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RESEARCH ARTICLE

PREVALENCE OF NASAL CARRIAGE OF STAPHYLOCOCCUS AUREUS AND ITS ANTIBIOTIC SUSCEPTIBILITY PATTERN AMONG PRIMARY SCHOOL CHILDREN IN A RURAL AREA OF PUDUCHERRY, INDIA

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ABSTRACT

Staphylococcus aureus is a common pathogen responsible for community and hospital associated infections. There is increasing evidence that Community acquired methicillin resistant (CA -MRSA) is spreading among healthy individuals especially children. Our present study is done to determine the colonization rates of S.aureus in the nasal cavity of school children. Nasal swab was collected from (n=265) primary school children aged 3- 8 years and transported to the laboratory within 30 minutes. The samples were processed in the microbiology laboratory as per standard protocol. The carrier rate of S.aureus isolated from the nasal cavity was 76/265 (29%). The colonization rates in males were 44 (17%) and females were 32 (12%) which shows colonization rate is higher among males than females. The prevalence of MRSA among them was 7/265 (2.6%) which is of 9.2% (7/76) of S. aureus. The study concluded that the prevalence rate of S.aureus in our study was 29% and MRSA (2.6%) in healthy children without prior health care visit or intake of antibiotics. The observed precipitating factor was poor personal hygiene. By strengthening school health program and imparting health education regarding personal hygiene is the simple but effective way to contain CA -MRSA among school children in India.

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INTRODUCTION

Staphylococcus aureus (S.aureus) is a common pathogen responsible for community as well as hospital associated infections. The infections caused by S.aureus have clinical range from minor skin infections to severe life threatening infections like necrotizing fasciitis, necrotizing pneumonia and osteomyelitis (Lowy, 1998, Gonzalez *et al.*, 2005). Moreover Methicillin resistant Staphylococcus aureus (MRSA) has been steadily increasing worldwide. In the late 1990s, studies conducted in various countries have revealed a significant prevalence of community acquired methicillin resistant Staphylococcus aureus (CA - MRSA) colonization or infection in both children and adults (Nakamura *et al.*, 2002). There is increasing evidence that CA -MRSA is spreading among healthy individuals, especially children (Rao, 2009).

The anterior nares have been shown to be the main reservoir of S.aureus in both adult and children. S.aureus nasal carriage plays a major role in the epidemiology and pathogenesis of infection. Approximately 20% of individuals are persistently nasal carriers of S.aureus and 30% are intermittently colonized (Gordon *et al.*, 2008). Three factors observed for nasal carriers of S.aureus viz it is an important risk for Staphylococcal septicemia; carriers develop infection more frequently compared to non - carriers; infected individuals harbor the same strain as the infecting strain and treatment of nasal carriage significantly reduces infection. Colonization also increases the risk of transmission among individuals in health care and community settings (Peacock *et al.*, 2003, Ceres Paulino *et al.*, 2013). Infection caused by S.aureus especially MRSA are emerging as a major public health issue (Maple *et al.*, 1989). The first case of CA - MRSA in children was reported in 1988 (Boxbaum *et al.*, 1998). The emergence of MRSA as a cause of infection in the community in patients who have never been hospitalized and who have no risk factors for MRSA is a significant concern. Recent studies from India also confirmed the prevalence of CA- MRSA is being

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increased in skin and soft tissue infections in India and globally (Phakade *et al.*, 2012). The spread of colonized bacteria occur especially in close contact areas like schools, preschools or households probably by the contaminated hands and surfaces where it can survive for months (Peacock *et al.*, 2003). This present study is done to determine the colonization rates of S.aureus in the nasal cavity of school children and to evaluate the antibiotic susceptibility pattern of isolated S.aureus.

MATERIALS AND METHODS

This study was a cross sectional study and the participants (n= 265) were school children aged 3 – 8 years, studying in a municipal school of rural area. The samples were collected after getting informed consent from the parents. By using sterile cotton swab sample was collected from both the nostrils by rotated in both directions.

(50.5%) and females were 131 (49.4%). The carrier rate of S.aureus isolated from the nasal cavity was 76/265 (29%). The colonization rates in males were 44 (17%) and females were 32 (12%) which shows colonization rate is higher among males than females. Also colonization was predominantly seen in the age of 5 years (43.1%), 6 years (41.3%), and 4 years (35.2%). (Table 1)The prevalence of MRSA among them was 7/265 (2.6%) which is of 9.2% (7/76) of S. aureus. The antibiotic susceptibility pattern of the above isolates is given in the histogram. (Fig. 1) in which the S.aureus was showing resistance to Penicillin (100%), Amocyclav (100%), Erythromycin (54%) and Ciprofloxacin (25.3%). The resistance shown by MRSA was Penicillin (100%), Amocyclav (100%), Erythromycin (100%), Clindamycin (43%) and Ciprofloxacin (43%).

Table 1. Nasal carriage of Staphylococcus aureus in the children aged 3- 8 years

Age of the participants	Total no of samples (n =265)			No of isolates of S.aureus			No of MRSA	
	Male	Female	Total	Male	Female	Total	Male	Female
3 years	42	26	68 (25.6%)	2	6	8	0	3
4 years	25	26	51(19.2%)	9	9	18	1	0
5 years	25	26	51(19.2%)	14	8	22	0	0
6 years	14	15	29 (10.9%)	8	4	12	0	0
7 years	28	34	62 (23.3%)	11	3	14	3	0
8 years	0	4	4 (1.5%)	0	2	2	0	0
Total	134	131	265 (100%)	44	32	76	4	3

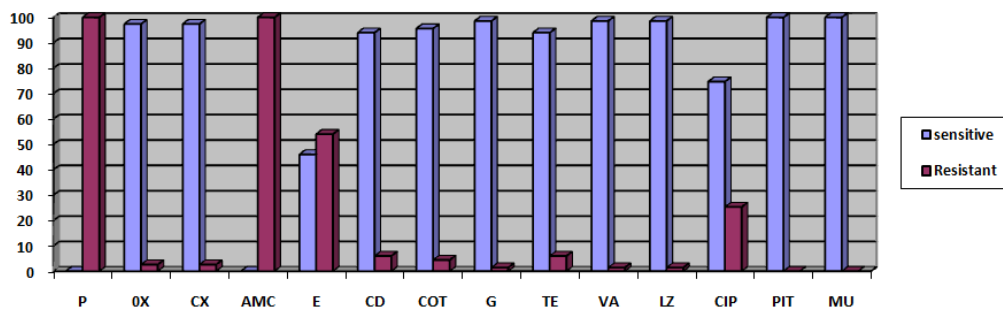


Fig 1. Histogram showing Antimicrobial susceptibility pattern of the isolated S.aureus

The collected samples were transported to the laboratory within 30 minutes in an icepack.

Culture

The swabs were inoculated in Mannitol Salt Agar (MSA) and Blood agar, incubated at 37°C for 24 – 48 hours. The colonies in MSA were circular, opaque, yellow or white in colour was further processed for identification. S.aureus was identified as gram positive cocci, ferments mannitol, positive for slide and tube coagulase tests. Antibiotic susceptibility testing (AST) was performed by Kirby – Bauer disc diffusion method as per CLSI guidelines. The MRSA was identified by using Cefoxitin 30µg and zone of inhibition less than 22 mm was identified as MRSA.

RESULTS

The total participants (n= 265) were in the age group ranges from 3-8years. Amongst, the male participants were 134

One isolate of MRSA was resistant to Vancomycin and Linezolid.

DISCUSSION

The study showed the prevalence rate of nasal carriage of S.aureus was 76/265 (29%) in the age groups of 3-8 years and MRSA was 7/265(2.6%) which is of 9.2% of S.aureus. Many studies globally have reported the prevalence of Carriage of S.aureus in children varies from 40 -70 % (Noble *et al.*, 1964, Mainous *et al.*, 2006). But in India it is underestimated and many region has not been estimated. A community based study in USA showed prevalence of carriers of S.aureus (42%) in 5 – 19 years of age groups (Fang *et al.*, 2003). Recent reports showed that the isolation rate of S.aureus and MRSA in healthy children of low socio economic status was 22.17% and 7.39% respectively which is very well accordance to our study. In our study all children belongs to low socio economic status with poor personal hygiene (Bharathi *et al.*, 2014). Chatterjee

et al. of India announced colonization rate of S.aureus and MRSA was 52.3% and 3.16% which was higher rate for S.aureus and same for MRSA in comparison to our study results (Chatterjee *et al.*, 2009). The MRSA colonisation rate (19%) was very high in a study done in children by Ramana *et al.* in India (Ramana *et al.*, 2009). Analyzing the factors favoring the colonization of S.aureus gives various results in different studies. Exposure to health care facilities and frequent administration of antibiotics predisposes to nasal carriage of MRSA which is not present in our participants and still holding quite high carrier status (Saxena *et al.*, 2003). The same status was also noted in a study in Taiwan where the prevalence rate of MRSA was 3.4% independent of prior exposure to health care settings and antibiotics (Lu *et al.*, 2005).

Low socio economic group could be a proxy indicator factors known to increase nasal colonization such as overcrowding, poor hygiene, a low level maternal education and limited access to health care. All the above mentioned factors were well associated with our study (Chen *et al.*, 2011; Miller *et al.*, 2011). But there are conflicting findings in the relationship between socio economic status and S.aureus nasal carriage. Based on a nationwide surveillance in the United States socio economic status was not significantly related to the risk of S.aureus colonization for MSSA, but it increased the likelihood of carriage of MRSA (Graham *et al.*, 2006; Gorwitz *et al.*, 2004). On the other hand in a study conducted by Ozguven and associates in Turkey, children of higher socio economic status were found to be more prone to nasal colonization (Ozguven *et al.*, 2008). Also according to Pathak *et al.*, in a resource rich countries had relatively high prevalence of S.aureus nasal carriage, probably due to lesser exposure to antigens because of better personal hygiene (Pathak *et al.*, 2010). The antibiotic susceptibility pattern varies with region. The study conducted by Bharathi *et al.* showed that higher resistance was seen for Cotrimoxazole and Ciprofloxacin which is of less in our study (Bharathi *et al.*, 2014). The study in Iran 2014 showed the resistant pattern of MRSA was high for Erythromycin (73.9%) and Ciprofloxacin (52.2%) which is similar to our study where Erythromycin has shown (100%) and Ciprofloxacin (42.8%) resistance (Reza Sharif *et al.*, 2014).

Conclusion

The prevalence rate of S.aureus in our study was 26% and MRSA (2.6%) in healthy children without prior health care visit or intake of antibiotics. The observed precipitating factor was poor personal hygiene. By strengthening school health program and imparting health education regarding personal hygiene is the simple but effective way to contain CA -MRSA among school children in India.

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