FOODBORNE STREPTOCOCCAL TONSILLOPHARYNGITIS OUTBREAK IN A HOSPITAL

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SUMMARY

Objective: Group A beta-haemolytic streptococci (GAS), which are responsible for most cases of acute bacterial tonsillopharyngitis, are transmitted from person to person and may rarely cause foodborne outbreaks. This study aims to report the epidemic caused by GAS in our hospital and to draw attention to the explosive outbreaks of the bacteria.

Methods: Acute tonsillopharyngitis was seen in 201 of 450 hospital employees who ate in the hospital cafeteria on 4–5 June 2015.

Results: GAS was detected in 106 (68%) of 157 cases and in 40 (63.5%) of 62 throat culture samples. The attack rate was 44.7%. The most suspected source of the outbreak was a food handler who had been showing signs of streptococcal tonsillopharyngitis for six days, and perhaps the food prepared by these staff.

Conclusion: It should not be forgotten that GAS can cause explosive outbreaks by infecting food through hand lesions or mouth secretions of food service personnel.

Key words: Streptococcus pyogenes, streptococcal tonsillopharyngitis, outbreak, foodborne, GAS

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INTRODUCTION

The most common bacterial agent in patients with acute tonsillopharyngitis is group A beta haemolytic streptococci (GAS). *Streptococcus pyogenes* is also one of the lethal species that can cause skin and systemic infections in humans.

Rapid diagnosis and antibiotic treatment are important to prevent the spread. Bacteriological diagnosis of GAS is made mainly by culture (gold standard), direct antigen detection methods and nucleic acid tests. In addition, the host's antibody response helps detect a recent GAS infection (1). Streptococci can multiply most effectively at a temperature of 37 °C. Above 56 °C, it is inactivated. They are capable of both aerobic and anaerobic growth. At pH 7.4, they prefer to reproduce. Reproduction is increased in an atmosphere with 10% CO_2.

Some studies have found that GAS carrier rates can reach 20%. Adults, on the other hand, have a very low carrier rate. Type M group A streptococci are frequently seen in high concentrations in the nose and throat during the acute phase of tonsillopharyngitis. Person to person transmissions involve respiratory droplets or direct contact or environmental items such as blankets, dust, and food. Infected or asymptomatically colonized food handlers' hands, infected skin lesions or their respiratory droplets may contaminate food (2, 3). Bad practice by food handlers and conditions of place during preparation are the most important factors in cross-contamination of foodborne outbreaks (4). It has been also reported that it rarely causes explosive outbreaks caused by food and water (3–8). Therefore, it is important to control the epidemics in hospitals, military units, kindergartens, schools, etc., as it may spread through skin lesions and close contact.

We describe a tonsillopharyngitis outbreak brought on by GAS that occurred in a tertiary hospital. There were 612 beds and 2,728 healthcare workers at this facility during the outbreak, and about 600 staff members ate in the hospital cafeteria each meal.

MATERIALS AND METHODS

The records of patients with acute tonsillopharyngitis were examined two days before and seven days after the epidemic retrospectively. Patients were compared to those who had tonsillopharyngitis during the same time period the year before. The potential sources of the outbreak, including communal spaces, dining rooms, workplace spaces, and menus were investigated and reported. Nasopharyngeal swabs were obtained from patients who had fever, sore throats and tonsil exudate. These samples were then subjected to throat culture techniques and quick tests for streptococcal antigen (QuikVue + Strep-A, USA). When the catalase test was negative, beta-haemolytic gram-positive cocci were grown on 5% sheep blood agar, PYR was positive, and the

colony was susceptible to bacitracin (0.05 IU, Oxoid, Germany) but resistant to co-trimoxazole, the colony was classified as GAS (Oxoid, Germany). In a certain subset of patients, viral agents were looked for using nucleic acid tests. Food samples were examined in the Central Laboratory of the Directorate of Agriculture.

Statistical Analysis

SPSS software was used for all analyses. ROC analysis was used to evaluate the Strep-A test's usefulness, and the AUC value was computed. The chi-square test was used to investigate the association between the units and the findings of the Strep-A test. The Ethics Committee of our hospital gave its approval for the project.

Table 1. *The most common symptoms and signs of the cases*

Clinical signs	n	%
Fever	126	80.5
Cryptic tonsillitis	79	50.3
Sore throat	78	49.6
Hyperaemia-hypertrophy	20	12.7
Muscle pain	17	10.8
Weakness	12	7.6
Nausea	8	5.0
Headache	7	4.5
Eye inflammation	3	1.9
Ear ache	2	1.1
Stomach ache	2	1.1

RESULTS

On the first day, after 450 personnel had lunch during the day shift, 21 health personnel presented to the emergency department with symptoms of acute tonsillopharyngitis. The next day, the number of staff affected by the outbreak peaked at 180 cases. Since the third day was the weekend, there was no application and no case of acute tonsillopharyngitis was detected.

According to hospital records, the number of adult tonsillopharyngitis patients with tonsillopharyngitis who applied to the hospital in the same period in the last five years was around 12 per day.

Samples were taken for rapid antigen testing from 18 of the 21 patients who went to the emergency department on the first day, and 14 of them tested positive. *S. pyogenes* was obtained on the second day in 4 of 5 patients whose tonsils were exuded and cultured. One of these patients was a food handler who had clinical findings from the past six days and worked in the cafeteria.

The antigen test was positive in 92 of the samples taken from 157 personnel who had complaints on the second day. Throat culture was performed in 57 of the cases on the second day and GAS was isolated in 36 (63.15%) cases. The primary attack rate was 44.7%. No other viral agents were detected in the patients in whom viral agents were investigated. It was assumed that there was a hospital-acquired epidemic due to the absence of non-staff patients. Patients with similar complaints and clinically compatible with tonsillopharyngitis were treated with antibiotics according to Centor' et al. criteria (9). The most common symptoms and signs of the cases are shown in Table 1.

During the outbreak, 7 out of 14 of the kitchen staff had antigen test positivity and 1/4 had positive culture for GAS. The affected staff members had different professions and were working at different places of the hospital. Among these cases, the only common area was the hospital cafeteria.

Antibiotherapy was performed on total of 172 patients (85.6%) who had positive antigen or culture test results or who had at least two of these symptoms: fever, tonsillar exudate, concomitant diseases, lymphadenopathy sensitivity, and absence of cough. There were no patients with similar complaints within the next week. Both samples of meat beans, rice, and seasonal salad from two days prior as well as samples of noodle soup, rice, ayran, chicken, and salad from the day prior to the outbreak were sent to the Central Laboratory of the Directorate of Agriculture for analysis. However, food analyses were found suitable for the Turkish Food Codex and influenza virus tests were negative.

Within two days, 201 hospital staff members were diagnosed with acute tonsillopharyngitis. Throat cultures and rapid antigen tests were obtained from 30.8% and 78.1% of the 201 cases, re-

Table 2. *Diagnostic test results (N = 201)*

		First day	Second day	Total
Throat culture	Positive	4	36	40
	Negative	1	21	22
	Total	5	57	62
Rapid test	Positive	14	92	106
	Negative	4	47	51
	Total	18	139	157
	Throat culture positive	**Throat culture negative**	**Throat culture none**	**Total**
Rapid test positive	32	1	73	106
Rapid test negative	7	20	24	51
Rapid test none	1	1	42	44
Total	40	22	139	201

spectively. Not all patients were tested. ROC analysis shows that the Strep-A test can be used to diagnose this disease ($p < 0.001$; AUC = 0.886). The sensitivity of the test was 0.82 and the specificity was 0.95, with a positive predictive value of 97% and a negative predictive value of 74%. Table 2 lists the diagnostic procedures used and their outcomes.

Number of patients diagnosed with tonsillopharyngitis before and after the time period of the outbreak was shown in Figure 1.

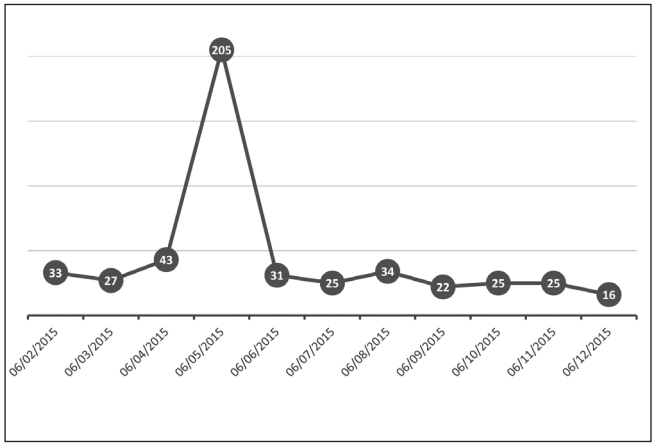

Fig. 1. *Number of patients diagnosed with tonsillopharyngitis before and after the epidemic.*

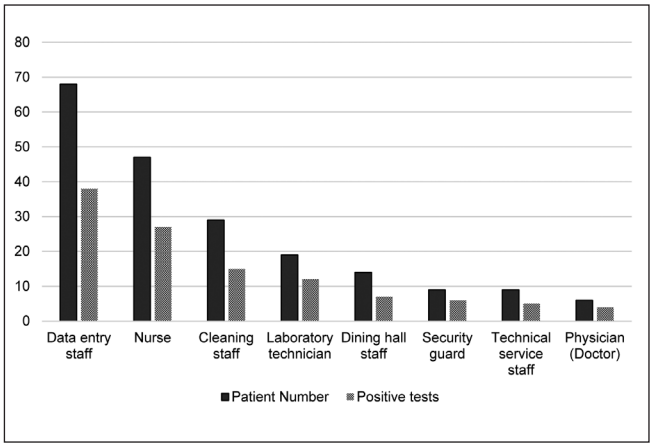

Fig. 2. *Occupational distribution of patients.*

Distribution of patients by profession and test positivity are shown in Figure 2.

Hospital staff members' Strep-A test results were examined according to the units they work at. The findings of the Chi-Square test showed that data entry of staff and cafeteria workers had higher rates of Strep-A test positivity than other employees (Table 3).

DISCUSSION

Throat cultures are a gold standard for diagnosis of sporadic streptococcal pharyngitis. Clinical criteria may be sufficient for diagnosis in epidemic situations (8). In our case the most frequent complaints were fever, sore throat, muscle pain, and weakness while the most common symptoms were fever and tonsillar exudate. In an outbreak that occurred in a military camp, *S. pyogenes* was found in 41 (12.5%) people, and fever was observed in 75% of them, similar to our study (8). Myalgia (87%), fatigue (83%), headache (78%) and fever (57%) were the most common signs, and attack rate (56%) and incubation time (12–84 hours) were similar to our results in another outbreak (10). Takayama et al. (11) reported another foodborne outbreak of GAS with similar attack and fever rate (64.6% and 70.7%). The reported attack rates of tonsillopharyngitis due to foodborne group A streptococci vary between 10% and 85% (3).

The most significant causes of cross-contamination and foodborne outbreaks are poor food handling techniques and the environment at the preparation site (4). In addition to the known droplet route, streptococci cause epidemics as a result of contamination with food.

In foodborne outbreaks, the incubation period was found shorter, and the attack rate was found higher in contrast to droplet contamination in a review. It was emphasized that unlike other tonsillopharyngitis these outbreaks happened in warmer climates and in the hottest time of the year. Inappropriate storage of food, or serving food contaminated with saliva or skin lesions of diseased person are the most presumed ways of foodborne outbreaks (12). This epidemic also occurred during the warm season. The epidemic curve in foodborne outbreaks shows that the epidemic has a single cause and is spreading rapidly (13).

In the outbreaks reported earlier, some of the cooks and waiters carried streptococci in their pharynxes or skin lesions. In an

Table 3. *Number of staff affected by the outbreak*

Occupations	Negative n (%)	Positive n (%)	Total (n)	p-value
Data entry staff	354 (90.3)	**38 (9.7)**	392	
Nurse	603 (95.7)	27 (4.3)	630	
Cleaning staff	403 (96.4)	15 (3.6)	418	
Dining hall staff	51 (87.9)	**7 (12.1)**	58	
Laboratory technician	166 (93.3)	12 (6.7)	178	< 0.001
Security guard	91 (93.8)	6 (6.2)	97	
Doctor	371 (98.9)	4 (1.1)	375	
Technical service staff	85 (94.4)	5 (5.6)	90	
Total	2,124 (94.9)	114 (5.1)	2,238	

High positivity rate in particular staff groups is marked in bold.

elementary school outbreak, GAS was found three times more often in those who ate pasta and cheese, also the chef had the same germ in his wound (14, 15). Although GAS is detected in the anamnesis and throat of the presenters, bacteria may not be produced from the accused foods (12). In two different outbreaks, 56.6% and 25% of those exposed became sick, respectively, and the source of infection was a dessert they ate (16, 17).

If the food that might be a source is consumed and there is a strong association between the food and pharyngitis, epidemiological studies have acknowledged the source as food in these outbreaks (10).

In the epidemic that occurred in our hospital, it was not possible to show the causative agent in the food samples, despite the examination of the food samples from the two previous days. However, the detection of GAS in a significant part of the cafeteria employees gave rise to the thought that the explosive epidemic was caused by the sick cafeteria staff. The course of development of this outbreak was similar to those previously reported, as only the staff was affected and patients responded to antibiotic therapy (12).

Confirmation of GAS as the causative agent in many hospital staff suggests that cafeteria staff with positive clinical signs and culture in the past six days may have contaminated food. The only common area of health professionals working in different fields is the cafeteria. The increase in the number of cases from 21 to 180 in just 2 days and the absence of the disease in inpatients supports the idea that the cafeteria can be a source. The complete disappearance of the epidemic on day 3 and the absence of secondary cases are similar to other outbreaks suggestive of food contamination (18). Studies report that significant amounts of *Streptococcus* are spread when nasal carriers sneeze or cough. Depending on the type of GAS, bacteria can survive for 6 weeks in dried cultures (19). This explains the long-term persistence on dried surfaces and contamination of hands, tools, surfaces, and foods (12). In case of compatibility of clinic symptoms, rapid antigen tests help the diagnosis. Especially with the new tests developed in recent years, the sensitivity has increased. The sensitivity and specificity of different rapid diagnostic kits vary between 79 and 97.9% (20, 21). It was observed that the sensitivity of the kit we used was low and the predictive value of detecting non-patients was less than desired. For negatives, the diagnosis does not seem to be excluded, however, it can be used for diagnosis. In a recent study, it has been shown that performing rapid antigen testing on GAS-suspected colonies in culture for diagnosis can speed up the result (22).

Streptococcus isolating rate is ranging between 33–71% in similar foodborne outbreak studies (5, 11, 14, 23, 24). In our study, throat culture reproduction rate was 65% and rapid test positivity was 68%, which is similar to epidemics with higher rates. Penicillin and amoxicillin as antibiotics were sufficient in our patients, there were no complications. Penicillin has been the best option for streptococcal infections for many years (21, 25).

Because of insufficient facilities, serotype determination and nucleic acid tests of the obtained streptococci was not performed. Unfortunately, despite strong epidemiological suspicion, we could not determine the bacterium in food samples. These are the limitations of our study.

Hospital's cafeteria staff members are trained to comply with hygiene rules. However, it should be kept in mind that streptococci can reach and spread to some food from people with overlooked pharyngitis symptoms and skin lesions.

CONCLUSION

In the presence of patients with more than usual tonsillopharyngitis findings, the epidemiological relationship should be sought and common points should be reviewed. The diagnosis of GAS should be confirmed using available resources.

It should not be forgotten that the diagnosis and treatment of kitchen staff are a priority, as the bacteria can cause explosive outbreaks by contaminating the food from the kitchen workers or waiters serving the food.

Conflict of Interests

None declared

Authors' Contribution

ŞNK – statistical analysis, conceiving, designing and manuscript writing; SŞ, ÖAA, ÖA – data collection, KNB statistical analysis and its evaluation; KKY – manuscript editing and final approval

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