A case of simultaneous anterior and inferior ST-segment elevation myocardial infarction due to isolated occlusion of a wrapped right posterior descending artery

Peiren Shan, MD, Sheng Li, MD, Zhouqing Huang, PhD, Weijian Huang, MD

Abstract

We present a case of a 72-year-old man with acute coronary syndrome due to isolated acute occlusion of a wrapped right posterior descending artery. Electrocardiogram showed simultaneous anterior and inferior ST-segment elevations. We discuss the causes of this exceptional electrocardiographic pattern.

Keywords: Right posterior descending artery; Electrocardiogram; Myocardial infarction

Introduction

The electrocardiogram (ECG) is the most accessible and widely used diagnostic tool for patients with acute myocardial infarction (AMI), providing good correlation between ST-segment elevation and the culprit coronary artery. Combined ST-segment elevation in the precordial and inferior leads in AMI patients is an unusual and interesting ECG finding. Here, we first describe ECG findings consistent with simultaneous anterior and inferior ST-segment elevation myocardial infarction (STEMI) due to the occlusion of the right posterior descending artery (RPDA).

Case presentation

A 72-year-old hypertensive man with no prior angina was referred to the emergency department because of anterior chest pain persisting for one hour. Upon admission, physical examination revealed a blood pressure of 115/67 mmHg and pulse rate of 68/min. The 18-lead ECG showed ST-segment elevation in leads II, III, aVF and V2–V6, while right sided and posterior lead tracings were within normal limits (Fig. 1A). Echocardiography revealed a hypokinetic left ventricular inferior wall, but no right ventricular enlargement, and a global left ventricle (LV) ejection fraction 58%. Urgent coronary angiography (Fig. 2A and B) showed patent left anterior descending (LAD) and circumflex (LCX) coronary arteries, with the LAD not reaching the LV apex (Fig. 2A) and absence of myocardial blush in the LV apical–anterior portion (Fig. 2B), and total RPDA occlusion (Fig. 2C). Coronary angiography after RPDA stenting revealed a long RPDA extending beyond the LV apex (wrapped RPDA) (Fig. 2D) and myocardial stain was apparent in the apical–anterior territory (Fig. 2E). Maximal troponin I level was 78.5 μg/L (normal, <0.15 μg/L). Level of creatine kinase and of its MB band peaked at 2215 IU/L (reference value: 38–174 IU/L) and 253 IU/L (reference value: 0–25 IU/L), respectively. ECG (Fig. 1B) after successful recanalization of the RPDA showed complete ST-segment resolution and T-wave inversion. The patient has been event free during six-month follow-up.

Discussion

To the best of our knowledge, this is the first report demonstrating that myocardial infarction with simultaneous ST-segment elevation in anterior and inferior leads also can be secondary to isolated occlusion of a wrapped RPDA. Simultaneous ST-segment elevation in anterior and inferior leads has been reported in acute myocardial infarction secondary to wrapped LAD occlusion or simultaneous double vessel occlusion. It has also been reported that right ventricular infarction during inferior myocardial infarction due to acute occlusion of a dominant right coronary artery proximal to the right ventricular branch may appear as precordial ST-segment elevation, maximally in leads V1–V2, and decreased towards more left-sided leads because of...
the anteriorly directed injury current and right ventricular dilatation.\textsuperscript{5-7} However, the possibility in this case of simultaneous concomitant right ventricular infarction due to occlusion of the right ventricular branch by thrombosis and/or spasm was excluded because of lack of ST-segment elevation in the right-sided precordial leads, including V\textsubscript{1},

Fig. 1. (A) Electrocardiogram on admission showing simultaneous ST-segment elevation in the inferior and precordial leads. (B) Electrocardiogram after stenting displaying ST-segment resolution and T-wave inversion.

Fig. 2. Pre-procedure angiography showing: (A) patent left coronary system (straight cranial projection), with a short LAD terminating well before reaching the LV apex (arrowhead); (B) absence of myocardial blush in the LV apical–anterior portion; and (C) total occlusion of the right posterior descending artery (RPDA, white arrow) with intracoronary thrombus formation (left anterior oblique projection). Final coronary angiography (straight cranial projection) (D) reveals a long RPDA reaching the LV anterior wall beyond the apex (black arrow), and (E) evident myocardial stain in the apical–anterior territory.
and of a dilated right ventricle in echocardiography performed during the acute phase.

In our patient, this quite exceptional ECG pattern may be explained by the unusual coronary anatomy. The small LAD coronary artery terminates well before the LV apex, whereas the RPDA from the right coronary artery extends around the apex to supply part of the LV anterior wall (wrapped RPDA), which was further supported by the angiographic image of apical–anterior myocardial stain supplied by RPDA, rather than LAD, and the ECG findings of complete ST-segment elevation and T-wave inversion in precordial leads after successful RPDA recanalization. The sparing of the antero-lateral injury current, resulting in no superiorly oriented ST-segment elevation and therefore no reciprocal inferior ST depression, is another important reason for combined anterior and inferior ST-segment elevations.

Although the ECG finding of simultaneous ST-segment elevation in anterior and inferior leads due to single-vessel occlusion has been reported in several conditions, there remain distinctive features among cases. In both the patient in this case and the previously reported one with a mid-to-distal wrapped LAD occlusion, the maximal ST-segment elevation was in leads V3–V4 among precordial leads, which is different from the ECG pattern in the previously reported patient with RCA occlusion and predominant right ventricular infarction, showing precordial maximal ST-segment elevation in leads V1 to V2, disappearing toward leads V3 and V6. The patient with combined anterior and inferior STEMI due to a mid-to-distal wrapped LAD occlusion had greater ST-segment elevation in lead II than III, indicating an ST-segment axis ≤ 90°, whereas the patient in this case report had more pronounced ST-segment elevation in lead III than II.

In contrast with studies showing that greater number of leads with ST-segment elevation correlate with larger AMI size, LV dysfunction and poor clinical outcome, the patient in this case had limited AMI size and preserved LV function despite widespread ST-segment elevation in 8 leads, indicating that such a generalization may not be applicable to patients with combined anterior and inferior STEMI.

In summary, this is a quite unusual ECG showing simultaneous ST-segment elevation in anterior and inferior leads secondary to isolated occlusion of a wrapped RPDA.

References