

## Intra-hisian 2:1 atrioventricular block secondary to Lyme disease

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**KEY WORDS:** Intra-hisian atrioventricular block, Lyme disease, ceftriaxone.

*We describe a case of Lyme carditis with intra-hisian 2:1 atrioventricular (AV) block documented by electrophysiological study. To our knowledge, only two cases of AV block at the level of the His bundle has been described in the literature. Sinus rhythm was restored after 4 days of i.v. ceftriaxone.*

### Introduction

Lyme disease is a tick-borne spirochetal infection, characterized by erythema chronicum migrans and an acute systemic illness. Neurological, cardiac and joint involvement may develop weeks to months later. Some manifestations may last for years or even decades<sup>[1]</sup>. Cardiac disturbances may rarely become permanent<sup>[2]</sup>. Lyme carditis is characterized by various degrees of atrioventricular (AV) block with or without syncope, which usually resolve within a few weeks. The level of block has been described as supra-hisian in most cases in whom an electrophysiological study was performed during the acute phase of the illness. In this report, we describe a patient who presented with intra-hisian 2:1 AV block related to Lyme disease.

### Case report

A 49-year-old man complained of sudden discomfort with sweating and unusual shortness of breath occurring during exercise. No syncope or chest pain was reported. An ECG showed 2:1 second degree AV block, and the patient was admitted to hospital. The patient remembered that 7 weeks earlier he had had arthritis in all the toes of his left foot 2 weeks after a bite by an unidentified insect. He also developed a flu-like syndrome with diffuse myalgia, arthralgia, tiredness, and an erythematous itching rash of the lower left thigh. There was nothing remarkable in his past medical history. On examination, the patient was well with bilateral inguinal lymphadenopathies. His temperature was 37°C, the pulse was regular at 60 beats per minute and blood pressure was 140/80 mmHg. A protosystolic murmur was heard at the left sternal border. Pulmonary auscultation was normal. Liver and spleen were of normal size. There was oedema of the left ankle; the left toes were warm and pain was elicited by pressure over the foot. Neurological examination was normal. Erythrocyte sedimentation rate was 22 mm per hour, haemoglobin 13.7%, white blood cells count 6100 .mm<sup>-3</sup>.

An electrocardiogram showed sinus rhythm at a rate of 80 min<sup>-1</sup> and 2:1 second degree AV block (Fig. 1).

An exercise stress test showed persistent 2:1 AV block with a normal increase in sinus rate to 140 beats . min<sup>-1</sup> at 125 W (Fig. 2). Echocardiography was normal. An electrophysiological study was performed 4 days after the beginning of symptoms: it showed two hisian potentials, H<sub>1</sub> and H<sub>2</sub>, but these were never recorded in sequence. However, on the tracing showing 2:1 block, the H<sub>1</sub> potential appeared every time after a blocked P wave; the A-H<sub>1</sub> interval was 130 ms. The H<sub>2</sub> potential was recorded only in the case of AV conduction. The A-H<sub>2</sub> interval was 160 ms and the H-V interval 50 ms on conducted beat (Fig. 3). Although the His potential was difficult to visualize, the sequence suggesting intra-hisian block was highly reproducible with constant A-H<sub>1</sub> and A-H<sub>2</sub> intervals (Fig. 4). Atrial pacing rapidly aggravated the degree of AV block (3 to 1, 4 to 1) and atropine did not restore 1:1 AV conduction. No other electrophysiological abnormalities were observed and a temporary pacemaker was inserted. Ceftriaxone (2 g per day i.v.) was administered for 15 days together with only one oral dose of prednisone 50 mg. Lyme disease was confirmed by serology, showing positive borrelia burgdorferi IgG (titre: 1/64) and positive borrelia burgdorferi IgM antibodies. The clinical course was uneventful: normal AV conduction resumed after 4 days of treatment and the pacemaker was removed. At follow-up, five months later, the patient was asymptomatic; the physical examination, the 12 lead ECG and a Holter recording were all normal.

### Discussion

Carditis occurs in 4 to 12% of cases of Lyme disease, usually at a mean of 4.8 weeks (range 4 days to 7 months) after the initial disease<sup>[1]</sup>. Varying degrees of AV block are the commonest manifestations of Lyme carditis<sup>[2,3]</sup>: from 56 reported cases, 49 (87.5%) had documented AV block; in 32 cases complete or high-grade AV block was observed, usually with syncope. The escape rhythm rarely had a wide QRS pattern (11 cases) or a rate below 40 beats . min<sup>-1</sup> (10 cases). Fluctuating or intermittent left or right bundle branch block has also been observed<sup>[2,4-6]</sup>.

Submitted for publication on 13 August 1990, and in revised form 29 October 1990.

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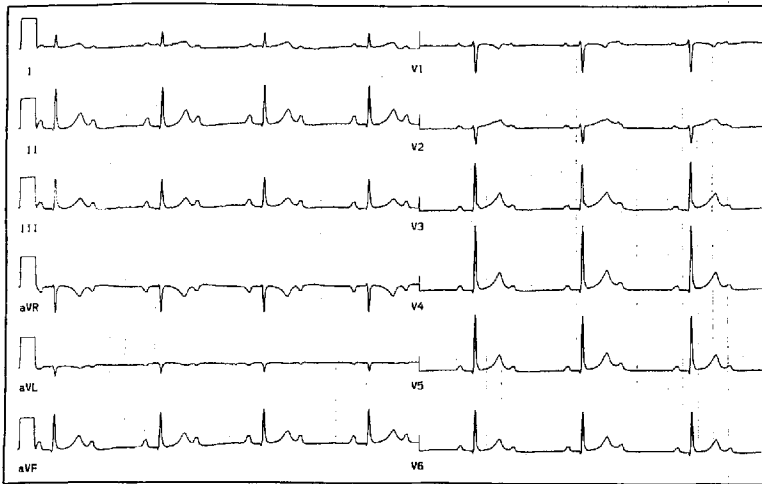


Figure 1 Resting 12-lead electrocardiogram showing 2:1 AV block (atrial rate 80 beats  $\cdot$  min $^{-1}$ , ventricular rate 40 beats  $\cdot$  min $^{-1}$ ).

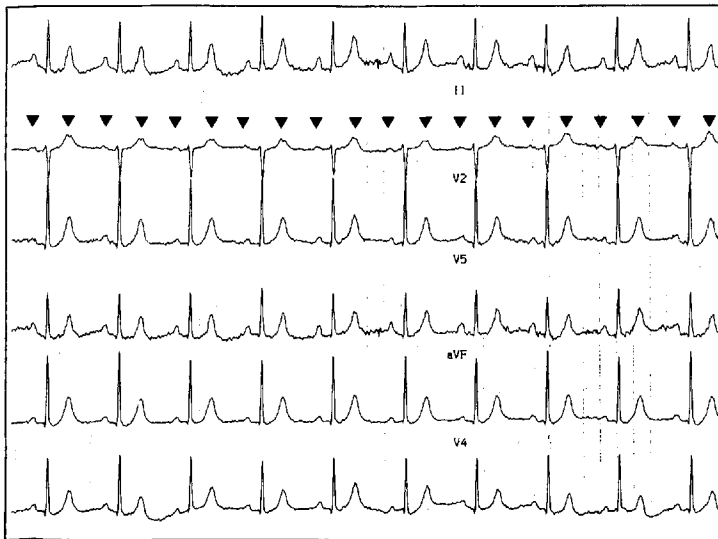


Figure 2 Exercise electrocardiogram showing persistent 2:1 AV block with an atrial rate of 140 beats  $\cdot$  min $^{-1}$  (arrows) and a ventricular rate of 70 beats  $\cdot$  min $^{-1}$ .

Several reports have mentioned transient lack of any escape rhythm, with asystole of 4 to 9 seconds<sup>[2,4,5,7-9]</sup>. An electrophysiological study was performed in only 12 patients with Lyme carditis during the acute or subacute phase of the disease (Table 1); in the majority of cases (10/12), the level of AV block was considered to be above the bundle of His. Intra or infra-hisian block has been only rarely suspected or documented<sup>[2,3,7]</sup>. Van der Linde *et al.*<sup>[2]</sup> reported a case where the electrophysiological study showed a small positive His bundle deflection without a negative deflection at all sites mapped in the His bundle region. The AH interval was normal, but there was no relation between His bundle activity and QRS complexes. In the case reported by McAlister *et al.*<sup>[3]</sup>, a prolonged HV interval (70 ms) suggested an infra-hisian conduction delay. In the case published by Cornuau *et al.*<sup>[7]</sup>, the electrophysiological study showed a normal

AH interval (80 ms), major intra-hisian conduction delay ( $H_1$ - $H_2$  120 ms) and infra-hisian block. The recording published by Dunica *et al.*<sup>[9]</sup> suggested supra-hisian block with an AH interval of 175 ms and an HV interval of 45 ms; however the author suspected that the block could have also been present at a lower level because there was a small atrial deflection on the AV lead during the AV block and because no escape rhythm was present during complete AV block. Kapusta *et al.*<sup>[10]</sup> also observed a small deflection after the first blocked A wave, which could be interpreted as a partial activity of the His bundle. Our patient had an electrophysiological study performed 4 days after the onset of cardiovascular symptoms, which showed intra-hisian AV block; although the double His potential was difficult to visualize, the sequence suggesting intra-hisian block was highly reproducible. All groups have reported that patients with AV block have an

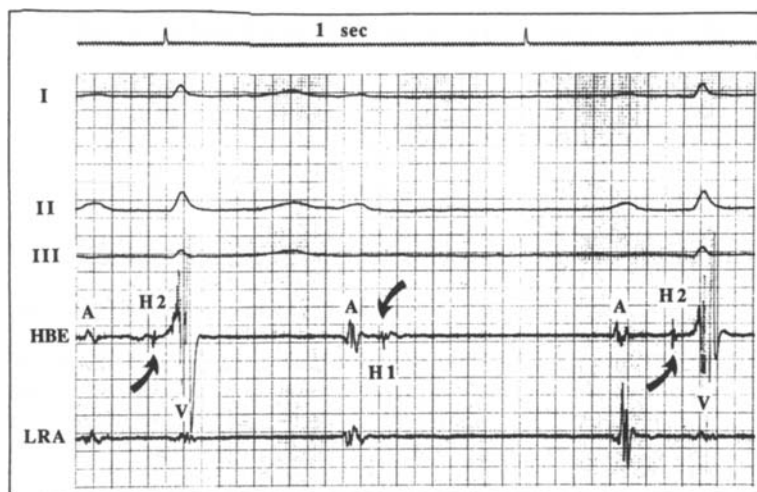


Figure 3 A 2:1 AV block arising with the His bundle: during sinus rhythm, two H potentials (arrows) are identified (H<sub>1</sub> and H<sub>2</sub>) and the block occurs between the two H deflections. HBE: His bundle recording; LRA: low right atrium; A: atrium; V: ventricle.

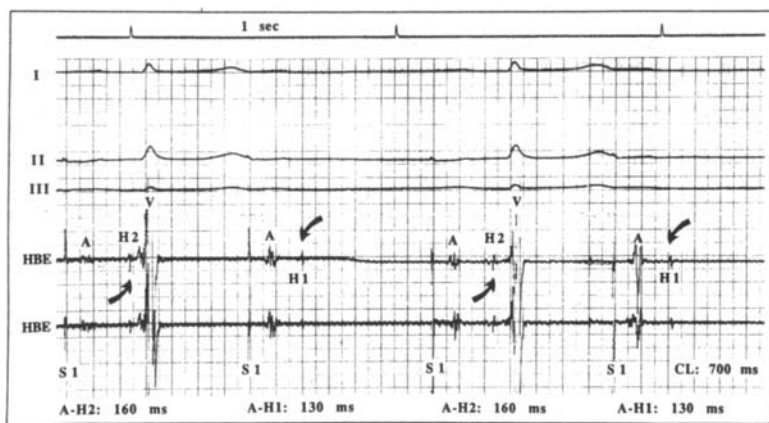


Figure 4 A 2:1 AV block occurring within the His bundle during atrial pacing at a cycle length of 700 ms. Abbreviations same as Fig. 3.

Table 1 Electrophysiological data obtained during the acute or subacute phase of Lyme carditis: review of the literature

First author	n	ECG	Level of block	Evolution
Van der Linde <sup>[2]</sup>	1	complete AV block	intra-hisian	permanent PM
McAlister <sup>[3]</sup>	2	complete AV block + LBBB, junct. escape	supra-hisian	SR
Cornuaud <sup>[7]</sup>	1	high grade AV block	supra-hisian	SR
Reznick <sup>[8]</sup>	1	complete AV block	intra-hisian	SR
Dunika <sup>[9]</sup>	1	2:1 AV block	supra-hisian	SR
		2:1 AV block		
		complete AV block		
		incomplete RBBB	supra-hisian	SR
Kapusta <sup>[10]</sup>	2	2-3:1 AV block, RBBB	supra-hisian	SR
			intra-hisian?	
Steere <sup>[11]</sup>	1	complete AV block	supra-hisian	SR
Lavaud <sup>[14]</sup>	1	complete AV bloc	supra-hisian	SR
Rey	1	2:1 AV block	intra-hisian	SR

AV = atrioventricular; SR = sinus rhythm; LBBB = left bundle branch block; n = number of cases; RBBB = right bundle branch block; PM = pacemaker.

excellent prognosis: most cases resolved within 1 to 2 weeks, and three within 6 weeks<sup>[3]</sup>. Only Van der Linde *et al.*<sup>[2]</sup> reported a case who required implantation of a permanent pacemaker after 15 weeks of follow-up. Therefore, the insertion of a permanent pacemaker is rarely indicated. Lyme carditis may occur with high-degree AV block during the sub-acute phase of infection: this was the case for our patient who had the first symptoms of erythema in August 1989, 7 weeks before the cardiovascular manifestations of the disease.

Several therapeutic principles of Lyme carditis are generally accepted: hospitalization and continuous monitoring are advisable for patients with second-degree or complete AV block, and with first-degree AV block if the PR interval exceeds 0.30 s<sup>[11]</sup>. At the present time either intravenous penicillin G 20 millions units per day or oral tetracycline for 10 to 20 days are recommended; in high degree AV block, ceftriazone 2 g intravenously once a day for 14 days can be prescribed instead of penicillin<sup>[1,12]</sup>. It seems that the persistence of the spirochetes within the myocardium is an intrinsic part of the pathophysiology of Lyme carditis. The observation of spirochetes within cardiac tissue<sup>[9,13]</sup> lends further support to this hypothesis. It remains unclear, however, whether continued disease activity requires the persistence of live spirochetes or whether it results primarily from immune-mediated mechanisms.

In our case, the administration of ceftriazone resulted in rapid restoration of normal AV conduction without any sequelae.

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