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Painful left bundle branch block syndrome successfully treated by His-bundle pacing

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Accepted 26 November 2022

SUMMARY

Painful left bundle branch block (LBBB) syndrome is a rare cause of episodic chest pain associated with transient LBBB in the absence of flow-limiting coronary artery disease and myocardial ischaemia on functional testing. The aetiology of this phenomenon is not clear, but in many reported cases, these transient episodes of LBBB are rate related. The mechanism of chest pain is not well understood. Still, it is postulated that sudden loss of the ventricular contraction synchrony, which happens in LBBB, will induce a different perception of heartbeat in the brain with possible translation to the chest pain. Various treatment modalities were attempted in the past, including exercise training, medical therapy with beta-blockers and calcium channel blockers or device therapy with right ventricle pacing, biventricular pacing and lately, His-bundle pacing. This case report presents a woman with intermittent episodes of typical angina with periodic LBBB changes on her ECG. Telemetry monitoring and treadmill exercise tests show a 100% association between angina episodes and LBBB changes on ECG. Her transthoracic echocardiogram shows normal left ventricle structure and function, and her coronary angiogram shows no flow-limiting coronary artery disease. She has been successfully treated by His-bundle pacing, and her symptoms entirely resolved on her serial follow-up.

BACKGROUND

Painful left bundle branch block (LBBB) syndrome is frequently under-recognised by healthcare providers as it is a rare condition. Chest pain from this condition can be pretty debilitating. Different modalities of treatment were tried with variable responses. These included pharmacological suppression of sinus node activity with beta-blockers to prevent higher rate-related LBBB or a permanent pacemaker to pace the ventricles from a different site from the left bundle. However, there are no current agreed guidelines yet. We noticed consistent response with complete resolution of chest pain in cases treated by His-bundle pacing in five reported cases in the literature.¹⁻⁵ Reporting this case will increase our awareness of this clinical entity and enhance our evidence about His-bundle pacing as an effective treatment modality in this condition.

CASE PRESENTATION

A woman in her 70s presented with intermittent episodes of typical anginal chest pain that can happen both at rest and on exertion. She has no significant medical history. Her father died at the age of 62 from myocardial infarction. She is a

non-smoker and lives alone independently. She had a normal cardiovascular examination.

Her admission 12-lead ECG, which was done shortly after an episode of chest pain, showed normal sinus rhythm with normal QRS complex morphology and duration with an inverted T wave in anterior leads with a heart rate of 60 beats per minute (figure 1). Another ECG was done during an episode of chest pain, and this showed a new onset of LBBB with a leftward axis and anterior S/T ratio of 2 and a heart rate of 75 beats per minute (figure 2). A repeat ECG after resolution of the chest pain episode showed resolution of LBBB morphology with the return of baseline narrow QRS and T wave inversion memory on anterior leads.

INVESTIGATIONS

Routine blood tests showed normal complete blood counts with normal renal and liver function tests. Her first, second and third troponin T were all negative. Her transthoracic echocardiogram showed normal Left ventricle structure with preserved systolic function. There was no significant valve disease. Her telemetry monitoring showed clear association between her angina episodes and change of QRS morphology on ECG with mild increase in heart rate. During a treadmill exercise test, she developed typical angina pain immediately when QRS morphology changed to LBBB pattern, and this happened less than a minute after exercise with heart rate of 74 only (there was more than 24 hours after her last beta-blocker dose). Her pain improved when the QRS got narrower, and she was completely pain free when QRS returned to normal morphology (figure 3). We then performed

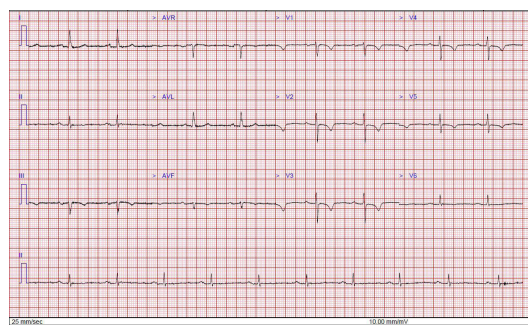


Figure 1 12-leads ECG on admission, which was done shortly after an angina episode but was pain free, showing normal sinus rhythm with a rate of 60 beats per minute. The QRS morphology is narrow and normal. There is T wave inversion anteriorly which represents T wave memory.



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To cite: Al-Shammari A, Edwards T, Al-Sharbatee G. *BMJ Case Rep* 2022;**15**:e251071. doi:10.1136/bcr-2022-251071

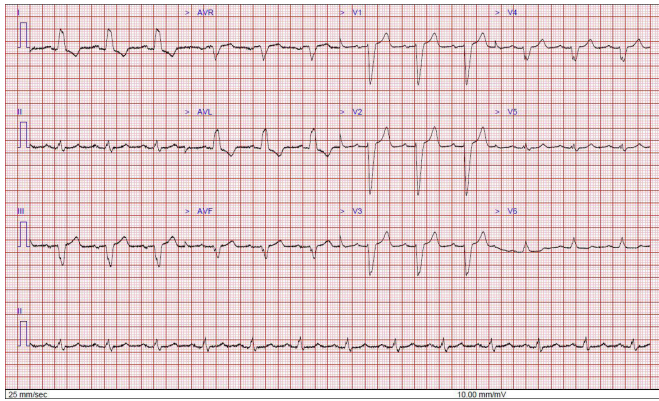


Figure 2 12-leads ECG done during angina pain showing left bundle branch block morphology with S/T of 2 and leftward axis.

a coronary angiogram which showed some mild diffuse coronary atheroma but no evidence of any flow-limiting coronary artery disease (figure 4).

DIFFERENTIAL DIAGNOSIS

Ischaemic heart disease is a common cause of chest pain with LBBB, and therefore ruling out an obstructive coronary artery disease is mandatory. We rule out this possibility by coronary angiogram. Cardiomyopathies are also an important cause of LBBB in patient with chest pain. This patient’s echocardiogram was essentially normal, ruling out any structural cardiomyopathies. Other causes of LBBB on ECG like hypertension do not cause episodic chest pain, and LBBB would be a permanent rather than intermittent change on ECG.

TREATMENT

Beta-blocker therapy was first attempted. However, the patient could not tolerate it due to a low-resting rate which went to as low as 45 beats per minute after taking only 1.25 mg of bisoprolol, and there was only minimal improvement in symptoms. We, therefore, discussed the option of conductive system pacing in the form of His-bundle pacing to abort the LBBB by pacing from a different level in the conductive system, the His-bundle. She then had a successful permanent His-bundle pacemaker (figure 5). Her symptoms improved, and she was discharged the next day.

OUTCOME AND FOLLOW-UP

During the first follow-up, the patient reported significant improvement in her symptoms. She reported two episodes of angina; both were consistent with non-pacing rhythm. Pacemaker interrogation showed intermittent right ventricular

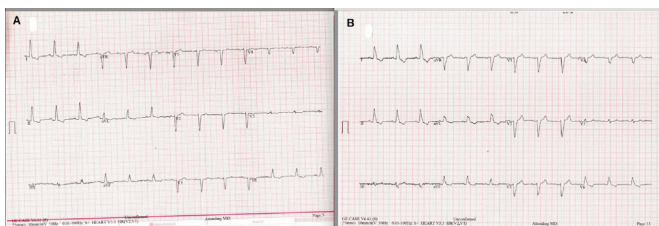


Figure 3 The exercise test showed the sudden change of QRS morphology to left bundle branch block at the same time when patients started to have the symptoms, (A) at rest and (B) at 1 min after exercise.

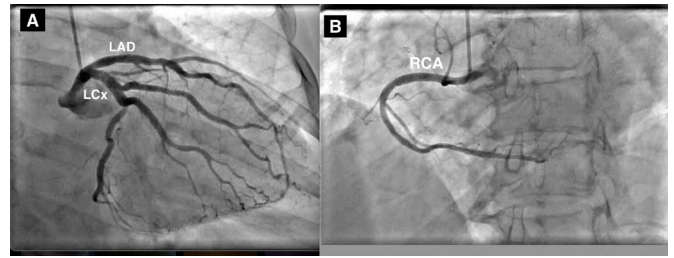


Figure 4 Coronary angiogram performed from right radial artery showing no evidence of obstructive coronary artery disease. (A) Left coronary system with unobstructed left anterior descending (LAD) artery and left circumflex (LCx) artery. (B) Right coronary artery (RCA).

pacing. We reprogrammed the device with shortened AV delay to prevent the persistent episodic LBBB.

On her second follow-up, her symptoms resolved completely, and she had no more angina. Interrogating pacemaker showed that she was 100% time paced. ECG showed sinus rhythm with A sensing and V pacing with narrow QRS complexes.

DISCUSSION

Painful LBBB syndrome is defined as intermittent episodes of angina associated with simultaneous LBBB changes on ECG with the absence of flow-limiting coronary artery disease or ischaemia on functional testing. The aetiology of this condition remains unclear, but many of these are rate-related LBBB changes on ECG. With faster heart rates, an impulse may reach left ventricular myocytes during the refractory period, allowing proper ventricular contraction to start in the right before the left ventricle inducing transient dyssynchrony, typical of LBBB. One proposed theory about why this is painful suggested that dyssynchronous ventricular contraction will suddenly change the brain’s perception of heartbeat and interpret it as angina pain.⁶ Vieweg et al. reported the first case of rate-dependent LBBB associated with angina and normal coronary angiogram in 1976⁷. Another series of 7 similar topics was written in 1982 by Virtanen et al. and 2 cases by Said et al. in 2013^{8,9}. Specific

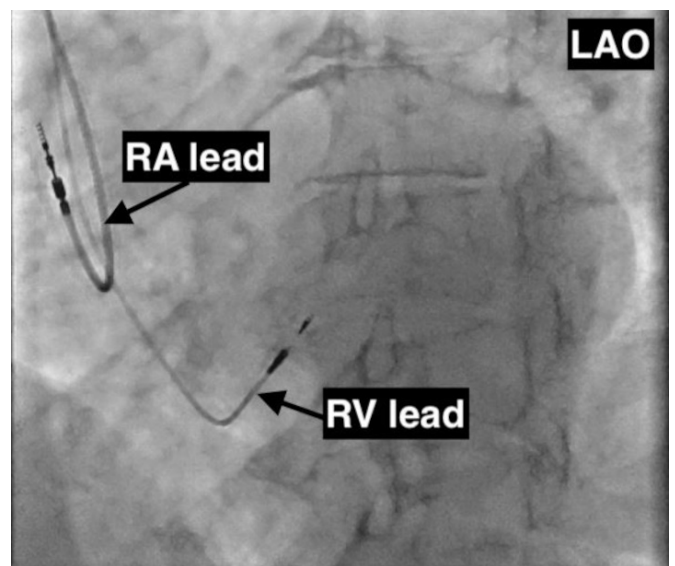


Figure 5 A fluoroscopy image in left anterior oblique (LAO) projection during pacemaker implant showing right ventricular lead facing posterolaterally in the upper part of the interventricular septum (His-bundle position).

criteria for diagnosing painful LBBB have been developed by Shvilkin et al. after reviewing and analysing clinical and electrocardiographic features of 50 reported cases (4 by his team and 46 in the literature). The criteria are 1) Sudden onset chest pain that coincides with LBBB, 2) concurrent resolution of symptoms with a resolution of LBBB, 3) standard 12 leads ECG before and after LBBB (but sometimes an inverted T wave memory is present), 4) absence of myocardial ischemia on stress testing, 5) normal LV systolic function and 6) low precordial S/T wave ratio with inferior QRS axis [1]. In our reported case, the patient meets most of the criteria apart from the inferior axis of LBBB. Exercise training and beta-blockers have proved beneficial for rate-dependent LBBB (LBBB that starts at a higher rate than the average resting heart rate). However, the response was inconsistent, and some patients continued to have symptoms [1,5,6,9].

Changing the site of electrical stimulation of the left ventricle from the right ventricle by continuous right ventricle pacing via a permanent pacemaker has abolished symptoms in intractable cases that did not respond to medical therapy.^{6 10} However, patients will have permanent right ventricle pacing and chronic dyssynchrony. With the substantial body of evidence we have nowadays about the benefits of His-bundle pacing in preventing long-term deleterious effects of chronic dyssynchrony from RV

acing only, it has become apparent that His-bundle pacing would be a much better option for long-term treatment of painful LBBB syndrome. In the five reported cases of His-bundle pacing, there was a consistent response in all patients on serial follow-up visits.¹⁻⁴ Our patient did not respond well to pharmacological therapy. This is partly due to their low-resting heart rate and the fact that she changes her QRS morphology at a lower rate than was reported in the cases that responded to beta-blockers (the 70s in our case vs 100s in others).

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Contributors AA-S: writing the draft report, searching the literature and obtaining patient consent. TE: supervising the report writing. GA-S: help with the draft and multimedia preparation.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient consent for publication Consent obtained directly from patient(s).

Provenance and peer review Not commissioned; externally peer reviewed.

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Case reports provide a valuable learning resource for the scientific community and can indicate areas of interest for future research. They should not be used in isolation to guide treatment choices or public health policy.

Patient's perspective

I had had supra-ventricular tachycardia when I was a child. This was stopped when I took beta-blockers. Since the pacemaker implant, I had two angina symptoms for 1 week that were relieved by GTN spray. I want to say a big thank you to the consultant and all the fantastic nursing staff that looked after me during my stay.

Learning points

- ▶ Painful left bundle branch block syndrome is a rare cause of angina and should always be considered without any evidence of coronary artery disease or cardiomyopathies that can explain the symptoms.
- ▶ There are no clear guidelines about management, but different treatment options have been tried with a suboptimal response. Recently, His-bundle pacing is a promising treatment strategy that is gaining popularity in treating this condition.
- ▶ This condition can be rate related and happens only with exertion once the heart rate exceeds 100 beats per minute. In other cases, like our patient, it can occur at rest with relatively slower heart rates.

REFERENCES

- 1 Viles-Gonzalez JF, Mahata I, Anter E, et al. Painful left bundle branch block syndrome treated with his bundle pacing. *J Electrocardiol* 2018;51:1019–22.
- 2 Suryanarayana PG, Frankel DS, Marchlinski FE, et al. Painful left bundle branch block [corrected] syndrome treated successfully with permanent His bundle pacing. *HeartRhythm Case Rep* 2018;4:439–43.
- 3 Oladunjoye OO, Oladunjoye AO, Oladiran O, et al. Persistent exertional chest pain in a marathon runner: exercise-induced, painful, left bundle branch block syndrome treated with His-Bundle pacing. *Mayo Clin Proc Innov Qual Outcomes* 2019;3:226–30.
- 4 Ferrara M, Cappucci R, Wang D. Chest pain resolution with His-bundle pacing in a patient with left bundle branch Block-related nonischemic left ventricular dysfunction. *J Innov Cardiac Rhythm Manage* 2019;10:3810–4.
- 5 Garg A, Master V, Ellenbogen KA, et al. Painful Left Bundle Branch Block Syndrome Successfully Treated With Left Bundle Branch Area Pacing. *JACC Case Rep* 2020;2:568–71.
- 6 Shvilkin A, Ellis ER, Gervino EV, et al. Painful left bundle branch block syndrome: clinical and electrocardiographic features and further directions for evaluation and treatment. *Heart Rhythm* 2016;13:226–32.
- 7 Vieweg WV, Stanton KC, Alpert JS, et al. Rate-Dependent left bundle branch block with angina pectoris and normal coronary arteriograms. *Chest* 1976;69:1p123–4.
- 8 Virtanen KS, Heikkilä J, Kala R, et al. Chest pain and rate-dependent left bundle branch block in patients with normal coronary arteriograms. *Chest* 1982;81:326–31.
- 9 Said SA, Bultje-Peters M, Nijhuis RL. Exercise-Induced left bundle branch block: an infrequent phenomenon: report of two cases. *World J Cardiol* 2013;5:359–63.
- 10 Sroubek J, Tugal D, Zimetbaum P. Treatment of painful left bundle branch block syndrome with cardiac resynchronisation therapy or right-ventricular pacing. *HeartRhythm: Case Report* 2019;5:6p321–4.

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