study, 43(54%) were boys, 37 (46%) were girls. The overall growth was noted to be 11.25%(9/80), prevalence of MSSA was found to be 10% (8/80) and MRSA was found to be 1.25% (1/80) among the S.aureus isolates, H.influenzae strain was found to be 1.25% (1/80), normal flora was 67.5%(54/80), with no specific growth noted in 21.25 %(17/80) of the study group.

Interestingly, the predominant MSSA growth was noted in females 62% (5/8, p=0.511), males 38% (3/8) which was similar to studies done in India, although the p value of >0.05 (0.511) showed no significant association in terms of gender (Fig 1). Age wise distribution of the collected data showed 49% children (n=63) belonged to group between 5 to 7 yrs, 35 % (n=25) were between 8 to 10yrs and 16 % (n=12) belonged to 11 to 12 yrs age group (Fig 2). Maximum S.aureus growth was noted between the age group of 5 to 7 yrs, with the one MRSA isolated between the age group of 8 to 10yrs. However, the p value > 0.05 (0.564), showed no significant difference between the frequency of the organism in association with the age group. In our study it was also observed that the positive growth results obtained were from the children attending school, which could probably be attributed to overcrowding being a risk factor (Fig 3).

The antibiotic susceptibility pattern showed Staphylococcus aureus isolates sensitive to common antibiotics like cephalexin (86%), ciprofloxacin (86%), cloxacillin (43%), gentamycin (86%), clindamycin (14%), although resistance to common antibiotics like ampicillin (71%), erythromycin (43%) and cephalexin (14%) was observed. The only one identified MRSA strain was sensitive to vancomycin, clindamycin, linezolid and ciprofloxacin (Table 1).

DISCUSSION

The emergence of MRSA in the community is of paramount importance and is the subject of multiple studies in a variety of clinical settings and from many parts of the world (Table 2). This study conducted from the southern part of India showed maximum growth between the age group of 5 to 7 years which was similar to the results from the study by Shetty et al (15). The prevalence of MSSA was found to be 10% (8/80) among healthy children, MRSA was found to be 1.25% (1/80) among the S.aureus isolates. These results are consistent with various previous studies from India (15,20).

In another study by Chatterjee et al, 489 school children (5 to 15 years of age) were subjected to PCR assay for mecA gene, and colonization was found in 256 (52.5%) children, MRSA was 3.9% which was higher than most of the other Indian study results (5). A large scale (n=1562) study by Pathak et al showed the prevalence of nasal carriage of S. aureus to be 6.3% (95% CI 5.1-7.5) out of which 16.3% (95% CI 8.9-23.8) were MRSA in children between 1month to 5 years of age (14). It was consistent with factors like living in mud-thatch housing and those attending schools, establishing overcrowding as an associated risk factor for nasal carriage in children (5,14). Many studies from other countries have also shown prevalence rates between 16 % - 23% (15). The overall variation in the prevalence of nasal CA – MRSA in children may be due to varied geographical location, sampling and culture techniques involved.

In our study, the Staph. Aureus isolates were sensitive to most of the common antibiotics, cephalosporins, ciprofloxacin, Clindamycin and linezolid, though the MRSA isolate was found to be resistant to Ampicillin ,erythromycin, Cloxacillin, Cefotaxim, Gentamycin with fortunately no resistance to Vancomycin. Pathak et all study at Ujjain (14) also showed MRSA isolates being resistant to ampicillin, and not resistant to vancomycin. Similar results observed in a study by Lee et all in korea (17), where all MRSA isolates were reported to be sensitive to clindamycin, vancomycin but resistant to erythromycin. Shetty et all study showed resistance to many classes of antibiotics in S. aureus isolates including trimethoprim sulfamethoxazole (TMP-SMX) (39%), ciprofloxacin (16%), erythromycin (19%) and constitutive clindamycin resistance (5%), and yet again none resistant to vancomycin (15).

The prevalence of MRSA and MSSA nasal carriage in our group of patients was 10% and 1.3% respectively and both were sensitive to common antibiotics. The study conducted by Dey et all in Ujjain (16), showed increased prevalence of nasal carriage for MSSA of 35%, MRSA 29% among the study group of 1002 children, and the antibiotic sensitivity pattern showed multi drug resistance to common antibiotics like cotrimoxazole, gentamycin, tetracycline.

There were several limitations in our study, the sample size was relatively small, only those who presented on outpatient basis were enrolled and community recruitment on large scale was not done. Analysis was done based on

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only nasal swab, swabs from hand and nose would have given better results for comparison and interpretation. Association with regards to factors like nutritional status, socio demographic data and hand hygiene were not assessed, the persistence of nasal colonization was not assessed and lastly molecular typing of the strains was not done.

CONCLUSION

In comparison to other studies, rate of nasal carriage of *Staphylococcus aureus* and Methicillin Resistant *Staphylococcus aureus* among children in this setting is not in an alarming rate. Proper personal hygiene measures to be propagated, with regular screening methods and strategies to interrupt transmission should be implemented. Overall , it is observed that children are potent source of nasal MRSA ,which serves to be an important source of serious infections. Thus, potent antibiotic stewardship is recommended to prevent indiscriminate use of antibiotics and to avoid the emergence of resistance of *Staph aureus* to common antibiotics

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TABLES AND FIGURES

FIGURE 1

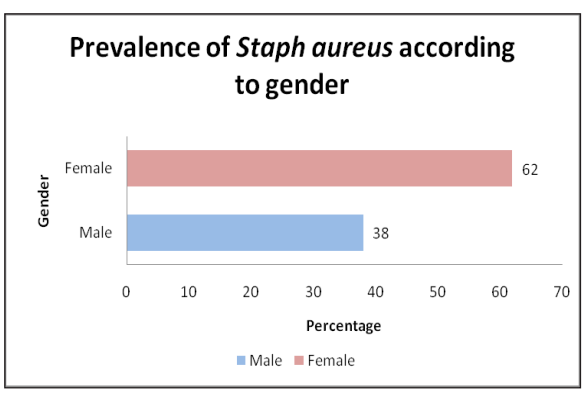

FIGURE 2

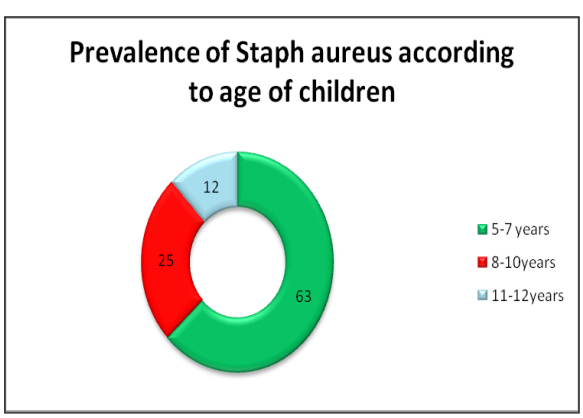

FIGURE 3

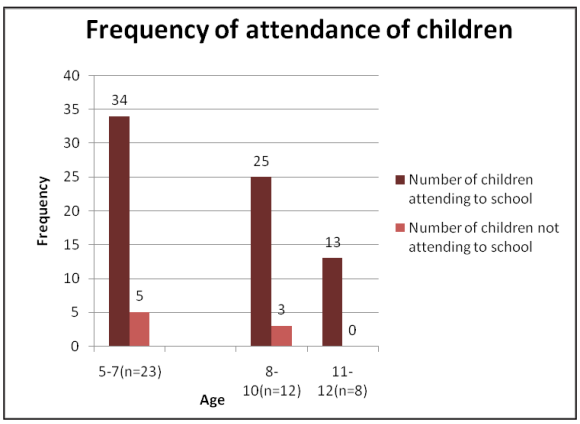

TABLE 1

Antibiotic susceptibility pattern of Staph.aureus isolates

ANTIMICROBIAL DRUGS	RESISTANT	SUSCEPTIBLE
Ampicillin	5(71%)	2(29%)
Cephalexin	1(14)%	6(86%)
Cefotaxime	1(14%)	6(86%)
Ciprofloxacin	1(14%)	6(86%)
Cloxacillin	1(14%)	3(43%)
Erythromycin	3(43%)	4(57%)
Gentamycin	1(14%)	6(86%)
Clindamycin	0	1*(14%)
Linezolid	0	1*(14%)
Vancomycin	0	1*(14%)

*MRSA Isolate

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TABLE 2
Comparison on Nasal carriage rate of MSSA and MRSA from various studies

Authors	Year of publication	Country	Age group	Study setting	Study sample	MSSA	MRSA
Davoodabadi et al (18)	2016	Iran	2 to 6 years	Child care centres	345	69.3%	24.9%
Ayesha et al (19)	2015	India (Uttar Pradesh)	5 to10 years	Hospital	50		38%
Shetty et al (15)	2014	India (Karnataka)	1mon to 17 years	Hospital -out-patients	500	25%	3%
Dey et al (16)	2013	India (Uttar Pradesh)	1 to 6 years	Anganwaries	1002	35%	29%
Pathak et al (14)	2010	India (Madhya Pradesh)	1 mon to 5 years	Hospital -out-patients	1562	6.3%	**16.3% of the *S.aureus* samples**
Ramana et al (20)	2009	India (Andhra pradesh)	5 to15 years	Schools	392	16%	**19% of *S.aureus* samples**
Chatterjee et al (5)	2009	India (Chandigarh)	5 to15 years	Schools	489	52.9%	4.85%
Ko KS et al (21)	2008	Korea	1 to11 years	Hospital -out-patients	296	32.1%	**18.9% of *S.aureus* samples**
LoWT et al (22)	2007	Taiwan	< 7 years	Day care centres	68	25%	13.2%
Hussain et al (23)	2001	USA	<16 years	Hospital -out-patients	122	-	2.5%
Mari et al (24)	2002	USA	2 wks to 21 years	Primary care clinic/private practice	500	29%	0.8%

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