Apparent ST elevation in right bundle branch block pseudo-mimicking myocardial infarction

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Abstract
We report a case of right bundle branch block, in which the patient’s symptoms and the electrocardiogram findings mimicked those of acute coronary syndrome. In this case report, we stress the significance of apparent ST segment elevation in right bundle branch block. The differential diagnosis is important because right bundle branch block is often complicated with acute coronary syndrome. In addition, right bundle branch block with an ST segment elevation in the specific leads can be a predictor of sudden cardiac death. In such cases, close monitoring of the electrocardiogram findings and careful observation of the patient’s symptoms would be necessary.

Keywords
Right bundle branch block, ST segment elevation, acute coronary syndrome, the “currents of injury”

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Introduction
The ST segment is the flat and isoelectric section of the electrocardiogram (ECG) between the end of the S wave and the beginning of the T wave. If it is upsloping, it can also be a normal variant, even without invoking the “early repolarization” pattern. In the cardiac action potential, the ST segment represents the interval between the ventricular depolarization and repolarization.¹ The elevation of this segment occurs in a variety of cardiac events or abnormalities, including acute myocardial infarction, coronary vasospasm, pericarditis, left ventricular hypertrophy, Brugada syndrome, and fascicular bundle branch blocks.² The differential diagnosis is important because cardiac ischemia induces the large loss of cardiomyocytes, which eventually leads to impaired cardiac contractility, pump dysfunction, and the subsequent development of congestive heart failure.³ Here, we report a case of right bundle branch block (RBBB), in which the patient’s symptoms and the ECG findings mimicked those of acute coronary syndrome (ACS). We stress the significance of ST segment elevation in RBBB, which can predict the incidence of sudden cardiac death.⁴

Case
A 53-year-old man came to our outpatient clinic due to intermittent chest tightness and back pain which started 1 week prior to his visit. From 5 years ago, he had several episodes of back pain, each of which lasted more than an hour at the longest. He had medical history of hypertension, diabetes mellitus, and dyslipidemia. On physical examination, the patient had epigastric abdominal tenderness without rebound pain or guarding. Cardiac auscultation revealed normal heart sounds, but slightly increased heart rates. In the laboratory data, cardiac enzymes, such as creatine kinase (96 IU/L), lactate dehydrogenase (172 IU/L), and aspartate aminotransferase (22 IU/L), were not elevated and the troponin T test was negative. However, at first glance, the ECG appeared to show an elevation of the ST segments in leads III and aVF (Figure 1, arrows) and a reciprocal depression of the segments in precordial leads (V2-5) (Figure 1, arrowheads). In addition, chest computed tomography (CT) scanning, which ruled out the possibility of acute aortic dissection, revealed a calcification in the right coronary artery. Since ACS was

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considered to be the most likely diagnosis, the patient was immediately referred to a cardiologist. However, echocardiography did not show any motion abnormalities in the entire heart including the inferior wall, and an exercise stress electrocardiography did not show evidence of myocardial ischemia. Since the patient’s ECG originally showed typical findings of RBBB, including a widening of QRS, rSR′ patterns in precordial leads (V1-3), and the slurred S waves in the lateral leads (I, aVL, V5-6) (Figure 1), the apparent ST segment elevation in leads III and aVF was considered to be the end of QRS in this widened RBBB (Figure 1, arrows). Likewise, the apparent reciprocal changes observed in V2-5 were actually the S-wave, not the depression of the ST segment (Figure 1, arrowheads). The patient’s symptoms and signs subsided after initiating oral antacid treatment.

Discussion

RBBB is a right ventricular conduction delay or block caused by functional or anatomical defects in the right bundle branch. In addition to idiopathic origin, the causes of RBBB include acute myocardial infarction, right ventricular hypertrophy, congenital heart disease, myocarditis, pulmonary embolism, and less frequently, Wolff-Parkinson-White syndrome. The ECG findings of RBBB are contrasted with those of coronary occlusion, such as acute myocardial infarction and angina pectoris, since a superficial understanding of the ECG or an initial evaluation in an emergency situation could lead to an erroneous over-interpretation of the apparent ST segment changes. In cases of RBBB complicated with acute myocardial infarction, there are typical ECG findings as a result of cardiac ischemia, such as a significant elevation of ST segments (≥2 mm), the presence of abnormal Q waves, and reciprocal ST segment changes. However, as shown in our case (Figure 1), RBBB itself can induce apparent ST segment changes in the absence of ACS. In RBBB without coronary occlusion, the T wave is usually opposite in polarity to the last deflection of the QRS, a discrepancy induced by the altered sequence of repolarization which occurs secondary to altered depolarization. In contrast, in RBBB with coronary occlusion, the ST-T changes are independent of changes in the QRS, being the primary repolarization abnormalities caused by ischemia. Concerning the mechanisms, in RBBB without coronary occlusion, the conduction delay in the right ventricle causes the altered sequence of repolarization within the myocardium. This is different from RBBB with coronary occlusion, in which the “currents of injury” are primarily responsible for the mechanisms. In myocardial infarction, the currents of injury created by a voltage gradient between the intact and damaged areas of the myocardium, negatively deflected the ECG vector during the diastolic phase, making the ST segment appear elevated during the systolic phase. In most cases, once the involvement of cardiac ischemia was ruled out, RBBB itself does not require any additional treatment.

In conclusion, we experienced a case of RBBB, in which the patient’s symptoms and the ECG findings seemed to mimic those of ACS on initial evaluation. In this case report, we stress the significance of apparent ST segment elevation in RBBB.

Declaration of conflicting interests

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Ethical approval

Our institution does not require ethical approval for reporting individual cases or case series.

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Informed consent

Written informed consent was obtained from the patient(s) for their anonymized information to be published in this article.

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