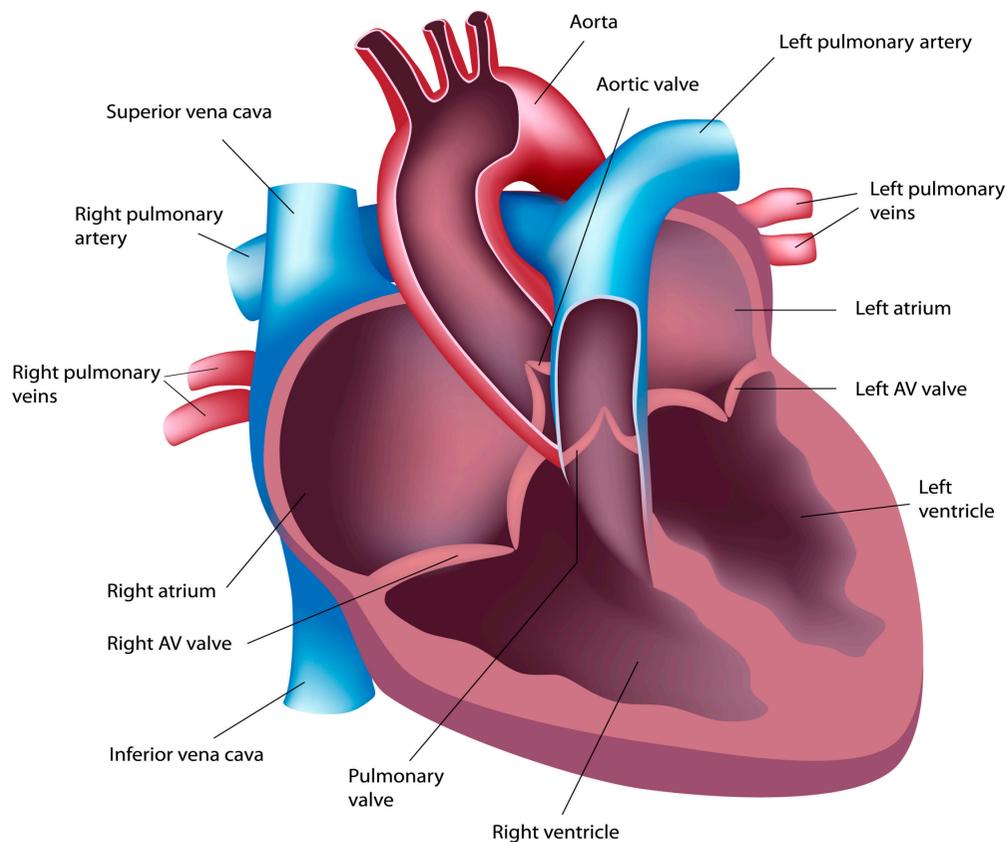


# Cardiac Manifestations of Tick-Borne Diseases©

## Internal Anatomy of the Heart



### Lyme disease, *Borrelia burgdorferi* (Bb)

- Can directly attack heart and endothelial cells (which line blood vessels).
- Infection can involve the collagen-containing tissues that make up heart valves and surround blood vessels.
- Can affect blood vessels of all sizes, causing vasculitis.
- Endocrine imbalances and altered nerve function can disrupt normal function of heart and blood vessels, resulting in excessive constriction or dilatation of blood vessels and changes in pulse and blood pressure.

**Carditis:** the general term for any inflammation of the heart. Lyme disease can affect any layer of the heart, from the interior to the exterior lining.

**Pancarditis:** term used when all layers are involved.

The following list describes functional problems and symptoms associated with cardiac involvement in Lyme disease.

- Dysrhythmias:** result from inflammation of the electrical conduction system, producing:
  - Abnormal rhythms, including heart rates that are too fast or too slow.
  - AV block of varying degrees, due to inflammation of atrioventricular node.
  - 3rd degree, or complete heart block is the most severe and can result in sudden death or the need for a temporary pacemaker.
  - SA node dysfunction. The sinoatrial node is the normal cardiac "pacemaker;" failure to fire can lead to -
    - Atrial fibrillation and sinus pauses produce irregular heart rates.
  - Medications used to treat Lyme can also affect the conduction system.
  - Common symptoms: Palpitations, lightheadedness, syncope (fainting), chest pain, shortness of breath, trouble breathing (dyspnea).

### II. Myocarditis - inflammation of the heart muscle (myocardium).

- Can be acute or chronic; severity varies.
- Can result in a dilated cardiomyopathy (enlarged heart with thinned heart muscle).
- Can affect all age groups, including children.
- Myocardial dysfunction reduces the ability to pump blood.
- Common symptoms are those of heart failure and may be subtle early on.
- Symptoms include: fatigue, rapid or irregular heartbeats, shortness of breath at rest or during physical activity, fatigue.
- Some patients may have fever.
- Chronic.

### III. Endocarditis - inflammation of the valves and/or inner lining of the heart chambers.

- Can cause severe and permanent damage to natural valves, and potentially, prosthetic ones.
- Can lead to a new heart murmur or a change in an existing one.
- Damage to valves can lead to heart failure and death.
- Damaged valves more susceptible to recurrent infections.
- Initial symptoms may include: fever, weakness, fatigue, weight loss, arthralgia and night sweats.
- Symptoms can last for weeks.

### IV. Pericarditis - inflammation of the outer, sac-like covering of the heart (pericardium).

- Results in inflammatory fluid (effusion) filling the space between the pericardial layers.
- Excessive effusions prevent heart from filling properly, causing cardiac tamponade.
- Rubbing of inflamed layers produces symptoms.
- Primary symptom is pain, especially a stabbing pain related to taking a deep breath, coughing and movement. Many feel worse when lying flat.
- Can be associated with low-grade fever.

## Tick-Borne Diseases Known to Cause Cardiac Health Issues

### Lyme disease

Lyme is a Multi-Systemic disease caused by the bacteria *Borrelia burgdorferi* (Bb). There are a multitude of symptoms associated with the illness.

Lyme disease is usually transmitted by the bite of the blacklegged tick; also known as the deer tick (*Ixodes scapularis*) and western blacklegged tick (*Ixodes pacificus*). Lyme disease may also be transmitted in utero, from a mother to her unborn baby.

Although transfusion transmitted Lyme disease has not been demonstrated, according to a study published in *Transfusion*, "B. burgdorferi may survive storage under blood banking conditions and that transfusion-related Lyme disease is theoretically possible." *Transfusion*, 1990 May; 30(4):298-301.

"Individuals being treated for Lyme disease with an antibiotic should not donate blood." CDC web site: "What you need to know about Lyme carditis."

**General Early Signs & Symptoms:** tick bite (Not all patients recall a bite), headache, extreme fatigue, EM rash and/or other rashes, Bull's Eye rash that is found in less than 50% of patients. Fever & flu like symptoms, such as, fever, headache, muscle aches, pain & swelling. Malar flush, TMJ/jaw pain, neck & back pain, joint pain & swelling, bone pain. (To see the full list of symptoms go to [www.LymeDiseaseAssociation.org](http://www.LymeDiseaseAssociation.org))

**Symptoms related to Cardiac/Pulmonary:** Chest pain or rib soreness, shortness of breath, heart palpitations, pulse skips, heart block, heart murmur or valve prolapse.

Based on national surveillance data from 2001-2010, Lyme carditis occurs in approximately 1% of Lyme disease cases reported to CDC. Also, "Carditis has been reported in approximately 4-10% in surveillance studies of untreated adults with Lyme disease in the U.S." *N. Am J Med Sci*. 2012 December

Over 300,000 people in the USA will contract Lyme disease each year. Approximately 3,000 a year will develop Lyme carditis.

According to the CDC between 1985 - 2013 seven deaths have been reported worldwide, as a result of Lyme carditis. (See Warthin-Starry stain slide below.) CDC web site: "What you need to know about Lyme carditis."

### Q fever

Q fever is caused by the bacterial pathogen, *Coxiella burnetii* (Cb).

Disease can be tick-borne, but most cases result from inhaling Cb-containing dust. Cattle, sheep and goats are the primary reservoirs.

Symptoms include high fevers up to 105°F, severe headache, malaise, myalgia, chills and/or sweats, cough, nausea, vomiting, diarrhea, abdominal pain, chest pain.

Acute symptoms include hepatitis and pneumonia or chronic endocarditis. IFA titers are used for diagnosis. Usually treated with doxycycline.

Ticks that transmit Q fever include; *Amblyomma americanum* (lone star tick) and *Dermacentor andersoni* (Rocky Mountain wood tick). Multiple infections may be transmitted from the bite of the same tick.

According to the CDC, endocarditis is the major form of chronic Q fever disease comprising 60-70% of all reported cases. The estimated case fatality rate in untreated patients with Q fever endocarditis is 25-60%. CDC web site: "Q-fever -Symptoms, Diagnosis, and Treatment."



Spirochetes in heart tissue. Image taken using Warthin-Starry stain of cardiac tissue at 158X magnification demonstrating *Borrelia burgdorferi* (Bb) spirochete (arrow).

In one of three patients whose death was associated with Lyme carditis.

United States, 2013.

Image to left, courtesy of CDC.

"Pathologists and medical examiners should be aware that Lyme carditis can cause sudden cardiac death. Health-care providers should ask patients with suspected Lyme disease about cardiac symptoms, and conversely, ask patients with acute, unexplained cardiac symptoms about possible tick exposure and symptoms of Lyme disease. Clinicians should encourage all patients to practice tick bite prevention strategies." CDC 2013.

### Q fever, *Coxiella burnetii* (Cb)

#### A. Q fever may be acute or chronic.

- A serious complication of chronic Q fever is endocarditis & this can be especially problematic for those with pre-existing valve problems.

#### B. Endocarditis:

- Infection of the innerlining of your heart (endocardium).
- This condition can be fatal.
- It can cause severe permanent valve damage.
- Can lead to heart failure.
- Prosthetic valves are susceptible.
- Initial symptoms may include: fever, weakness, fatigue, weight loss, arthralgia & night sweats.\*

- Sometimes the symptoms can last for weeks.\*
- May resolve & can recur.\*
- A new heart murmur or existing heart murmur.\*
- Signs & symptoms of Q fever are similar to those of other TBDs & may be misidentified.
- Patients may have more than one TBD at the same time as Q fever.
- Only half those infected with *Coxiella burnetii* (Cb) ever show signs of infection. (CDC web site.)
- Valve replacement may be necessary if symptoms do not resolve with treatment.
- Patients with other chronic illness or transplants are at greater risk of developing chronic Q fever.

\* National Institutes of Health.

## Tick Vectors — LDA's "Lymer Primer"™



### *Ixodes scapularis* (deer tick or blacklegged tick)

Found in Northeast & Upper Midwest

Transmits agents of: Lyme, babesiosis, anaplasmosis (aka human granulocytic ehrlichiosis), Powassan encephalitis, tick paralysis, tularemia, bartonellosis, ehrlichiosis (due to *Ehrlichia muris*-like). *Ixodes scapularis* have been shown to carry Ehrlichiosis (HME), but to date, transmission is still in question.

Image: Nymph - Adult Male - Adult Female.



### *Amblyomma americanum* (lone star tick)

Found throughout the United States

Transmits agents of: human monocytic ehrlichiosis, Heartland (Phlebovirus), STARI (Southern Tick-Associated Rash Illness), tularemia, tick paralysis, Q fever. NOTE: Bite may cause allergy to meat (immune response to alpha gal). Image: Nymph - Adult Male - Adult Female.



### *Dermacentor andersoni* (Rocky Mountain wood tick)

Found in Rocky Mountain States and Southwest Canada

Transmits agents of: Rocky Mountain spotted fever, tularemia, Colorado tick fever, tick paralysis, Q fever. Looks similar to American dog tick.

Image: Male - Female. Image courtesy of CDC.



### *Ixodes pacificus* (western blacklegged tick)

Found in West

Transmits agents of: Lyme, babesiosis, anaplasmosis, (aka human granulocytic ehrlichiosis), bartonellosis. *Ixodes pacificus* has been shown to carry ehrlichiosis (HME), but to date, transmission is still in question.

Image: Larvae - Nymph - Adult Male - Adult Female.

## Cardiac Manifestations of Tick-Borne Diseases © Lyme Disease Association, Inc. 2015, 2016.

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- National Institutes of Health (NIH)

This document provides practical and useful information on the subject matters covered. It is distributed with the understanding that LDA is not engaged in rendering medical or other professional services. Seek professional services if necessary. Do not alter this document in any way.

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