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Foodborne Illness Associated with a Pig Roast

THOMAS NOVOTNY[1,2*], JAMES D. DINGMAN[3] and ANDREW PAVIA[4]

Division of Field Services, Epidemiology Program Office, Centers for Disease Control, Atlanta, Georgia 30333; Tri-County District Health Department, Environmental Health Division, 7000 E. Belleview, Suite 301, Englewood, Colorado 80111 and Enteric Diseases Branch, Center for Infectious Disease, Centers for Disease Control, Atlanta, Georgia 30333

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ABSTRACT

Roasting of whole pigs for summer picnics is popular, but technically difficult. We report an outbreak of gastroenteritis which followed a pig roast in Colorado. Twenty (35%) of 57 guests who had attended the roast had nausea, diarrhea, abdominal cramps, vomiting, or fever. An investigation implicated pork as the vehicle of transmission ($p=0.003$, Fisher exact test). The 11 stool specimens tested were not cultured anaerobically, but the illness was strongly suggestive of *Clostridium perfringens* gastroenteritis. An environmental investigation revealed deficiencies in both storage and cooking of the commercially prepared pig. To prevent foodborne outbreaks of illness resulting from whole pig roasts, suppliers should caution customers about adequate cooking processes, customers should be aware of refrigeration requirements if the animal is to be stored before cooking, meat thermometers should be used to monitor internal cooking temperatures, other food should not be cooked inside the pig carcass during roasting, and leftover meat should be promptly cooled for later consumption.

Roasting whole pigs for picnics and barbecues in the continental United States has recently become more popular. Proper storage and cooking of whole pigs is essential to prevent foodborne illness associated with such activities. Though trichinosis due to consumption of inadequately cooked pork during whole pig roasts has been reported *(8), Trichinella spiralis* is found in pork only if pigs eat contaminated food *(2). Salmonella* species *(3), Campylobacter jejuni (13), Yersinia enterocolitica (10),* and *Clostridium perfringens (11)* have also been found in commercially raised and butchered pork and are common causes of foodborne illness. We report an outbreak of gastroenteritis after a summertime pig roast in Colorado that was most likely caused by inadequate storage and cooking of a whole, commercially obtained pig.

MATERIALS AND METHODS

On August 26, 1984, the Colorado Department of Health (CDH) was informed of an outbreak of illness among 66 guests who had attended a privately hosted pig roast and picnic on August 24. Approximately 20 attendees reported gastrointestinal illness to the hostess. In addition to the roast pig, the meal included a turkey (which had been cooked inside the pig) and several food items brought by guests. Guests reported a foul-smelling dark substance on the inside of the cooked pig carcass, to which they attributed illness. To determine the cause of the outbreak, an epidemiological, laboratory, and environmental investigation was performed by the local health department and the CDH.

Clinical and food histories were obtained from ill and well persons beginning 48 h after the pig roast; unsure answers were excluded from analysis. To determine illness risk associated with each food, food-specific attack rates were calculated. A case was defined as a person attending the pig roast who became ill on August 25, 26, or 27, and who had gastrointestinal illness lasting more than 12 h. The Fisher exact and Chi-square tests were used to determine association between food and illness *(9)*.

Stool specimens obtained on August 28 from persons who attended the roast were tested for *Salmonella, Shigella, Yersinia,* and *Campylobacter* at the CDH. Anaerobic, quantitative analysis for *Clostridium perfringens* was not available. Pork samples were collected from the refrigerated, left-over roast pig on August 27. These were examined using standard laboratory techniques *(1)*.

To determine if deficiencies in preparation of the pig carcass had occurred, the pig distributor's butchering and processing plant was inspected and plant personnel were interviewed by sanitarians from the local health department.

RESULTS

Twenty (35%) of 57 persons who completed interviews met the case definition. The median age of cases was 34 years (range 11-60 years). Reported symptoms included nausea (17, or 85%), diarrhea (15, or 75%), abdominal cramps (6, or 30%), vomiting (4, or 25%), and fever (1, or 5%). The epidemic curve is shown in Fig. 1. The median incubation period was 18.5 h (range 4-72

[1]*Current address: Behavioral Epidemiology and Evaluation Branch, Division of Health Education, Center for Health Promotion and Education, Centers for Disease Control, Atlanta, GA 30333.*
[2]*Division of Field Services, CDC.*
[3]*Environmental Health Division, Englewood, CO.*
[4]*Enteric Diseases Branch, CDC.*

h). The median reported duration of illness was 24 h (range 12-72 h).

Among persons interviewed, only pork consumption was positively associated with illness (Table 1). The relative risk of illness was 4.7 for persons eating any pork and 9.0 for persons eating only the inner, less well done meat. No other foods were positively associated with illness, but consumption of the fruit bowl, deviled eggs, and chocolate cake appeared to have a protective effect.

Eleven of 20 patients (55%) submitted stool samples for enteric culture. Among these, one, from a mildly symptomatic person who had participated in the cooking process, yielded *Salmonella typhimurium;* no other pathogens were identified. Two follow-up cultures from the person with *Salmonella* were negative. Cultures of the leftover pork grew nonpathogenic coliforms only.

Inspection of the meat processing plant revealed no deficiencies in standard butchering and processing procedures. The kidneys had been left inside the carcass by the processor, as is the usual practice. After the hosts obtained the carcass, it was stored for 7 h in a home refrigerator. However, the door could not be closed completely because the carcass was too large to fit into the refrigerator. Refrigeration temperatures were not recorded. At 11:00 P.M., the carcass was stuffed with a raw turkey, placed on a spit over an open fire, and cooked until the next afternoon (total cooking time 16 h). A meat thermometer was not used. The kidneys were not removed from the carcass. Meat was cut from the roasted pig and served from a common platter when the guests arrived at 5:00 P.M.

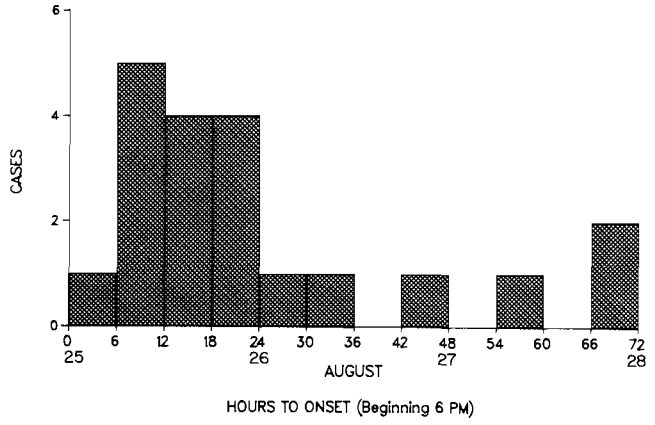

Figure 1. *Hours to onset of illness, pig roast, Colorado, August 25-28, 1984.*

DISCUSSION

The epidemiological investigation conducted after this pig roast confirmed that a foodborne outbreak had occurred and that roast pork was the implicated vehicle of transmission. Symptoms were predominantly lower gastrointestinal, consistent with a bacterial pathogen. *C. perfringens* and *Bacillus cereus* are the most likely pathogens given the reported symptoms, incubation periods, and durations of illness, but appropriate cultures for these organisms were not done. The single guest with *S. typhimurium* isolated from stool may have been a *Salmonella* carrier *(6);* this outbreak is highly unlikely to have been caused by *Salmonella,* not only because of the clinical and epidemiologic characteristics but also because *Salmonella* is readily cultured from stool. Only one of 11 stools yielded this pathogen even though they were collected promptly and handled appropriately. Of six pork-associated foodborne outbreaks reported to the Centers for Disease Control (CDC) in 1982, two were due to *Salmonella,* two were due to *Staphylococcus aureus,* one was due to *Trichinella,* and in one, no pathogen was

TABLE 1. *Food-specific attack rates for gastrointestinal illness associated with a pig roast, Colorado 1984.*

	Ate food			Did not eat food					
Food item	Ill	Well	% Ill	Ill	Well	% Ill	RR	95% CI	P value
Cucumber/onion salad	5	10	33.3	9	28	24.3	1.4	(0.5,3.5)	0.37[a]
Baked beans	11	30	26.8	8	8	50.0	0.5	(0.3,1.1)	
Macaroni salad	4	10	28.6	15	28	34.9	0.8	(0.3,2.0)	
Potato salad	9	23	28.1	9	15	37.5	0.8	(0.3,1.6)	
Fruit bowl	2	23	8.0	17	15	53.1	0.2	(0.1,0.4)	0.001[a]
Deviled eggs	4	26	13.3	15	12	55.6	0.2	(0.1,0.6)	0.001[b]
Dips	9	21	30.0	9	16	36.0	0.8	(0.4,1.8)	
Vegetables	6	20	23.1	13	31	41.9	0.8	(0.3,1.8)	
Jello	1	7	12.5	18	31	36.7	0.3	(0.1,1.7)	
Bean salad	4	11	26.7	15	42	26.3	1.0	(0.4,2.6)	
Frogeye salad	2	8	20.0	17	30	36.2	0.6	(0.2,1.8)	
Chocolate cake	2	14	12.5	17	24	41.5	0.3	(0.1,1.0)	0.04[b]
Zucchini dish	5	10	33.3	14	28	33.3	1.0	(0.4,2.3)	
Turkey	8	16	33.3	11	21	34.4	1.0	(0.5,2.0)	
Pork (inner)	6	4	60.0	1	14	6.7	9.0	(2.0,40.8)	0.014[a]
Pork (inner & outer)	16	24	40.0	1	14	6.7	6.0	(1.4,26.6)	0.03[a]
Pork (any)	22	18	55.0	2	15	11.8	4.7	(1.7,12.8)	0.003[a]

[a]Fisher exact test.
[b]Chi-square test.

identified *(7)*. However, a specific pathogen was identified in only 34% of all foodborne outbreaks reported to the CDC *(7)*. *C. perfringens* food poisoning is suspected in outbreaks of diarrhea and abdominal cramps occurring 6-24 h after eating the implicated food, usually a meat product *(3)*, and is the most commonly recognized pathogen in outbreaks where the incubation period is 8 to 14 h *(12)*. Anaerobic cultures of food should show *C. perfringens* counts of at least 10^6 organisms/g, and anaerobic cultures of stool obtained within 48 h of onset should show at least 10^6 spores/g of feces for diagnosis *(12)*.

The foul-smelling substance in the pig carcass was probably partially cooked kidneys. These are usually removed before cooking, but they may actually have been protective by discouraging guests from eating larger quantities of pork. The cooking of a turkey inside the pig carcass is an interesting innovation, and at first the investigators suspected that it might have contaminated the pig with *Salmonella, Campylobacter* or other pathogens commonly found in raw turkey. However, our epidemiologic investigation did not incriminate the turkey, and guests reported that the turkey was well cooked. It had been placed in the body cavity so that it was directly exposed to the fire and therefore may have shielded the inner carcass and prevented thorough cooking of the pork.

The most common deficiencies noted in foodborne disease outbreaks, in order of frequency are *(a)* improper holding temperature, *(b)* food from an unsafe source, *(c)* inadequate cooking, *(d)* poor personal hygiene on the part of food handlers, and *(e)* contaminated equipment *(7)*. Outbreaks of *C. perfringens* food poisoning are often related to inadequate cooling of foods, lapses of a day or more between cooling and serving, and inadequate temperature during cooking or holding *(4)*. The roasting of a whole pig is a time-consuming process, and careful attention to storage and cooking temperatures is necessary to prevent foodborne illness. In addition, cooked whole pigs cool slowly, and may maintain temperatures that allow rapid growth of bacteria for several hours *(5)*. This outbreak probably resulted from both poor refrigeration (permitting growth of pathogenic bacteria in the carcass) and inadequate cooking (failing to kill the bacteria).

Recommendations for prevention of illness associated with whole-pig roasts are suggested by this episode: *(a)* If commercial processors sell whole pigs for roasting, they should advise customers as to safe cooking and refrigeration. *(b)* Facilities adequate to maintain whole carcasses at 45°F or below are necessary. This usually requires a walk-in refrigerator. *(c)* A meat thermometer should be used to insure adequate cooking of the entire carcass. Internal temperatures of 165°F are necessary to kill vegetative forms of common bacterial enteric pathogens. Large carcasses should be cut into smaller portions and heated more thoroughly to complete the cooking. *(d)* Foods should not be cooked inside the body cavity of the pig. *(e)* Kidneys should be removed before the pig is roasted. *(f)* Cooked meat should not be left at room temperature except for very short periods. *(g)* Leftover meat should be cooled rapidly to 45°F or below. It should be cut into smaller portions arranged in shallow layers to facilitate cooling.

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