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Microbiological Characteristics of Throat Cultures from School Children in Jinju, 2006

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Background: Group A streptococci (GAS) are the most common cause of pharyngitis in children. The streptococci in throat cultures from healthy elementary school children in Jinju were compared with previous results.
Methods: Throat cultures were taken from 1,402 healthy school children in 2006. β-hemolytic streptococci (BHS) were identified with a bacitracin disk (0.04 U) and latex agglutination test (Seroiden Strepto Kit, Eiken, Tokyo, Japan).
Results: Two-hundred sixteen (15.4%) and 149 (10.6%) cultures grew BHS and GAS, respectively. The isolation rate of GAS was significantly lower than in 2004 (16.0%) or 2002 (16.9%) ($P<0.05$). Among BHS, the prevalence of group A strains (69.0%) decreased significantly compared with 2004 (84.9%) and 2002 (83.8%) ($P<0.05$). None of the 1st-grade children yielded BHS or GAS.
Conclusion: The isolation rates of BHS and GAS from healthy school children were lower in 2006 than in previous years. Natural immunization against the common serotypes or improvement in individual hygiene might have played roles in the reduction of isolations of GAS. **(Korean J Clin Microbiol 2008;11: 1-4)**

Key Words: Group A streptococci, *Streptococcus pyogenes*, Throat culture

INTRODUCTION

Group A streptococci (GAS) are the most common cause of pharyngitis in children. Once GAS are isolated from patients with tonsillitis, the child should be given antibiotics, such as β-lactams, macrolides, quinolones, or clindamycin, to prevent complications such as scarlet fever, rheumatic fever, or post-streptococcal glomerulonephritis[1]. Recently, severe streptococcal infections such as sepsis, necrotizing fasciitis, or toxic shock-like syndrome also have been reported in many countries[2]. Antibiotics not only reduce the duration of symptoms and signs, but also prevent the transmission of GAS to others[1].

Group A streptococci are prevalent in elementary school-age children[1,3,4], and healthy carriers may transmit the organisms to classmates. As it takes time to collect GAS from patients with pharyngitis, sometimes, healthy children are studied to elucidate the epidemiological characteristics of a region to guide therapy of sick children. The authors have studied throat cultures for GAS in Jinju since 1995. We continued the microbiological surveillance in 2006 and compared the results with the previous findings.

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MATERIALS AND METHODS

1. Study population

A total of 760 boys and 642 girls from three elementary schools were included. Children with high fever, headache, sore throat, or cervical lymphadenopathy were excluded because we wanted to study only carriers, not patients with established bacterial tonsillitis. Although the numbers of students in each grade were different by school, all children in a chosen classroom were screened. All school grades were included from the Munsan School, whereas children from the 4th through 6th grades in the Chunjun School and only the 6th grade in the Gumsan School were included.

2. Isolation and identification of bacteria

After the student opened his or her mouth and said "ah," a cotton swab was rubbed vigorously on both tonsils and inoculated onto a blood agar plate (BAP, Asan, Seoul) followed by streaking with a loop. The BAP was incubated at 37°C in room air for 16~18 h. A small gray colony in the center of a wide area of β-hemolysis was identified with a bacitracin disk (0.04 U, BBL Microbiology Systems, Cockeysville, MD, USA) and a latex agglutination test (Seroiden Strepto Kit, Eiken, Tokyo, Japan). Latex agglutination was performed according to the manufacturer's instructions to identify the organism as group A, B, C, or G. Bacteria were stored at −70°C until the next experiment. The col-

ony numbers on the BAP were classified as 1+ (<10 colony-forming units [CFU]), 2+ (10~50 CFU), 3+ (51~100 CFU), or 4+ if there were β-hemolytic streptococci (BHS) more than 100 CFU.

3. Statistical analysis

The isolation rates of BHS and GAS and the composition of each serogroup by year of isolation were analyzed using the χ^2 test with the SPSS 14.0. Statistical significance was achieved if the probability was less than 5% ($P<0.05$).

RESULTS

Beta-hemolytic streptococci were isolated from 216 (15.4%) of 1,402 children. Classification of BHS revealed 149 (10.6%) isolates of group A, 14 (1.0%) of group B, 30 (2.1%) of group C, and 23 (1.6%) of group G streptococci (Table 1). The colony numbers were 1+ in 21.3% of children, 2+ in 32.4%, 3+ in 31.5%, and 4+ in 14.8%. None of the 1st-grade children yielded BHS or GAS, whereas 2nd- and 3rd-grade children showed the highest isolation rate of GAS. Although the isolation rates of GAS from boys and girls in each school were slightly different, the total isolation rates from boys (10.4%) and girls (10.9%) were similar (Table 2).

Table 1. β-hemolytic streptococci isolated from elementary school children in Jinju, 2006

School grade	N	Serogroup				
		A	(%)	B	C	G
1	94	0	(0)	0	0	0
2	78	11	(14.1)	2	0	2
3	91	13	(14.3)	0	9	1
4	309	38	(12.3)	6	4	5
5	338	36	(10.7)	1	10	10
6	492	51	(10.4)	5	7	5
Total	1,402	149	(10.6)	14	30	23

Table 2. Isolation rate of group A streptococci (GAS) by school and sex

School	Boys		Girls		Total	
	N	GAS %*	N	GAS %	N	GAS %
Munsan	267	13.9%	267	9.7%	534	11.8%
Gumsan	97	9.3%	66	6.1%	163	8.0%
Chunjun	396	8.8%	309	13.0%	705	10.4%
Total	760	10.4%	642	10.9%	1402	10.6%

*Isolation rate of group A streptococci.

DISCUSSION

The isolation rates of BHS and GAS in 2006 were significantly lower than those of 2004 and 2002 in the same community (Fig. 1)[3,4]. Groups C and G BHS rarely cause pharyngitis[5], but these BHS were not uncommon in 2006 (Fig. 2). Although we do not know the reason for the decline in the carrier rate from that detected in 2004 and 2002, we may speculate that either children became immunized naturally to the common serotypes or their nutrition or hygienes might have improved. A serologic opacity factor antibody study will demonstrate the status of immunologic reactivity against the common serotypes[6]. Also, the season of the study in 2006 (June to October) was different from that in 2004 (October to December), or 2002 (May), and the isolation rate probably was lower in the summer as according to other studies[7,8]. Moreover, the microbiological culture techniques such as streaking with a loop on BAP and picking a colony from among mixed normal throat flora may have affected the isolation rates of BHS or GAS[9,10].

Although the numbers of 1st-grade children are small, such that

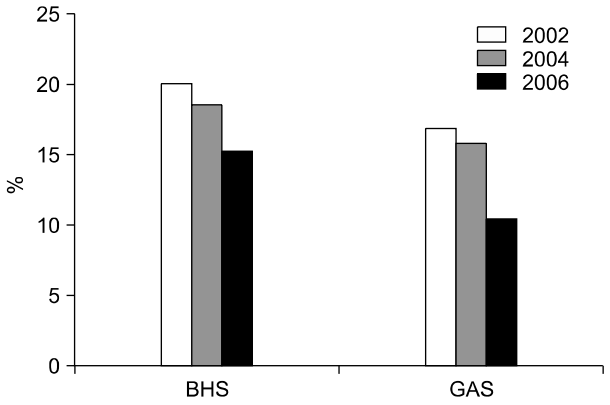

Fig. 1. Comparison of isolation rates of β-hemolytic streptococci (BHS) and group A streptococci (GAS) in Jinju ($P<0.05$).

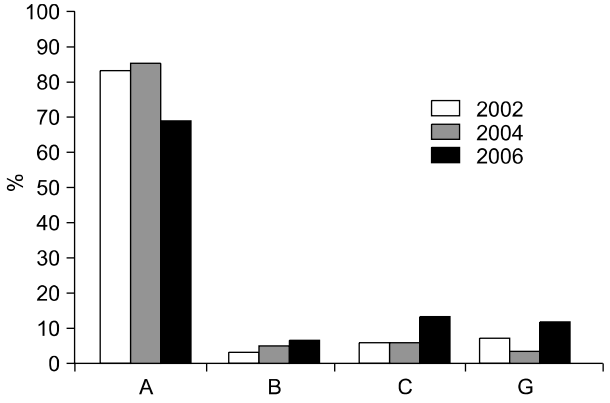

Fig. 2. Distribution of serogroups of β-hemolytic streptococci in Jinju ($P<0.05$).

one must be cautious about drawing conclusions, it is curious that none of these children yielded BHS or GAS. We need to follow up with regional surveillance cultures in a few years to detect any change in carrier rates as these children get older.

The likelihood of BHS in numbers of more than 3+ was about 45% in 2006, which is similar to the figures observed in 2004 and 2002[3,4]. As we suggested before[11], we cannot differentiate true infection from carriage from the colony numbers because carriers also tend to yield numerous colonies on throat culture.

Elementary school children are significant reservoirs of GAS. Epidemiologic study of BHS or GAS reveals the distribution of microbiological characteristics. Serotyping with T antisera and *emm* genotyping are being conducted to identify any changes of GAS serotypes or genotypes from the past. Also, the antibiotic resistance rate and its mechanisms will be investigated for the GAS isolates. Considering the high incidence of bacterial pharyngitis and its possible severe complications, the importance of monitoring changes in GAS in the community cannot be overstressed.

In conclusion, the isolation rate of BHS or GAS has decreased significantly since 2002. The likelihood of group A streptococci in decline is comparable when the isolation of groups C and G increased significantly. None of the 1st-grade children yielded BHS or GAS. Seasonal variance, natural immunization against the common serotypes, or improvement of personal nutrition or hygiene may have played a role in these changes.

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=국문초록=

2006년 진주지역 초등학생 인두배양의 세균학적 특징

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배경: A군 연쇄구균(group A streptococci, GAS)는 소아에서 인두염의 중요 원인균이다. 진주 지역의 건강한 초등학생으로부터 인두배양을 시행하여 세균학적 특성을 살펴보고, 과거의 결과와 비교하였다.

방법: 2006년 진주시내 3곳의 초등학교에서 1,402명의 학생들을 대상으로 인두배양을 실시하였다. 베타용혈 연쇄구균은 bacitracin 디스크와 라텍스 응집법(Seroiden Strepto Kit, Eiken, Tokyo, Japan)으로 동정하였다.

결과: 베타용혈성 연쇄구균은 216명(15.4%)에서 양성이었고, GAS는 149명(10.6%)에서 양성이었다. GAS 양성률은 2004년의 16.0%와 2002년의 16.9%에 비해서 유의하게 감소하였다($P<0.05$). 베타용혈성 연쇄구균 중 A군이 차지하는 비율은 69.0%로서, 역시 2004년의 84.9%, 2002년의 83.8%에 비해서 유의하게 감소하였다($P<0.05$). 모든 1학년 학생들에서 베타용혈성 연쇄구균과 GAS는 음성이었다. 남학생(10.4%)과 여학생(10.9%)의 GAS 분리율은 비슷하였다.

결론: 2006년에 시행한 인두배양에서 베타용혈성 연쇄구균이나 GAS 양성률은 과거에 비해서 유의하게 낮아졌다. 흔한 연쇄구균 혈청형에 대한 자연 면역이나 개인 위생 증진에 따른 결과인 것으로 추측할 수 있다. **[대한임상미생물학회지 2008;11:1-4]**

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