Now you see it, now you don't: alternating bundle branch block and its clinical implications

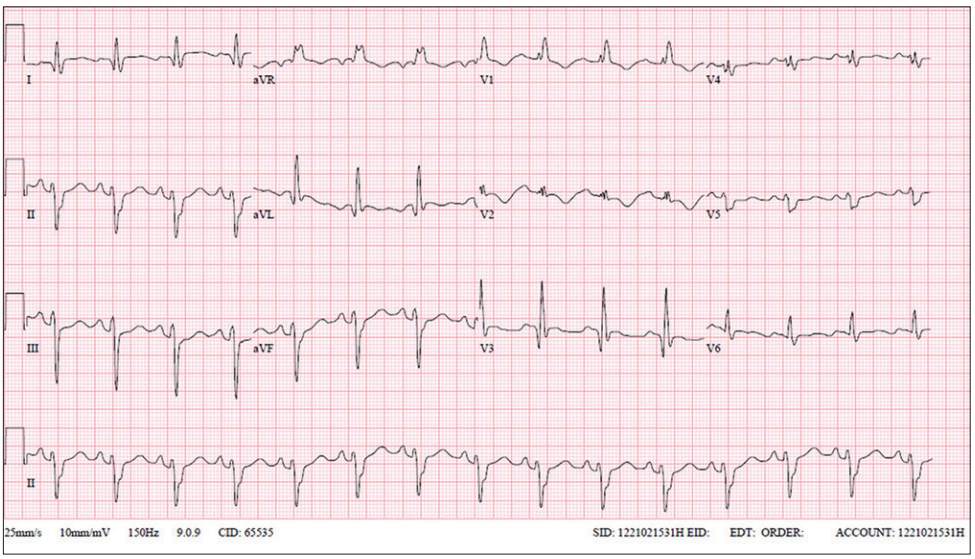

Figure 1: 12-lead electrocardiogram on admission.

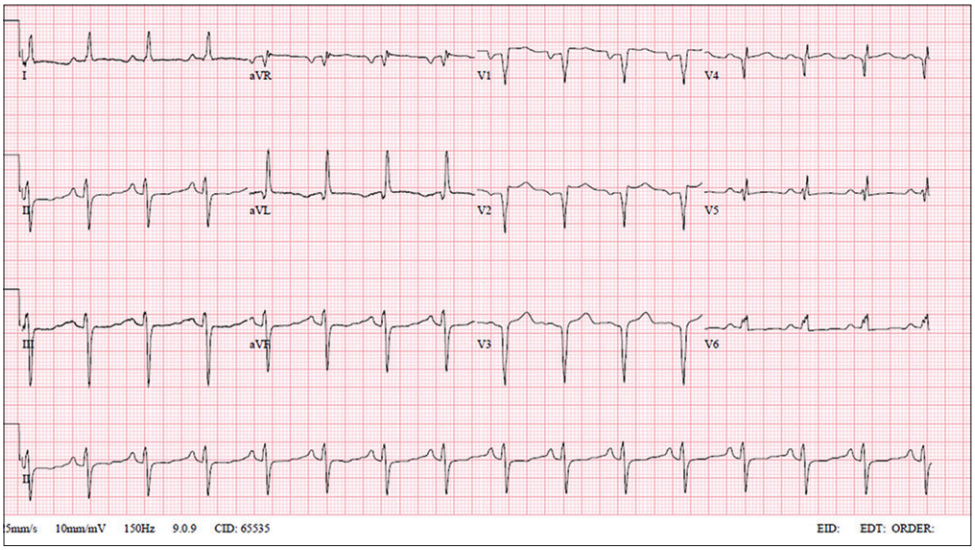

Figure 2: 12-lead electrocardiogram 8 hours post admission.

CLINICAL PRESENTATION

A 24-year-old female suffered a sudden out-of-hospital cardiac arrest. Her colleagues performed cardiopulmonary resuscitation as she was noted to be pulseless. The paramedics arrived 30 minutes later and sinus rhythm was noted on the automated external defibrillator. The patient regained full consciousness upon arrival at the emergency department. Prior to her cardiac arrest, she experienced intermittent rapid palpitations over three days.

She was a known case of ischaemic dilated cardiomyopathy, first diagnosed in her native country and subsequently on follow-up at another public healthcare institution in Singapore. Transthoracic echocardiography in 2018 revealed left ventricular ejection fraction (LVEF) 24%, severe left ventricular dilatation, regional wall motion abnormalities in multi-vessel territories, tenting of mitral valve with moderate mitral regurgitation, severe left atrial dilatation, normal right atrial size, normal right ventricular size and function. Cardiac

magnetic resonance imaging in 2018 showed LVEF 12%, extensive transmural infarction with thinned out segments in the left anterior descending (LAD) coronary artery territory, left circumflex (LCX) territory and infarcted anterolateral papillary muscles. Coronary angiography in 2018 revealed 100% chronic total occlusion (CTO) in the proximal LAD with good collateral flow from the LCX and right coronary arteries (RCA), 90% stenosis in the proximal LCX, ectatic and aneurysmal dilatation of the proximal to mid RCA. Successful balloon angioplasty and stenting were then performed to the LCX stenosis. She was recommended to undergo the implantation of a subcutaneous implantable cardioverter-defibrillator for primary prevention of sudden cardiac arrest, but she declined. Serum lipid profile, complement 3, complement 4, homocysteine, anti-double stranded deoxyribonucleic acid, antinuclear, anti-phospholipid, anti-Smith, anti-Ro, anti-La, anti-ribonucleoprotein, anti-scleroderma 70 and anti-Jo-1 antibodies were all negative. There was a possibility of her having suffered from Kawasaki disease during her childhood, but the hospital records then were not available. Her father had experienced sudden cardiac arrest in her native country at age of 40 and she was told it was likely due to an acute myocardial infarction.

Following admission, the patient was hemodynamically stable. Serum troponin I level rose from 18 to 435 ng/mL. No significant serum electrolyte abnormality was detected. Figures 1 and 2 show her serial 12-lead electrocardiograms (ECG). What do these two ECGs show?

ECG INTERPRETATION

Figure 1 shows sinus rhythm with right bundle branch block (RBBB) as evidenced by the following features: QRS duration >120 ms; RSR' pattern in leads V1 and V2 and S wave in leads I, aVL, V5 and V6. It also shows left anterior fascicular block as demonstrated by the following: left axis deviation; qR complexes in leads I, aVL and rS complexes in leads II, III and aVF.

The PR interval was top normal at 200 ms.

Figure 2 shows sinus rhythm with left bundle branch block (LBBB): QRS duration >120 ms; dominant S wave in lead V1; absence of Q wave in leads I, V5 and V6 and monomorphic R wave in leads 1, V5 and V6. The PR interval was top normal at 200 ms.

These two ECGs revealed that the patient had alternating bundle branch block, with Figure 2 ECG being her baseline.

CLINICAL COURSE

Computed tomography brain scan was performed and did not show any mass effect, acute intracranial haemorrhage, established territorial infarct or changes of established hypoxic ischaemic encephalopathy. Transthoracic echocardiography revealed LVEF 20%. Coronary angiography showed the known LAD artery CTO with good collateral flow from the LCX and RCA, ectatic proximal RCA with mid segment aneurysm and a patent LCX stent. Guidelines directed medical therapy was instituted. A transvenous single chamber implantable cardioverter-defibrillator (ICD) was implanted to prevent against sudden cardiac death from ventricular tachyarrhythmias.

DISCUSSION

Alternating bundle branch block refers to the occurrence of RBBB and LBBB in the same patient at different times. This phenomenon denotes likely severe disease in the infra-Hisian conduction system involving both bundle branches, with a propensity for developing complete atrioventricular (AV) block. The likelihood of complete AV block is higher in those who develop alternating bundle branch block at almost the same heart rates and with PR interval changes.[1] In our patient, the bundle branch block morphology changes occurred at 90–95 beats per minute but the PR interval remained top normal at 200 ms in both ECGs.

The possible causes of cardiac arrest in this patient included acute coronary syndromes, ventricular tachyarrhythmias and infra-Hisian conduction system disease leading to AV blocks or ventricular standstill. Coronary angiography did not reveal any need for further coronary revascularisation. ICD implantation was definitely indicated in view of her persistently poor LVEF since 2018, despite being compliant to guidelines directed medical therapy, and having survived an out-of-hospital cardiac arrest.

The alternating bundle branch block was a crucial determinant of the final type of ICD implanted for this patient to prevent sudden cardiac arrest from ventricular tachyarrhythmias. Given her very young age and active lifestyle, a subcutaneous ICD can be considered.[2] However, the presence of alternating bundle branch block implied a high risk of progression to complete AV block necessitating cardiac pacing which the subcutaneous ICD was incapable of and hence a transvenous ICD system would be indicated. Although a VDD lead ICD system can be considered, given the patient's petite body habitus, the long length of the VDD ICD lead may make lead positioning suboptimal. In view of the possible anticipated high-ventricular pacing burden, a biventricular ICD system was recommended to the patient.[3] She was also offered alternative options of a single or dual chamber ICD with a view to upgrade to a biventricular system in the future should she develop pacing dependence. Given her non-resident status, cost consideration was important and that led the patient to eventually choose a single chamber ICD system.

CONCLUSION

Alternating bundle branch block may be a subtle finding but carries huge clinical implications. It should be actively monitored in patients with underlying structural and coronary heart diseases.

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Conflicts of interest

Chia PL is a member of the SMJ Editorial Board, and was thus not involved in the peer review and publication decisions of this article.

Pow-Li Chia, MBBS, FRCP, Li Wei Tan, MBBS, MRCP, Shonda Ng, MBBS, MRCP, David Foo, MBBS, FACC

Tan Tock Seng Hospital, Dept of Cardiology, 11 Jalan Tan Tock Seng, Singapore

Correspondence: Dr. Pow-Li Chia,
Department of Cardiology, Tan Tock Seng Hospital, 11 Jalan Tan Tock Seng, 308433, Singapore.
E-mail: powlichia@gmail.com

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REFERENCES

1. Massumi R. Alternating bundle branch block together with alternation of PR intervals: Advanced Mobitz II atrioventricular block. Rev Cardiovasc Med 2010;11:44-52.
2. De Maria E, Olaru A, Cappelli S. The entirely subcutaneous defibrillator (S-ICD): State of the art and selection of the ideal candidate. Curr Cardiol Rev 2015;11:180-6.
3. 2013 ESC guidelines on cardiac pacing and cardiac resynchronization therapy: The task force on cardiac pacing and resynchronization therapy of the European Society of Cardiology (ESC). Developed in collaboration with the European Heart Rhythm Association (EHRA). Europace 2013;15:1070-118.

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SMC CATEGORY 3B CME PROGRAMME

Online Quiz: https://www.sma.org.sg/cme-programme

Deadline for submission: 6 pm, 30 December 2022

Question	True	False
1. The following features are diagnostic of left anterior fascicular block on electrocardiogram (ECG):		
(a) Left axis deviation		
(b) qR complexes in leads I and aVL		
(c) rS complexes in leads II, III and aVF		
(d) PR interval>200 ms		
2. The following features are diagnostic of left bundle branch block on ECG:		
(a) QRS duration>120 ms		
(b) Dominant S wave in lead V6		
(c) Absence of Q wave in leads I, V5 and V6		
(d) Monomorphic R wave in leads 1, V5 and V6		
3. The following features are diagnostic of right bundle branch block on ECG:		
(a) QRS duration>120 ms		
(b) RSR' pattern in leads V1 and V2		
(c) PR interval>200 ms		
(d) S wave in leads I, aVL, V5 and V6		
4. The following features are recommended for patient selection for subcutaneous implantable cardioverter-defibrillator:		
(a) Young age		
(b) Lack of vascular access		
(c) Need for bradycardia pacing		
(d) Need for anti-tachycardia pacing		
5. The following features are part of Class 1 indications for biventricular implantable cardioverter-defibrillator:		
(a) QRS duration≥150 ms		
(b) Left bundle branch block		
(c) Left ventricular ejection fraction (LVEF) 40%		
(d) Atrial fibrillation		