Research Article EMUJPharmSci ISSN 2651-3587 https://dergipark.org.tr/emujpharmsci

EMU Journal of Pharmaceutical Sciences

EMUJPharmSci

Investigation of *Streptococcus pyogenes* carriage among pharmacy students in North Cyprus

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Abstract

Streptococcus pyogenes is one of the most frequently detected bacterial agent of pharyngitis and skin infections that may result in the late complications of rheumatic fever and glomerulonephritis. The aim of the study was to investigate *S. pyogenes* carriage among pharmacy students in a university in Cyprus.

Throat samples were inoculated onto blood agar which was incubated at 37 °C for 48 hours. Gram positive, catalase negative beta hemolytic cocci which were sensitive to bacitracin and resistant to trimethoprim-sulfamethoxazole were identified as *S. pyogenes*.

A total of 140 healthy students were included in the study. 77.1% of students were Iranian, 5% each were Syrian and Iraqi, 4.3% were Nigerian and 8.6% were from other nationalities. Five (3.6%) students, all Iranian, were found to be *S. pyogenes* carriers. 4.6% of Iranian students were determined to carry *S. pyogenes*.

The study is the first study in North Cyprus reporting the low rate of group A beta hemolytic *Streptococcus* carriage in young adults in Turkish Republic of North Cyprus.

Keywords

Carriage, *S. pyogenes*, students, throat.

Article History

Submitted: 11 June 2019 Accepted: 29 July 2019 Published Online: 11 September 2019

Article Info

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Research Article:

Volume: 2 Issue: 1 September 2019 Pages: 1-6

INTRODUCTION

Streptococci which are Gram positive cocci arranged in chains or pairs are classified according to their hemolytic characteristics (alpha, beta, gamma) and to the C-polysaccharide present in their cell wall. Although many species of *Streptococcus* are normal flora in various parts of human body, some serogroups of beta hemolytic streptococci, especially group A *Streptococcus* (GAS, *S. pyogenes*) and group B *Streptococcus* (*S. agalactiae*), cause important infections in human. *S. pyogenes* cause pyogenic infections, with a characteristic tendency to spread, as opposed to staphylococcal skin infections which are generally localized. GAS is also responsible for the non-suppurative complications, acute rheumatic fever (ARF) and acute glomerulonephritis (AGN), which may develop following upper respiratory tract and skin infections related with *S. pyogenes*. GAS associated diseases and complications which mainly affect children continue to have devastating effects on public health and the national economy. The prevalence of GAS pharyngitis in school aged children with sore throat was reported to be 37%. In addition to the infection it causes, GAS can also be carried in the upper respiratory tract without any symptoms. 15-32% of school-aged children and 25% of household contacts of children with *S. pyogenes* pharyngitis were reported to be GAS carriers. GAS transmits from person to person with close contact via inhalation of organisms in large droplets or by direct contact with respiratory secretions. Carrying GAS in the throat asymptomatically has been shown to have little or no effect in the development of ARF. Likewise, GAS carriers have been shown to have a minor role in transmitting the disease. However, role of GAS carriage in the development of invasive diseases has not clearly been excluded yet. Twelve of 152 household contacts of patients with invasive GAS infection were reported carry the same strain that had infected the index patient. Eradication of GAS in the carriers is not suggested by health authorities except for those who have familial history of ARF or in the presence of *S. pyogenes* outbreaks (Demuri and Wlad 2014; Martin 2016; Moloi 2015; Davies *et al*. 1996).

Cyprus has recently been an attractive country in Eastern Mediterranean to students for undergraduate and graduate studies of foreign students. Taking into account the variation in the rate of people living in different parts of the world carrying the agents of various infectious diseases, it is inevitable that such an increase in the number of foreign population in a country may lead to the change of the epidemiology of some

infectious diseases locally. To our knowledge, studies related with the carriage of *S. pyogenes* in foreigners and in young adults are limited in Cyprus. The present study was undertaken to determine the rate of GAS carriage among students from different nationalities studying pharmacy in Eastern Mediterranean University in Cyprus.

MATERIALS AND METHODS

Pharmacy students without any clinical symptoms of upper respiratory tract were included in the study. After the informed consent form had been signed, students were requested to fill out a questionnaire in order to determine the demographic characteristics of the students and the presence of any risk factors.

Throat samples were taken from the posterior pharyngeal wall and tonsils using a sterile cotton swab without swabbing the cheeks, tongues, lips or other areas of the mouth. Swabs were immediately inoculated onto Colombia agar containing 5% sheep blood (Biomérieux, France) and media were incubated at 37 °C under the atmosphere containing 5% CO_2 for 48 hours (Spellerberg and Brandt 2015).

After incubation, dome-shaped beta hemolytic colonies, with a diameter of $\geq$ 0.5 mm were further identified by Gram staining, catalase test, 0.1 international unit bacitracin and trimethoprim-sulfamethoxazole sensitivity. Catalase negative beta hemolytic streptococci which were found to be sensitive to bacitracin and resistant to trimethoprim-sulfamethoxazole were identified as *S. pyogenes* (Spellerberg and Brandt 2015).

RESULTS

In total, 140 (Confidence Level (CL) 95%, Confidence Interval (CI) 7.7%) students were included in the study. Of 140 students, 52 (47.1%) and 88 (62.9%) were male and female, respectively. Ages of students were determined to range from 17-42 and the mean age was calculated to be 21. 77.1% of students were Iranian, 5% of each were Syrian and Iraqi, 4.3% were Nigerian and 8.6% were from other nationalities.

Five (3.6%) of 140 students were found to carry *S. pyogenes* in their upper respiratory tract. All of the carriers were found to be Iranian and the rate of the carriage among Iranian students was determined to be 4.6%. Demographical data related to the 5 *S. pyogenes* carriers are given in the Table 1.

Table 1: Demographical data associated with five *S. pyogenes* carriers.

Age/Sex	Living in a crowded home	Hospitalization	Use of antibiotics within 3-6 months	Previous infection with *S. pyogenes*	Contact with someone with *S.pyogenes* infection	Chronic disease	Immunosupression	Heavy smoker	Frequency of hand-washing in a day	Group sports	Sharing clothes and home utensils	Living in dormitory
21/Female	No	No	No	No	No	No	No	No	More than 5 times	basketball	No	No
20/Female	No	No	Yes	No	No	No	No	No	2-4times	No	No	No
20/Female	No	No	No	No	No	No	No	No	2-4times	No	No	No
21/Male	No	No	No	No	No	No	No	yes	2-4 times	No	No	No
23/Female	No	No	No	No	No	No	No	No	2-4 times	No	No	No

DISCUSSION

S. pyogenes is a facultative anaerobic, Gram positive coccus that is responsible for important suppurative infections and non-suppurative complications. Pharyngitis related with *S. pyogenes* is still an important public health problem worldwide with an average of hundred millions of cases annually (Sanyahumbi *et al*. 2016). *S. pyogenes* carriage in children has been well investigated worldwide. In a systematic review done in 2010, the pooled prevalence of *S. pyogenes* carriage in throat samples of asymptomatic children younger than 18 in different countries were reported to be 12% (CL 95%; CI 9–14%) (Shaikh *et al*. 2010). In another systematic review including 5-15 year old children in African countries, the prevalence of carriage was reported to be 6% (CL 95%, CI 6-11%) (Moloi 2015). In a study, including a total of 1893 throat samples from 1-6 year old healthy children in 13 day-care centers, the carriage rate was reported to be 4.8% in Turkey (Sevinc and Enoz 2008). In some other studies, as high as 15–20% of the school aged children who were asymetomatic were reported to be carriers of *S. pyogenes* (Schwartz *et al*. 1981; Shulman 1994). In spite of the presence of many studies investigating the asymptomatic carrier state of GAS in children, data related with the carriage in young adults are limited. In a study performed in Poland on 205 healthy adults between 18 and 44 years old, only three (1.5%) adults were reported to carry GAS (Bura *et al*. 2016). Levy *et al*. (2015) reported the asymptomatic carriage rate of GAS as 9.6%, lower than that of our study, among students aged 18-27 years. In parallel to the result of our study, asymptomatic pharyngeal GAS colonization of adult population was reported to be less than 5% (Spellerberg and Brandt 2015; Bura *et al*. 2016).

In Cyprus, studies related with *S. pyogenes* are very limited with only one study in which the strains isolated from pharyngitis or scarlet fever cases were serotyped and their antibiotic resistance rates were reported (Koliou *et al*. 2007). To our knowledge, the present study is the first study reporting the carriage rate of *S. pyogenes* in young adults in our country.

Although the enrollment of limited number of adults is an important limitation, the present study, together with the finding of low level of carriage rate among young adults, is the first study related with GAS carriage in our region. Large scale studies are needed in the field to clarify the epidemiology of GAS carriage in Cyprus and in Eastern Mediterranean.

REFERENCES

Bura M, Michalak M, Padzik M, Gowin E, Celczyńska-Bajew L, Mozer-Lisewska I (2016). The carriage of potentially pathogenic β-haemolytic streptococci (β-HS) in healthy adult inhabitants of Wielkopolska, Poland. *Fam Med Prim Care Rev* **3**:221-224.

Davies HD, McGeer A, Schwartz B, Green K, Cann D, Simor AE, Low DE (1996). Invasive group A Streptococcal infections in Ontario, Canada. *New Engl J Med* **335**(8):547-54.

Demuri GP, Wlad ER (2014). The group A streptococcal carriage state reviewed: Still an enigma. *J Ped Infect Dis Society* **3**(4):336-42.

Koliou M, Ioannou Y, Efstratiou A, Hannidou N, Pieri V, Alexandrou M, Soteriades ES (2007). Circulating serotypes and antimicrobial sensitivity of *Streptococcus pyogenes* isolates from children in Cyprus. *Clin Microbiol Infect* **13**:645-647.

Levy RM, Leyden JJ, Margolis DJ (2015). Colonization rates of *Streptococcus pyogenes* and *Staphylococcus aureus* in the oropharynx of a young adult population. *CMI* **11**(2):153-155.

Martin J (2016). The *Streptococcus pyogenes* carrier state. In: Ferretti JJ, Stevens DL, Fischetti VA (eds). *Streptococcus pyogenes*: Basic Biology to Clinical Manifestations [Internet]. Oklahoma City (OK): University of Oklahoma Health Sciences Center.

Moloi HA (2015). Prevalence of group A β-hemolytic Streptococcal carriage in children in Africa: A systematic review. MSc Thesis (supervised by Dr Mark E. Engel and Ms Leila Abdullahi). Cape Town: University of Cape Town. https://open.uct.ac.za/bitstream/handle/11427/16604/thesis_hsf_2015_moloi_annesinah.pdf;sequence=1.

Sanyahumbi AS, Colquhoun S, Wyber R, Carapetis JR (2016). Global disease burden of group A *Streptococcus*. In: Ferretti JJ, Stevens DL, Fischetti VA (eds). *Streptococcus pyogenes*: Basic Biology to Clinical Manifestations [Internet]. Oklahoma City (OK): University of Oklahoma Health Sciences Center.

Schwartz RH, Wientzen RL, Pedreira F, Feroli EJ, Mella GW, Guandolo VL (1981). Penicillin V for group A streptococcal pharyngotonsillitis. A randomized trial of seven vs ten days' therapy. *JAMA* **246**(16):1790-1795.

Sevinc I, Enöz M (2008). The prevalence of group A beta-hemolytic *Streptococcus* in healthy Turkish children in day-care centers in Ankara. *Chang Gung Med J* **31**(6):554-8.

Shaikh N, Leonard E, Martin JM (2010). Prevalence of streptococcal pharyngitis and streptococcal carriage in children: A meta-analysis. *Pediatrics* **126**(3):e557‑64.

Shulman ST (1994). Streptococcal pharyngitis: Diagnostic considerations. *Pediatr Infect Dis J* **13**(6):567-571.

Spellerberg B, Brandt C (2015). *Streptococcus*. In: Jorgensen JH, Pfaller MA, Carrol KC, Landry ML, Funke G, Richter SS, Warnock DW (eds). Manual of Clinical Microbiology. pp:383-402. Washington: ASM Press.