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## Skeleton found in a Rhode Island cave, Possibility of Lyme Disease

Tooba Ghafoor

### ABSTRACT

A skeleton of a member of the Wampanoag tribe was recently found in a cave near the eastern shore of Narragansett Bay, Rhode Island. Examination of the skeleton revealed the individual was most likely a male in his late 40s. Six *Amblyomma americanum* and nine *Ixodes scapularis* ticks were found in the fur cloth of the individual. These ticks, as well as abnormalities of the skeleton, including a missing arm and broken rib, raise the possibility of the individual suffering and dying from Lyme disease. Carbon-14 dated the remains and ticks to the year 1600.

### INTRODUCTION

A skeleton belonging to a member of the Wampanoag tribe was recently found in a cave near the shores of Rhode Island. The Wampanoag were a native American tribe that inhabited the area from Narragansett Bay to Cape Cod in the northeastern United States until the arrival of Europeans in the mid-1500s led to the decline of the tribe (DeKeyser 2005). By 1677 the population had dwindled down from over 12,000 to less than 400 members of the tribe due to disease and warring with the Europeans (Dulik et al., 2012, Cray 2009).

Diseases affecting the Wampanoag are of interest in this study, particularly tick-borne illnesses, since the deer tick, *Ixodes scapularis*, and the Lone Star Tick, *Amblyomma americanum*, were found on the fur cloth of the human. *I. scapularis* is a known carrier for the Lyme disease spirochete *Borrelia burgdorferi* (Esposito et al. 2013). *Amblyomma americanum* is known to carry *Rickettsia rickettsii*, which can cause Rocky Mountain Spotted Fever (RMSF),

and *Ehrlichia chaffeensis*, which causes Human monocytic ehrlichiosis (Goodard and Varela 2009).

Lyme disease is a multi-systematic tick-borne illness. Its early symptoms include the “bull’s-eye” rash erythema migrans, as well as flu-like symptoms including fever and lymph node swelling. Later symptoms are more severe, such as neurological problems, including aseptic meningitis and facial palsy, long-term joint pain and skin rash, as well as cognitive problems (Jensenius et al. 2006). RMSF is more common in children than adults, and initial symptoms include fever, nausea, and rash (Buckingham et al 2007). Later symptoms are more severe, such as vasculitis, an inflammation of the blood vessels, cardiac arrhythmia, confusion, coma, and others. Death can occur in as early as eight days if left untreated (Weinberg 2007). Lyme disease appears to have been present in North America many thousands of years before European settlement, having originated and radiated from the northeast United States (Hoen et al. 2009). The Wampanoag were at more risk for exposure to the Lyme disease and RMSF spirochete due to the abundance of animals, such as white-tailed deer, that are host to the deer tick and lone star tick (Esposito et al 2013).

In this study, the skeleton and ticks were analyzed to determine the health of the individual, as well as the age, gender, and possible cause of death of the human whose remains were found.

## METHODS

The skeleton was examined and measured to determine age, gender, and possible health conditions. The age was determined by examining the ossification of the bones, particularly in the skull and clavicle. For the gender, two measurements were taken: the pelvic ratio and the subpubic angle. The overall health of the individual was evident through the skeleton by

examining the joints for lesions or arthritis, and any broken bones. Ten samples from the human remains, lone star ticks, and deer ticks were used in carbon-14 dating to determine the age of the material, and two-tailed t-tests were used to test for differences in ages between the human remains and tick samples.

## RESULTS AND DISCUSSION

The individual's clavicle was fused completely at the center of his chest, which happens between the ages of twenty-four and thirty years old, and the cranial sutures were almost fully closed up. The ossification of the clavicle indicates that the individual was an definitely at least in his mid-twenties, and the closed cranial sutures indicate the individual was most likely in his late 40s, due to the fact that this fusing of the skull does not happen until middle age (Libal 2006). The pubic angle was measured to be 60°, and the pubic ratio was 0.8, which indicates the remains were that of a male. All of the teeth were present and whole. The individual had one broken rib and was missing an arm.

From the carbon-14 dating, the skeletal remains and ticks were found to be 413 years old, so the individual lived to about the year 1600. The age of the skeletal remains did not vary from those of the ticks (Table 1).

The missing arm, broken rib and slight erosion of the pelvic bone could have happened post-mortem. The erosion of the pelvic bone could be due to rheumatoid arthritis or a similar condition.

The presence of the ticks does not rule out that the human suffered, and perhaps died from, a tick borne disease. The complaints of the people of that time include rashes, shooting pain, fever, joint aches, and malaise. These symptoms can be attributed to many diseases, but are also symptoms of Lyme disease or Rocky Mountain spotted fever. Modern medicine

involves using antibiotics to treat these diseases, but if they are left untreated they can be fatal (Weinberg 2007).

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Table 1. Summary (mean  $\pm$  standard deviation, all n=10) of carbon-14 samples taken from skeletal remains and ticks. Provided are two-tailed t-statistics and probability from comparisons to the skeletal remains.

Remain type	$\bar{x} \pm SE(\text{all } n = 10)$	t	P
Skeleton	413.2 $\pm$ 2.5		
Dear Tick	413.0 $\pm$ 3.4	0.047	0.963
Lone Star Tick	412.4 $\pm$ 2.9	0.209	0.837