Campylobacter Enteritis Associated with Undercooked Barbecued Chicken

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Abstract: An outbreak of *Campylobacter* enteritis occurred in 1982 among 11 of 15 members and friends of an extended family gathering in Colorado. Median onset for illness, characterized by diarrhea, abdominal cramps, fever and headache, was four days after the party. Illness was associated with eating undercooked chicken. Two ill persons had stool specimens positive for *C. jejuni*. Eight of ten ill persons tested had Immunoglobulin-M-specific indirect fluorescent antibody (IFA) titers to *C. jejuni* ≥ 32. IFA titers to *C. jejuni* peaked within three weeks of exposure and decreased to control levels within three months after exposure. Inadequate cooking of poultry may increase the risk of these infections. (*Am J Public Health* 1984; 74:1265–1267.)

Introduction

Campylobacter jejuni is a major cause of diarrheal illness in humans.[1–3] Outbreaks have been linked to raw milk,[4,5] water,[6] contaminated cake icing,[7] hamburger meat,[8] animal contact,[9] and person-to-person transmission.[10,11] Although *Campylobacter* frequently can be isolated from oven-ready poultry,[12–14] the only previously described outbreak of *Campylobacter* infection associated with poultry involved the ingestion of raw chicken.[15] We recently investigated an outbreak of *Campylobacter* infections in which an association with the ingestion of undercooked barbecued chicken was demonstrated.

On April 18, 1982, 15 members and friends of an extended family gathered for a party at the home of the elder members of the family. The entire group had last been together eight days before, but no common foods had been consumed. From April 20 to 24, illness developed in 11 persons who had attended the party. On April 25, *C. jejuni* was isolated from a stool specimen from one of the ill persons. An investigation of the outbreak began on April 28.

Methods

Epidemiology

A case was defined as a person with: 1) diarrhea (≥3 loose stools in a 24-hour period) and either abdominal cramps or fever ≥37.8°C; or 2) any three of the following: abdominal cramps, bloating, excessive gas, vomiting, fever. In the period April 28–30, all persons (or parents of the young children) who had attended the party completed questionnaires that asked about previous consumption of raw milk or untreated water, contact with animals or pets with diarrhea, and contact with ill persons or young children. Food and drink histories were obtained for each item served at the party, and each person was asked to specify which chicken parts he or she ate and whether these were undercooked (pink meat or bloody) or well cooked. Persons who helped prepare the meal were interviewed.

Microbiology

On April 29, two rectal swabs each were taken from two ill persons who had not received antimicrobial therapy, and from three well persons. One swab was placed into Cary Blair medium, another into buffered glycerol saline, and both were refrigerated until plated onto media as previously described for *C. jejuni*,[7] *Salmonella*,[16] and *Shigella*.[16]

Serology

Acute-phase serum specimens (S_1) drawn 11 days after the party, and convalescent-phase serum specimens (S_2), drawn 25 days after the party, were obtained from 13 (87 per cent) of the 15 persons who had attended the party. A third serum specimen (S_3) was obtained from eight ill persons 90 days after the party. Serum specimens obtained from 10 healthy women were used as controls. All serum specimens were tested for Immunoglobulin M (IgM) and Immunoglobulin G (IgG) antibody titers to *Campylobacter*, using the indirect fluorescent antibody (IFA) technique.[9] The antigen was a formalinized suspension of a strain of *C. jejuni* isolated from one of the ill persons attending the party. These sera were also tested for anti-*Campylobacter* antibodies using a complement-fixation (C'F) assay.[17]

Results

Epidemiologic Investigation

Questionnaire data revealed that 11 (73 per cent) of the 15 persons who had attended the party had developed illness fitting the case definition. Onsets of illness occurred over a five-day period, with a median incubation period of four days (mean, 4.2 days) after the party (Figure 1). Diarrhea (91 per cent), abdominal cramps (91 per cent), and fever (82 per cent) were the most common symptoms; headache (73 per cent), excessive gas (64 per cent), weakness (64 per cent), and lethargy (64 per cent) were somewhat less common. Three persons had gross blood visible in their stools. Median duration of diarrhea was six days (mean, 5.2 days; range 1 to 8 days). None of the affected persons was hospitalized for these symptoms, but two had been seen by a physician. One of these persons had a stool specimen positive for *C jejuni*. The physician prescribed erythromycin for all ill persons, but two persons refused to take the drug.

Analysis of food and drink consumption revealed that 14 of 15 persons had eaten barbecued chicken, cake, and ice cream. Only undercooked chicken parts were eaten by significantly more ill persons (eight of nine who remembered) than well persons (0 of 4) ($p = 0.012$ by Fisher's exact test). In addition, more ill persons had eaten skin from the chicken (10 of 11) than had well persons (1 of 4) ($p = 0.032$).

Whole raw chickens had been purchased at a local grocery store and cut in half before being placed on a barbecue grill. A homemade sauce made of a commercial brand of butter, salt, and garlic salt was brushed over the chickens as they cooked over coals for approximately 45–60 minutes. The chickens were turned with tongs and never

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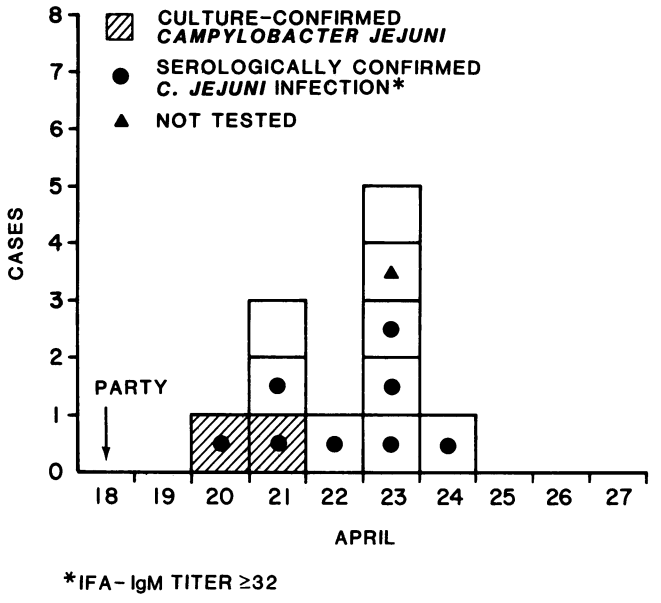

FIGURE 1—Gastroenteritis Cases, by Date of Onset, Denver, Colorado, 1982

speared or punctured. The ice cream had been bought at a grocery store; the cake was made at home. Raw eggs were used in the preparation of the cake mix, which was then baked for 35–40 minutes at 375°F. No raw milk was used in the cake mix or at the party. None of the persons involved in preparing or serving the food had had any gastrointestinal symptoms before the party.

Microbiologic Investigation

C. jejuni was isolated from a rectal swab from one of two ill persons who did not receive erythromycin. None of three well persons had positive specimens, and all *Salmonella* and *Shigella* cultures were negative. In addition, one of two ill persons who had seen a physician had a stool specimen positive for *C. jejuni*. Eleven days after the party, culture of the brush used to spread the barbecue sauce was negative for *Campylobacter*.

Serologic Investigation

A summary of results of serologic testing for IgM and IgG-specific IFA antibody and for C'F antibody for *C. jejuni* are listed in Table 1. Eight of 10 ill persons had an acute IgM-specific IFA titer ≥32, compared with none of three well persons ($p = 0.035$ by Fisher's exact test), and none of 10 healthy controls ($p = 0.0036$). Reciprocal geometric mean titer (GMT) by C'F was significantly higher on S_1 specimens from both the ill and well groups when compared with controls ($p < 0.01$ by ANOVA) and on S_2 specimens from the ill persons compared with controls ($p < 0.01$). S_3 specimens from eight ill persons 90 days after exposure had returned to levels similar to those of controls. Although no patient had a four-fold rise in anti-*Campylobacter* titer, all (8/8) ill persons who had S_3 drawn showed at least a four-fold drop by C'F, seven of eight showed four-fold decrease by IgG-specific IFA titer, and five of eight by IgM-specific IFA titer.

Discussion

The symptoms and incubation periods in this outbreak are consistent with previous descriptions of *Campylobacter* enteritis.[1] Eight ill persons had IgM-specific IFA titers which were compatible with recent infection, and two of these had stool cultures positive for *C jejuni*. Since both the ill and well groups from the party had reciprocal GMT significantly higher than the control group, it is possible that some well persons had asymptomatic infection with *C. jejuni*. However, 11 days after the party two of these well persons had rectal swab cultures negative for *C. jejuni*, suggesting that they may not have had recent infection.

Chicken was the most likely vehicle of transmission. Having eaten an undercooked piece of chicken or skin from the chicken was significantly associated with illness. *C. jejuni* can be cultured routinely from store-bought poultry.[12,14]* With sensitive culture techniques, 54 per cent–100 per cent of chicken carcasses may harbor *Campylobacter*.[18]

It is likely that most barbecued chickens will harbor viable *Campylobacter* on their surface until adequate cooking has killed the organism. In this outbreak, using a brush to apply sauce to the chicken may have increased the risk of transmitting infection, since the brush itself could have become a vehicle for further contamination of the chicken with subsequent applications of sauce after cooking was finished. In a study of sporadic *Campylobacter* infections in The Netherlands, Severin found that although consumption of chicken per se was not a risk factor, consumption of

*When a relatively insensitive swab technique was used in our laboratory, 25 per cent of chicken carcasses bought in grocery stores in several areas of Colorado proved to be positive for *C. jejuni* (Humphreys JT: Personal communication).

TABLE 1—Reciprocal Geometric Mean Titers (RGMT) for Antibody to *C. jejuni* by Indirect Fluorescent Antibody (IFA) Test of IgM-specific and IgG-specific Varieties and by Complement Fixation (C'F) Test among Persons Who Consumed Chicken at Party, Colorado, 1982

	IFA-IgM			IFA-IgG			C'F			No. with S_1 IFA-IgM
	S_1	S_2	S_3	S_1	S_2	S_3	S_1	S_2	S_3	Titer≥32
Ill Persons (N=10)	39	32	6.7	52[a]	32	6.7	92[b]	86[b]	15	8/10[c,d]
Well Persons (N=3) (Exposed)	8[a]	6[a]	ND	25[a]	32[a]	ND	101[b]	40	ND	0/3
Controls (unexposed) (N=10)	2	ND	ND	6	ND	ND	25	ND	ND	0/10

S_1 = serum drawn 11 days after party.
S_2 = serum drawn 25 days after party.
S_3 = serum drawn 90 days after party.
a = $p < 0.05$ by ANOVA test, compared with controls.
b = $p < 0.01$ by ANOVA test, compared with controls.
c = $p = 0.035$ by Fisher exact test, compared with well persons.
d = $p = 0.0036$ by Fisher exact test, compared with controls.
ND = Not done.

chicken that was cooked for only a short time was associated with illness.[19] Longer cooking was defined as baking, roasting, or boiling, and shorter cooking was defined as fondue or barbecue. The outbreak reported here emphasizes the importance of proper cooking of poultry to prevent this infection.

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Nurse-Midwifery Practice in the United States, 1982

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Abstract: During 1982 the American College of Nurse-Midwives conducted a national survey of certified nurse-midwives residing in the United States. About 68 per cent of the 1,584 respondents (response rate 76 per cent) were practicing nurse-midwifery. Most of them were providing prenatal and family planning care. The 937 participants who were conducting deliveries reported that they conducted about 1.8 per cent of the estimated 3,704,000 deliveries which took place in the United States during 1982. (*Am J Public Health* 1984; 74:1267–1270.)

Introduction

Nurse-midwives educated in the United States and certified by the American College of Nurse-Midwives (ACNM) have been prepared to manage health care for women without medical problems during the antepartal, intrapartal, postpartal, and gynecologic phases of the reproductive cycle, as well as for essentially normal newborns.[1] This care takes place in a health care system where medical consultation and referral are obtained according to medically approved written protocols.[2]

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Methods

During 1982, survey questionnaires were distributed to 2,086 nurse-midwives certified by the ACNM and known to be living in the United States. These nurse-midwives represented 81.8 per cent of the 2,550 ever certified by that organization as of July 1, 1982; the remaining nurse-midwives were either living outside of the United States, deceased, or had no address recorded at ACNM headquarters.

The survey was conducted to determine how many nurse-midwives were practicing in the United States and what services they were providing. Usable questionnaires were returned by 1,584 (75.9 per cent) of the 2,086 nurse-midwives.

Results

A total of 1,065 (67.2 per cent) survey participants reported that they were practicing nurse-midwifery in the United States. As illustrated in Table 1, prenatal care and family planning care were the services provided by the largest numbers of survey participants while abortion counseling was the service offered by the smallest number. Most of the nurse-midwives who were providing prenatal care reported that they conducted initial prenatal physical examinations which included responsibility for pregnancy diagnosis and that they had responsibility for management of some prenatal complications.

The 937 (59.2 per cent) nurse-midwives who were conducting deliveries reported that they had conducted 68,165 deliveries in the 12 months prior to the 1982 survey, or about 1.8 per cent of the estimated 3,704,000 deliveries which took place in the United States during 1982[3]; most of these deliveries were conducted in hospitals. Only 14 per