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Previously undescribed transient trifascicular block: left septal fascicular block associated with left anterior fascicular block and complete right bundle branch block

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ABSTRACT

Exercise-induced complete right bundle branch block (CRBBB) remains a rare finding during a treadmill test. Both exercise-induced CRBBB and left anterior fascicular block (LAFB) have been associated with coronary artery disease, more specifically with stenosis of the left anterior descending coronary artery. Left septal fascicular block (LSFB) has been associated with acute and chronic coronary syndromes. We describe a patient case with severe left main coronary artery disease. In an exercise test, a rare combination of these three ventricular conduction disorders developed. In a second exercise test after coronary bypass surgery, LAFB and typical CRBBB developed without LSFB.

Case presentation

A 47-year-old woman with a positive family history for coronary artery disease reported slowly worsening dyspnea during effort. Half a year earlier she had undergone an exercise stress test for Canadian Cardiovascular Society (CCS) II chest pain. Because of exercise-induced ST depressions in the lateral precordial leads, betablocker, statin, and acetylsalicylic acid therapy was initiated. She had a normal body build (height 152 cm, weight 55 kg), and auscultation of the heart and lungs was normal. Medication had no effect on the symptoms, and myocardial perfusion single-photon emission computed tomography (SPECT) was performed.

The baseline ECG only showed short PQ/PR interval (110 ms), with normal QRS in the absence of delta waves, suggesting Lown-Ganong-Levine pattern. The patient had no complaints of palpitations or tachycardic events.

In the SPECT bicycle test, the initial workload was 20 watts, and horizontal/downsloping ST depression developed quickly, and gradually increasing ST elevation was observed in lead aVR. At end-exercise, there was ST depression in nine leads, indicating global (circumferential subendocardial) ischemia, which is characteristic for left main coronary artery (LMCA) or severe 3-vessel disease (Fig. 1) [1]. Also, ST elevation >1 mm in lead aVR has been associated with LMCA disease. Lead aVL showed mild ST elevation and T-wave inversion.

After 3,5 min´ exercise, the QRS complex suddenly broadened to more than 120 ms (Figs. 1 and 2). Left anterior fascicular block (LAFB) and complete right bundle branch block (CRBBB) developed. In addition, prominent anterior QRS forces, indicating left septal fascicular block (LSFB), were noted in leads V1 and V2. The R-wave in lead V2 exceeded 15 mm [2,3]. Typical symptoms developed, and in addition, the patient reported mild chest pain. The stress test was terminated, and the dromotropic disturbances resolved quickly. The blood pressure did not increase during the test.

The perfusion imaging showed severe ischemic perfusion defects in the anterior wall and the apex. The ejection fraction dropped from 63 % to 43 %, and there was a clear increase in the end-systolic left ventricular

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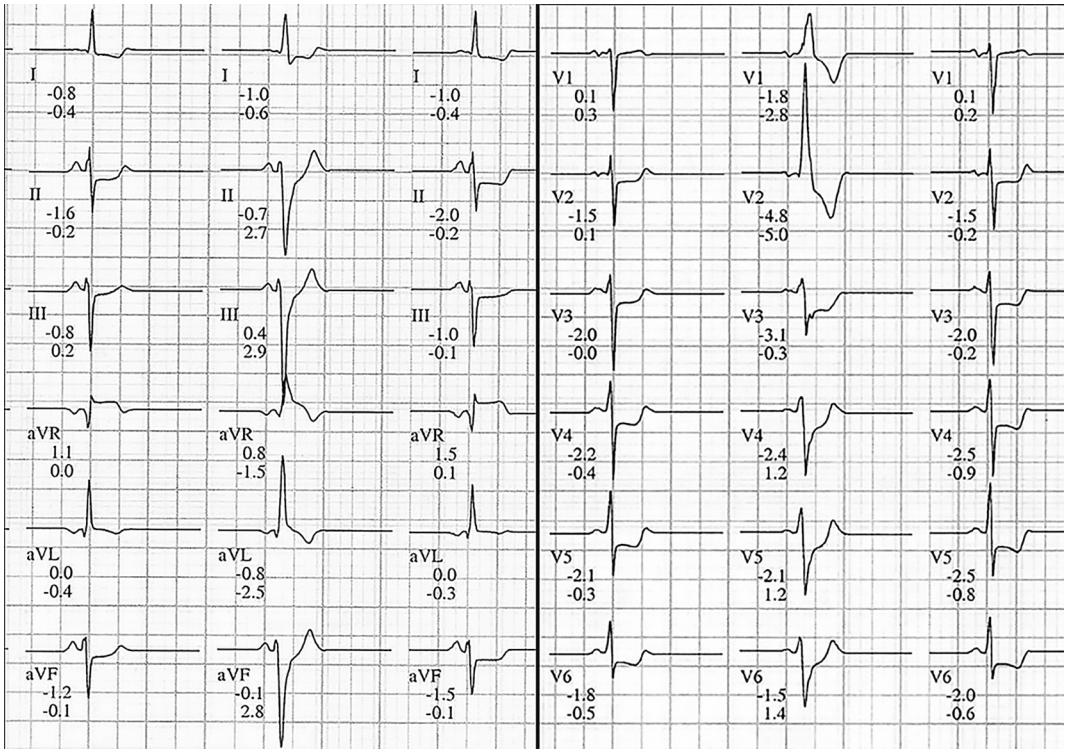

Fig. 1. Lead samples (25 mm/s, 10 mm/mV) with the extremity leads to the left and precordial leads to the right. The numbers refer to the ST level at 60 ms post-J-point and ST slope. In both the extremity and precordial leads, the first sample displays the ECG findings at 3 min of exercise (30 watts, HR 129 bpm). Ischemic ST depression is present in four extremity leads and five precordial leads, accompanied by >1 mm ST elevation in lead aVR. The middle sample represents 3,5 min of exercise (30 watts, HR 137 bpm), showing left axis deviation (QRS axis − 55°) caused by LAFB, broad S wave in lead I and V6 and final R wave in lead aVR associated with complete RBBB; there is a qR pattern with very tall R-wave (>15 mm) and prolonged R-wave peak time (≥50 ms) in V2, indicating LSFB. The sample to the right represents the immediate post-exercise stage (HR 93 bpm) with the maximal ST deviations. The QRS duration has normalized, but there is still left axis deviation (LAFB). Even a minor Q wave in lead V2 could be considered a post-myocardial infarction Q wave. However, minor Q waves in V2-V3 or V1-V2 associated with prominent anterior forces are typical for LSFB.

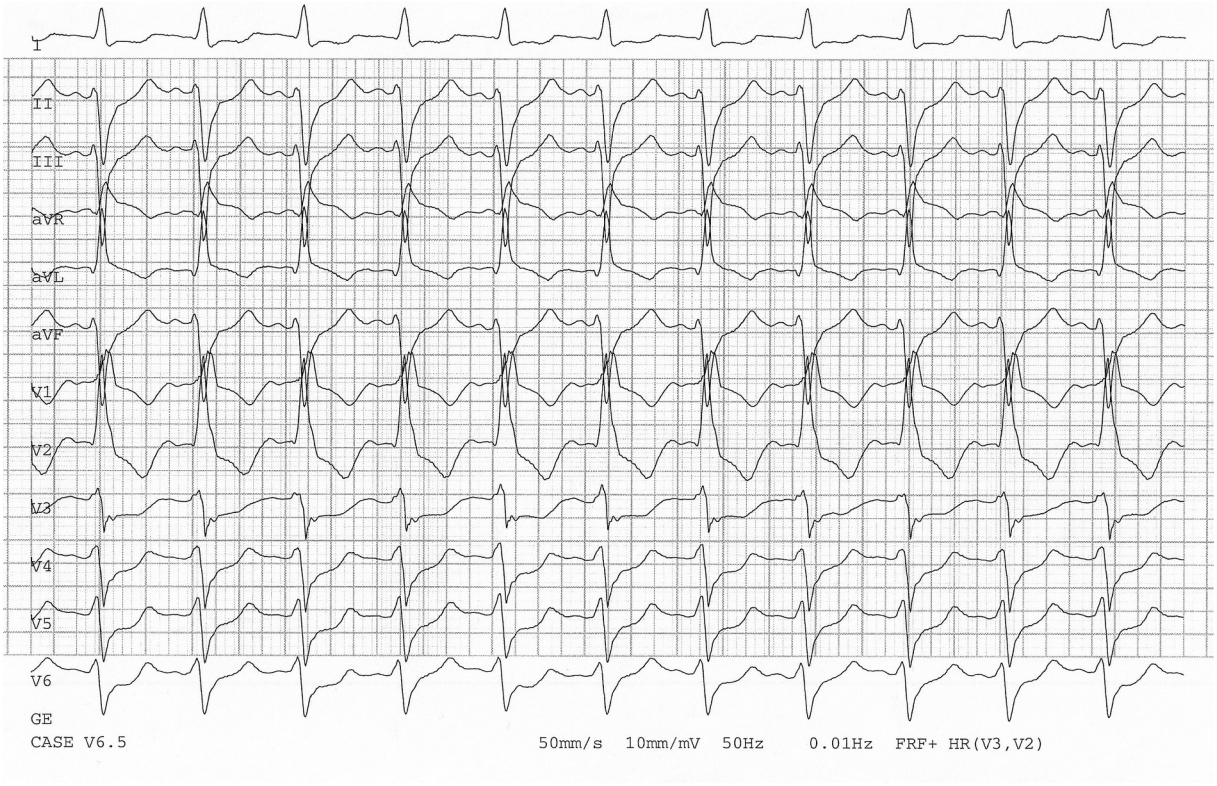

Fig. 2. The 12-lead ECG at the end of the exercise test (50 mm/s, 10 mm/mV), showing sinus rhythm, CRBBB, prolonged R-wave peak time (≥50 msec), LAFB and LSFB (qR pattern with R-wave >15 mm in V2), ST-segment elevation in aVR, and ST-segment depression in more than 7 leads (inferior+anterolateral walls), characteristic of critical obstruction of the LMCA. Conclusion: LAFB, LSFB, CRBBB – to our knowledge a previously undescribed trifascicular block, and circumferential subendocardial ischemia, suggesting critical obstruction of the LMCA or severe 3-vessel disease.

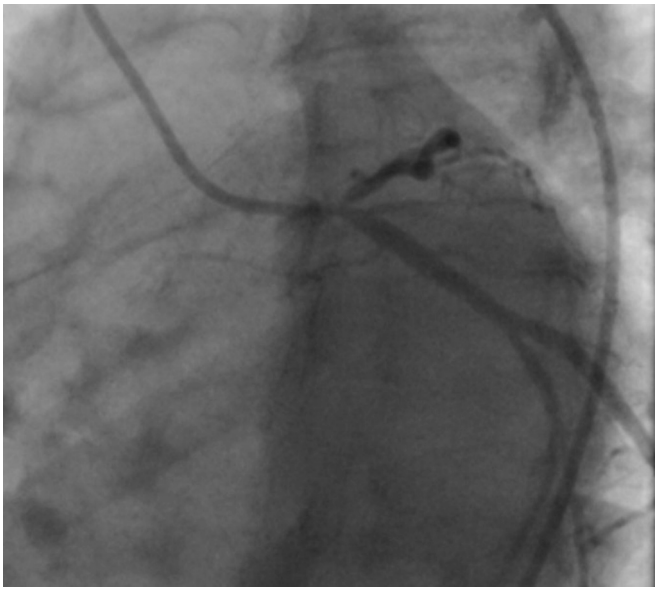

Fig. 3. Angiography of the left coronary artery. The left main coronary artery was short and of relatively small diameter. Therefore, the angiography was performed sub-selectively. There is severe stenosis of the distal left main artery and of the proximal left anterior descending and left circumflex arteries.

volume.

The patient underwent urgent coronary angiography, which revealed a short LMCA with severe stenosis in the distal LMCA and in the proximal left anterior descending (LAD) and left circumflex arteries (Fig. 3). Coronary artery bypass surgery was performed. Asystole during weaning from cardiopulmonary bypass was corrected by open cardiac massage, adrenalin and balloon pump insertion. Postoperatively, T-wave inversions associated with minor ST depression developed in the

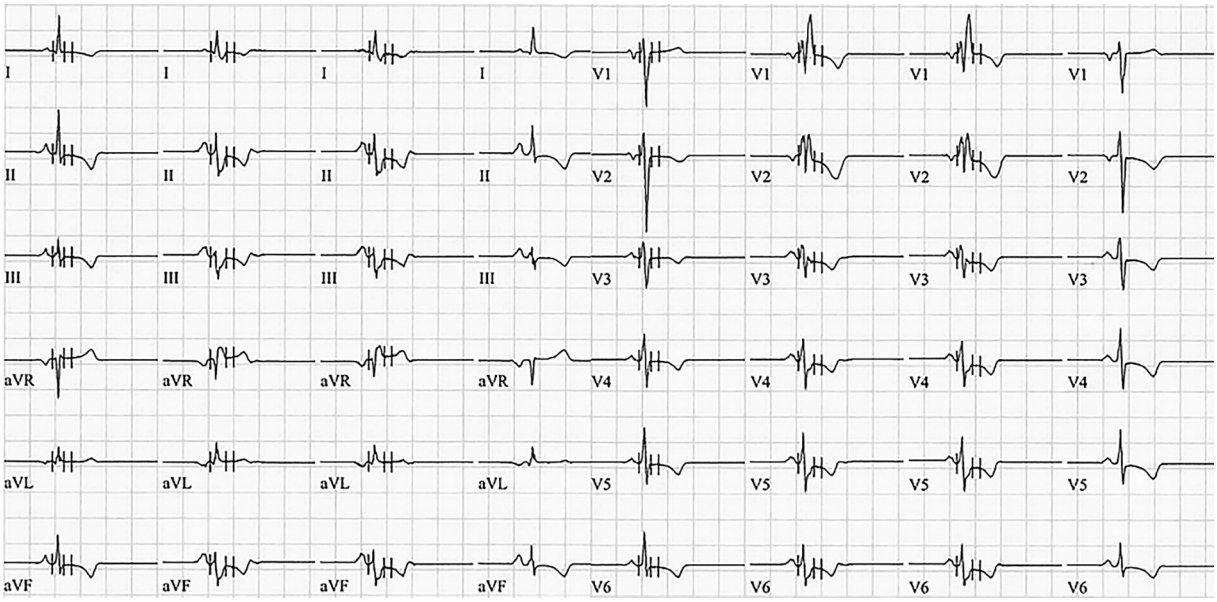

Fig. 4. Lead samples (25 mm/s, 10 mm/mV, extremity leads to the left and precordial leads to the right) at rest, 7 min and 8 min of exercise, and end-exercise, respectively, of the postoperative stress test. At 7 and 8 min of exercise there is left axis deviation caused by LAFB and typical CRBBB without prominent anterior forces (absence of LSFB).

inferior leads and in the leads V2-V6, possibly indicating perioperative myocardial injury. A new bicycle exercise test was performed one month after bypass surgery (Fig. 4). No chest pain developed, and no significant ST depressions appeared. At six minutes of exercise (HR 114, workload 60 watts), LAFB and typical CRBBB developed. However, this time LSFB did not appear. At end-exercise, there were no dromotropic disturbances.

Discussion

Exercise-induced CRBBB and LAFB have been associated with coronary artery disease, more specifically with stenosis of the LAD [4,5]. LSFB has been associated with acute and chronic coronary syndromes. The existence of a septal fascicle in addition to the anterior and posterior fascicles in the left ventricular conduction has been well documented by several diagnostic methods [2]. The ECG criteria for LSFB have been published, and prominent anterior forces (PAF) is a key diagnostic ECG criterion [2,6]. PAF is not specific for LSFB and therefore, in clinical practice, the transitory nature of the ECG phenomenon is an important diagnostic criterion for the conduction disturbance.

In our patient with severe LMCA disease, a rare combination of ventricular conduction disorders developed during an exercise test. We believe that this case shows for the first time the transient association of CRBBB + LSFB + LAFB (trifascicular block) appearing during exercise and disappearing at rest. This exercise test was done before bypass surgery and showed widespread ST depressions caused by severe coronary disease. In a second, postoperative, exercise test, LAFB and typical RBBB developed without LSFB. This indicates that LSFB was caused by myocardial ischemia.

CRediT authorship contribution statement

Kjell Nikus: Conceptualization, Data curation, Writing – original draft. **Jani Rankinen:** Writing – review & editing. **Raine Virtanen:** Writing – review & editing. **Yochai Birnbaum:** Writing – review & editing. **Andrés Ricardo Pérez-Riera:** Conceptualization, Writing – review & editing.

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Declaration of competing interest

The authors have no conflicts to disclose.

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