JOURNAL OF CLINICAL MICROBIOLOGY, Mar. 2004, p. 1363–1364 Vol. 42, No. 3
0095-1137/04/$08.00+0 DOI: 10.1128/JCM.42.3.1363–1364.2004

Occurrence of *Campylobacter jejuni* in Pets Living with Human Patients Infected with *C. jejuni*

Peter Damborg,[1] Katharina E. P. Olsen,[2] Eva Møller Nielsen,[2] and Luca Guardabassi[1]*

Department of Veterinary Microbiology, The Royal Veterinary and Agricultural University, 1870 Frederiksberg C,[1] and Department of Gastrointestinal and Parasitic Infections, Statens Serum Institut, 2300 Copenhagen S,[2] Denmark

Received 14 October 2003/Returned for modification 27 November 2003/Accepted 6 December 2003

Campylobacter jejuni **was recovered from four dogs (11%) and four cats (33%) living with Danish human patients infected with *C. jejuni*. Pulsed-field gel electrophoresis (PFGE) analysis revealed the occurrence of the same quinolone-resistant strain in a girl and her dog. *C. jejuni* isolates with closely related (>95% similarity) PFGE profiles occurred in humans and pets from different Danish counties.**

Various risk analysis studies have shown evidence that pet ownership is a significant risk factor for *Campylobacter* infections in humans (1, 5, 6). Direct evidence of transmission of a *Campylobacter jejuni* strain between a human and a dog living in the same household was recently shown based on amplified fragment length polymorphism (12). However, the actual importance of pets as a source of *Campylobacter* infections in humans remains unclear.

In this study, the occurrence of *Campylobacter* spp. was investigated in pets (i.e., dogs and cats) living together with human patients infected with *C. jejuni*. Among 137 patients contacted, 54 (39%) were pet owners and 45 (33%) agreed to participate in the study. Fecal samples collected from pets living with these patients were cultured (48 h, 37°C) on mCCDA agar (SSI Diagnostika, Hilleroed, Denmark) under microaerobic conditions. *Campylobacter* was recovered from six dogs (16%) and five cats (42%). Based on phenotypic (hippurate hydrolysis, indoxyl acetate hydrolysis, and oxidase and catalase production) and multiplex PCR identification (13), *C. jejuni* was present in 8 of the 11 pets positive for *Campylobacter*, including four dogs (11%) and four cats (33%) (Table 1). The three remaining pets carried *Campylobacter coli* (n = 1) or *Campylobacter lari* (n = 2). The occurrence of *C. jejuni* was significantly higher in pets living with patients less than 17 years of age (37%) than in those living with older patients (4%) (Fisher exact test, P = 0,004). Although this study cannot explain the reason for this difference, a likely explanation is that either human-to-pet or pet-to-human transmission of *C. jejuni* occurs more frequently between young patients and their pets.

The genetic relatedness of *C. jejuni* isolates from pets and humans was determined by pulsed-field gel electrophoresis (PFGE) analysis with *Sma*I and *Kpn*I (Medinova, Glostrup, Denmark) (8). A 2-year-old girl and her dog (pair 1) shared the same strain, as evidenced by the identical *Sma*I (Fig. 1) and *Kpn*I profiles found in the human and the animal isolate (Table 1). The isolates from another young patient and his puppy (pair 3) had very similar *Sma*I profiles (Fig. 1) but distinct *Kpn*I profiles (Table 1). In the remaining six cases, the PFGE profiles of animal and human isolates differed by one or more bands (data not shown). A cluster analysis including other canine strains previously isolated in Denmark (4) revealed the occurrence of closely related (>95% similarity) *Sma*I profiles in humans and pets from different Danish counties (data not shown). In addition to the two human isolates with the same *Sma*I profile as that of the corresponding pet isolates, a third human isolate showed an *Sma*I profile closely related to those of two canine isolates from a different geographical area. However, most strains with identical or closely related *Sma*I profiles showed distinct *Kpn*I profiles, indicating that the detection of identical *Sma*I profiles does not necessarily reflect the occurrence of the same strain in different populations.

The strain isolated from the 2-year-old girl and her dog (pair 1) was resistant to nalidixic acid and ciprofloxacin. The recovery of quinolone-resistant isolates from Danish patients is associated mainly with travel (2). However, the case reported in this study was not associated with travel, since the girl did not travel in the period preceding the manifestation of clinical symptoms. Both the girl and the dog had never been treated with quinolones, indicating that the strain was not selected by exposure of one of the two individuals to quinolones but rather was acquired from an external source. As an alternative to transmission, environmental exposure to contaminated sources (e.g., soil, water, etc.) could have caused the presence of the same strain in the two hosts. Even though the dog was fed a commercial diet, acquisition from a common food source was also possible, since the dog was occasionally given human food scraps.

This study shows that *C. jejuni* occurs frequently among pets living with human patients infected with *C. jejuni*, especially children. Transmission appears to be uncommon, since there was only one case among 45 cases studied (2%) where isolates from a patient and a pet living in the same household showed identical *Sma*I and *Kpn*I profiles. However, the frequency of transmission could be underestimated due to a number of factors. First, some strains could be undetected in pets due to the time interval between the analyses of human and pet samples (4 to 30 days, 11 days on average). Second, the occurrence of mixed *C. jejuni* populations (4) could not be detected, as only one isolate was obtained from each positive sample. Fi-

* Corresponding author. Mailing address: Department of Veterinary Microbiology, The Royal Veterinary and Agricultural University, Stigbøjlen 4, 1870 Frederiksberg C, Denmark. Phone: 45-35282745. Fax: 45-35282755. E-mail: lg@kvl.dk.

TABLE 1. Description of the eight human-pet pairs where *C. jejuni* was found in both the human patient and the pet

Pair no.	Patient age (yr)	Pet species	Pet age	Diarrhea in pet[a]	Patient isolate		Pet isolate		Isolation interval (days)[c]
					Code	PFGE profile (*Sma*I/*Kpn*I)[b]	Code	PFGE profile (*Sma*I/*Kpn*I)[b]	
1	2	Dog	5 yr	No	H1	1/A	D1	1/A	18
2	8	Dog	5 mo	Yes	H2	2/−	D2	3/−	9
3	16	Dog	2 mo	Yes	H3	4/B	D3	4/C	23
4	72	Dog	7 yr	No	H4	−/D	D4	5/E	5
5	1	Cat	1 yr	No	H5	−/F	C1	4/G	30
6	3	Cat	1 yr	No	H6	6/−	C2	7/−	13
7	6	Cat	2 yr	No	H7	8/−	C3	7/−	16
8	5	Cat	1 yr	Yes	H8	9/−	C4	4/−	9

[a] Signs of diarrhea observed in the pet within 30 days prior to the isolation of *Campylobacter* from the human patient.
[b] The same number and/or letter was used to indicate indistinguishable or closely related (>95% similarity) *Sma*I/*Kpn*I profiles; −, restriction analysis did not result in any band with *Sma*I or was not performed with *Kpn*I.
[c] Interval between isolation of *C. jejuni* from the patient and that from the pet.

nally, an epidemiological relationship could exist between human and pet isolates having indistinguishable *Sma*I profiles but different *Kpn*I profiles (e.g., pair 3) or *Sma*I profiles differing by only one band (e.g., pair 6), since small genetic rearrangements may determine variations in the PFGE profiles of *C. jejuni* (7, 10, 11). It should be noted that, according to the criteria established by Tenover et al. for interpreting PFGE patterns (10), an epidemiological relationship could exist between isolates having up to six band differences. However, such criteria are not applicable in the present study, because PFGE profiles generally contained fewer than 10 distinct bands (Fig. 1).

In addition to the possible transmission of *C. jejuni* by direct contact, pet animals can contribute to the dissemination of this pathogen in the environment. Pets can shed *Campylobacter* for long periods (over 1 year) (4) and usually do not show clinical symptoms (3, 9). In this study, five out of eight pets carrying *C. jejuni* did not show signs of diarrhea, and one dog appeared to be colonized by the same strain for at least 27 days (data not shown). Accordingly, pets could play an important role in the propagation of this pathogen, especially in urban areas, where direct pet-to-pet contact or exposure to feces from other pets is likely to occur.

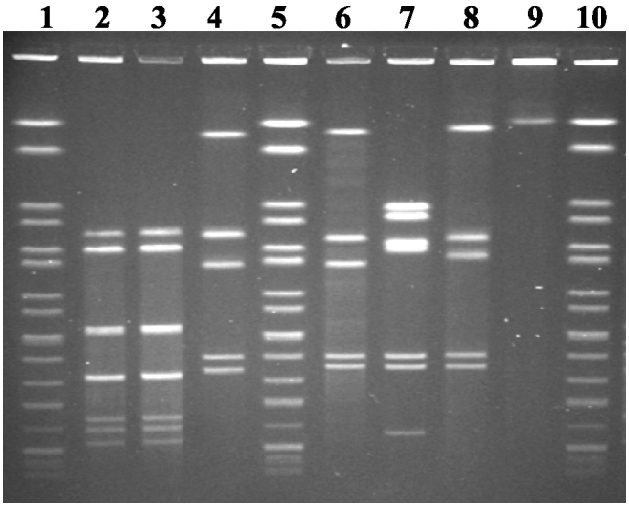

FIG. 1. PFGE profiles with *Sma*I of *C. jejuni* isolates from human patients and their pets. Lanes 1, 5, and 10, size-standard strain *Salmonella enterica* serovar Braenderup H9812; lanes 2 and 3, isolates from a 2-year-old girl and her dog (pair 1); lanes 4 and 6, strains isolated from a 16-year-old boy and his puppy (pair 3); lanes 7 and 8, isolates from an 8-year-old boy and his dog (pair 2); lane 9, human isolate that could not be typed with *Sma*I.

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