RESEARCH PROGRESS REPORT SUMMARY

Grant 02287: Enhanced Testing for the Diagnosis of Bartonellosis in Dogs

Principal Investigator: Edward Breitschwerdt, DVM

Research Institution: North Carolina State University

Grant Amount: $103,013.00

Start Date: 8/1/2016 **End Date:** 12/31/2018

Progress Report: FINAL

Report Due: 12/31/2018 **Report Received:** 1/31/2019

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Original Project Description:

Bartonellosis, a zoonotic bacterial disease of worldwide distribution, is caused by approximately 10 different *Bartonella* species. *Bartonella* are transmitted to canines and humans by ticks, fleas, lice, mites, and sand flies. Dr. Breitschwerdt's laboratory demonstrated the first evidence for *Bartonella* infections in dogs in 1993. Bartonella species have been associated with an expanding spectrum of important disease manifestations including anemia, endocarditis, hepatitis, lymphadenitis, myocarditis, thrombocytopenia and vascular tumor-like lesions. Infections can be life-threatening. Due to a lack of sensitive and reliable diagnostic assays, definitive diagnosis of bartonellosis in dogs remains a significant problem. Because these bacteria invade cells and infect tissues throughout the body, this chronic intracellular infection is difficult to cure with currently used antibiotic regimens. This study will develop improved serodiagnostic tests for bartonellosis in dogs. These assays can also be used for world-wide sero-epidemiological prevalence studies, and to establish early and accurate diagnosis. Dr. Breitschwerdt's research group has described concurrent infection in dogs, their owners and veterinary workers; this allows for a One Health approach to this important emerging infectious disease.

Publications:

Balakrishnan N, Sevala S, Lappin ML and Breitschwerdt EB. Evaluation of *Bartonella henselae* Western Immunoblotting for canine bartonellosis. Manuscript in preparation.

Neupane, P., Hegarty, B. C., Marr, H. S., Maggi, R. G., Birkenheuer, A. J., & Breitschwerdt, E. B. (2018). Evaluation of cell culture-grown Bartonella antigens in immunofluorescent antibody assays for the serological diagnosis of bartonellosis in dogs. *Journal of Veterinary Internal Medicine.* 32(6), 1958-1964. https://doi.org/10.1111/jvim.15301

Presentations:

Neupane P, Hegarty BC, Marr H, Maggi RG, Breitschwerdt EB. Evaluation of Eight *Bartonella spp.* Indirect Immunofluorescent Assays for the Serological Diagnosis of Bartonellosis in Dogs. NCSU-CVM Research Forum, September 2017

Report to Grant Sponsor from Investigator:

This AKC-CHF funded research has resulted in substantial refinement of our *Bartonella* serodiagnostic testing knowledge of healthy dogs (pets, working dogs and potential blood donors) and sick dogs being evaluated for a differential diagnosis of Bartonellosis. Based upon testing and comparing results using eight different *Bartonella* species or strains, we were able to identify two species that when used in combination should increase serodiagnostic sensitivity compared to the three strains that we have used diagnostically for the past decade. As these are not the two species currently in use diagnostically, our historical testing most likely underestimated the prevalence of *Bartonella* antibodies in seroepidemiological studies published by our research group and more importantly failed to report positive *Bartonella spp*. serological results that could be used to guide therapy in a sick dog. In both our research and diagnostic laboratory testing, we have always adhered to the adage: The kindest form of therapy is an accurate diagnosis. This study also allowed us to begin to assess the utility of another serodiagnostic technique called Western immunoblotting for assessment of a dog's exposure to a *Bartonella* spp. WB interpretation can be challenging and this study has allowed us to compare IFA and WB sensitivities and to define minimal criteria for reporting a "positive" WB. Our efforts to date have identified individual and potential combinations of small *Bartonella* proteins (peptides) that appear to have diagnostic utility as an inhouse rapid assay that could be used by veterinarians to rapidly determine if a dog has been exposed to a *Bartonella spp.* We are currently purifying individual proteins and assessing other peptide combinations in an effort to define an assay with optimal sensitivity and specificity. This brief paragraph does not do justice to the numerous hours of research effort that was made possible because of the research funding support from the American Kennel Club Canine Health Foundation or the dogs and their owners who will ultimate benefit from these findings, as we improve serodiagnosis of bartonellosis.