

Bartonella defies Koch's postulates

Pedro P. Diniz

College of Veterinary Medicine, Western University of Health Sciences,
Pomona, California, USA

In the last two decades, the scientific community has significantly expanded the understanding about arthropod-borne bacteria and their relationship with animals and humans. During this time, the genus *Bartonella* has had one of the largest expansions in the number of zoonotic species among all known bacteria. Nowadays, there are over 50 species, subspecies or *candidatus* species of *Bartonella* spp., detected from terrestrial mammals, marine mammals and even from sea turtles. Among these, at least 15 species can infect humans, at least 11 species infecting dogs, and at least six species capable of infecting cats. When a non-adapted species of *Bartonella* infects an accidental host, clinical manifestation is commonly seen, ranging from mild illness to life-threatening endocarditis and neurological signs. This ubiquitous distribution of *Bartonella* spp. among different hosts is based on the bacteria's ability to be transmitted by multiple blood-sucking arthropods (fleas, ticks, lice, sand flies, etc.) and to adapt to one or more mammalian reservoir hosts, causing long-lasting, relapsing, intra-erythrocytic bacteria. This "stealth" approach to pathogenesis makes the diagnosis of *Bartonella* infection in humans and animals very challenging. In addition, *Bartonella* infection does not follow all Koch's postulates, because isolation in pure culture is very challenging and time consuming, because experimental infection studies cannot adequately reproduce natural disease and because the organism is present in a significant number of subjects not demonstrating clinical signs at the time of sample collection. *Bartonella* spp. exemplifies the importance of One Health because in order to elucidate the microbiological, pathophysiological and medical importance of bartonellosis, collaboration among ecologists, environmentalists, microbiologists, geneticists, physicians, vector biologists and veterinarians is necessary.

Keywords: Bartonella, Type 4 secretion system, antigenic variation, stealth pathogen, endocarditis