Study on carrier rate of *Streptococcus pyogenes* among the school children and antimicrobial susceptibility pattern of isolates

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ABSTRACT

This study was done to investigate the rate of *Streptococcus pyogenes* or Group A streptococcus (GAS) and antimicrobial susceptibility pattern of isolates in asymptomatic school children in Kathmandu and Sindhuli districts. Pharyngeal swabs were collected and subjected to crystal violet blood agar (CVBA). A total of 468 asymptomatic school aged children were included and 51 (10.8%) were found to be GAS carrier. Among the isolates 23 (12.0%) were from boys where 28 (10.1%) were from girls. The GAS colonization rate was statistically insignificant (P>0.05) with sex and age sub-group, although the rate was slightly higher among the boys and age sub group 10-12 years. GAS was significantly higher in large family size ($p< 0.05$). Out of 51 isolates, 100.0% isolates were sensitive to antibiotic penicillin where as 7.8% and 5.8% isolates were resistant to antibiotic ampicillin and erythromycin respectively.

Keywords: *Steptococcus pyogenes*, pharyngeal swab, school children, cvba, antimicrobial susceptibility pattern, Nepal.

INTRODUCTION

Streptococcus pyogenes (group A beta-hemolytic streptococci) colonizes on the skin and throat of human. Report shows that 5-15% of school children has *S. pyogenes* in their throat and are at the risk of having the disease.[1] It spread through the infected secretion when comes in contact with the mouth, nose or eyes of an uninfected person.[2] *S. pyogenes* is the most frequently isolated pathogen in acute pharyngitis among school children.[3] Streptococcal pharyngitis may be associated with characteristic skin rash and fever (scarlet fever). Untreated streptococcal infection may give rise rheumatic fever, rheumatic heart disease and less often gomerulonephritis as sequelae.[4] Asymptomatic carrier of *S. pyogenes* is source of bacterial dissemination and is able to transmit the disease.[5]

In case of streptococcal infection penicillin and its derivatives the most frequently used.[6] Proper usage of antibiotics lead to rapid treatment of streptococcal infection, but inadequate treatment and changing in bacterial characteristics leads to increasing trend of bacterial resistance.[7] Asymptomatic carriage rate of 15-20% have been reported in several studies among children.[8-9]Among the Nepalese school children, asymptomatic carriage rates of 5-12% have been noted in several studies.[10-12] We are interested to conduct this study to know the prevalence of *S. pyogenes* among school children of Kathmandu and Sindhuli districts. This type of study is done for the first time in Sindhuli District. This study provides information on prevalence and antibiotic susceptibility of the isolates in and outside Katmandu District.

MATERIALS AND METHODS

The study was carried out in National Institute of Tropical Medicine and Public Health Research (NITMPHR), Narayan Gopal Chowk, Kathmandu, Nepal. The study population included school and orphanage children from Kathmandu and Sindhuli districts. During February through July 2011, 468 asymptomatic children were included of which 41.0% were boys and 59.0% were girls. Children between the age group 7-15 years were included in the study. Student who received antimicrobial therapy or who had suffered from *S. pyogenes* during last two weeks before sampling were excluded from the study.

Samples were collected with a sterile cotton wool swabs by rubbing over each tonsil and over the back wall of pharynx. The collected swabs were placed in Pike's medium and transported to the NITMPHR laboratory in the ice box in less than one hour. The swabs obtained in transport medium were cultured into CVBA plates and then incubated at 37°C for 24 hours in CO2 enriched atmosphere.

After 24 hours, small grayish white colonies surrounded by clear zone of hemolysis were selected and performed gram staining and catalase test. Bacteria which had negative catalase and appear in chain was sub cultured on

10% sheep blood agar with low concentration bacitracin (0.02 IU-0.05 IU) and incubated at 37°C for 24 hours. *S. pyogenes* was further identified by observing sensitivity to bacitracin. Antibiotic susceptibility test of the isolates were done by using penicillin, ampicillin, ciprofloxacin, chloramphenicol, erythromycin, azithromycin and ofloxacin kirby disc diffusion method.

Data was analyzed by means of SPSS 13 soft ware and the significance level was determined.

RESULTS

S. pyogenes was isolated from 10.8% (51/468) school children from Kathmandu and Sindhuli districts of Nepal. Among the isolates 12.0% (23/192) were from boys where 10.1% (28/276) were from girls (Table-1). The *S. pyogenes* colonization rate was statically insignificant (p>0.05) with sex and age sub group (Table-2 & 3). *S. pyogenes* were significantly higher in consanguineal family (P<0.05) (Table-3). Isolation rate was slightly higher in school children of Sindhuli (12.5%; 17/136) than Kathmandu (10.2%; 34/332) however it was statically insignificant (P> 0.05) (Table-4). There was no significance difference in the colonization rate among the children living at orphanage (10.4%; 10/96) and children living with their family(11.3%; 41/372).

Out of 51 isolates, 100.0% isolates were sensitive to antibiotic penicillin. 94.1% were found sensitive to ciprofloxacin. Sensitivity to chloramphenicol, ofloxacin and azithromycin was 92.1%, 88.2% and 84.3% respectively. 7.8% and 5.8% was found to be resistance to ampicillin and erythromycin respectively (Table-5).

Table-1: Sex wise distribution of the isolate

Sex	Totalsample	Positive sample	%	p- value
Boys	192	23	12.0%	
Girls	276	28	10.1%	> 0.05
Total	468	51	11.0%	

Table-2: Age wise distribution of the isolates

Age group of children	Total	Positive sample	%	p-value
7-9 years	109	11	10.0%	
10-12 years	202	29	14.3%	>0.05
13-15 years	157	11	7.0%	
Total	468	51	11.0%	

Table-3: Distribution of the isolates according to family type

Types of family	Total	Positive sample	%	p-value
Conjugal family	211	19	9.0%	
Consanguineal family	120	22	18.3%	< 0.05
Total	331	41	12.3%	

Table-4: District wise distribution of the isolates

District	Total	Positive sample	%	p-value
Kathmandu	332	34	10.2%	
Sindhuli	136	17	12.5%	>0.05
Total	468	51	11.0%	

DISCUSSION

Streptococcal disease is the worldwide health problem. Many children have *S. pyogenes* in their throat but without any symptoms of disease**.** Those showing the symptoms of disease develop life threatening sequalae**.** ***S. pyogenes*** is seen more commonly in children compared to adult.[10,13] In our study, 10.8% asymptomatic children under age of 15 years have *S. pyogenes* (carrier state) in their throat. Among them highest prevalence was in the age group 10-12 years. It might be due to high exposure of the children with this age group to outer environment and lack of awareness. This was similar with findings of previous studies conducted in Nepal.[11, 12] Asymptomatic carrier rate of 15-20% have been reported in several studies conducted in different countries.[5,8,9,14] The study conducted in Nepal showed the asymptomatic carrier rate of 5-12 %.[10-12] This study showed that there was no significant correlation between gender and throat carrier rate. Similar studies conducted also showed that the carrier rate for boys and girls were similar.[12,15]

In our study, carrier rate was higher in children from consanguineal family indicating an association between the carrier rate and number of family member.

Table-5: Antibiotic susceptibility pattern of *S. pyogenes*

Antibiotics	Total isolates	Susceptibility	Intermediate	Resistant
		n. (%)	Number (%)	Number (%)
Penicillin		51 (100%)	-	-
Ampicillin		36 (70.6%)	11 (21.6%)	4 (7.8%)
Ciprofloxacin		48 (94.1%)	3 (5.8%)	-
Chloramphenicol	51	47 (92.2%)	4 (7.8%)	-
Erythromycin		47 (92.2%)	1 (1.9%)	3 (5.8%)
Azithromycin		43 (84.3%)	8 (15.6%)	-
Ofloxacin		45 (88.2%)	6 (11.7%)	-

One infectious member of the family can spread the organism to other member in the family. Crowding and poor hygiene therefore, increases the chance of the transmission of *S. pyogenes*. Faroq *et al.,* (1995) reported that GAS was significantly higher in large family size and suggested that children of large family may require special attention regarding prevention of streptococcal infection. In this study the school children of Sindhuli District had high prevalence compared to children in Kathmandu. This appeared to be associated with relatively poor hygienic condition of the children in Sindhuli District. Study had done else where have also shown an association of high prevalence with contamination of food.[17] Study showed that the colonization rate for the children living at orphanage and children living with their family were similar.

Penicillin and its derivatives remained the drug of choice for streptococcal infection. This study showed that all the isolates were found susceptible to penicillin. 7.8% and 5.8% isolates were found resistant to ampicillin and erythromycin respectively. Several different studies conducted also showed that *S. pyogenes* were susceptible to penicillin and other antibiotics such as erythromycin, gentamycin, cefalexin, amoxicillin.[11,15,18] Surprisingly all *S. pyogenes* tested were resistance to penicillin in the study conducted in Kerman Iran.[5] Use of antibiotics without any prescription increases the trend of resistance of *S. pyogenes* to commonly used antibiotics. In Nepal, penicillin derivatives are among the easily available antibiotics.[12]

This study highlighted the problem of asymptomatic carrier rate in Nepalese children. This study suggests that reducing the number of asymptomatic carrier is one of the methods to control the spread of streptococcal infection. Treatment is important because infection with *S. pyogenes* can lead to serious complication.

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