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Interference dissociation during a baseline complete left bundle-branch block with advanced right bundle-branch block☆

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ABSTRACT

A 64-year-old woman presented to the hospital with a complaint of dyspnea on effort. The 12-lead electrocardiogram showed a baseline complete left bundle-branch block, in which the right bundle developed >2:1 block. The subsequent blocked sinus impulse resulted in a ventricular pause that caused the ventricular escape presenting as a QRS complex with right bundle-branch block pattern. However, some of them disclosed typical fusion beats and led to interference dissociation. Although other possibilities including Lenegre's disease or myocardial disease were not excluded, the effective refractory period of both bundle branches degenerated by myocardial ischemia might be attributed to this rhythm.

Case presentation

A 64-year-old woman with a history of diabetes mellitus presented to the hospital with a complaint of dyspnea on effort. The 12-lead electrocardiogram (ECG) on admission is shown in Fig. 1. The ECG was characterized by the following features: [1] a constant PP interval (480 ms); [2] RR intervals of 1320, 1240, and 1400 ms; and [3] continuation of the same cycle over the remaining strip.

Another ECG taken later (Fig. 2) showed the following features: a QRS complex with an LBBB pattern, and PP, RR, and PR intervals of 660 ms, 1320 ms, and 140 ms, respectively. Fig. 3 shows the diagrammatic description of precordial leads V1 and V2 of Fig. 1. The third and sixth QRS complexes with a left bundle-branch block (LBBB) pattern had the preceding P waves with a PR interval of 140 ms. These were consistent with a diagnosis of 2:1 atrioventricular block (AVB) with LBBB. Although the PP intervals were different between Figs. 1 and 2, both PR intervals preceding the QRS complexes with an LBBB pattern and the QRS morphologies were almost identical. Thus, the QRS complexes with an LBBB pattern in Figs. 1 (the third and sixth QRS complexes) and 2 were likely sinus complexes. The subsequent blocked sinus impulse resulted in a ventricular pause that allowed the appearance of ventricular escape (VE) presenting as a QRS complex with a right bundle-branch block (RBBB) pattern (the first, second, fourth, sixth, and seventh QRS complexes). The RP intervals of the blocked and captured beats were 920 ms, and 1040 ms, respectively. Therefore, the effective refractory period (ERP) of the right bundle-branch (RBB) could be estimated to be ≥920 ms, and < 1040 ms (segments on top of Fig. 3). Sinus impulses conducted to the ventricles via the RBB, constituting captured beats presenting as a QRS with an LBBB pattern when the timing of the P wave exceeded the ERP of the RBB (the third, and seventh QRS complexes; Fig. 3). Likewise, sinus beats 1, 4 and 7 with the RBBB morphologies also partially captured the ventricles as fusion beats. To be noted, they are different from those of the second and fifth complexes, which are pure VEs with RBBB pattern. In the fusion beats, the first, the fourth and the seventh QRS complexes of Fig. 3, the focus of the VE depolarized first and concomitantly, the sinus impulse running through the RBBB depolarized part of the right ventricle (RV) and consequently, the shape and voltage of the QRS configuration is different. Therefore, partial AV conduction to the ventricle was feasible, which consequently gave rise to a fusion beat and a form of interference dissociation.

The RR interval between the QRS complexes with RBBB pattern was 1320 ms. The following RR interval between the QRS complex with RBBB pattern and that with LBBB pattern was shorter (1240 ms). As mentioned before, the third QRS complex with LBBB pattern (conducting down the RBB) was a sinus complex; therefore, subsequent retrograde penetration via the left bundle resulted in input to the focus of VE. Hence, the subsequent RR interval between the QRS complex with LBBB pattern and that with RBBB pattern was longer (1400 ms; Fig. 3).

Although some reports described interference dissociation [1–3] and bilateral bundle-branch block [4], interference dissociation with

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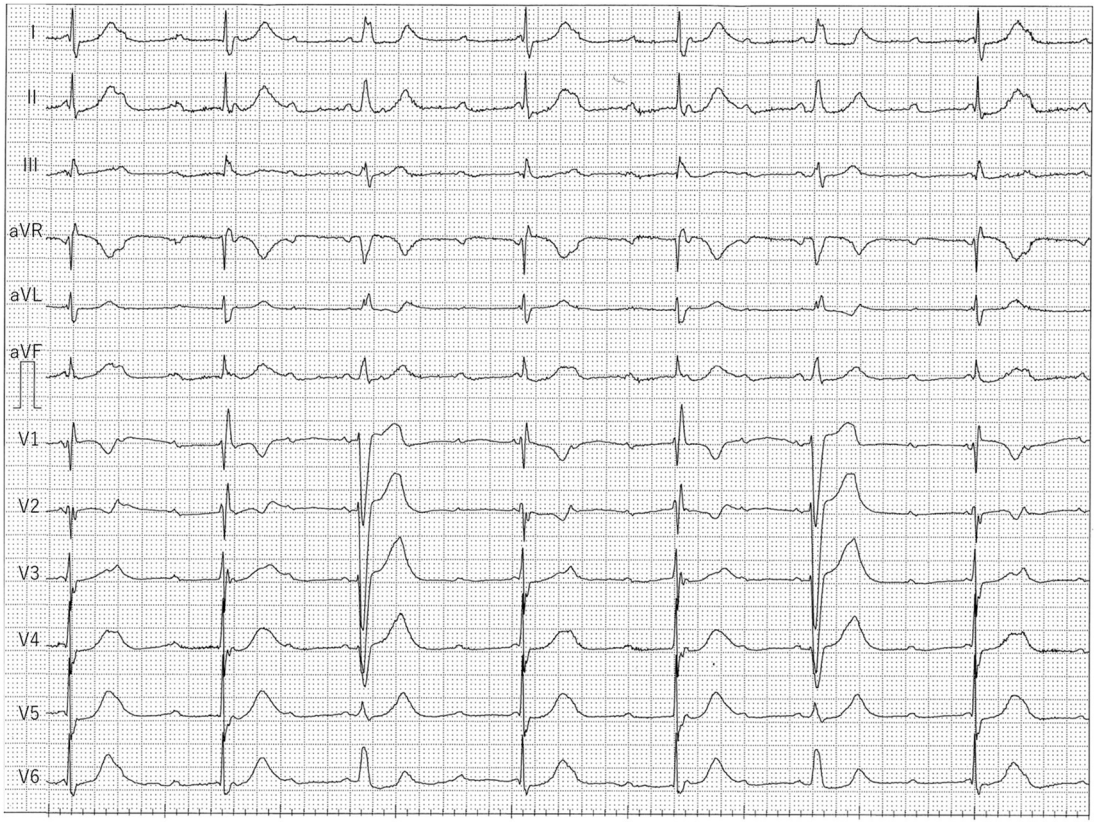

Fig. 1. The 12-lead electrocardiogram on admission (for further description see the text).

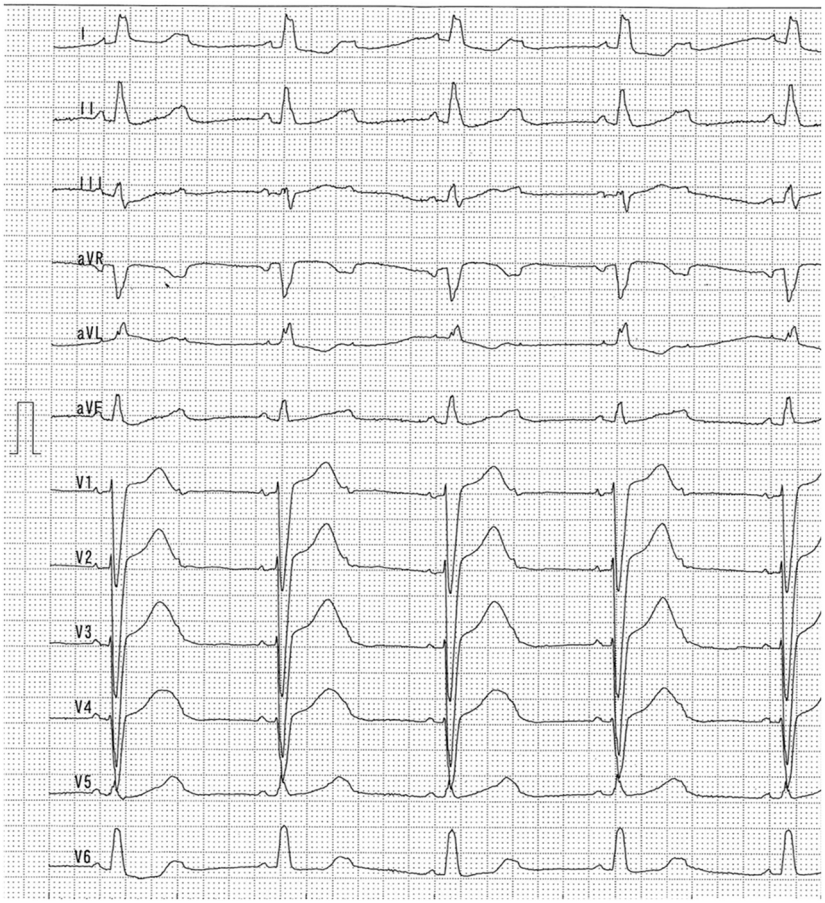

Fig. 2. A 12-lead electrocardiogram taken later showing 2:1 atrioventricular block with left bundle-branch block (LBBB).

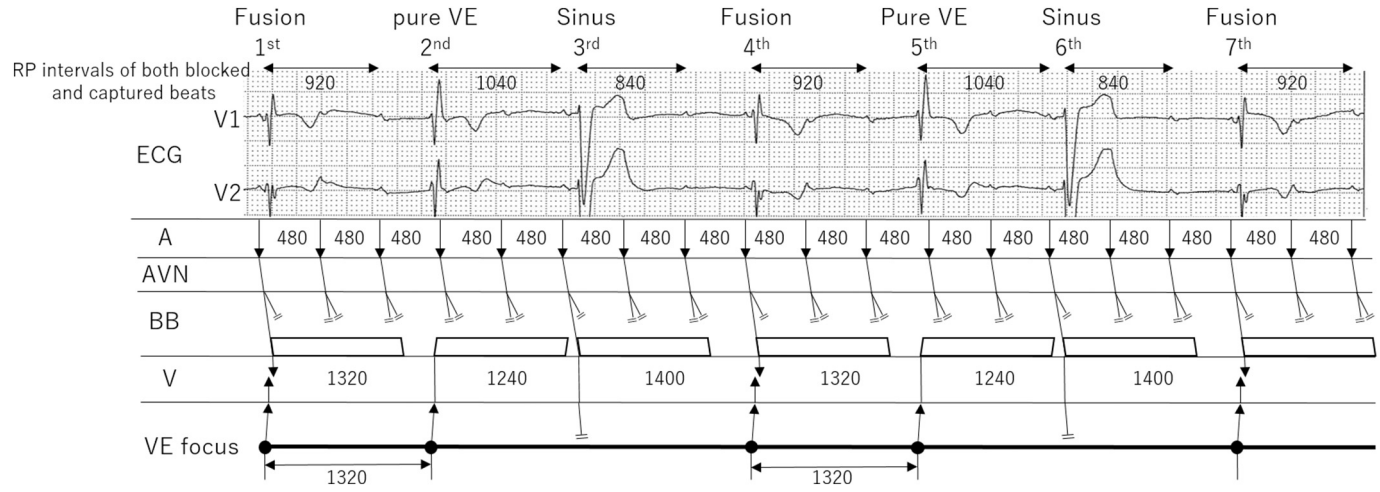

Fig. 3. Diagrammatic description of leads V1 and V2 of Fig. 1. The solid lines indicate conduction. Measurements are in milliseconds. A squares represent the effective refractory period of the right bundle estimated from the RP intervals of the blocked and captured beats. The QRS complexes with the LBBB pattern (the third, and sixth QRS complexes) are the normal AV conducted sinus beats. The QRS complexes with a right bundle-branch block (RBBB) pattern (the second, and fifth QRS complexes) are the pure ventricular escape (VE). The QRS complexes with RBBB pattern (the first, fourth, and seventh QRS complexes) are fusion beats. A indicates atrium; AVN, atrioventricular node; BB, bundle branch; V, ventricle; VE, ventricular escape.

opposite bundle-branch QRS morphologies has rarely been reported. The term "interference dissociation" has been electrophysiologically defined and interpretated [5]. In the present case, the sinus impulse via the RBB (the first, the fourth and the seventh QRS complexes in Figs. 1 and 3) are interfered by the VE, which is consistent with the interference dissociation between the sinus impulse and the VE that occurred below the AVN and above the focus of the escape.

In summary, the ECG showed a baseline complete LBBB, in which the RBB developed greater than the second-degree block. The subsequent blocked sinus impulse resulted in a ventricular pause that caused the VE presenting as a QRS complex with RBBB pattern. The VEs interfered with AV conduction of the sinus impulses. The patient underwent coronary intervention for angina pectoris. Although other possibilities including Lenegre's disease or myocardial disease were not excluded [6], the ERP of both bundle branches degenerated by myocardial ischemia might be attributed to this rhythm.

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