Survey of *Coxiella burnetii* in Ticks Collected from Dogs in Japan

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NOTE Public Health

Q fever is a worldwide zoonosis caused by the obligate intracellular bacterium *Coxiella burnetii*. It is a notifiable infectious disease of humans in Japan. The host range of *C. burnetii* is wide, ranging from mammals including humans, domestic animals and companion animals to reptiles, birds and arthropods [10]. Ticks have been well known to carry *C. burnetii*, and more than 40 tick species are reported to carry the bacteria [17]. Isolates from ticks are reported in many countries including Japan [4, 5, 10]. Identification of an infection source is usually difficult, especially in sporadic cases. Companion animal-related Q fever is rare, but has been reported in urban outbreaks [10]. There is no report of an urban Q fever outbreak in Japan. However, seroepidemiology of companion animals shows the presence of *C. burnetii* in urban residential areas of Japan; 60 of 589 (10%) and 95 of 950 (10%) dogs [9] and 4 of 310 (0.3%) companion cats [8], and the bacteria was isolated from 9 of 29 (31%) companion cats [15].

The major *C. burnetii* infection route in human is considered to be inhalation of contaminated aerosols [13]. Tick bites are considered to have low potential for *C. burnetii* transmission [10]. However, *C. burnetii*-carrying ticks excrete high concentrations of infective bacteria in their feces, which contaminate the host’s skin, and the bacteria may then persist in the environment [1]. Therefore, ticks are considered to have an important role in dissemination of the pathogen. There is no evidence of tick-borne Q fever in Japan so far, but the risk of infection from ticks is important to know as a public health consideration. In this study, we focused on ticks that infest companion dogs, which can bring environmental elements into a human’s life.

The ticks for this study were removed randomly from companion dogs in animal clinics in Aomori, Tochigi, Gifu and Okinawa Prefectures. A total of 261 ticks were collected, and their species were identified morphologically. Five tick species were identified: *Ixodes ovatus*, *Haemaphysalis concinna*, *H. flava*, *H. longicornis* and *Rhipicephalus sanguineus*. Total DNA was extracted from them individually following by real-time PCR to detect a *C. burnetii*-specific gene. The results of real-time PCR were all negative, which might suggest a low risk of *C. burnetii* infection via these ticks and their hosts in urban residential areas in Japan.

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other tick species were only adults (Table 1). All of these tick species have affinity not only for dogs but also for humans [23]. H. concinna, which is distributed in cool climates, was found only in Aomori Prefecture. R. sanguineus, whose habitat is warm climates in Japan, was only found in Okinawa Prefecture. The numbers of ticks represent their affinity to hosts and the habitat. Tick rrs genes were amplified from all samples demonstrating successful DNA extraction. However, no C. burnetii coml gene was detected. Several DNA samples were randomly tested by nested PCR detection for the coml gene, which is also highly sensitive and can detect as few as 1 organism [24]; the results were all negative. Therefore, the negative real-time PCR results are not, because of a lack of sensitivity of the detection system.

In this study, no ticks carrying C. burnetii were found in dogs living in urban residential areas in Japan. The C. burnetii-negative ticks in this study were all enzootic in dogs, and the results may suggest a limited risk of transfer of Q fever to humans via ticks infesting these animals or the animals themselves. Since the samples were collected only from 4 prefectures, more tick samples are required to draw conclusions about the risk in urban areas of Japan. Our negative results may correlate in part with the low incidence of Q fever in Japan (1 to 7 cases per year during 2007 to 2011) [7]. Companion animals related to previous urban Q fever outbreaks have all been parturient [10]. Further research with host information, such as health condition in companion animals, might lead to better understanding of urban Q fever including sporadic cases. Also, serology of the host animals may help to reveal their correlation to human Q fever.

The negative detection result may depend on tick species and the surrounding environment. Some tick species investigated in this study have been reported to carry C. burnetii based on PCR in several countries, but the scales of these studies have been somewhat small. The detection rates have varied and included negative results. H. concinna was reported to have C. burnetii in 10 of 35 ticks, none of 56 ticks and 1 of 26 ticks in Serbia, Spain and Slovakia and Hungary, respectively [2, 19, 21]. H. longicornis in Korea had C. burnetii in 2 of 100 ticks [11]. R. sanguineus has a preference mainly for dogs, and C. burnetii was detected from 5 of 209 R. sanguineus in Italy [18]. In Egypt, C. burnetii DNA was detected from 1 of 24 R. sanguineus collected from a domestic dog [12]. There are no reports about I. ovatus and H. flava ticks with regard to carriage of C. burnetii. Interestingly, even in the epidemic area of Q fever, ticks did not carry C. burnetii (none of 1891 I. ricinus) [20].

Ticks harbor C. burnetii in general, as has been proved by isolation of the bacteria numerous times since its discovery, but the present study found negative incidence of C. burnetii-carrying ticks in companion dogs in Japan. Further studies need to be performed with expanded sample numbers, study areas, host information and host animal species. Also, investigation of coinfection with other tick-borne pathogens will be important. This is preliminary data showing that ticks and their host companion animals seem to have very limited roles in the Q fever cycle in Japan.

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REFERENCES


