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Extreme Right Axis Deviation in Acute Myocardial Infarction: A Hazardous Signal of Poor Prognosis

Authors' Contribution:
Study Design A
Data Collection B
Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
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Conflict of interest: None declared

Patient: Male, 72
Final Diagnosis: Acute myocardial infarction
Symptoms: —
Medication: Cardiac catheterization
Clinical Procedure: —
Specialty: Cardiology

Objective: Unusual clinical course

Background: New-onset extreme right axis deviation and right bundle branch block (RBBB) are rare during acute myocardial infarction (AMI), and has only been reported in several cases reflecting the severity of AMI. It could predict severe clinical complications and higher risks in coronary artery disease. Although there is little electrophysiological explanation, the complications are severe. They should be emphasized in newly diagnosed extreme right axis deviation and RBBB in AMI.

Case Report: A 72-year-old male was admitted to our department with a chief complaint of intermittent retrosternal chest pain and was diagnosed with extensive anterior myocardial infarction with RBBB, by elevated myocardial enzymes and ECG. The main wave direction of QRS in lead aVR was positive and showed an extreme right axis deviation. After a month, the patient's chest distress and the RBBB vanished, but a right axis deviation still existed. The echocardiogram showed prior extensive anterior myocardial infarction (including apex myocardia) and lower LVEF.

Conclusions: New diagnosed RBBB and right axis deviation is uncommon and could be a useful clue to evaluate myocardial ischemia in AMI cases. This electrocardiographic marker can identify coronary artery occlusion where ST-segments are hard to evaluate, and hence, patients may benefit most from early and complete revascularization strategies such as primary angioplasty.

MeSH Keywords: Anterior Wall Myocardial Infarction • Axis • Bundle-Branch Block

Full-text PDF: <https://www.amjcaserep.com/abstract/index/idArt/908486>

Background

The incidence and mortality rates of acute myocardial infarction (AMI) continue to be high despite the emergence and development of exciting therapies. As we know, diagnosis should be established accurately before treatment commences. ECG changes, such as ST-segment elevation and left bundle branch block (LBBB), may be used as a clue for poor prognosis of AMI. The QRS axis shift is an uncommon finding during AMI and it has been reported to be associated with LBBB [1]. New-onset extreme right axis deviation and right bundle branch block (RBBB) are rare during AMI and have only been reported in several cases reflecting the severity of AMI [2]. Meanwhile, extreme right axis deviation may be used as a special indicator of poor perfusion in coronary artery as well as left ventricular heart dysfunction. Although there is little electrophysiological explanation, the complications are severe. They should be emphasized in newly diagnosed extreme right axis deviation and RBBB in AMI.

We present a case of RBBB and extreme right axis deviation in a 72-year-old male diagnosed of AMI.

Case Report

A 72-year-old male was admitted to our department with a chief complaint of intermittent retrosternal chest pain during resting on June 16, 2017. The pain radiation into the neck started the day before the admission without obvious precipitating factors. He had no hypertension, diabetes, smoking history, or

family history. Physical examination showed his blood pressure was 90/60 mm Hg and his heart rate was 71 bpm. The ECG performed on June 16 showed the pathological Q wave in lead I, aVL, and V2-V6. The troponin-I was 10.17 mg/L (reference value <3.10 mg/L). Therefore, the patient was diagnosed with extensive anterior myocardial infarction with RBBB, by elevated myocardial enzymes and ECG. What surprised us, was that the main wave direction of QRS in lead aVR was positive (QRS axis: 231°) (Figure 1). Coronary angiography revealed that the proximal left anterior descending (LAD) was 100% obstructed, and the left circumflex artery (LCX) showed 70–80% stenosis (Figure 2). A sirolimus-eluting stent (3.0×35 mm drug-eluting stent) was implanted in the LAD. After percutaneous coronary intervention, the patient's pain was relieved, but the patient suffered from recurrent heart failure. ECG showed no significant difference (Figure 3). Echocardiogram presented an enlarged left atrium, a low left ventricular ejection fraction (LVEF) of 42%, and left regional wall motion abnormalities, indicating severe cardiac dysfunction.

The patient was later readmitted to our hospitalized with recurrent heart failure after about a month. At this time, chest distress and the RBBB vanished, but a right axis deviation still existed. The echocardiogram showed prior extensive anterior myocardial infarction (including apex myocardia), and lower LVEF of 34%(Figure 4).

Figure 1. The arrows show the main wave direction of QRS in lead aVR was positive (QRS axis: 231°).

Figure 2. CAG shows left anterior descending 100% obstruction and 70–80% stenosis of left circumflex artery (A). CAG shows left anterior descending and left circumflex artery after PCI (B).

Figure 3. The ECG show showed an extreme right axis deviation and RBBB (QRS axis: 203°).

Figure 4. Echocardiogram showed prior extensive anterior myocardial infarction (including apex myocardia), and lower LVEF of 34%.

Discussion

The QRS axis deviation between $+90^\circ$ to $+180^\circ$ is considered as right axis deviation. It indicates that the fascicular block, lateral myocardial infarction, right ventricular hypertrophy, pre-excitation syndromes, ventricular tachycardia, and ventricular ectopy are prone to right axis deviation [3]. In this case, we reported RBBB and extreme right axis deviation in a patient with extensive anterior myocardial infarction.

There have been no experimental studies in which the ECG was observed in myocardial infarction of RBBB and right axis deviation, nor have there been any histopathologic studies to shed any light on the combined effect on QRS axis deviation and LVEF. In our case, we speculated the presence of right axis deviation during complete right block represented the association of the left posterior fascicular block. LVEF may be lower when extreme right axis deviation with RBBB is noticed in a patient with extensive anterior myocardial infarction [4–7]. The pathological change of anterior infarction and extensive lateral myocardial infarction could change the axis [8]. And extensive lateral myocardial infarction with involvement of basal areas may cause an opposite electric vector, which may explain the presence of a positive main wave direction of QRS in lead aVR [9].

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Furthermore, extreme right axis deviation or QRS axis change is a sign of a severe obstructive lesion of a major coronary artery. Kurisu et al. [10] found that poor prognosis was present in 71 patients with myocardial infarction, especially in those with RBBB. In the present case, our patient had a diagnosis of supply ischemia in the extensive anterior myocardial infarction, and similarly showed RBBB and extreme right axis deviation supporting the recurrent heart failure and lower LVEF.

Conclusions

Newly diagnosed RBBB and right axis deviation is uncommon and could be a useful clue to evaluate myocardial ischemia in AMI. Thus, this electrocardiographic marker can identify coronary artery occlusion where ST-segments are hard to evaluate. Patients may benefit most from early and complete revascularization strategies such as primary angioplasty.

Conflict of interest

None.