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Infection Due to *Campylobacter jejuni*: A Report of 524 Outpatients

Summary: Within a three-year period 712 patients with *Campylobacter jejuni* infection were diagnosed at our laboratory in Helsinki and 524 (72%) were treated as outpatients. More than half (57%) of the patients became infected when abroad, chiefly during holiday trips in the Mediterranean and in East European countries. The risk of acquiring infection was about 250 times greater abroad than in Finland, and it differed considerably from country to country, being highest in Morocco and Tunisia. Among domestic cases the incidence of infection was significantly higher ($p < 0.001$) during the summer and autumn months than during winter or spring. Animal contact prior to infection was reported in 59% of domestic and 31% of imported cases, and previous consumption of poultry in 28% and 42% of those from whom information was obtained. Besides diarrhoea (98%), the main symptoms included abdominal pain (87%), fatigue (81%), fever (78%), malaise (70%) and headache (51%). Arthralgia was observed in 19% and arthritis in 2% of patients. The mean duration of diarrhoea was 10.8 days, of fever 2.8 days.

Zusammenfassung: Infektion durch *Campylobacter jejuni*: Bericht über 524 ambulante Patienten. In einem Zeitraum von drei Jahren wurden in unserem Labor in Helsinki bei 712 Patienten Infektionen durch *Campylobacter jejuni* diagnostiziert; davon wurden 524 (72%) ambulant behandelt. Mehr als die Hälfte der Patienten (57%) infizierten sich im Ausland, vorwiegend auf Urlaubsreisen in Mittelmeerländer und nach Osteuropa. Im Ausland war das Infektionsrisiko 250mal höher als in Finland; zwischen den Ländern bestanden beträchtliche Unterschiede, das höchste Risiko bestand in Marokko und Tunesien. Bei den zu Hause infizierten Fällen war die Inzidenz der Infektion während der Sommer- und Herbstmonate signifikant höher als im Winter und Frühling ($p < 0,001$). Bei 59% der inländischen und bei 31% der importierten Fälle wurde über Tierkontakt vor der Infektion berichtet; soweit angegeben, hatten in 28% der im Inland und 42% der im Ausland infizierten Patienten Geflügel gegessen. Neben Durchfällen (98%) traten als Hauptsymptome Bauchschmerzen (87%), Müdigkeit (81%), Fieber (78%), schlechtes Befinden (70%) und Kopfschmerzen (51%) auf. Bei 19% der Patienten wurden Arthralgien und bei 2% eine Arthritis beobachtet. Die Diarrhöe hielt im Durchschnitt 10,8 Tage an, das Fieber 2,8 Tage.

Introduction

Since Skirrow's article in 1977 (1), the importance of *Campylobacter jejuni* as a cause of human enteritis has become well known. This bacterium is believed to be the second most common cause of human enteritis in developed countries after salmonella, comprising about 5–10% of all cases (2). According to some reports, however, *C. jejuni* may at least temporarily be even more common than salmonella as a bacterial cause of diarrhoea (3–6). In 1981 the Communicable Disease Surveillance Centre in Britain received reports of some 12,500 cases due to *C. jejuni* and some 10,750 due to salmonella (4). In Sweden, among 2,550 patients with enteritis, Svedhem and Kaijser (3) found *C. jejuni* in 10.9% and salmonella in 7.2%, and in another series comprising about 9,000 patients with enteritis described by Walder (6), the corresponding figures were 8.3% for campylobacter and 4.0% for salmonella. Most papers describing the clinical picture and epidemiology of campylobacter enteritis comprise only hospitalised patients or both inpatients and outpatients, or no information about hospitalisation has been given (3, 5–12). Recently, Kendall and Tanner (13) presented the epidemiological and clinical data of 34 cases of campylobacter enteritis treated in general practice in England. In addition, all but five of the samples from 57 patients described by Skirrow in 1977 (1) were submitted by general practitioners. In the present article we give epidemiological and clinical information about 524 outpatients with campylobacter infection during a three-year period in Finland.

Patients and Methods

During the three-year period (July 1978 to June 1981) *C. jejuni* was found at our laboratory in 712 patients, of whom 188 inpatients have been described elsewhere (14). The remaining 524 were treated as outpatients either in general practice or at outpatient departments in hospitals all over Finland. A questionnaire was sent by mail to gather information on the clinical picture, treatment and epidemiology of the illness. With regard to epidemiology, the following inquiries were made: travel abroad, time of onset of illness, occurrence of similar cases in the vicinity, animal contact and eating of poultry within a week before

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illness. Replies were received from 358 (68%) patients, and in some further cases information was obtained by telephone calls to patients or to their physicians.

Stool cultures were grown as described by Skirrow (1). All *C. jejuni* strains grew at 43°C, but not at 25°C, and were sensitive to nalidixic acid on Skirrow's selective medium in an atmosphere of 5% oxygen. All strains were catalase and oxidase-positive. In the statistical analysis the chi-square test was used.

Results

Epidemiology

Age and sex distribution: The age-related yearly incidence of domestic campylobacter infection was calculated from the population statistics of the Finnish Central Statistical Office (15). The incidence of domestic cases was highest among small children (0-4 years old) and second highest among young adults (20-39 years old) (Table 1). In contrast, the incidence was significantly lower among 15 to 19-year-olds and among 50-year-olds. Among imported cases the incidence similarly reached a peak between 20 and 39 years. However, both imported and domestic cases were observed in all age groups.

Among domestic cases there was a slight male predominance ($0.05 < p < 0.10$), but in no age group did the difference reach statistical significance (Figure 1).

Geographical distribution: Over half of the patients, 298 (57%), acquired the infection when abroad, mainly during holiday trips to the Mediterranean and East European countries. Table 2 shows the risk of acquiring diagnosed campylobacter infection abroad. The mean frequency of diagnosed cases was about 15 per 100,000 journeys; one-fifth of the patients with imported disease were treated as inpatients (14). The mean duration of trips was about ten days. The present figures indicate that the mean risk of contracting campylobacter infection was 250 times greater among those travelling abroad outside Scandinavia.

The patients imported the disease from 43 different countries on all continents except North America. Only 15 cases were imported from Central Europe, five of them from France. The risk of infection was above the average in Morocco, Tunisia, Portugal, Rumania and Bulgaria; in Morocco it was 20 times and in Tunisia ten times as high as the average.

Seasonal distribution: The seasonal distribution of domestic and imported cases are presented in Figure 2. Among the domestic cases the incidence reached a peak in July to August, but was also high in October to November. The incidence was significantly higher ($p < 0.001$) during the summer and autumn months than during winter and spring. Imported cases showed no such variation, but the incidence was highest in April. This was partly due to a cluster of 20 cases imported from the USSR in April.

Other epidemiological aspects: No epidemics involving more than ten people were found among domestic cases, though there were several small outbreaks and family in-

Table 1: The age-related yearly incidence of domestic diagnosed infection due to *Campylobacter jejuni* in Finland.

Age (years)	Incidence/100,000/year	95% confidence limits
0-4	2.94	2.04 , 4.24
5-9	1.43	0.83 , 2.42
10-14	1.30	0.77 , 2.23
15-19	0.79	0.43 , 1.51
20-29	2.18	1.66 , 2.87
30-39	2.00	1.50 , 2.66
40-49	1.46	0.99 , 2.16
50-59	1.11	0.71 , 1.75
60-69	1.11	0.67 , 1.87
70+	0.69	0.40 , 1.50

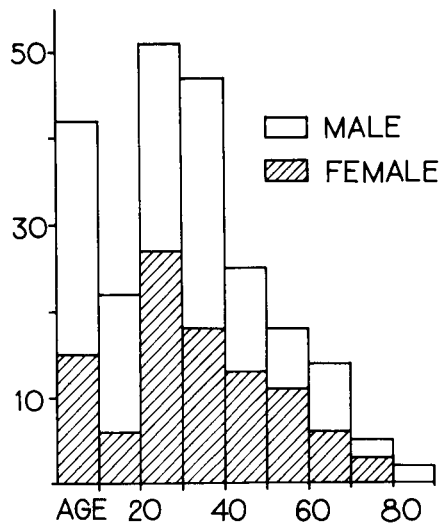


Figure 1: Age and sex distribution of 226 patients with domestic infection due to *C. jejuni* in Finland.

Table 2: The number of diagnosed campylobacter infections acquired outside Scandinavia as shown by a three-year survey among Finnish travellers.

Country	No. of infections	No. of travellers	Infections/100,000 travellers
Morocco	55 (43)*	19,000	289.5 (226.3)*
Tunisia	17 (16)	10,400	163.5 (153.8)
Portugal	12 (8)	30,800	39.0 (25.9)
Rumania	10 (9)	47,800	20.9 (18.8)
Bulgaria	9 (7)	52,900	17.0 (13.2)
Spain	63 (50)	502,000	12.5 (10.0)
Poland	11 (11)	100,000	11.0 (11.0)
USSR	63 (54)	764,000	8.2 (7.1)
Greece	16 (13)	266,000	6.0 (4.9)
Italy	8 (7)	197,000	4.1 (3.5)
33 other countries	95 (69)	453,100	21.0 (15.2)
All 43 countries	369 (298)	2,443,000	15.1 (12.2)

* The figures for outpatients are presented in parentheses. For inpatients see Pitkänen et al. (14).

fections. In one family, in which seven out of nine members fell ill, the successive order of illness suggested person-to-person transmission. The above-mentioned cluster

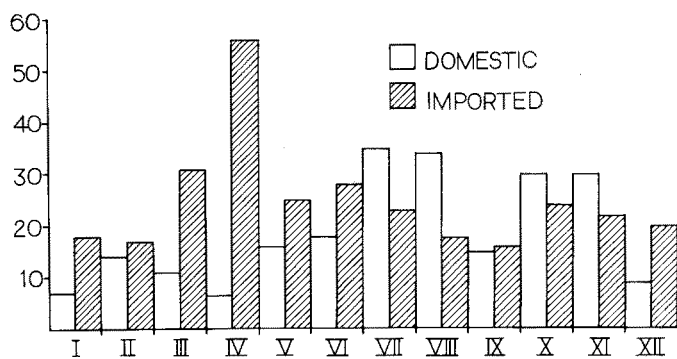


Figure 2: Monthly distribution of 524 cases of *C. jejuni* infection.

of infection imported from the USSR was the largest during the study period; its source remained unknown. These patients had travelled in three separate charter planes to the Tashkent area.

Similar cases of illness in the close vicinity were reported by 61% of the domestic patients and by 55% of the patients who were infected abroad ($p > 0.05$, $n = 218$). Contact with an animal was reported significantly more often by those who fell ill in Finland (59% vs. 31%; $p < 0.001$, $n = 268$). The corresponding percentages concerning previous eating of poultry were 28% and 42% ($p < 0.05$, $n = 246$).

Clinical Manifestations

The symptoms of these patients are presented in Table 3. As many as 98.4% had diarrhoea which lasted on the average 10.8 days. In about one-third of cases the diarrhoea was severe, i.e. at least ten evacuations daily. Gross blood in the stools was observed by 18% and mucus by 38%.

Abdominal pain occurred in 87%, being severe in 46%. Four-fifths of the patients had fever and fatigue, with average durations of 3.7 and 6.3 days, respectively. The maximal fever was often high, more than 39°C in 110 patients (41%, $n = 280$). Half the patients had nausea and headache, the mean duration of the latter being 2.8 days. Myalgia and arthralgia were reported by 36% and 19% of the patients, the mean duration of these symptoms being 3.1 and 5.8 days. Arthritis was observed in six patients (2.1%).

Information on the duration of inability to work was obtained from 179 patients: the mean was 5.3 days.

Treatment and Prognosis

No case was fatal. One-fifth of the patients (55 out of 269) received antibiotics, 44 of them erythromycin; 60% received medicines which reduce bowel motility, and 22% had no medicine at all.

Discussion

We previously reported a series of 188 patients with *C. jejuni* infection who were treated as inpatients (14). In the

Table 3: The main clinical manifestations in 524 outpatients with *Campylobacter jejuni* infection.

	No. with manifestations/ no. giving information	
Diarrhoea	377/383	98%
evacuations per day > 10	114/334	
evacuations per day 5-10	143/334	
evacuations per day < 5	77/334	
Abdominal pain	294/337	87%
Fatigue	257/318	81%
Fever	287/367	78%
≤ 37.9° C	39/260	
38.0-38.9° C	111/260	
39.0-39.9° C	93/260	
≥ 40.0° C	17/260	
Malaise	193/276	70%
Chills	179/267	67%
Headache	158/313	51%
Nausea	152/327	47%
Myalgia	106/296	36%
Vomiting	62/314	20%
Arthralgia	54/282	19%
Conjunctival irritation	31/253	12%
Rash	11/253	4%
Arthritis	6/283	2%

outpatients now considered, the symptoms were surprisingly similar, not only in quality but also in severity. No statistically significant difference was found between these groups in the frequency of the following parameters: diarrhoea, abdominal pain, fever, myalgia, headache or arthralgia, or in the severity of diarrhoea as measured by the number of evacuations per day. Fatigue and the presence of gross blood were statistically almost significantly more frequent among the inpatients ($p < 0.05$), and the difference was significant in the following parameters: malaise, chills, nausea, vomiting, arthritis and degree of fever ($p < 0.01$). The frequencies of symptoms observed among these outpatients were similar to those reported in earlier series comprising both in and outpatients (3.6-9.11) and also to those reported by Kendall and Tanner (13) from general practice. The mean duration of fever was now exactly the same as among our previous series of inpatients (14) and the mean duration of diarrhoea was even longer than among inpatients, 10.8 and 6.5 days, respectively. This difference may have been due to the stricter dietary regimen in the hospital; however, the inpatients received effective antibiotics more often ($p < 0.01$).

The incidence of domestic cases was highest in late summer, as in earlier studies carried out in temperate zones (4, 6, 10, 13). The age distribution was also similar to that seen in some previous studies, with a peak incidence among small children and another among young adults (6, 14, 16). The reasons for such an age distribution are not known but are obviously related to the mechanism of transmission of the infection. The suggested modes of transmission are: ingestion of food, water or milk contaminated by animals; direct contact with infected animals, either with or without symptoms; ingestion of poultry or

red meat infected in abattoirs; and rarely, by person-to-person transmission (2, 4, 6, 17, 18). The animals most often suspected of spreading infection are chickens, dogs, cats, cows, pigs, sheep and wild birds. Most chickens and 32–70% of carcasses of cattle, pigs and sheep are infected with *C. jejuni* during processing in abattoirs; in red meat, however, campylobacter usually die during cold storage, but not in broiler meat (19–22). The proper heating of meat always destroys all campylobacter (23). About 50% of urban pigeons, 20–70% of seagulls, 0–27% of dogs and 0–4% of cats are carriers of *C. jejuni* (4, 17). However, the implications of these findings cannot yet be grasped and must await reliable serotyping of the various animal and human strains.

A slight male predominance was seen in the younger age groups, as in some earlier series (6, 16). This is presumably due to the greater exposure of boys and young men to infected material or animals in hobbies or at work. In addition, boys in the youngest age groups may be more susceptible to *C. jejuni*, as they are to many other intestinal pathogens.

C. jejuni is an important cause of traveller's diarrhoea. In Finland, as in Sweden, the proportion of imported cases is high, being about half of all cases (3, 5, 14). In England, in contrast, only 3% of all cases are thought to be imported (16). The difference may in part be due to the absence of milkborne epidemics in Finland and Sweden, in contrast to England (24), owing to the pasteurisation of all

milk sold. Our figures show that the risk of infection varies greatly from country to country, and is obviously correlated with the general standard of hygiene. However, the huge differences, especially when Morocco and Tunisia were compared with other countries, suggest that other factors besides hygiene are involved, e.g. use of raw or insufficiently heated food and the nature of the food. The strains in different countries may also differ in virulence and antigens, which may partly explain the high frequency of acquired infections among tourists.

During the study period, *C. jejuni* was a major bacterial cause of enteritis in Finland besides salmonella, shigella and yersinia. It is obvious that the incidence now observed represents only a small proportion of the total incidence, because stool cultures for bacteria, especially for campylobacter, are not always made from patients with diarrhoea. However, the common occurrence of campylobacter, the rather severe illness caused by it, and the fact that campylobacter enteritis cannot with certainty be distinguished clinically from enteritis due to other bacteria, indicate that testing all stool samples from diarrhoeal patients for campylobacter should be done as a routine.

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