Bartonella henselae in cats: Results of a seroprevalence survey and relevance to New Zealand veterinary practitioners

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Introduction

Bartonella henselae is an important and common zoonotic bacterial pathogen. The organism uses cats as a reservoir host and is found in cats worldwide. Seroprevalence in various studies ranged from 8% in Switzerland (Glaus *et al,* 1997) to 93% among feral cats in Florida, USA (Nutter *et al,* 2004). Five species of *Bartonella* can be carried by cats, but *B. henselae* is the most common (Chomel *et al,* 2006; Lappin *et al,* 2009). The prevalence of bacteraemia in a population tends to be approximately half that of seroprevalence (Brunt *et al,* 2006).

Fleas act as vectors to transmit *B. henselae* from cat to cat. Transmission between cats during mating, pregnancy or lactation has not been demonstrated (Abbott *et al,* 1997). Cats infect humans by scratching and biting, although direct vector transmission to humans is possible (Carr *et al,* 2008). Contamination of wounds by flea faeces on the claws of cats may be the route of human infection (Foil *et al,* 1998). Given the role of vectors in the epidemiology of this pathogen, transmission of the organism is highly dependent on climate, with the highest prevalence occurring in warm, humid regions, where fleas can breed year-round (Chomel *et al,* 2004).

Infection in humans is known as "cat scratch disease" (CSD) and causes regional lymphadenopathy, sometimes accompanied by fever and malaise. Lymphadenopathy is poorly responsive to antibiotic treatment and may persist for weeks to months (Brunt *et al,* 2006). In immunocompetent patients, the infection tends to resolve spontaneously, but in immunocompromised patients infection can result in severe inflammatory and vasoproliferative disease, including bacillary angiomatosis, peliosis hepatitis and endocarditis. Severe disease occurs in 5% to 14% of affected patients (Rolain *et al,* 2004).

The New Zealand context

Despite extensive prevalence surveys worldwide and documented cases of human CSD in New Zealand, little information exists regarding the prevalence in New Zealand cats. To our knowledge, only two New Zealand studies have been published on the subject.

A study in 1997 involving blood culture of 48 healthy cats presented to Auckland veterinary clinics showed eight (17%) were shown to have current bacteraemia (Joseph *et al*, 1997). Kelly *et al* (2005) showed that 11% of 114 fleas collected from client-owned domestic cats in the North Island were positive to *B. henselae* on PCR.

Given the small study sizes and lack of recent data, a seroprevalence survey was planned in Hamilton, using a local shelter facility as the source population.

Seroprevalence in cats in a Hamilton shelter

Aim

The aim of this study was to provide an estimate of the seroprevalence of *B. henselae* infection among cats presented to a shelter facility in the Hamilton region of New Zealand.

Materials and methods

The eligible population included cats over four months of age admitted to a Hamilton rescue facility in the three month period from 1 October 2009 to 31 December 2009. A convenience sample of the first 70 eligible cats taken after recording origin and signalment and conducting a full clinical examination comprised the study population. Approximately 2mL serum and 0.5 mL EDTA blood was collected aseptically from each cat. Serum samples were analysed by the IFA (immunofluorescent antibody) test (Veterinary Medical Research and Development USA), using fluorescent antibody conjugate sourced from Sigma-Aldrich, USA. The test used a cutoff dilution of 1:50.

Results

Seven of the 70 serum samples (10%) were positive for *Bartonella henselae* antibodies, with a 95% confidence interval between 4.45% and 15.45%. No significant statistical association was identified between seropositivity to *B. henselae* and origin of the cat, age, sex, breed, the presence of elevated temperature at the time of sampling or clinical disease.

Discussion

The seroprevalence of *B. henselae* infection in this study was lower than expected. Studies of other temperate countries showed a seroprevalence of 50–56% in The Netherlands (Bergmans *et al,* 1997), 41% in France (Gurfield *et al,* 2001), 28% in Washington D.C., USA (Guptill *et al,* 2004) and 30% in Spain (Pons *et al,* 2005). In the Auckland study, 17% of subjects cultured positive (Joseph *et al,* 1997), and the prevalence in the Auckland cats was reflected in recently published data from eastern Australia, where *Bartonella* DNA was identified by PCR in 16.2% of 111 cats (Barrs *et al,* 2010). Seroprevalence tends to occur at approximately twice the rate of bacteraemia in a population (Brunt *et al,* 2006). Given this information, we expected seroprevalence to be approximately 20–40% in our study population. The lower than expected seroprevalence may be a result of more effective and widespread flea control in recent years, or a colder than expected winter in 2009, reducing the exposure of cats less than 12 months of age to infected flea vectors.

Samples have been sent to Colorado State University for PCR, ELISA (enzyme-linked immunosorbent assay) and Western blot analysis, and we are currently awaiting results, which will be published in due course. PCR analysis should enable us to define the prevalence of

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bacteraemia in our study population, and to assess the correlation of bacteraemia with serological status.

Recommendations to NZ practitioners

Prevention of human infection

Our results, and those of other surveys, have provided evidence that *B. henselae* exists at moderate prevalence in the North Island, and is likely to be widespread in New Zealand cats. Its ubiquitous nature in cat populations and the fact that cats are silent hosts makes *B. henselae* an occupational risk to veterinarians and veterinary nurses in this country. As part of a health and safety programme, staff should be educated about the risks of zoonoses such as *Bartonella* infection. People working with cats should take precautions against infection with this zoonosis by avoiding flea bites, contact of wounds with flea faeces, bites and scratches from feline patients and needle stick injuries from needles used on cats (Breitschwerdt *et al,* 2010). The human illness known as Parinaud's oculoglandular syndrome is thought to occur from contact of flea faeces with the conjunctiva (Cunningham Jr and Koehler, 2000), so hands should be washed after handling cats and before touching the face. The organism is capable of surviving in flea faeces for up to nine days (Higgins *et al,* 1996). Cat associated wounds of people should be thoroughly washed with soap and water (Brunt *et al,* 2006).

Veterinarians have an important role in educating pet owners about the risk of CSD. The role of fleas in the epidemiology of *Bartonella* is another reason for promoting the need for excellent flea control in pets, particularly those owned by the elderly or the immunocompromised. Bradbury and Lappin (2010) demonstrated that monthly administration of a topical product containing imidacloprid and moxidectin prevented the transmission of *B. henselae* to study cats, compared with untreated controls.

Infection in cats

In cats, *B. henselae* tends to cause a chronic fluctuating bacteraemia, which may persist for months to years (Kordick and Breitschwerdt, 1997), probably due to its endotheliotropic nature and the predominantly cell-mediated immune response, which is ineffective at completely clearing infection (Breitschwerdt *et al,* 2010). Although cats usually carry the infection asymptomatically, cases of endocarditis have been recorded with *Bartonella* being isolated from the heart valves (Chomel *et al,* 2003) and/or the blood (Perez *et al,* 2010). The organism has also been linked with pyrexia, uveitis, gingivostomatitis and neurologic disease (O'Reilly *et al,* 1999; Lappin *et al,* 2000; Leibovitz *et al,* 2008; Sykes *et al,* in press), although some studies have found no evidence of a causal link with these disorders (Pearce *et al,* 2006; Fontenelle *et al,* 2008; Quimby *et al,* 2008; Lappin *et al,* 2009). Factors causing immune suppression in cats, such as concurrent infection with FIV or FeLV, old age and immunosuppressive drug treatment, may increase the risk that a *Bartonella* infection will cause clinical disease (Ueno *et al,* 1996; Breitschwerdt *et al,* 2010). Transient clinical signs such as fever may occur in infected cats following stress, for example after surgery (Breitschwerdt *et al,* 2010).

Diagnosis of current infection is problematic. Cats with a current infection are usually positive on both serology and PCR or culture, but occasionally a PCR positive cat may be serologically negative (Lappin *et al,* 2009). A negative PCR is not an assurance that infection is cleared, as bacteraemia tends to relapse (Kordick *et al,* 1999). A positive PCR and serology does not mean a cat's illness can be attributed to *Bartonella*, as most cases are asymptomatic, and concurrent infection with other viral and bacterial pathogens can occur. However, Breitschwerdt *et al* (2010) recommend that cats with chronic granulomatous or lymphocytic/lymphoplasmocytic inflammation, demonstrable bacteraemia and positive serological status be considered for antimicrobial treatment. Testing healthy cats is not recommended, because of the difficulty in interpreting results (Brunt *et al,* 2006). Healthy cats with bacteraemia probably should not be treated, to avoid unnecessary antibiotic use and because of the high prevalence of the carrier state (Breitschwerdt *et al,* 2010).

Cats can become infected through blood transfusion. Cats receiving experimental transfusions from infected donors developed fever, lymphadenopathy and inflammatory histological changes in tissues (Kordick *et al,* 1999). *Bartonella* infection must be considered as a differential in the case of febrile illness following a blood transfusion.

Antibiotics suitable for treating known or suspected *Bartonella* infection include doxycycline (10 mg/kg PO bid) and amoxicillin-clavulanic acid (22 mg/kg PO bid). If a response is seen after seven days, the antibiotic should be continued for at least a week following resolution of clinical signs (Brunt *et al,* 2006). If there is no response, azithromycin (10 mg/kg PO sid 7d followed by 10mg/kg PO eod) should be effective, but is not a first-line choice in animals because of its usefulness as a human antibiotic and the risk of inducing antibiotic resistance. A long duration of therapy (4–6 weeks) may be necessary to clear the infection (Breitschwerdt *et al,* 2010).

Conclusion

Our survey has shown that *Bartonella henselae* exists at moderate prevalence in cats in our study population, and evidence from other studies suggests prevalence is likely to be higher in areas north of Hamilton. *Bartonella* infection is a differential diagnosis to be considered in cases of inflammatory disease in cats, and may warrant antimicrobial treatment. Veterinarians need to be aware of the risk that this disease poses as a zoonosis to cat owners, and promote precautions such as flea control and desexing to prevent roaming, thereby minimising infection of pet cats. Occupational exposure in veterinary clinics can also be reduced by educating staff on the methods of transmission of this potential zoonosis.

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