

IMAGES IN CARDIOLOGY

Right Bundle Branch Block Pattern During Right Ventricular Pacing: Inadvertent Pacing Lead Placement or a False Alarm? / Just a Need for a Lower Relocation of V1/2 ECG Lead Placement!

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Abstract

A case of right bundle branch block pattern of right ventricular pacing is presented wherein a simple maneuver of precordial V1/2 ECG lead relocation clarified the problem. *Rhythmios 2020; 15(2):33-34.*

Key Words: right ventricular pacing; left bundle branch block; right bundle branch block; electrocardiogram

Abbreviations: ECG = electrocardiogram; ICS = intercostal space; LBBB = left bundle branch block; LV = left ventricular; RBBB = right bundle branch block; RV = right ventricular

An 89-year-old lady was seen at the office for a routine visit for a pacemaker check. All pacing and sensing parameters were within normal limits. However, when a 12-lead electrocardiogram (ECG) was obtained by our nurse (**Fig. 1**), there was concern about the appearance of lead V1, which showed a right bundle branch block (RBBB) morphology of the paced QRS complex. Right ventricular (RV) pacing should have been reflected by a left bundle branch block (LBBB) pattern on the ECG.

This patient had a history of hypertension, diabetes and psychiatric disease under medical therapy and 15 months earlier she had been admitted through the emergency room to the hospital with complete heart block. As there was no correctable or reversible cause, she received a permanent pacemaker. This was a single-pass lead VDD pacemaker with the pacing lead placed at the right ventricular (RV) apex. The intraoperative measurements were excellent, as were the repeat measurements during this follow-up visit; a ventricular pacing threshold of 0.5 V at 0.4 ms pulse width, a sensed P wave of 2 mV, a sensed R wave of 7.6 mV and an electrode impedance of 692 Ohms.

As there was no reason to suspect a misplaced or displaced pacing lead, a repeat ECG was obtained with the V1/2 leads placed at the 4th intercostal space (ICS) and this recording was consistent with RV pacing showing an LBBB pattern (**Fig. 2**). The nurse who performed the initial ECG was asked about the position of the V1/2 leads and she indicated that these had been placed “a bit” higher, actually at the 2nd ICS. Then a repeat ECG was obtained with the V1/2 leads placed at the 2nd ICS confirming the LBBB pattern obtained with the initial ECG (**Fig. 3**).

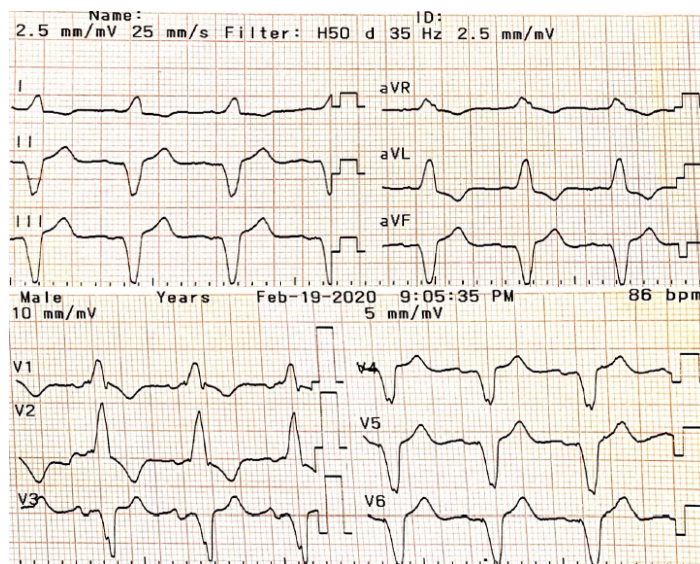


Figure 1

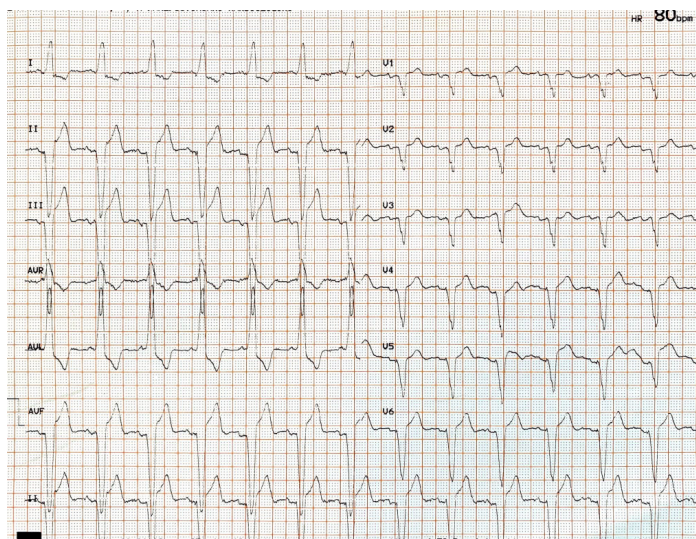


Figure 2

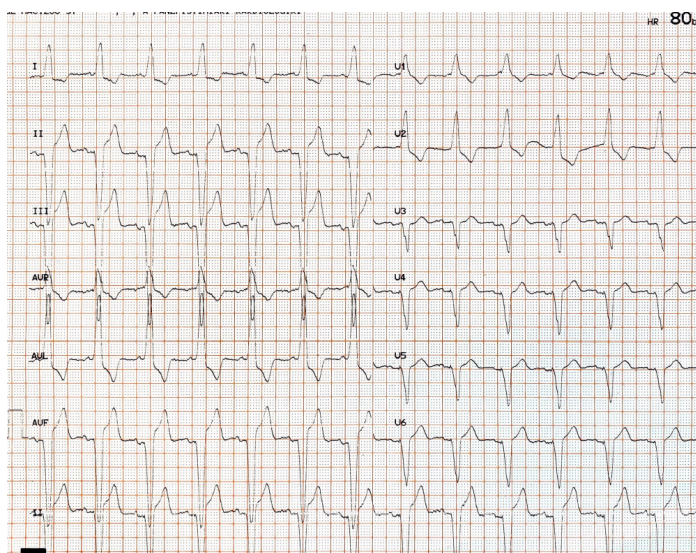


Figure 3

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RV pacing produces an LBBB morphology of the QRS. An RBBB morphology of a paced ECG can occur in the case of LV pacing, either by intentional placement of a pacing lead in the LV, as in coronary sinus pacing,^{1,2} or by inadvertent LV pacing via a lead that has perforated the RV septal or free wall, or a malpositioned lead in the LV through a septal defect or patent foramen ovale,^{3,4} or retrograde transarterial pacing.^{5,6} The inadvertent endocardial LV lead position is associated with a high risk of thromboembolism and the dilemma arises whether extraction should be performed or life-long anticoagulation applied.⁶

In general, the presence of an RBBB pattern after pacemaker implantation should alert the physician to a malpositioned lead. However, an RBBB pattern in leads V_{1/2} with RV pacing does not necessarily mean a lead misplacement, as shown in the present case and as has been shown by other investigators, as well; it is commonly a matter of V_{1/2} lead placement.⁷ Thus, before one gets alarmed and resorts to further investigation by cardiac imaging (e.g. echocardiography and/or fluoroscopy), a simple maneuver is suggested which entails the placement of the V_{1/2} ECG leads to lower locations (5th/6th ICS); one may even need to reach the epigastric area on occasion to demonstrate the LBBB pattern. In our case, we just repeated the ECG by placing the V_{1/2} leads at the proper position, as they had initially been placed at higher ICS, in order to record an LBBB pattern. It has been commonly noted, at least in our experience in several hospitals, that many nurses place the V_{1/2} ECG leads at the 2nd rather the 4th ICS, which is usually inconsequential, or it might even be revealing for some cases of Brugada syndrome, but in other cases, as in the present one, it may be alarming.

An important clue that the recorded ECG may be related to ECG V_{1/2} lead position can be inferred by paying attention to the standard (limb) leads, which do show an LBBB-like pattern and a left axis when the pacing lead is placed in the RV apex, as in our case, or a different axis if the RV lead is placed in the RV septum or in the outflow tract. This is the reason why some investigators have called this a “*pseudo RBBB*” pattern.⁷ Other investigators have suggested the presence of a left superior axis and precordial transition by lead V₃, as a means to discern true RV from LV pacing in the presence of RBBB;⁸ however, they did not relocate the V_{1/2} leads. This transition pattern by lead V₃ may not apply for leads placed in the RV outflow tract, especially in patients with congenital heart disease, wherein, the axis is also different (inferior).⁹

A retrospective analysis of post-implantation ECGs in 943 patients indicated that the prevalence of RBBB-like pattern was ~8% (n=77).¹⁰ When studying 26 of these

patients, it was noted that placement of leads V₁₋₂ to the 5th ICS resulted in transition to a LBBB-like pattern with a QS wave in V₁ in 14 of 26 patients (sensitivity, 53%; specificity, 100%), whereas placement of V_{1/2} leads at the 6th ICS resulted in a QS pattern in all patients (sensitivity and specificity, 100%). In all patients in the control group, the ECG depicted an RBBB configuration with leads V_{1-V2} in the standard position, as well as at the 5th and 6th ICSs. The authors concluded that in patients with paced rhythm and a RBBB-like pattern on the 12-lead ECG, relocation of leads V_{1-V2} to the 6th ICS accurately identified the presence of true RV pacing.

Other studies have reported RBBB recordings in ~15% of RV paced patients with the majority having a left axis; with a higher prevalence observed in patients with an apical compared to a midseptal RV lead location.¹¹ However, authors who are trying to explain and rationalize a safe RBBB pattern during RV pacing have not performed ECGs with the V_{1/2} leads relocated to lower ICS.^{11,12}

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