

Nasal Carriage of *Staphylococcus aureus* among Healthy School Children in Kathmandu Valley

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Abstract

Staphylococcus aureus remains one of the most frequently isolated pathogens in both community and hospital practices. Methicillin resistant *S. aureus* (MRSA) continues to be a major cause of serious infections in the community worldwide. This study was undertaken to determine the prevalence of *S. aureus* and MRSA in school children in Kathmandu valley and, also to evaluate the antibiotic susceptibility pattern of the isolates. Identification of the *S. aureus* was confirmed by standard microbiological methods and the antibiotic susceptibility testing was performed by disk diffusion method according to the Clinical Laboratory Standards Institution (CLSI). Of the 324 school children who participated in the study, 38 (11.8%) had *S. aureus* isolated from nasal swabs. The potential risk factors for the *S. aureus* carriage showed the antibiotic usage within past 4 weeks to be associated with the rate of the nasal carriage (p value 0.000). Out of 38, two (5.2%) isolates were MRSA. One of the MRSA strains was also resistant to Cloxacillin. Erythromycin and Cloxacillin resistance was present in 3 (7.9%) isolates. Resistance to two or more antibiotics was noted in 2 (5.3%) isolates. However, no strains were resistant to Vancomycin. The results of this study indicated that the carriage of MRSA exists among young healthy school children who lack traditional risk factors for MRSA.

Key words: community acquired MRSA, *Staphylococcus aureus*, nasal carriage, school children

Introduction

Staphylococcus aureus colonizes large proportion of human populations, besides being a major human pathogen (Nilsson & Ripa 2006). The anterior nares have been shown to be the main reservoir of *S. aureus* in adults and children (Cole *et al.* 2001). Nasal carriage of *S. aureus* has demonstrated to be a significant risk factor for nosocomial and community acquired infections in variety of populations (von Eiff *et al.* 2001). Infections caused by Methicillin or Oxacillin resistant *S. aureus* (MRSA) is mainly nosocomial and increasingly reported from many countries worldwide (King *et al.* 2006).

MRSA was first reported in 1961 and recognized as a nosocomial pathogen by late 1960s. The known MRSA risk factors include recent surgery or hospitalization, residence in a long-term care facility, presence of a per-cutaneous device or indwelling catheter of recent dialysis (Brumfitt & Hamilton-Miller 1989). In 1980s MRSA infections were reported in persons who lacked traditional MRSA risk factors. These infections appeared to be acquired in the community and are now known as community acquired MRSA (CA-MRSA) infections. These infections have been reported worldwide (CDC 2003). Outbreaks have occurred in

many settings and among different populations (Graham *et al.* 2006). Incidence of MRSA continues to increase with emergence of CA MRSA in the developing countries as well and can be found in many settings meaning that in the future we will see younger people carrying the bacteria (Davis *et al.* 2007).

The nasal carriers of *S. aureus* among school children in Kathmandu valley was reported 24.5% by Joshi *et al.* (2003). However, studies examining possible risk factors for the nasal carriage status and CA MRSA are noticeably absent. This study was conducted to determine the prevalence of *S. aureus* and MRSA in school children in Kathmandu valley and to evaluate the antibiotic susceptibility pattern of the isolates.

Materials and Methods

A cross-sectional descriptive study was conducted among school children studying at public and private schools namely Shanti Vidya Griha Secondary School, Lainchaur, and National Model Science School, Gongabu, in the urban settings of Kathmandu valley from July to December 2007. Written questionnaires concerning demographics and medical history

(antibiotic usage in the past 4 weeks, presence of respiratory infection, and household number) were completed as per the information provided by the students. Informed consent was obtained from teachers and the students.

All nasal samples were collected from 324 students of the above schools, belonging to class 3-7, aged 5-16 years; boys: 167 and girls: 157. Specimens for the culture were collected from the anterior nares with sterile cotton swab, placed in peptone water and then transported to and processed in microbiological laboratory of National College, Lainchour within 4 hours. All the collected swab samples were inoculated in Mannitol Salt Agar (MSA) and incubated at 37°C for 24 hours. Isolates of *S. aureus* were identified by standard microbiological methods and confirmed by different biochemical tests as catalase and coagulase tests (Baird 1996).

Antibiotic susceptibility test of the isolates against different antibiotics (Hi-media) such as Oxacillin (1 mcg/disc), Erythromycin (15mcg/disc), Gentamicin (30mcg/disc), Vancomycin (30mcg/disc), Cloxacillin (10mcg/disc), and Tetracycline (30mcg/disc) were determined by disk diffusion method according to the Clinical Laboratory Standards Institution (CLSI 2006).

Statistical package for the social sciences (SPSS) for windows (version 13.0; SPSS, Chicago, Ill., USA) software was used for the statistical analysis of the data. Frequency and percentage were presented for

categorical data. Fischer's exact test was applied to determine potential factors associated with *S. aureus* nasal carriage. The level of significance was set at 0.05 using the two tailed method.

Results

A total of 324 school children with 167 (51.5%) boys and 157 (48.5%) girls were included in the study. Overall nasal carriage of *S. aureus* in this study population was 11.8%, and out of 38 isolates, 5.2% in two children was reported MRSA. Both the children were having antibiotics usage within the past 4 weeks. One of the MRSA strains was also resistant to Cloxacillin.

The statistical analysis of the potential risk factors for the *S. aureus* carriage showed antibiotic usage within past 4 weeks to be associated with the rate of the nasal carriage, whereas no association was found between nasal carriage and sex, having a respiratory infection now, and household number (Table 1).

Of the 38 strains of *S. aureus* isolated from the nasal swabs, the antibiotic sensitivity pattern showed 3 (7.9%) isolates were resistant against Erythromycin and Cloxacillin. However, all strains were found to be sensitive towards Vancomycin and Gentamicin. Resistance to two or more antibiotics was noted in 2 (5.3%) isolates. Two of the strains were resistant to two antibiotics; one strain resistant with the Erythromycin and Tetracycline and the other with the Cloxacillin and Oxacillin respectively.

Table 1. Potential risk factors for *S. aureus* nasal carriage among school children

Factors		Positive No. (%)	Negative No. (%)	P value
Sex	Boy	18 (10.8)	149 (89.2)	0.548
	Girl	20 (12.7)	137 (87.3)	
Antibiotic usage in past 4 weeks	Absent	29 (9.5)	275 (90.5)	0.000
	Present	9 (45.0)	11 (55.0)	
Having a respiratory infection now	Absent	35(13.0)	234 (87.0)	0.165
	Present	3 (5.5)	52 (94.5)	
Household number	<4	4 (6.9)	54 (93.1)	0.263
	≥4	34 (12.8)	232 (87.2)	

Antibiotic susceptibility testing of the nasal isolates found 2 isolates resistant to Oxacillin, 2 isolates resistant

to Tetracycline, 3 isolated resistant to Erythromycin, and 3 isolates resistant to Cloxacillin (Table 2).

Table 2. Antibiotic sensitivity pattern of 38 strains of *S. aureus* isolated from nasal carriers

Antibiotics	Sensitive No. (%)	Intermediate No. (%)	Resistant No. (%)
Cloxacillin	30 (79)	5 (13.1)	3 (7.9)
Erythromycin	25 (65.8)	10 (26.3)	3 (7.9)
Gentamicin	38 (100)	-	-
Oxacillin	36 (94.8)	-	2 (5.2)
Tetracycline	36 (94.8)	-	2 (5.2)
Vancomycin	38 (100)	-	-

Discussion

S. aureus is one of the most common causes of both community- and hospital-acquired infections of skin, surgical sites, blood, and the lower respiratory tract (Lowy 1998). The anterior nares are the most consistent locations from which *S. aureus* can be isolated. Although this colonization is a normal process, it may be a source for invasive infection (Graham *et al.* 2006). In this study, 11.7% of the healthy school children were found to be the carriers of *S. aureus*. This rate was similar to other studies which have been conducted on the same age groups as reported by Lo *et al.* (2007) and Creech *et al.* (2005). Similar findings were reported by Joshi *et al.* (2003) as the nasal carriage rates (24.5%) for *S. aureus*. However, globally such rates have been reported to vary from 18 to 50% in different populations and the carriage of *S. aureus* in the nose appears to play a key role in the epidemiology and pathogenesis of infection (Kluytmans *et al.* 1997).

The MRSA rate was found to be 5.2% among the *S. aureus* carriers. Our finding was lower than the findings of Lo *et al.* (2007) and Creech *et al.* (2005) whereas, higher than the finding of Hussain *et al.* (2001). These variable results in the prevalence of MRSA were reflections of the local endemicity, sanitary standard, environmental conditions, timing and seasonal differences in the design of the work and personal hygiene.

Though the higher proportions of girls (12.7%) of the subjects were found to be the carriers of *S. aureus* than boys (10.8%), there is no correlation between the gender and the carriage of *S. aureus*. In similar study conducted by Joshi *et al.* (2003), similar proportion of boys and girls were found to be the carriers of *S. aureus*. The difference in the carriage pattern could be due to the difference in study population of different age groups.

In our study, the risk factors of antibiotic usage in past 4 weeks were found to be associated with the rate of *S. aureus* nasal carriage among school children. This might probably be an identifiable risk factor for MRSA acquisition. It is reported that the use of antibiotics generally changes the rate of *S. aureus* nasal carriage pattern due to the increased antibiotic pressure by indiscriminate and empirical use of these drugs (Kluytmans *et al.* 1997).

In the study, erythromycin resistance was observed to be 7.9% against the organism. This corroborates with the finding of Creech *et al.* (2005) and Dietrich *et al.* (2004). Oxacillin and Tetracycline resistance were observed 5.2% each. These indicate the frequency of antimicrobial resistance pattern among *S. aureus* carriers with no exposure to the hospital systems.

The findings of this study showed that the carriage of MRSA exists among young healthy school children who lack traditional risk factors for MRSA. Our knowledge of community-acquired MRSA epidemiology is incomplete, which adds to the challenge of controlling infection by community-acquired MRSA, so, continuing surveillance is needed to more accurately assess the prevalence, geographic distribution and epidemiology of community-acquired infection and to develop strategies that will improve therapy and control the spread.

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