

11. Eickoff, T. C.: Immunization against influenza: rationale and recommendations. *J Infect Dis* 123: 446-454, April 1971.
12. Seward, E., Blank, J., and Lamb, H.: Some information descriptive of a successfully operating HMO. DHEW Publication No. (HSM) 73-13011, U.S. Government Printing Office, Washington, DC, 1973.
13. Freeborn, D. K., Pope, C. R., Davis, M. A., and Mullooly, J. P.: Health status, socioeconomic status, and utilization of outpatient services for members of a prepaid group practice. *Med Care* 15: 115, February 1977.
14. Barker, W. H., and Mullooly, J. P.: Impact of epidemic type A influenza in a defined adult population. *Am J Epidemiol* 112: 798-813, December 1980.
15. Mullooly, J. M., and Barker, W. H.: Impact of type A influenza on children: a retrospective study. *Am J Public Health* 72: 1008-1016, September 1982.
16. Centers for Disease Control: Influenza—United States. *MMWR* Nov. 24, 1978, Dec. 5, 1980, pp. 472-474.
17. Gregg, M. E., Hinman, A. R., and Craven, R. B.: The Russian flu: its history and implications for this year's influenza season. *JAMA* 17: 2260-2263, Nov. 17, 1978.

## Foodborne Streptococcal Pharyngitis After a Party

SETH F. BERKLEY, MD  
 JOSÉ G. RIGAU-PÉREZ, MD  
 RICHARD FACKLAM, PhD  
 CLAIRE V. BROOME, MD

Dr. Berkley is Epidemiologist and Dr. Broome is Chief, Respiratory and Special Pathogens Epidemiology Branch, Division of Bacterial Diseases, Center for Infectious Diseases, Centers for Disease Control, Atlanta, GA. Dr. Rigau-Pérez is Epidemiologist, Division of Field Services, Epidemiology Program Office, CDC, located at the Epidemiology Division, Puerto Rico Department of Health, San Juan. Dr. Facklam is Chief, Reference Bacteriology Section, Division of Bacterial Diseases, Center for Infectious Diseases, CDC, Atlanta.

Tearsheet requests to Dr. Berkley, Centers for Disease Control, Rm. 5405-1, 1600 Clifton Rd., Atlanta, GA 30333.

**B**EFORE THE ADVENT OF PASTEURIZATION of milk and the general availability of adequate refrigeration, foodborne streptococcal outbreaks were common. Outbreaks have been reported that resulted in cases of scarlet fever, rheumatic fever, and suppurative complications (1-3). Since the institution of these sanitary control measures, foodborne streptococcal outbreaks have become relatively uncommon. Recent outbreaks have been reported primarily from institutions or community-associated events (3-6) and have occurred when there has been a breakdown in normal refrigeration practices. Because complications may still occur from such infections and only a small percentage of persons with sore throats seek medical attention and ultimately receive treatment for their illnesses, it is important to recognize these outbreaks. We report an outbreak of streptococcal pharyngitis that occurred after a private party; its source was a marinated conch salad.

## Synopsis.....

*Following a private party in Río Piedras, PR, 23 (56 percent) of those who attended developed an illness characterized by pharyngitis, myalgia, fatigue, headache, and fever. Consumption of carrucho (conch) salad was significantly associated with illness (P = 0.013, Fisher's exact test). Group A beta-hemolytic streptococci (M nontypable T12, serum opacity factor positive) were isolated both from throat cultures in 11 of 47 persons who attended the party and from the implicated food. The original source of contamination of the conch salad was not identified. Because complications may still occur from such infections and only a small percentage of persons with sore throats seek medical attention and ultimately receive treatment for their illnesses, it is important to recognize these outbreaks.*

## The Outbreak

On the evening of Friday, August 3, 1984, 47 persons attended a party in a private home in Río Piedras, PR, to celebrate the birthdays of three persons who worked in a large office. Over the weekend numerous people who had attended the party developed pharyngitis, fever, lymphadenopathy, and myalgia. Because of the large number of persons who became ill, the office director recognized the existence of an outbreak and notified the Division of Epidemiology of the Puerto Rico Department of Health on August 8. It was suspected that a cold marinated "carrucho" (conch) salad was the vehicle of transmission because several persons who were friends of the hosts had not attended the party and did not work at the office but became ill after eating leftover carrucho.

*'It was suspected that cold marinated "carrucho" (conch) salad was the vehicle of transmission because several persons who were friends of the hosts had not attended the party and did not work at the office but became ill after eating leftover carrucho.'*

## Methods

Information about office routines and personnel, party attendees, and the food served was collected from the director of the office and the party hosts. Questionnaires were distributed to all persons who had attended the party and to their household contacts. The questionnaires inquired about attendance at the party, foods and drinks consumed, approximate quantities of each item consumed, symptoms and time of onset of the illness, smoking habits, physician visits, and medications taken. Throat cultures of all party attendees and their household contacts were obtained regardless of whether or not they had been treated with antibiotics. In addition, isolates were collected from local laboratories that reported positive throat cultures from persons who had attended the party.

Food hygiene sanitarians from the Puerto Rico Department of Health inspected the restaurant where the carrucho salad was prepared. All food handlers were interviewed and examined for skin lesions. Pharyngeal, nasal, and hand cultures were obtained from them. All swabs were placed in silica gel packets and cultured at the Centers for Disease Control (CDC). Streptococci were analyzed for their cell wall proteins (M and T typing) and were tested for the presence or absence of the streptococcal serum opacity factor (SOR) by CDC. In addition, a small sample of the implicated food remaining in the refrigerator from the evening of the party, as well as other samples of food prepared at the restaurant, were cultured by CDC.

An outbreak-associated case of pharyngitis was defined as a sore throat in a person who had attended the party and developed symptoms between August 4 and August 11. Persons were excluded from analysis if the onset of pharyngitis was prior to the party. A household contact was defined as a person who did not attend the party but lived in the household of one of the persons who did attend. A secondary case was defined as a

case of pharyngitis that developed during August 4-11 in a household contact who did not eat carrucho.

Because patrons of the restaurant where the carrucho was sold were not from any particular district, and no other large groups who had eaten food from the restaurant could be identified, attempts were made to see if there was any increase in streptococcal pharyngitis in the community at large during this period. Four randomly chosen clinical microbiology laboratories serving the San Juan-Río Piedras area were surveyed in an attempt to detect an increase in the number of throat cultures positive for group A streptococci during the preceding month, using the same period in 1983 as a basis for comparison.

## Results

Forty-seven persons attended the party. Forty-five questionnaires were received from persons who had attended, a response rate of 96 percent. Four respondents were excluded from the analysis—three because the reported onset of pharyngitis was before the evening of the party and one because of an incomplete questionnaire. Of the remaining 41 persons, 23 met the definition of a case, an attack rate of 56 percent.

The median incubation period of the illness was 36 hours, with the mode at 24 hours. The incubation period ranged from 12 to 84 hours except for one person whose illness began on August 11 (8 days). One person was hospitalized, and 61 percent of the ill persons saw a physician. In 26 percent of the cases throat cultures were obtained, and in 74 percent antibiotics were taken. Of the case-patients who took antibiotics, 9 took antibiotics within 48 hours of becoming clinically ill, 6 took antibiotics after 48 hours, and 2 were unsure of the time that they started antibiotics; 6 persons did not take antibiotics. The predominant symptom was pharyngitis which, by definition, was seen in all the ill patients. The other commonly reported symptoms included myalgia (87 percent), fatigue (83 percent), headache (78 percent), and fever (57 percent).

The attack rate for persons who ate carrucho was 70 percent (19 of 27), compared with an attack rate of 29 percent (4 of 14) for persons who did not eat carrucho ( $P = .013$ , Fisher's exact test, 1-tailed). No other food or drink gave significantly different food-specific attack rates (see table). No dose-response effect for those who ate carrucho was demonstrated, nor was a differ-

## Attack of foodborne streptococcal pharyngitis by foods consumed

Food	Food consumed			Attack rate, percent	Food not consumed			Attack rate, percent	Relative risk
	Ill	Not ill	Total		Ill	Not ill	Total		
White cheese .....	9	4	13	69	14	14	28	50	1.38
American cheese.....	2	1	3	66	19	17	36	53	1.25
Cheddar cheese.....	8	3	11	73	14	15	29	48	1.52
Onion dip.....	5	2	7	71	17	16	33	52	1.37
Chicken dip.....	3	2	5	60	20	16	36	56	1.07
Shrimp dip.....	9	4	13	69	13	14	27	48	1.43
Tuna stew .....	6	3	9	66	17	15	32	53	1.25
Salchichon .....	7	4	11	64	16	14	30	53	1.21
Carrucho .....	19	8	27	70	4	10	14	29	2.41
Ham .....	5	4	9	55	17	14	31	55	1.00
Crab stew .....	15	10	25	60	8	8	16	50	1.20
Beer .....	12	9	21	57	11	9	20	55	1.04
Piña colada.....	7	4	11	64	16	14	30	53	1.21
Juice.....	3	2	5	60	19	16	35	54	1.11
Cola .....	10	5	15	66	10	13	23	43	1.53

ence in attack rates observed in persons who ate early in the evening as opposed to those who ate later in the evening. No differences in the age-specific attack rates were demonstrated, nor was a relationship seen between illness and smoking habits or consumption of alcohol at the party. That carrucho was the source of infection was supported by the fact that 2 persons became ill out of 4 persons who were not at the party but ate carrucho that had been brought home to them, an attack rate of 50 percent. This compares with a secondary attack rate of 4 percent (1 of 26) in household contacts who did not eat carrucho ( $P = .039$ , Fisher's exact test, 2-tailed).

Most of the food served at the party was prepared at the home where the party took place. The main exception was the marinated carrucho, which was prepared outside the house and brought in the day of the party. The carrucho was prepared at a small, unlicensed beachside restaurant in the Piñones area outside San Juan. The conch (*Strombus gigas*) used in the salad came frozen in a torn, unlabeled plastic bag and was alleged to have been illegally imported from Santo Domingo. The conch was reported to have been boiled for 2½ hours and then cooled and sliced. Onions, peppers, and a vinegar marinade were added. Seventy pounds of carrucho salad was prepared on the day of the party. Twenty-five pounds was purchased by the host of the party and kept for approximately 3 hours in an automobile at ambient temperature before arrival at the home of the host.

An unknown number of the 2,000 persons who visited the restaurant that weekend consumed the 45 pounds of carrucho that remained. None of the four community laboratories surveyed showed an increase in the number of positive throat cultures processed during the month of the outbreak.

### Laboratory Results

Throat cultures were obtained from 43 of the 47 persons at the party (91 percent). Of these, 37 had completed questionnaires and were not excluded because of intercurrent infection (onset of pharyngitis prior to the party). From the 37 persons, 6 cultures taken August 10-11 were positive for group A beta-hemolytic streptococci. Typing of these isolates showed that all were M nontypable, T12, SOR positive. Group G streptococci were isolated from two persons and group B streptococci from one individual. No culture was positive from persons who had been treated with antibiotics before we obtained the cultures, and only one person who had eaten the carrucho at the party had a positive culture but not clinical illness. None of the three persons excluded from analysis because of intercurrent infections had throat cultures taken prior to the investigation, and two of the three had receive antibiotics before we took cultures; all three were negative for group A streptococci by our cultures. All five cultures from the hosts or their family members were positive for group A streptococci, compared with one of six cultures from other ill

*'The median incubation period of the illness was 36 hours, with the mode at 24 hours. The incubation period ranged from 12 to 84 hours except for one person whose illness began on August 11 (8 days). One person was hospitalized, and 61 percent of the ill persons saw a physician.'*

persons who had not taken antibiotics before their cultures were taken ( $P = .015$ , Fisher's exact test, 2-tailed).

In addition, all five subcultures taken from the cultures done by other laboratories grew the epidemic strain; one of these was from a person who attended the party, ate carrucho, and became ill but could not be contacted for a questionnaire to be administered. One other person had a positive culture for group A streptococci isolated by a private laboratory, but the isolate was no longer available and therefore could not be typed or confirmed. Thus, 11 of the 23 confirmed ill persons (48 percent) at some time had throat cultures positive for group A streptococci. All persons with positive throat cultures for group A streptococci had eaten carrucho.

Of the 19 cultures from the household contacts, only one grew group A streptococci. This isolate (M nontypable, T11, SOR positive), from a person who had eaten carrucho brought home from the party but who had never become ill, was of a different type from the etiologic agent. One case-contact developed a sore throat on August 8, but no streptococci were isolated when a throat culture was obtained on August 11.

All cultures from the four food handlers at the restaurant who prepared the carrucho were negative for group A streptococci. All food handlers denied having any illnesses. The epidemic strain was isolated from a sample of the carrucho left over from the party. No streptococci were found in the carrucho or other food samples were taken from the restaurant 1 week later.

## Discussion

Carrucho salad, a cold conch marinade, was implicated as the vehicle for transmission of streptococcus in this outbreak. The source of

contamination for the carrucho was not found. It is unclear whether the contamination occurred after the carrucho salad was picked up or sometime during preparation at the restaurant. The 3-hour period when the carrucho was not refrigerated before its arrival at the party may have contributed to increasing the inoculum size. The fact that no streptococci were isolated from carrucho or other foods at the restaurant the week after the epidemic suggests that contamination is not an ongoing problem; however, it does not rule out a role for the food handlers in the original contamination of the carrucho.

The attack rate of 56 percent is similar to that seen in other outbreaks (3-5). The secondary attack rate is much lower than in previously reported studies except in an outbreak where an attempt was made to use penicillin prophylaxis to prevent secondary spread. In that outbreak the secondary attack rate was 3 percent (5). Lower secondary attack rates in this outbreak may have resulted from the liberal use of antibiotics early in the course of the illness. Although in only 61 percent of the cases did ill persons consult physicians for their illness, 74 percent took antibiotics. There were no secondary cases of pharyngitis among the 12 contacts whose index cases took antibiotics within 48 hours of the onset of illnesses. In contrast to this, 1 of the 6 household contacts exposed to an ill person who received antibiotics after more than 48 hours developed pharyngitis (secondary attack rate, 17 percent). However, the small numbers of such contacts preclude a definite conclusion. Early use of antibiotics may have also contributed to the lack of further sequelae from the infections.

It is surprising that no dose-response relationship or differences in attack rates by time of consumption were noted for the outbreak. This may have been related to the fact that food was consumed in small portions throughout the evening rather than at a single sitting. Also, this might have resulted in recall bias about both when the food was eaten and the total quantity consumed.

It is intriguing that five of the six persons whose throat cultures remained positive 1 week after the party were the hosts and their family. Whether they received a larger initial inoculum or their exposure continued following the party is not clear. Another possibility is that there was family colonization and carriage of the epidemic strain before the party, and the person who picked up the carrucho was the source of the original contamination.

The difficulty in detecting possible transmission of infections in all the customers of the beach restaurant illustrates a frequent problem in foodborne streptococcal outbreaks. Foodborne transmission of streptococci that caused pharyngitis, compared with person-to-person transmission of streptococci, is suggested by a shorter incubation period, a higher attack rate, and a large clustering of cases. However, unless disease occurs in a setting where this clustering is likely to be recognized by the ill persons, it is difficult, if not impossible, for public health personnel to pick up the increased incidence of streptococcal disease in the community. This is especially true since usually only a small percentage of persons with sore throats seek medical attention for their illnesses and have throat cultures taken. Even in this outbreak of clinically severe illness only 61 percent (14 of 23) of the ill persons saw a physician, and only 26 percent (6 of 23) had a throat culture taken, and some of these visits may have been motivated by our investigation.

Foodborne streptococcal disease is now felt to be relatively rare. In the last decade, fewer than 10 outbreaks have been reported. Nonetheless, it is important to recognize this mode of transmission, because recognition of an epidemic will allow identification of cases of streptococcal pharyngitis that would otherwise go undiagnosed and thus allow provision of antibiotic therapy for a greater percentage of those who are ill. In addition, it is important to recognize these outbreaks early, because immediate therapy will prevent late complications and likely decrease secondary cases of

disease. Rapid confirmation of the presence of an outbreak should be facilitated by the recent availability of rapid diagnostic tests for group A streptococcus that allow immediate laboratory confirmation of the presence of an epidemic. It is unclear what the public health impact of foodborne streptococcal outbreaks is in the United States because the number of cases of endemic streptococcal pharyngitis caused by foodborne transmission is not known; investigations of foodborne streptococcal disease provide an opportunity to study the epidemiology of streptococcal transmission, and perhaps to define better the role of this apparently uncommon mode of transmission.

#### References.....

1. Scamman, C. L., Lombard, H. L., Beckler, E. A., and Lawson, G. M.: Scarlet fever outbreak due to infected food. *Am J Public Health* 17: 311-316 (1927).
2. Commission on Acute Respiratory Diseases: A study of a foodborne epidemic of tonsillitis and pharyngitis due to beta-hemolytic streptococcus type 5. *Bull Johns Hopkins Hosp* 77: 143-210 (1945).
3. Hill, H. R., et al.: Food-borne epidemic of streptococcal pharyngitis at the United States Air Force Academy. *N Engl J Med* 280: 917-921, Apr. 24, 1969.
4. McCormick, J. B., Kay, D., Hayes, P., and Feldman, R.: Epidemic streptococcal sore throat following a community picnic. *JAMA* 236: 1039-1042, Aug. 30, 1976.
5. Ryder, R. W., et al.: An evaluation of penicillin prophylaxis during an outbreak of foodborne streptococcal pharyngitis. *Am J Epidemiol* 106: 139-144 (1977).
6. Decker, M. D., Lavelly, G. B., Hutcheson, R. H., and Schaffner, W.: Food-borne streptococcal pharyngitis in a hospital pediatrics clinic. *JAMA* 253: 679-681, Feb. 1, 1985.