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Short Communication

Bartonella Carriage Must be Included in Blacklegged Deer Tick (*Ixodes scapularis*) Tick Pathogen Carriage Studies

Robert-A Ollar*

Clinical Assistant Professor of Neurology, Department of Neurology, New York Medical College, Valhalla, New York, USA

***Corresponding Author:** Robert-A Ollar, Clinical Assistant Professor of Neurology, Department of Neurology, New York Medical College, Valhalla, New York, USA.

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Quotation: "This Pike County Survey marks an important milestone as it is the first time in the Commonwealth of Pennsylvania that *Bartonella* has been included in a statistically valid sample sized (988 ticks tested) study".

It is important to understand that tick bites are often multi-pathogenic events beyond just Lyme disease. It is therefore important to always keep in mind that Lyme disease is not a synonym for all infections associated with the bite of a tick. This is why it is extremely important if possible to have a tick associated with the bite tested for specific pathogen carriage.

Pathogen carriage surveys in a specific local such as county or state play an important role in providing local physicians with vital information as to the kinds of tick borne infections that they will potentially have to deal with among tick bite victims in their area.

Thus in 2018 the Pike County Commissioners engaged the East Stroudsburg University, Jane Huffman Wildlife Genetics Institute, to study pathogen carriage in *Ixodes scapularis* ticks at selected sites throughout Pike County, Pennsylvania. This survey spanned 2018 to 2019 [1,2].

In the Pike County Survey, one hundred *Ixodes scapularis* ticks were collected from ten collection zones. This study included the borough of Milford PA. Collection sites were selected on the basis of use by community members and on the presence of tick favorable habitats. These tick favorable habitat sites were located in: a) state parks, b) state game lands, c) township buildings, d) schools, e) township parks, f) communities and g) hiking trails [1,2].

The Pike County Survey collected a total of 1000 *Ixodes scapularis* ticks. These ticks were tested for the carriage of seven specific pathogens found in Pennsylvania namely: a) Lyme Disease, b) Bartonellosis, c) Anaplasmosis, c) Mycoplasmosis, d) Babesiosis, e) *B. miyamotoi* and d) Powassan virus [1].

It was discovered that of the 988 *Ixodes scapularis* ticks that were tested, 123 ticks were found to contain more than one tick borne pathogen [1].

The occurrence of the aforementioned pathogens in the Pike County Survey were: Lyme Disease (38.9%), b) Bartonellosis (18.9%), c) Anaplasmosis (13.8%), d) Mycoplasmosis (3.4%), e) Babesiosis (5.3%), f) *B. miyamotoi* and g) Powassan virus (1.7%) [1].

Bartonella a tick borne pathogen

Pathogens belonging to the genus *Bartonella* cause the pathogenic condition known as Bartonellosis [3]. This disease has been mainly linked to fleas and lice [3].

In the past it was thought that a cat infected with *B. henselae* transmitted this pathogen to humans via cat scratch or cat bite [3]. Cats caught the disease from the droppings or bite of cat fleas. The cat thus served as the reservoir host and according to that concept, humans did not directly contract the disease from cat fleas [3].

By the end of the 1990's further investigations had found that *B. henselae* was a tick borne pathogen that was often found to be a co-infecting organisms alongside of Lyme Disease [4]. Thus, Bartonellosis is now considered to be an emerging tick-borne pathogen present in *Ixodes scapularis* ticks [3,4]. Recent investigations have revealed that there occurs a tick to mouse transmission [3].

Bartonella symptoms can go from mild to severe, and the onset of symptoms will commence from a period of 5 to 14 days [3]. Bartonellosis is frequently associated with fever, headaches, fatigue, poor appetite, muscle pain and swollen glands around the head, neck and arms [3]. More specific symptoms involve enlarged lymph nodes, a papule or pustule at the inoculation site, severe muscle pain, hepatosplenic infection, and osteomyelitis [3]. *Bartonella* can also cause severe neurological ramifications such as meningitis, seizures, brain fog, ophthalmological manifestations and encephalitis [3].

Bartonellosis infection manifests in two specific phases, namely, a) bacteria invading the erythrocytes during the acute phase and b) bacterial invasion of the endothelial cells in the chronic phase [3].

The Pike County Pennsylvania Tick Borne Pathogen carriage survey has revealed that among the 988 ticks surveyed 18.9% of the ticks carried *Bartonella* pathogens [1]. The presence of the *Bartonella* pathogen ranked in second place when compared to the pathogen carriage of the Lyme disease pathogen which was found in 38.9% of the 988 ticks surveyed [1].

The present Pike County Survey marks an important milestone because it is the first study in the Commonwealth of Pennsylvania that also included *Bartonella* among the important tick borne pathogens carried by *Ixodes scapularis* known to cause serious pathological consequences in human victims of tick bite. The Pike County Study marked another first in that is the first county based study to utilize a statistically valid sample size (988 ticks tested) study.

Thus, given the known fact that *Ixodes scapularis* ticks in North America do carry *Bartonella* and the severe medical ramifications of *Bartonella* infections, it is absolutely crucial for all future tick borne pathogen carriage surveys to include *Bartonella* in such studies.

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