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Evaluation of acute anterior myocardial infarction cases with de-Winter T waves by coronary angiography images

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A B S T R A C T

Introduction: Acute myocardial infarction (AMI) is the leading cause of mortality worldwide and with immediate invasive strategy, the extent of myocardial injury can be reduced. In recent studies, de-Winter T waves were defined as a sign of proximal left anterior descending artery (LAD) occlusion. In this electrocardiography (ECG) pattern, no ST elevation is seen, but an upsloping ST segment depression (> 1mm) beginning from J-point, and symmetrical, long and significant T waves are seen in precordial leads.

Case reports: We present three patients who were admitted to emergency department with symptoms of chest pain. Their ECGs revealed de-Winter T waves, therefore, coronary angiography was performed. Total LAD occlusion was observed in all patients, and stents were implanted to the culprit lesion.

Conclusion: We aim to emphasize the importance of de-Winter T waves since physicians should recognize this ECG pattern immediately in emergency situations to provide appropriate treatment to STEMI patients.

1. Introduction

Acute myocardial infarction (AMI) is the leading cause of mortality, accounting for 12.8% of all deaths worldwide.[1] In the United States, it is estimated that an AMI occurs in every 42 seconds.[2] All physicians should be well informed about the possible abnormal findings on electrocardiography (ECG) since it is the fastest non-invasive method to diagnose AMI.

According to the fourth universal definition of MI, in order to diagnose ST-segment elevation myocardial infarction (STEMI), there should be ST-segment elevation (STE) in at least two consecutive derivations about 1.5 mm for women, 2 mm for men aged over 40 years, 2.5 mm for men aged under 40 years, 1 mm in limb leads, and 0.5 mm in the V7-V8-V9 derivations.[3] For patients with STE, cardiac catheter laboratory activation should be performed.[1] In recent studies a pattern named as de-Winter T waves was identified.[4] In this ECG pattern, no STE is present in the related leads, but there is an up-sloping ST segment depression (STD, > 1 mm) starting from the J-point, with symmetrical, long and significant T-waves in the precordial leads. This ECG pattern indicates a left anterior descending artery (LAD) obstruction, and these cases were labelled as anterior STEMI equivalents.[3–5] Most cases with de-Winter T waves present with a serious LAD occlusion.[4]

In this case report, we present three patients with the symptom of chest pain. In their ECGs, no STE was present but de-Winter T waves were evident. We think it is important to emphasize this clinical picture which guides physicians to serious LAD occlusion.[4,5]

2. Case series

2.1. Case 1

53-year-old male patient was admitted to the emergency department with symptoms of chest pain and shortness of breath, which started about 30 minutes ago. He stated that his pain was severe, on sternum, with burning sensations. He scored his pain as 10/10 according to the Numeric Pain Scale. He denied having a similar pain before. The patient had a history of smoking and diabetes mellitus and no history of cardiovascular disease. His blood pressure was 90/60 mmHg. Physical examination revealed anxious appearance, and rales at bilateral pulmonary bases. In his ECG (Fig. 1), there was no ST segment elevation but segment depression in J-point, up-sloping ST segment depression and symmetrical, long and significant T waves in the anterior leads. The Troponin T (Cobas-hsSTAT) level was 0.012 ng/ml (Normal: 0.014 ng/ml). An emergency echocardiography was performed. Left ventricular ejection fraction (LVEF) was 40%, lateral and anterior wall hypokinesia was present, therefore, a coronary angiogram

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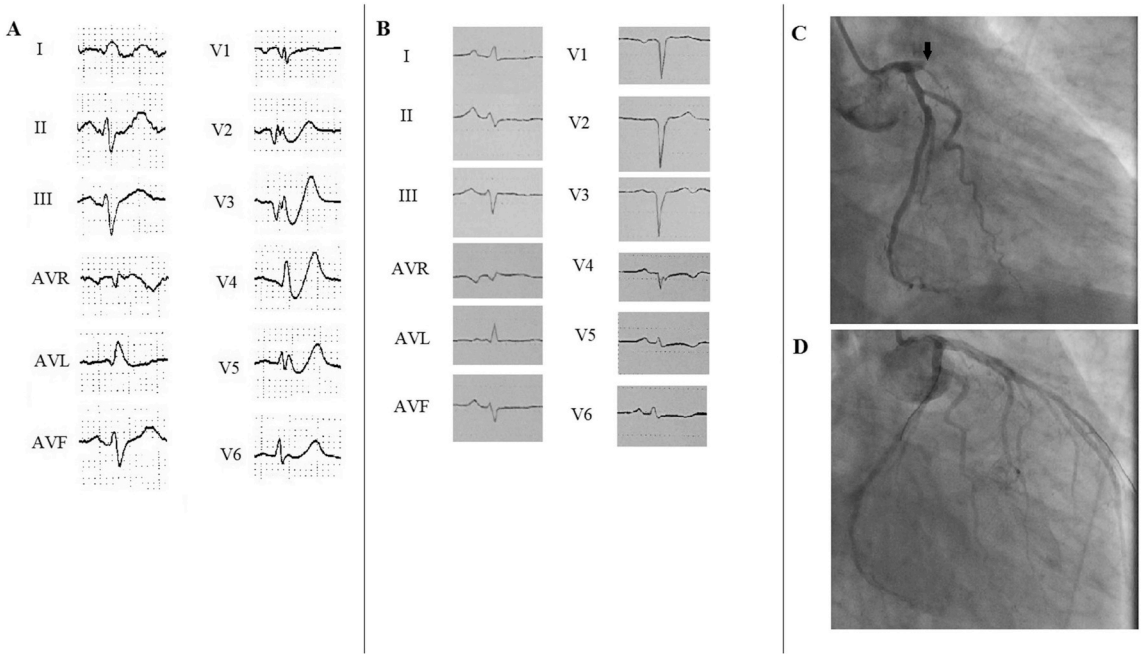

Fig. 1. (A) ECG before percutaneous coronary intervention. (B) ECG after percutaneous coronary intervention. (C) LAD occlusion was present before the percutaneous coronary intervention. (D) LAD flow was achieved after the percutaneous coronary intervention.

was performed at the 45th minute of his admission. Total occlusion of the LAD was observed and Thrombolysis in Myocardial Infarction (TIMI) 3 type flow was obtained after drug-eluting stent (DES) implantation (Fig. 1). After the procedure and follow-up period, the patient had no post-procedural complications and discharged from the hospital.

2.2. Case 2

45-year-old male patient was admitted to the emergency department with a chest pain lasting for 60 minutes, which started at rest. The pain radiated to his back and left arm. He reported that his pain was on the sternum with severe burning sensation. He denied to have a similar pain before. The pain score was 10/10. The patient had a history of smoking and no history of cardiovascular disease. Vital signs were all within normal limits. No abnormal findings were found in physical examination. The ECG showed the de-Winter T waves (Fig. 2). The Troponin T level was 0.021 ng/ml. LVEF was 45%, there was lateral hypokinesia. Coronary angiography was performed 35 minutes later. The procedure showed total occlusion of the LAD, and 90% occlusion of the circumflex artery (Fig. 2). A DES was implanted to LAD and stent implantation to Cx was planned for a subsequent procedure.

2.3. Case 3

61-year-old male patient was admitted to the emergency department with a chest pain lasting for 60 minutes. The patient described a severe searing and burning sensation on the sternum. The pain score was 10/10. The patient, who had previously had similar pain, had 2 coronary angiography examinations and one stent implantations before. He had a history of smoking and diabetes mellitus. His blood pressure was 90/60 mmHg. Physical examination revealed rales at bilateral pulmonary bases. The ECG demonstrated de-Winter T waves (Fig. 3). The Troponin T level was 0.039 ng/ml. LVEF was 40%. After 30 minutes, coronary angiography was performed. During the procedure in-stent restenosis of LAD artery was observed and DES was implanted (Fig. 3). There was no critical occlusion on the other arteries. After the procedure the patient had no post-procedural complications and discharged from hospital.

3. Discussion

With immediate invasive strategy, the extent of myocardial injury can be reduced and the incidence of heart failure caused by coronary artery disease may be decreased. To decrease the rate or morbidity and mortality, ECG should be recorded and intrepreted in 10 minutes, and door-to-balloon time should not exceed 90 minutes at the first contact with the patient.[1–3] If a period of more than 120 minutes for transfer to another hospital and percutaneous interventions is foreseen, the patient's fibrinolytic need should be assessed and treatment should be initiated.[1] In addition, acute coronary syndrome can occur even though the ECG is totally normal. Patient's symptoms such as severe chest pain are more important than ECG findings.[2]

In 2008 de-Winter identified specific T waves which were almost always together with a proximal LAD lesion. According to this definition, “up-sloping ST depression and symmetrical long and distinct T waves starting from J-point in precordial leads" were defined as deWinter T waves.[5] T-wave spikes may also be indicative of acute coronary syndromes because this finding may be caused by the deterioration in early blood flow.[6–8] De-Winter ECG also shows long and distinct T waves, but unlike hyper-acute T waves, T spikes in these patients are fixed and the lesion continues until revascularization is accomplished.[9] ST segment depression is uncertain in cases such as these. A possible hypothesis is that retrograde filling of the LAD with contralateral blood vessels and prolonged repolarization of the endocardium causes an increased repolarization vector in the same direction.[10]

There are conditions in which a rapid invasive procedure without ST segment elevation. These include angina that does not respond to treatment, life-threatening ventricular rhythm disorders, patients with unstable hemodynamic status, and severe heart failure.[11] Except for these, some conditions that may be equivalent to ST segment elevation have been shown in the literature. These include the newly developed left bundle branch block (LBBB), old LBBB patient with the presence of Sgarbossa criteria, ST depression in 6 or more derivations and ST elevation in aVR due to left main coronary artery occlusion, Wellens

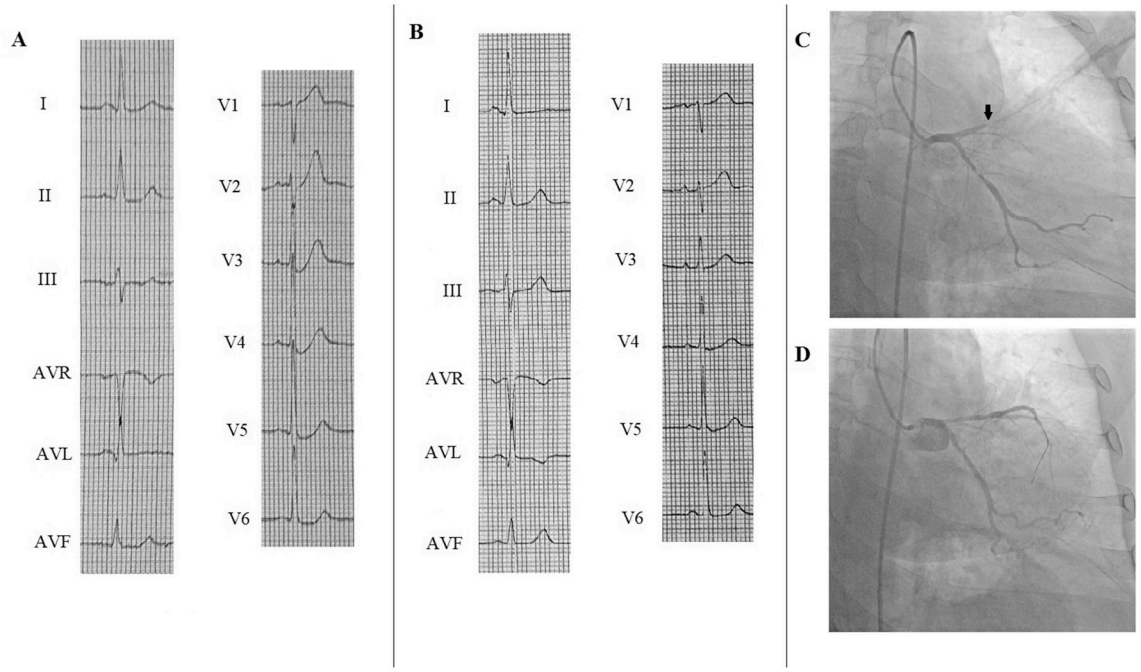

Fig. 2. (A) ECG before percutaneous coronary intervention. (B) ECG after percutaneous coronary intervention. (C) LAD occlusion was present before percutaneous coronary intervention. (D) LAD flow was achieved after the percutaneous coronary intervention.

syndrome, and de-Winter T waves.[12,13] These mentioned changes were mostly included in the 2017 ESC STEMI guidelines, but de-Winter T waves was not mentioned in the immediate invasive strategy list.[1] Although acetylsalicylic acid, clopidogrel, has been used as a treatment for these patients, STEMI/NSTEMI evaluation should be done for these patients. The option for ticagrelor/prasugrel treatment should be evaluated in the upcoming guidelines.

4. Conclusion

We discussed the common aspects and interventions of our patients with de-Winter T waves in our three-case series. It was noted that all patients explained their chest pain as severe, searing and burning sensation at anterior chest with a strength of 10/10. In addition, LAD occlusion was present in all 3 patients. The purpose of this case presentation was to emphasize the importance of this ECG pattern because it is as important as STEMI and these patients need to undergo immediate percutaneous coronary intervention. The de-Winter T waves should be expressed clearly in educational courses and in the guidelines such that patients would receive appropriate treatment in time and morbidity and mortality can be reduced.

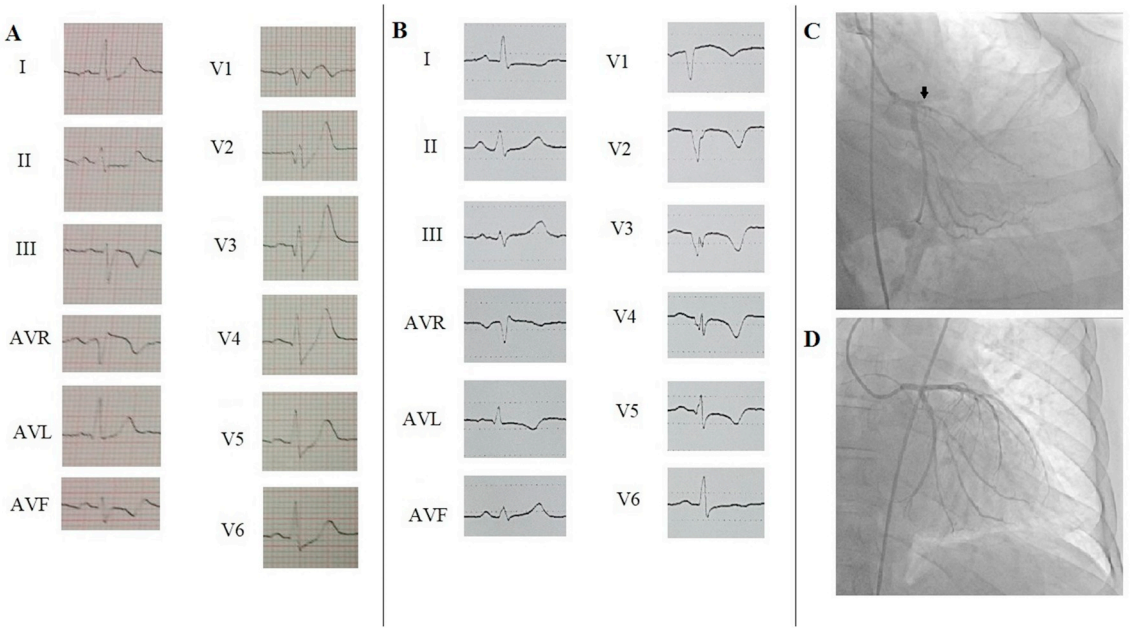

Fig. 3. (A) ECG before percutaneous coronary intervention. (B) ECG after percutaneous coronary intervention. (C) LAD occlusion was present before percutaneous coronary intervention. (D) LAD flow was achieved after percutaneous coronary intervention.

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Author contribution statement

MEC: conceived and designed the experiments, analyzed and interpreted the data, contributed reagents, materials, analysis tools or data, wrote the paper.

OTY: contributed reagents, materials, analysis tools or data, wrote the paper.

NA: performed the experiments, analyzed and interpreted the data.

KUM: performed the experiments, contributed reagents, materials, analysis tools or data.

Conflict of interest statement

As authors we declare that we have no conflict of interest and no funding was taken for this case report.

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