



Review

Manifestations of Lyme carditis



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ABSTRACT

The first data of Lyme carditis, a relatively rare manifestation of Lyme disease, were published in eighties of the last century. Clinical manifestations include syncope, light-headedness, fainting, shortness of breath, palpitations, and/or chest pain. Atrioventricular (AV) electrical block of varying severity presents the most common conduction disorder in Lyme carditis. Although is usually mild, AV block can fluctuates rapidly and progress from a prolonged P-R interval to a His-Purkinje block within minutes to hours and days. Rarely, Lyme disease may be the cause of endocarditis, while some studies and reports, based on serological and/or molecular investigations, have suggested possible influence of *Borrelia burgdorferi* on degenerative cardiac valvular disease. Myocarditis, pericarditis, pancarditis, dilated cardiomyopathy, and heart failure have also been described as possible manifestations of Lyme carditis. The clinical course of Lyme carditis is generally mild, short term, and in most cases, completely reversible after adequate antibiotic treatment.

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1. Introduction

Lyme borreliosis is the most prevalent tick-borne disease in the United States and Europe [1]. It is also reported in Middle-East, South-East Asia and former Soviet Union [2], while in Australia locally acquired Lyme disease is not established [3]. In the USA, a total of 251,720 confirmed cases of Lyme borreliosis were notified from 2000 to 2010 in the 50 states [4]. Based on data obtained in 2014 from Center for Disease Control, the incidence rate of the disease in the country was 7.9 confirmed cases per 100,000 population, with a total number of 25,359 confirmed, and 8102 probable cases [5]. The incidence is significantly greater in highly endemic regions (~0.5 cases per 1000 persons per year) with predominance among children ages 5 to 10 years [6]. In Europe, Lyme borreliosis is distributed from southern Scandinavia to some parts of northern Mediterranean countries [7], whereas the most prevalent regions are Central and Eastern Europe [8]. It is estimated that the average number of reported patients with Lyme disease in Europe is >65.400 per year. Epidemiological studies have showed the

highest incidence rates of the disease in Slovenia, Germany, Austria, the Baltic coastline of southern Sweden, and some Estonian and Finnish islands [9]. On the other hand, the lowest incidence rates have been notified in the UK and Ireland [10].

Lyme carditis, first time reported in 1980, represents a relatively rare manifestation of Lyme disease [10]. It is estimated that cardiac involvement occurs in 0.3–4% of *Borrelia burgdorferi*-infected adults in Europe and in 1.5–10% in the United States without an appropriate antibiotic treatment [11]. Besides, the distribution of cases by sex has showed predominance among males with an approximate 3:1 male:female ratio. On the other hand, there are insufficient data on the prevalence of Lyme carditis among pediatric population [11,12].

Lyme carditis usually occurs between June and December, in the range of few days to several months after infecting tick bite or appearance of erythema migrans [13]. The clinical presentation is unspecific, consistent with wide spectrum of cardiac disorders, and usually includes syncope, light-headedness, fainting, shortness of breath, palpitations, and/or chest pain [14]. Based on the literature data, Lyme carditis is frequently associated with skin rash, neurological symptoms or arthritis, while in some cases represents the only manifestation of Lyme borreliosis [12]. Also, a large number of patients may be clinically asymptomatic making diagnosis difficult [11]. The clinical course is generally

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mild, short term, and in most cases, completely reversible after adequate antibiotic treatment [15,16]. However, fatal outcomes have also been reported [12,13].

Until today, different manifestations of Lyme carditis, such as cardiac conduction abnormalities of varying degrees, endocarditis and degenerative cardiac valvular disease, myocarditis, myocardial infarction, coronary aneurisms, pericarditis, pancarditis, dilated cardiomyopathy, and congestive heart failure have been described (Fig. 1).

2. Cardiac conduction abnormalities

Atrioventricular (AV) electrical block of varying severity presents the most common conduction disorder in Lyme carditis. The exact pathophysiological mechanism is not fully elucidated, but it is considered that AV block occurs as a result of the host inflammatory response to the presence of bacteria in heart tissue [17,18]. Furthermore, based on the murine model, it has been shown that autoimmune responses due to molecular mimicry may also play important role. Actually, it is possible that cross-reactive IgM antibodies induced by initial exposure to *Borrelia burgdorferi* (*B. burgdorferi*) can react with self-components leading to autoimmune injury of cardiac tissue with consequently functional impairment [19]. Finally, it has been observed that there is a strong link between conduction disturbances, severity of myocardial inflammation, and the number of bacteria in heart tissues [11].

Previously conducted electrophysiological studies have shown that Lyme disease can affect different structures of the heart conduction system. Likewise, developed conduction block may be localized in individual structures of cardiac conduction tissue, may occur simultaneous in multiple locations, or diffuse, involving the entire conduction system. Heart block most commonly occurs in the atrioventricular node, which is considered to be the most vulnerable, but it should be pointed that the use of atropine is often not effective which excludes vagotonic effect of the disease. Although age-related structural and functional changes in AV node may be partially responsible, it is not fully

understood why manifestations of AV nodal dysfunction appear more often in adults than in children with Lyme carditis. Beside AV node, the origin of block may also be in the sinoatrial node, in atriums, within the bundle of His, bundle branches, and fascicles. Based on the literature data, supraventricular localization of heart block was established in 68% of patients, while in 32% diffuse extending to His-ventricular pathway was described. In addition, bundle branch block and intraventricular conduction delay were observed in 13% of patients with Lyme carditis [17,20–24].

Although is usually mild, AV block can fluctuates rapidly and progress from a prolonged P-R interval to a His-Purkinje block within minutes to hours and days [12,14,25]. Moreover, risk for this progression is much higher when PQ interval is above 300 ms in patients with first degree AV block [26]. The most severe form is third degree, or complete, AV block which is characterized by complete atrioventricular electrical dissociation between the atria and the ventricles. If not treated properly, third-degree AV block can cause fatal arrhythmias including ventricular tachycardia and ventricular fibrillation [18].

In some cases, AV block has been reported as the only manifestation of Lyme disease. It is possible that erythema migrans developed unnoticed or disappeared spontaneously in untreated patients before the onset of arrhythmia [21,27].

From the epidemiological point of view, AV conduction block is very rare manifestation of Lyme borreliosis with prevalence of approximately 1% among populations [18]. In study conducted by Steere et al., 20 patients with cardiac manifestations of Lyme disease were evaluated. Results of this study indicated that AV block was the most common abnormality presented even in 90% of patients. From them, in 44.4% (8 patients) complete AV block was developed [26]. According to van der Linde, from 105 published cases with Lyme carditis, 49% of patients had third-degree, 16% second-degree and 12% first-degree AV block [23]. In another study, Mc Alister and colleagues analyzed >52 reported cases of Lyme carditis and it was shown that 87% of all subjects were with AV conduction disturbances. Also, in 53% of subjects complete or

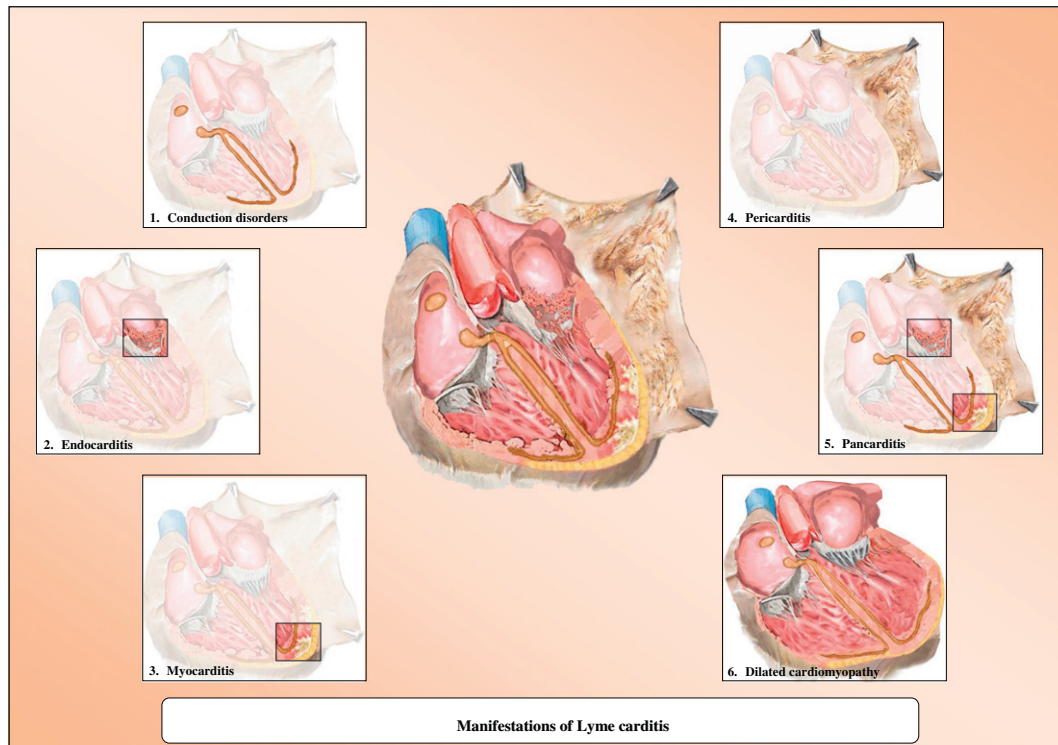


Fig. 1. Manifestations of Lyme carditis.

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