Int J Biol Med Res. 2013; 4(4): 3585-3589

BioMedSciDirect Publications

Contents lists available at BioMedSciDirect Publications

International Journal of Biological & Medical Research

Journal homepage: www.biomedscidirect.com

Research Article

Surveillance of Group A Streptococcal Throat Infections among School Children in Mangalore

[a]PavanChand, [b]Arvind N, [c]Vishrutha KV, [d]Vidyalakshmi K, [e]ShaliniShenoy

[a]*Associate Professor of Microbiology , SIMS&RC, Mukka, Suratkal , Mangalore - 574021*
[b]*Assistant Professor of Microbiology , IGMC&RI, Vazhudavur Road, Kathirkamam,Puducherry - 605009*
[c]*Assistant Professor of Physiology, SIMS&RC, Mukka, Suratkal, Mangalore- 574021*
[d]*Additional Professor of Microbiology, Kasturba Medical College, Mangalore, (Manipal University) Mangalore - 575001*
[e]*Professor of Microbiology, Kasturba Medical College, Mangalore, (Manipal University) Mangalore - 575001*

ARTICLE INFO

Keywords:
Acute pharyngitis
GAS
RHD
Streptococcus pyogenes

ABSTRACT

Acute pharyngitis can manifest as sore throat. The primary infection is presumed to be of viral etiology, infection with bacterial pathogens commonly present in the nasopharynx can occur during viral infections. Streptococcus pyogenes is one of the commonest bacterial pathogens that cause pharyngitis among school aged children. **Aim of Our Study:** To study the prevalence of throat carriage of Group A betahemolytic streptococci among school children in Mangalore and to find its antimicrobial susceptibility pattern. **Materials And Methods:** The throat swab was collected from 300 children from the age group 5-15 years, studying in various schools in Mangalore, over a period of 1 year, and Group A betahemolytic streptococci was isolated and sensitivity pattern was noted. **Results:** A total of 300 students from different schools were included in the study. The prevalence of GAS was 5% among the 300 school children included in this study. The highest prevalence for GAS was noted in the >14yrs age group (8.6%) and in males (6.2%). The prevalence of GAS was both found to be higher among the lower socio-economic group (60%) . The isolation rates for GAS was both found to be higher during the winter (oct-jan) season (8.7%) . All the isolates of GAS were found to be sensitive to penicillin. Significance of the study: it helps in the surveillance of streptococcal infection and thus helps in preventing the two non suppurative sequelae: Acute Rheumatic Fever and Acute Glomerulonephritis. These two non– suppurative sequelae are responsible for a significant number of cases of mortality and morbidity.

1. Introduction

Acute tonsillitis or pharyngitis can manifest as sore throat. Acute pharyngitis is an inflammatory condition of the pharynx caused by several different groups of micro-organisms. In most cases, the primary infection is presumed to be of viral etiology. Secondary infection with one of the potential bacterial pathogens commonly present in the nasopharynx can occur during viral infections. Even though various bacteria are incriminated in the etiology, streptococci are of importance worldwide [1].

Streptococcus pyogenes or Lancefield Group A beta hemolytic streptococci is one of the commonest bacterial pathogens that cause pharyngitis among school aged children living in lower socio-economic conditions. Streptococcus pyogenes can cause a wide array of infections, the most frequent of which are acute pharyngitis and impetigo. The other manifestations of the infection with Group A beta hemolytic streptococci includes sinusitis, otitis, peritonsillar abscess (quincy), pneumonia, scarlet fever, erysipelas, cellulitis, lymphangitis, puerperal sepsis, vaginitis, myositis, gangrene, perianal cellulitis [2].

The organism has been the focus of intense clinical investigative interest because of its association with two non suppurative sequlae: Acute Rheumatic Fever and Acute Glomerulonephritis, responsible for a significant number of cases of mortality.

Group A streptococci (GAS) is also responsible for post streptococcal sequelae. The other groups produce rather milder infection; possibly there are several factors other than the group of the organism contributing to the severity of the disease.

* Corresponding Author : **PavanChand**
Associate Professor of Microbiology
SIMS&RC, Mukka, Suratkal
Mangalore - 574021
docpavan2000@gmail.com

Acute Rheumatic fever and Rheumatic heart disease continue to be a major cause of cardiovascular morbidity and mortality in India. Approximately 6,00,000 children < 15 years of age are currently suffering from chronic rheumatic heart disease and approximately 1,21,000 children are newly diagnosed with acute rheumatic fever every year [3]. It has been estimated that approximately 20% of streptococcal infections of the upper respiratory tract produce symptoms. A history of upper respiratory tract infection may not be available in half the cases of acute rheumatic fever. It therefore becomes essential to identify sub clinical Group A streptococcal (GAS) throat infection so that they can be treated in order to minimize the risk of development of rheumatic fever.

It has been categorically observed that development of acute glomerulonephritis is more common following skin infections rather than throat infections. Conversely for rheumatic fever the predisposing infection is found in the throat. Recently, there are reports of streptococci belonging to Group C and Group G causing primary infection of upper respiratory tract and skin, occasionally of Group C infection leading to acute glomerulonephritis[4]. Hence surveillance over streptococcal infection by means of microbiological and epidemiological surveys and follow ups are very much needed in all parts of the world.

2.Materials And Methods

The study was a cross-sectional study carried out at the Department of Microbiology. K.M.C., Mangalore. The study included 300 children from the age group 5-15 years, studying in various schools in Mangalore, over a period of 1 year,

Inclusion Criteria: - All school going children aged between 5-15 years. The children were selected at random from various schools in Mangalore.

Exclusion Criteria: - All children who were taking or had received antibiotics in the past 2 weeks of collection of throat swab.

Three swabs were collected from each child. One was used for Grams stain, the second for culture on to 5% sheep blood agar and crystal violet blood agar and the third for inoculation on to Robertson's Cooked Meat (RCM) broth. The culture plates were stabbed 3-4 times to enhance hemolysis. The culture plates and RCM broth were incubated at 37^{0}C & upto 48 hours in 5% -10% carbon dioxide. All β- hemolytic colonies were subjected to Gram's staining and catalase test. The β-hemolytic colonies, which showed gram positive cocci in chains and which were catalase negative, were identified based on susceptibility to Bacitracin & Bacitracin & Trimethoprim- suphamethomethoxazole. Streptococcal grouping was carried out using Streptex kit for isolates which were sensitive for Bacitracin and resistant for resistant for Trimethoprim-suphamethomethoxazole were tested with Group A latex suspension (SXT) were tested with Group A latex suspension.

Susceptibility of all the isolates of Group A streptococci to the following antibiotics was tested by the disc diffusion methods of Kirby Bauer. The antibiotic discs were obtained from Hi Media Laboratories Private Limited Mumbai. After 18-24 hours incubation, the diameter of the inhibitory zone was measured. The zone size around each antimicrobial disc was interpreted as sensitive, intermediate or resistant according to CLSI criteria.

3. Results:

A total of 300 students from different schools were included in the study

Table 1 : Age wise distribution

Age group	Frequency	Percent
5 – 7	61	20.3
8 – 10	112	37.3
11 – 13	92	30.7
>14	35	11.7
Total	300	100.0

Table 1 shows the age group pattern of the participants in the study. Of the 300 children 61(20.3%) were in the age group of 5-7 years; 112 (37.3%) in the age group of 8-10 years; 92(30.7%) in the age group of 11-13years; 35(11.7%) greater than 14years.

Table 2 : GAS in different age groups

Age group		Result		Total
		Nil	Group A	
5 – 7	Count (%)	59(96.7%)	2(3.3%)	61(100.0%)
8 – 10	Count (%)	105(93.7%)	7(6.3%)	112(100.0%)
11 – 13	Count (%)	89(96.7%)	3(3.3%)	92(100.0%)
>14	Count (%)	32(91.4%)	3(8.6%)	35(100.0%)
Total	Count (%)	285(95.0%)	15(5.0%)	300(100.0%)

Table 2 show the incidence of Group A Streptococci (GAS) in the throat cultures of the children of different age groups. For GAS, the incidence was 3.3% in the 5-7years age group; 6.3% in the 8-10 years age group; 3.3% in the 11-13years age group and 8.6% in >14years age group.

Table 3 : Sex distribution of children

Table 3 shows the sex distribution of children included in the study. Of the 300 children 59.3% were boys and 40.7% were girls.

	Frequency	Percent
Male	178	59.3
Female	122	40.7
Total	300	100.0

Table 4 : Isolation GAS in male and female

Table 4 also shows the incidence of GAS among the children. The carrier state of GAS male children was 6.2% and among female children was 3.3%.

Sex		Result		Total
		Nil	Group A	
Female	Count(%)	118(96.7%)	4(3.3%)	122(100.0%)
Male	Count(%)	167(93.8%)	11(6.2%)	178(100.0%)
Total	Count(%)	285(95.0%)	15(5.0%)	300(100.0%)

Table 5 : Seasonal variation for GAS isolation

Seasons		Result		Total
		Nil	Group A	
Feb – May	Count (%)	81(100%)	0(0.0%)	81(100.0%)
June–September	Count (%)	89(95.7%)	4(4.3%)	93(100.0%)
October–January	Count (%)	115(91.3%)	11(8.7%)	126(100.0%)
Total		285(95%)	15(5.0%)	300(100.0%)

Table 5 shows the incidence of GAS isolation during the various seasons throughout the year. In accordance with the climate of Mangalore, the year was divided into 3 seasons - summer (Feb –May); Monsoon (June-Sept) and winter (Oct-Jan). The isolation rates for GAS was Nil, 4.3%, and 8.7% during summer, monsoon and winter respectively.

Table 6 : GAS in different socioeconomic groups.

Socio-economic status		Result		Total
		Nil	Group A	
Low	Count (%)	130(45.6%)	9(60.0%)	139(46.3%)
High	Count (%)	155(53.4%)	6(40.0%)	161(53.7%)
Total	Count (%)	285(100.0%)	15(100.0%)	300(100.0%)

Table 6 shows the distribution of streptococcal carriers according to Socio-economic status of the children. Socio-economic status of the family was classified into two category, depending on those studying in aided schools were classified as lower socio-economic group and where as those studying in unaided schools were classified as upper socio-economic group. The isolation of GAS was found to be more prevalent in lower socio-economic group 60% isolates where as in upper socio-economic group there was only 40% isolates.

Table 7 : Anti – Microbial Sensitivity pattern of GAS

	A		Cf		Ce		Co		Cp		E		P		T	
	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R
n	15	0	12	3	15	0	1	14	12	13	15	0	15	0	13	2
%	100	0	80	20	100	0	6.7	93.3	80	20	100	0	100	0	86.7	13.3

The 15 GABHS isolates was found to be sensitive to Ampicillin (A) (100%), Ciprofloxacin (Cf) (80%), Cefotaxime (Ce) (100%), Co-trimoxazole (Co) (6.7%) Cephalexin (Cp) (80%), Erythromycin (E) (100%), Penicillin (P) (100%) and Tetracycline (T) (86.7%)

4. Discussion

There is evidence that asymptomatic throat infection caused by GAS may lead to acute rheumatic fever. Asymptomatic infections with subsequent rise in streptococcal antibody titters have also been reported in patients with previously diagnosed rheumatic fever. In this study, we evaluated throat swabs from 300 school children aged 5-15 years.

The prevalence of GAS in throat swabs of asymptomatic children was 5 % This is in consistence with the various studies conducted in South India, which have also reported predominance of GAS [5,6,7]. A report from Delhi however was different [8] where GAS was the predominant group isolated. Prevalence rates of GABHS in other countries vary widely from as low as 2.5% to as high as 15.8% from children [9,10]. This difference could be attributed to difference in socioeconomic and climatic conditions.

In the present study, the highest prevalence of GAS was more in > 14 yrs age group (8.6%) followed by 6.3% in 8-10yrs age group, 3.3% both in 5-7 yrs and 11-13 yrs age group. Age has been reported to be an important factor in the microbiological etiology of pharyngitis. The peak incidence of GAS pharyngitis occurring in children aged 5-10 yrs. In our study the incidence of GAS was slightly higher in > 14 yrs age group. This finding was also observed in a previous study [11,12].

In our study higher carriage rates were found among males for GAS 6.2%. The corresponding carriage rate for females was 3.3%, for GAS. This is consistent with previous study [13] where the isolation rates were 31.4% and 25.5% respectively among males and females. But other workers did not observe any sex differences [12].

In the present study an attempt was made to assess the role of socio-economic status in the prevalence of streptococcal throat carriage. Furthermore the carrier rate was higher among children from the lower socio-economic group 60% of GAS. This could be due to overcrowding which is usually present in the lower socio-economic group. These results indicate that religious habits and socio-economic status of the individual probably influence throat carriage of streptococci.

We attempted to determine seasonal variation in the incidence of streptococcal throat carriage among the children. The isolation of GAS showed a bimodal peak, with higher incidence in the monsoon (June- Sept) and during the winter season (Oct-Jan) with isolation rates 4.3% and 8.7% for Group A. This finding co-relates with the study done by Sobhan Nandi et al [12]. But studies by Mackawa et al [14] did not show any significant seasonal variation.

Antimicrobial susceptibility: We tested the susceptibility of our isolates of GAS and GGS to the following antibiotics. Ampicillin (A), Ciprofloxacin (Cf), Cefotaxim (Ce), Trimethoprin– sufamethoxazole (Co), Cephalexin (Cp), Erythromycin (E), Penicillin (P) and Tetracycline (T) by disc diffusion method of the Kirby Bauwer. All our isolates of GAS were sensitive to Penicillin (100% sensitivity). This is in consistent with the previous reports[15,16,17]. Over the last two decades several workers have looked for resistance to penicillin, in isolates of GAS and in all these studies, all the isolates of GAS were extremely sensitive to penicillin G with MICs of $\leq$ 0.06 mg/ml [15,18,19]. Despite more than 4 decades of clinical use of penicillin in the treatment of GAS infection there has been no

significant change in the in-vitro susceptibility of GAS to penicillin. So for there has never been a well documented report of a penicillin resistant strain of GAS isolated from a patient [20]. Infact its MIC to penicillin has not changed in the past 70 years.

Penicillin remains the drug of choice for the treatment of GAS infections. The most proven efficacy in treating Group A streptococcal pharyngitis and preventing rheumatic fever. The low cost of penicillin, its relatively narrow s spectrum and its excellent safety record in individuals who are not penicillin allergic are added bonuses. For penicillin-allergic individuals, the alternative therapies include macrolides, first generation cephalosporin's and clindamycin.

In our study, 100% of GAS isolates were sensitive to erythromycin. In 1958, Lowbury[21] reported the first GAS resistance to erythromycin. From the 1970's onwards resistance to erythromycin is being widely reported among isolates of GAS. In some parts of Europe, resistance rates of >30% have been reported [20]. The resistance rates in the U.S. is considered to be low (<3%) [20]. Reports from India suggest erythromycin resistance rates among GAS strains vary between <1% and 17.9% [22].

In our study 80% of GAS were sensitive to Cephalexin (Cp). Little information is available about cephalosporin resistance in GAS and resistance to any of the commonly used oral cephalosporins has not been reported so far.

86.7% of GAS were sensitive to Tetracyclines. Reports on resistance to Tetracycline vary widely from 5% to 90% [15]. Tetracyclines are considered inappropriate for treatment of GAS infections.

Sensitivity to ciprofloxacin was 80% for GAS isolates.

Despite the use of penicillin for more than 40 years in treating GABHS infections, there has been no significant change in the in-vitro susceptibility of GABHS to penicillin. Reported failures to eradicate GABHS from the upper respiratory tracts of patients with pharyngitis and the apparent resurgence of serious Group A streptococcal infections and their sequelae probably are not related to the emergence of penicillin resistance.

Keeping in mind the variability in reports to erythromycin resistance it would be reasonable to periodically monitor isolates of GAS for erythromycin resistance. There is no reason based on the in-vitro susceptibilities of GABHS to change the current recommendations for treating GABHS infections with penicillin and for using erythromycin for patients who are allergic to penicillin.

The lack of Group A streptococcal penicillin resistance should not be allowed to lull clinicians into a sense of complacency, instead one must keep in mind lesion learnt from other organisms. A prime example is Streptococcus pneumoniae, which had remained exquisitely sensitive to penicillin for decades until 1970s when the organism rapidly acquired resistance, and currently upto 30% pneumococcal strains are penicillin – resistant [3].

5. Conclusion

300 Throat swabs from school children were screened for Group A beta hemolytic streptococci for over a period of one year.

The following observations were noted.

· The prevalence of GAS was 5% among the 300 school children included in this study.

· The highest prevalence was noted in the >14yrs age group (8.6%) for GAS.

· The highest prevalence was seen in male for GAS (6.2%).

· The prevalence of GAS was both found to be higher among the lower socio-economic group 60% and 77.8% respectively.

· The isolation rates for GAS was both found to be higher during the winter (oct-jan) season 8.7% and 10.3% respectively.

· All the isolates of GAS were found to be sensitive to penicillin. Hence penicillin is still the drug of choice for streptococcal infections.

6. Reference

[1] Alan L. Bisno, Acute pharyngitis, NEJM, 2001: 344, 205 – 211.

[2] Alan L. Bisno, Group A streptococcal infections and acute rheumatic fever. NEMJ, 1991; 325, 783-793.

[3] Shet A, Caplan E. Addressing the burden of group A streptococci diseases in India. Indian Journal of Paed 2004 ; 71 : 41-48.

[4] Barnham M, Thernton TJ, Lange K. Nephritis caused by streptococcal zoo epidermiccus. Lancet 1983 ; 8331 : 945-948.

[5] Koshy G, Myers RM. Streptococcal disease in children in Southern India. Indian J. Path Bact 1971, 14:17-23

[6] S.B. Pati, N.K Jajodia, S.Shawda and G.K. Panda. Beta hemolytic streptococcal carries among school children in Westren Orissa. Indian J. Pathol. Microbiol 1991, 34, 265-269.

[7] Navaneeth B.V et al. Prevalence of Beta hemolytic streptococcal carrier rate among school children in Salem. Indian Journal of Pediatrics 2001, 68: 985-986.

[8] Prakash K, Chawda S, Amma BP and Sharma KB. Distribution of groups and types of beta hemolytic streptococci in cases of rheumatic heart disease and apparently healthy school children. Indian J. Pathol Microbial 1973, 16:5-14.

[9] Michal E. Pichichero, Steven MM, Marie Lynal et al. Incidence of streptococcal carriers in Private Pediatric Practice. Arch Pediatr Adolese Med 1999, 153: 624-628.

[10] Cimolai, Mac Culloch and S. Damm. The epidemiology of beta – hemolytic non – Group A streptococci isolated from the throats of children over a one – year period. Epidermol infect, 1990, 104 : 119-126.

[11] Cauwenberge PBV, Mijnbrugge AV. Pharyngitis: a survey of the microbiological etiology. Pediatrics Infection Disease Journal, 1991, 10:539-542.

[12] Sobhan Nandi, Rajesh Kumar, Pallab Ray, Harpreet Vohra and Nirmal K Ganguly. Group A streptococcal sore throat in a periurban population. Bulletin of WHO 2001; 79 : 528-533.

[13] Srivastava VK, SK Agarwal, MR Chandra, V Narayan and J V Singh. Beta hemolytic streptococci throat carriage in a rural population of Lucknow. Ind J Med Res 1981; 73:853-855.

[14] Mackawa S, Fuludak, Yamauchi T et al. Follow-up study of pharyngeal carriers of Beta hemolytic streptococci among school children in Sopporo City during a period of 2 years and five months. J Clin Microbial, 1981, 13: 1017-1022.

[15] Bourbeau P., Compos JM. Current antibiotic susceptibility of Group A beta hemolytic streptococci. Journal of infection diseased 1982; 145 : 916.

[16] Istre GR, Welch DF, Marks MI et al. Susptibility of group A beta hemolytic streptococcus isolates to pencillin and erythromycin. Antimicrobial Agents chemotheropy1981, 20: 244-246.

[17] Conan KM, Kaplan EL. In vitro susceptibility of recent North American Group A streptococcal isolates to eleven oral antibiotics. Pediatiric infectious Disease Journel, 1994; 13 :630-635.

[18] Finland M, Garner C, Wilcox C, et al. Susceptibility of beta hemolytic streptococci to 65 antibacterial agents. Antimicrobio Agents Chemotherapy, 1976: 9: 11-19.

[19] Bass JW, Weisse ME, Plymer MR, et al. Decline of erythromycin resistance of Group A beta hemolytic streptococci in Japan. Archive Pediatric Adol Med, 1994,148:67-71

[20] Michael A, Gerber MD. Antibiotic Resistance: Relationship to persistence of Group A streptococci in the upper respiratory tract. Pediatrics, 1996, 971-975.

[21] Lowbury EJL. Symposium on epidemiological risks of antibiotics. Hospital Infections. Proc R Soc Med, 1958; 51:807-810.

[22] S Warn, A E Jacob, Thangam, Menon, Charmaine. Antimicrobial susceptilibitity of Streptococcal pyogenes from school children in Chennai. Poster presentation at annual conference of Indian association of medical microbiologists 2005.