Case Report

A Case of Lyme Disease Complicated with Atrioventricular Block in a 13-year-old Boy

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Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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ABSTRACT

Lyme disease is a common vector-borne disease caused by *Borrelia burgdorferi*. Erythema migrans represents the most common manifestation during the early phase of this disease; however, systemic manifestations involving the nervous system, joints, or heart are known to occur. We report a case of Lyme disease accompanied by cardiac complications in a 13-year-old Korean male adolescent. The patient developed annular erythematous lesions on his lower extremities after a field trip during his visit to Connecticut, USA, for a boarding school camp, and his skin lesions were consistent with erythema migrans. Indirect immunofluorescence assay and Western blot analysis for Lyme immunoglobulin M showed positive results. Electrocardiography revealed a first-degree atrioventricular block, and he was diagnosed with Lyme carditis and received a 4-week course of oral doxycycline. Follow-up electrocardiography performed a week later revealed normal findings, and the patient showed an uneventful recovery. Lyme carditis often presents as an asymptomatic heart block that can progress to an advanced heart block; however, this condition is reversible with appropriate antibiotic treatment.

Keywords: Lyme disease; Lyme carditis; Atrioventricular block

INTRODUCTION

Lyme disease is caused by the spirochetes of the *Borrelia burgdorferi*, which is transmitted through the bite of infected ticks (deer tick or certain species of *Ixodes* ticks).¹⁾ *B. burgdorferi* sensu lato is a genetically diverse group of spirochetes composed of 20 different genospecies. Three genospecies, *Borrelia afzelii*, *Borrelia garinii*, and *B. burgdorferi* sensu stricto, are primarily known to be pathogenic for human.²⁾ Lyme disease is the most common tick-borne infection in North America, primarily from the Northeastern United States, and in countries with moderate climates in Eurasia.²⁾ Lyme disease in South Korea was first reported in 1993. Currently, it is a reportable disease to the Korea Centers for Disease Control and Prevention. Of 119 cases from 2011 to 2018, 70 cases (58.8%) were domestic, and 49 cases (41.2%) were imported. Nine cases were under 19 years of age, and 4 among them were autochthonous.³⁾

The most common clinical manifestation of Lyme disease is erythema migrans, often accompanied by malaise, fatigue, headache, arthralgia, myalgia, fever, and regional

lymphadenopathy. The pathogen can disseminate to involve a patient's skin, nervous system, joints, or heart.⁴⁾ The clinical manifestation is generally divided into 3 phases; early localized, early disseminated, and late manifestation. Lyme carditis can occur in the early disseminated stage, with transient atrioventricular (AV) block as the most common conduction disturbance.⁵⁾

We present a 13-year-old boy with a transient first degree AV block resulting from Lyme disease, the first pediatric clinical report in Korea. This case obtained waiver of informed consent and was approved by the Institutional Review Board at Seoul National University Hospital (IRB No. H-2003-063-110).

CASE

A 13-year-old Korean boy visited a clinic of Seoul National University Children's Hospital for annular, erythematous skin lesions on his lower extremities. He reported a travel history to Connecticut, USA, for summer boarding school camp and having field trips from 4 weeks to 1 week (June 27th to July 15th, 2016) before this visit. The patient had a tick bite at his right inguinal area, and developed a 4-day history of fever, headache, and bilateral knee joint pain 9 days before this visit. He returned to Korea due to these symptoms (**Fig. 1**).

He was afebrile at the visit but reported having a mild headache, and arthralgia for several days. The rash first developed 9 days before the visit on his right inguinal area and spread to his left thigh and right calf. Diameter of the rash was 2–3 cm initially but gradually expanded to 5–10 cm. The skin lesions were consistent with erythema migrans. The most characteristic

Fig. 1. The patient had a field trip at the Connecticut, the United States from June to July, 2016 when Lyme disease was prevalent in the area. The patient presented fever, rash, headache and bilateral knee joint pain during the field trip, so he came back to Korea for clinic visit. Doxycycline was started and symptoms were improved within a week after receiving doxycycline. After a week treatment with doxycycline, the first degree AV block on electrocardiogram was detected without developing any symptom. A follow-up electrocardiogram a week later was completely normal. Abbreviations: SNUCH, Seoul National University Children's Hospital; Ig, immunoglobulin; AV, atrioventricular.

Fig. 2. Erythema migrans on both lower extremities of the case; 3 on left thigh, 1 on right inguinal area, and 1 on right calf as pointed with arrows. The classic appearance of the circular rash with central clearing with 10 cm in diameter is shown on anterior part of left upper thigh.

erythema migrans presenting circular rash with central clearing was observed on the anterior part of the left upper thigh (**Fig. 2**). His heartbeats were regular without murmurs and no abnormalities were found in the respiratory or gastrointestinal system. He did not have facial palsy, signs of meningeal irritation, nor show abnormal neurologic signs. A complete blood count revealed a white blood cell count of 10,820/ μ L, with a differential of 66.2% neutrophils, 22.6% lymphocytes, and 8.6% monocytes. The hemoglobin was 14.0 g/dL and platelet count was 397,000/ μ L. C-reactive protein was 0.53 mg/dL. Serological testing for antibodies to *B. burgdorferi* was sent to the Korea National Institute of Health at the first visit, and treatment with doxycycline was initiated at the second visit under clinical diagnosis of Lyme disease while waiting for the test results.

Initial indirect immunofluorescence assay (IFA) result of the serum revealed immunoglobulin (Ig) M titer was 1:512. Western blot was positive for IgM, but negative for IgG. Follow-up serological test was done in 2 weeks which revealed IFA IgG titer was 1:1,024 and IgM titer was 1:512. Both IgG and IgM antibodies were positive for western blot this time.

Erythema migrans faded and headache improved in a week after starting the treatment. An electrocardiogram revealed a first degree AV block with PR interval prolonged to 264 ms at 1-week course of doxycycline (**Fig. 3**). He denied having any chest pain, palpitation, dyspnea, or lightheadedness. A follow-up electrocardiogram, 2 weeks after doxycycline treatment

Fig. 3. Electrocardiogram obtained at 1-week course of doxycycline demonstrating the first degree AV block with PR interval prolonged to 264 ms (A). A follow-up electrocardiogram showed normalized PR interval at 2-week treatment of doxycycline (B).
Abbreviations: AV, atrioventricular.

showed normal PR interval. He was treated with 4 weeks of doxycycline and recovered without any complications.

DISCUSSION

We report the first pediatric case of Lyme disease complicated with the AV block in Korea. The patient was infected abroad by tick bite at a field trip, and recovered without complications after the management with doxycycline.

Lyme disease is a tick-borne illness primarily caused by the bacterium *B. burgdorferi* in North America and *B. afzelii* or *B. garinii* in Europe and Asia.⁶⁾ *B. burgdorferi*, *B. afzelii*, *B. garinii* were isolated in Ixodes ticks inhabiting in Korea and autochthonous infection cases have been reported.^{7,8)} Early localized disease is characterized by erythema migrans at the site of a recent bite. In early disseminated disease, multiple erythema migrans lesions may occur, and systemic symptoms such as low-grade fever, arthralgia, myalgia, headache, and fatigue may be present. Other manifestations in this phase include cranial nerve palsies, aseptic meningitis, or carditis. Late Lyme disease can occur in a patient who was not treated at earlier stages and presents commonly as arthralgia involving large joint after several months.⁹⁾

Lyme carditis occurs in 4%–10% of adults with Lyme disease, more common among men, and pediatric cases are less common. The principal manifestation of Lyme carditis is self-limited conduction derangement, most frequently involving the AV node.¹⁰⁾ Most patients with conduction abnormalities are found to be in first degree heart block, and rapid progression between first degree, Mobitz 1 (Wenckebach), and the complete AV block have been reported to occur. Hospitalization and continuous monitoring are advisable for these patients as the degree of block may worsen rapidly or unpredictably. Clinical manifestations of Lyme carditis are often asymptomatic and nonspecific, although complete heart block could present with chest pain, palpitation, dyspnea, or syncope.¹¹⁾ Other cardiac manifestations of Lyme disease include myopericarditis and cardiomyopathy.

Erythema migrans is usually diagnosed by clinical history and characteristic clinical features. The sensitivity range of the serodiagnostic tests is between 20% and 50% during the first several weeks of infection. Recognition of characteristic clinical features along with the history of a tick bite will be critical for establishing diagnosis during the early period. Serodiagnosis is made by the detection of antibodies to *B. burgdorferi*, determined by IFA or enzyme-linked immunosorbent assay and western blot. Laboratory confirmation is helpful in the case with nonspecific manifestations.¹²⁾ The majority of patients with cardiac manifestations of Lyme disease are seropositive at the time of presentation because the likelihood of hematogenous spread is high.¹³⁾

For the early localized stage of Lyme disease, patients can be successfully treated with 10–21 days of doxycycline. Amoxicillin or cefuroxime can be used for patients under 8 years of age.^{13,14)} Patients with Lyme carditis could be treated with either doxycycline or ceftriaxone for 14–21 days and there was no evidence suggesting parenteral antibiotic therapy is more effective than oral antibiotic therapy.⁶⁾ With proper antibiotics, rapid resolution of advanced heart block occurred within 5 days of starting antibiotic therapy, and temporary pacing was rarely needed. There was no apparent benefit to steroid therapy.¹⁵⁾

The clinical spectrum of Lyme disease varies from a mild nonspecific febrile illness to severe multisystem disease. Detailed travel history, insect bite, and physical examination to detect characteristic clinical features are important for the diagnosis of Lyme disease. Obtaining an electrocardiogram should be considered in a child with acute disseminated Lyme disease because Lyme carditis often presents as asymptomatic first degree heart block which can progress to high grade heart block. It is important to treat children suspected of Lyme carditis with an early administration of adequate antibiotics.

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요약

라임병은 진드기를 매개로 하여 보렐리아속균 감염에 의해 발생하는 세균 질환이다. 가장 흔한 증상으로 초기에 유주성 홍반이 대부분의 환자에게서 관찰되며, 신경, 심혈관계 및 관절을 침범하는 증상이 발현할 수 있다. 저자들은 미국 코네티컷주로 여행력이 있는 13세 남자에게서 발현한 라임병을 진단하여 보고하는 바이다. 환자는 2016년 여름에 미국에서 숲 체험에 참여하던 중 발열, 두통, 양쪽 무릎 관절통을 호소하여 귀국하였으며, 내원 시 양 하지에 다수의 유주성 홍반이 관찰되었다. 심전도 검사에서 1도 방실 차단이 확인되었다. 간접면역형광항체법과 웨스턴블롯법 검사에서 라임병 특이 IgM 항체가 양성으로 확인되었다. 경구 doxycycline으로 4주간 치료하였으며, 유주성 홍반이 소실되고 심전도가 정상 소견으로 회복되었다. 라임병의 진단에 있어 호발 지역으로의 여행력을 확인하는 것이 중요하다. 라임병에 의한 심장염은 무증상 방실 전도차단으로 나타날 수 있고 고도 방실 차단으로 진행할 수 있어 주의를 요하며 적절한 항생제 치료를 통해 회복될 수 있다.