

## Challenges in Clinical Electrocardiography

## Right Bundle-Branch Block Pattern in Precordial Leads and Left Bundle-Branch Block Pattern With Left Axis Deviation in Frontal Plane Leads—What Does This Mean?

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### Case Presentation

A patient in their 70s presented to the emergency department with a history of syncope that occurred 7 days before admission without preceding signs or symptoms. Since then, the patient had been experiencing fatigue, mainly from exertion. The patient had a history of hypertension, heart failure, and aortic valve replacement surgery in 2020, complicated on follow-up by prosthetic valve thrombosis. The patient had been taking warfarin, furosemide, metoprolol succinate, and spironolactone. Initial evaluation revealed a heart rate of 61 beats/min, blood pressure of 114/74 mm Hg, oxygen saturation of 96%, and temperature of 36.6 °C. The physical examination was unremarkable, and a 12-lead electrocardiogram (ECG) was obtained (Figure).

**Questions:** What are the notable findings of the patient's initial ECG? What are the prognostic implications of these findings?

### Interpretation

The ECG at presentation demonstrated regular sinus rhythm, heart rate of 75 beats/min, prolonged PR interval (240 milliseconds), and prolonged QRS duration (170 milliseconds). Morris index was presented in lead V<sub>1</sub>. In the precordial lead, a notched and monophasic R-wave was observed in V<sub>1</sub>, an electrocardiographic sign of right bundle-branch block (RBBB). However, S wave was absent in leads I and aVL, and a pattern of left bundle-branch block (LBBB) with left axis deviation (−81°) was present in the frontal plane leads. These ECG abnormalities were compatible with the diagnosis of masquerading bundle-branch block (MBBB), a rare form of bifascicular block associated with diffuse disease in the conduction system, poor prognosis, and a higher incidence of progression to advanced atrioventricular block.

### Clinical Course

Based on the history of syncope and electrocardiographic findings of elevated risk for advanced atrioventricular blocks, the patient was

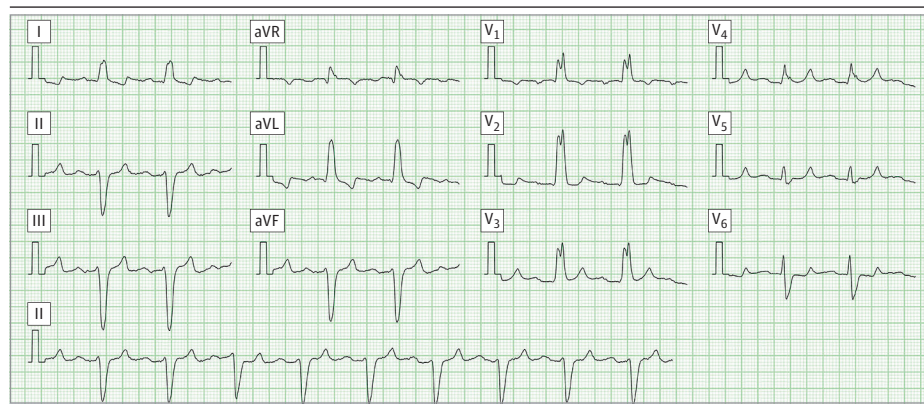
hospitalized for investigation and consideration of permanent pacemaker implantation. An echocardiogram revealed an ejection fraction of 28%, akinesia of the middle and basal segments of the inferior and inferoseptal walls, and diffuse hypocontractility of the left ventricle. Results from 24-hour Holter monitoring showed a regular rhythm, mean heart rate of 77 beats/min, and absence of pauses or atrioventricular blocks. On the fifth day of hospitalization, the patient complained about an unspecific discomfort, and a new ECG was performed demonstrating an advanced atrioventricular block. These findings justified the syncopal episode reported by the patient, and a definitive dual-chamber pacemaker was implanted. The patient was discharged after 7 days.

### Discussion

The condition MBBB is a rare form of bifascicular block associated with a high prevalence of progression to advanced atrioventricular block and poor prognosis.<sup>1</sup> The term was coined by Richman and Wolff<sup>2</sup> in 1954 to describe the electrocardiographic pattern of RBBB in precordial leads and LBBB in limb leads. Initially, the analysis of the vectorcardiogram of these exams was interpreted as LBBB modified by extensive septal and posterolateral infarctions. However, later studies including anatomopathological assessment of the cardiac conduction system showed severe damage to the conduction system in both the right and the left bundle branch, associated with severe fibrosis and substantial left ventricular hypertrophy.<sup>3</sup>

In typical cases of RBBB with a left anterior fascicular block (LAFB), the first part and main forces of the QRS complex are oriented superiorly and to the left, between −60° and −120°, which allows the identification of LAFB. The terminal forces of the QRS are oriented superiorly, anteriorly, and to the right, showing the terminal delay of RBBB. However, a high degree of LAFB, accompanied by anterolateral fibrosis and left ventricular hypertrophy promotes strong terminal forces toward the left and upwards that cancel the

Figure. Electrocardiogram (ECG) at Presentation



The ECG demonstrated features that are suggestive of right bundle-branch block in the precordial leads with left bundle-branch block and left axis deviation in the frontal plane leads.

terminal forces of RBBB, explaining the disappearance of S waves in leads I and aVL.<sup>1,4</sup>

The electrocardiographic diagnosis of MBBB is defined by the presence of a prominent R wave in V<sub>1</sub> (RBBB pattern), left axis deviation in the frontal plane, and absent or minimal S waves in leads I and aVL. The pattern of a wide and notched R wave in lead V<sub>1</sub> is characteristic of RBBB and can be seen in a minority of patients.<sup>5</sup> Rosenbaum et al<sup>6</sup> have described 2 types of MBBB, depending on the location of the masquerade: the standard type, which is diagnosed from the absence of S waves in leads I and aVL, and the precordial type with a minimal or absent S wave in V<sub>5</sub> and V<sub>6</sub>.

This type of block usually manifests in older adults and is associated with advanced heart disease and severe left ventricular dysfunction. The pathology most associated with this is ischemic cardiomyopathy. Other associated causes in the literature were prolonged systemic arterial hypertension, Chagas myocarditis, aortic stenosis, and degenerative conduction system disease.<sup>1,7</sup>

The real prevalence of MBBB is still unknown. Bayés de Luna et al<sup>8</sup> in a review of more than 100 000 ECGs found 16 cases. In the review by Schroder e Souza et al,<sup>9</sup> 25 cases were identified in a database with more than 600 000 ECGs. Fifteen patients were followed up for a period of 48 months, pacemaker implantation was necessary for 41.4%, and the mortality rate was 38.9%.

In the case described in this article, we observed an older adult patient who presented to the emergency department com-

plaining of syncope and had an ECG with an MBBB pattern. The history of syncope associated with this electrocardiographic pattern strongly suggests that transient episodes of atrioventricular block were occurring. Permanent pacemaker implantation was mandatory given the documentation of advanced atrioventricular block. However, pacemaker implantation does not substantially reduce mortality in these patients due to the severity of the underlying heart disease.<sup>8,10</sup>

### Take-home Points

- The condition MBBB is a rare form of bifascicular block associated with poor prognosis.
- The ECG in MBBB is characterized by the presence of RBBB in the precordial leads, left axis deviation, and absence of S waves in leads I and aVL, mimicking LBBB in the limb leads.
- Usually, MBBB is the result of advanced LAFB, severe left ventricular hypertrophy, and/or focal block in the anterolateral wall of the left ventricle due to myocardial infarction or fibrosis.
- The form MBBB occurs more frequently in older adult patients and in association with advanced cardiovascular disease such as coronary artery disease, cardiomyopathy, Chagas myocarditis, or idiopathic conduction system degeneration.
- Patients should be closely monitored due to the high incidence of advanced atrioventricular block and the need for pacemaker implantation.

### ARTICLE INFORMATION

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**Published Online:** October 24, 2022.  
doi:10.1001/jamainternmed.2022.4708

**Conflict of Interest Disclosures:** None reported.

**Additional Information:** Matheus Kiszka Scheffer, MD, took the lead in writing the manuscript. All authors provided critical feedback and helped shape the research, analysis, and manuscript. All authors have seen and approved the final version of the manuscript.

### REFERENCES

1. Elizari MV, Baranchuk A, Chiale PA. Masquerading bundle branch block: a variety of right bundle branch block with left anterior fascicular block. *Expert Rev Cardiovasc Ther*. 2013;11(1):69-75. doi:10.1586/erc.12.142

2. Richman JL, Wolff L. Left bundle branch block masquerading as right bundle branch block. *Am Heart J*. 1954;47(3):383-393. doi:10.1016/0002-8703(54)90295-1

3. Unger PN, Lesser ME, Kugel VH, Lev M. The concept of masquerading bundle-branch block; an electrocardiographic-pathologic correlation. *Circulation*. 1958;17(3):397-409. doi:10.1161/01.CIR.17.3.397

4. Rosenbaum MB, Yesurón J, Lázari JO, Elizari MV. Left anterior hemiblock obscuring the diagnosis of right bundle branch block. *Circulation*. 1973;48(2):298-303. doi:10.1161/01.CIR.48.2.298

5. Surawicz B, Childers R, Deal BJ, et al; American Heart Association Electrocardiography and Arrhythmias Committee, Council on Clinical Cardiology; American College of Cardiology Foundation; Heart Rhythm Society; Endorsed by the International Society for Computerized Electrocardiology. AHA/ACCF/HRS recommendations for the standardization and interpretation of the electrocardiogram: part III: intraventricular conduction disturbances: a scientific statement from the American Heart Association Electrocardiography and Arrhythmias

Committee, Council on Clinical Cardiology; the American College of Cardiology Foundation; and the Heart Rhythm Society. *J Am Coll Cardiol*. 2009; 53(11):976-981. doi:10.1016/j.jacc.2008.12.013

6. Rosenbaum MB, Elizari MV, Lázari JO. *Los Hemibloques*. Paidós; 1968.

7. Puerta RC, González EC, Elizundia JMC, Torres YT. El bloqueo de rama disfrazado revisitado. *Revista de la Federación Argentina de Cardiología*. 2012;41(2):75-79.

8. Bayés de Luna A, Torner P, Oter R, et al. Study of the evolution of masked bifascicular block. *Pacing Clin Electrophysiol*. 1988;11(1 Pt 1):1517-1521. doi:10.1111/j.1540-8159.1988.tb06267.x

9. Schroder e Souza TG, Almeida RL, Targueta GP et al Abstract 14845: masquerading bundle branch block: an electrocardiographic marker of poor prognosis. *Circ*. 2015;132(suppl\_3). doi:10.1161/circ.132.suppl\_3.14845

10. Gómez Barrado JJ, Turégano Albarrán S, García Rubira JC, et al. Características clínicas y electrocardiográficas del bloqueo bifascicular disfrazado. *Rev Esp Cardiol*. 1997;50(2):92-97. doi:10.1016/S0300-8932(97)73185-3