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Junctional ST-depression and tall symmetrical T-waves with an obtuse marginal artery occlusion: A case report☆

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ABSTRACT

A 54-year-old man presented to the emergency department with chest pain and electrocardiogram (ECG) changes of acute ST-segment elevation myocardial infarction (STEMI) and junctional ST-depression with tall symmetrical T-waves (de Winter T-wave) in the lateral and inferior leads. Emergent coronary angiography revealed a culprit lesion in the gigantic obtuse marginal artery (OM). This case demonstrates the de Winter T-wave can occur in a patient with an acute occlusion of OM. Emergency physicians, ambulance staff, cardiologists and all involved in STEMI networks should familiarize themselves with this unusual ECG pattern and consider transferring patients for urgent angiography and reperfusion therapy.

Introduction

The de Winter ECG pattern consisting of junctional ST-depression with tall symmetrical T-waves in patients with acute chest pain has been related with occlusion of the proximal left anterior descending artery (LAD) [1]. Recognition of this electrocardiogram (ECG) pattern (called the "de Winter T-wave" by some) by ambulance staff, emergency physicians and interventional cardiologists involved in ST-segment elevation myocardial infarction (STEMI) networks is important to ensure timely reperfusion therapy in these patients. As it is regarded as "a new ECG sign of proximal LAD occlusion", a de Winter ECG pattern with a non-LAD culprit lesion has rarely been reported.

In this paper, we present a case of a 54-year-old man with acute ST-segment elevation myocardial infarction due to a culprit lesion in the gigantic obtuse marginal artery (OM) and an initial ECG showing mild ST-segment elevation in the posterior leads and junctional ST-depression with tall symmetrical T-waves (de Winter T-wave) in the lateral and inferior leads.

Case report

A 54-year-old man with a personal history of smoking was admitted to the emergency department for a typical acute chest pain approximately 2 h after symptom onset. An electrocardiogram (Fig. 1A) was immediately obtained and showed a sinus rhythm of 75 bpm, junctional ST-depression with tall symmetrical T-waves in leads $V_{5–6}$, I, II and aVF, and a slight ST segment elevation in Lead aVR. A mild ST-segment elevation was found in posterior leads $V_{8–9}$ with a mirror image of ST-segment depression in leads $V_{2–3}$. Based on a suspected diagnosis of acute posterior ST-segment elevation myocardial infarction, he was immediately transferred to our primary coronary intervention (PCI) center. Coronary angiography showed a culprit lesion in the gigantic obtuse marginal artery (OM) (Fig. 2A B), which was occluded (TIMI-0 flow), and nonsignificant stenosis in the left anterior descending artery (LAD) (TIMI-3 flow) (Fig. 2C). Primary PCI was successfully executed, and a 3.0 × 33 mm drug-eluting stent was placed in the left circumflex artery (LCX) and OM with good angiographic results (TIMI-3 flow) (Fig. 2D). Postprocedural ECG (Fig. 1B) showed q-waves in inferior leads and complete resolution of the de Winter T-wave. The posterior leads showed a deepened Q wave with resolution of ST-segment elevation. Troponin I and creatine kinase-myocardial band levels observed approximately 18 h after symptom onset were 9.95 ng/mL and 160.1 U/L, respectively. Subsequent echocardiography revealed normal left ventricular systolic function, and no complications occurred during hospitalization.

Discussion

We present a case of a patient with acute STEMI with a culprit lesion in the gigantic OM. ECG changes of mild ST-segment elevation in the posterior leads and increased amplitude of T waves in right precordial leads $V_{1–2}$ after reperfusion supported the diagnosis of acute posterior myocardial infarction [2]. Interestingly, the preprocedural ECG showed junctional ST-depression with tall symmetrical T-waves in lateral and inferior leads, which was compatible with the

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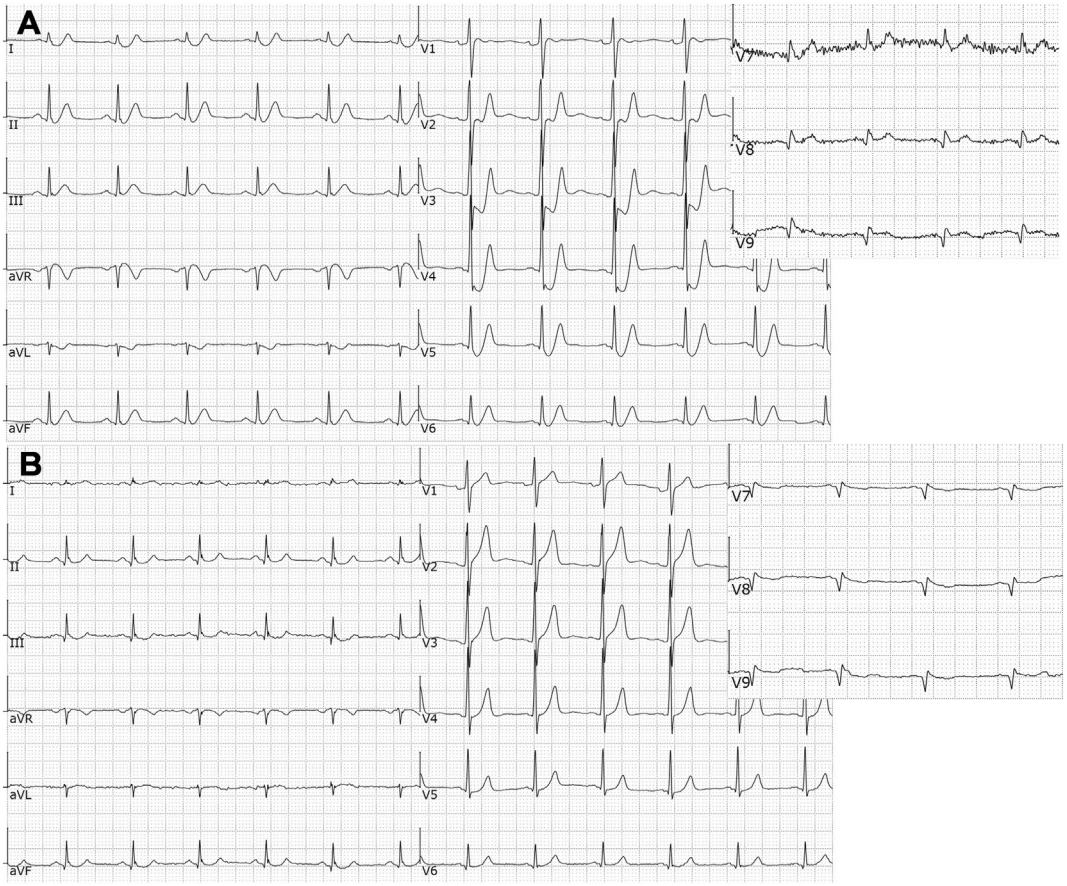

Fig. 1. (A) The initial ECG shows a mild ST-segment elevation in posterior leads $V_{8–9}$ with a mirror image of ST-segment depression in leads $V_{2–3}$ and de Winter T-wave in leads $V_{5–6}$, I, II and aVF. (B) Postprocedural ECG shows q-waves in inferior leads and complete resolution of de Winter T-wave. The posterior leads showed a deepened Q wave with resolution of ST-segment elevation.

de Winter T-wave. These ECG changes completely recovered after reperfusion.

In 2008, de Winter et al. [1] described an ECG pattern without ST segment elevation in anterior ECG leads that occurs in 2% of LAD occlusions, consisting of an upsloping ST segment depression at the J point in leads V_1-V_6 that continues into tall, positive symmetrical T waves. This pattern is often combined with an elevation of the ST segment in aVR and a loss of the precordial R-wave. However, de Winter described such changes eponymously in leads V_1 to V_6, whereas these were present in leads $V_{5–6}$, I, II and aVF in our case. We hypothesize that the culprit lesion in our case was a gigantic OM supplying the lateral-posterior segment of the left ventricle and inferior wall, which resulted in nonclassical distribution of the de Winter T-wave in the lateral and inferior leads.

Recently, de Winter et al. [3] reported the prevalence of the de Winter T-wave in a field triage system for STEMI with a cohort of 5588 patients. Junctional ST-depression with tall symmetrical T-waves was identified in 0.2% of total transmitted ECGs and 1.6% of anterior infarctions, in which angiograms invariably showed involvement of the LAD artery. Though the de Winter T-wave is an infrequent finding, this specific ECG has recently been described in STEMI patients with a culprit lesion of the first diagonal branch (D1) [4] or right coronary artery (RCA) [5]. It is not difficult to find that these ECG changes mainly occur on the leads corresponding to the area dominated by the culprit artery, which may imply that the position of the de Winter T-wave on the standard 12-lead electrocardiogram may be helpful in locating the involved artery.

In 1955, Pruitt et al. presented serial ECGs of a patient with severe chest pain. The first ECG, which was recorded 1 h after pain onset, showed junctional ST-depression with tall symmetrical T-waves in leads V_3-V_5; this ECG manifestation is now called de Winter T-wave [6]. A later ECG of their patient showed deeply inverted T waves in lead V_3 and V_4. Later, a pathophysiological explanation based on subendocardial ischemia for this peculiar ECG pattern was proposed by Sclarovsky et al. [7] Furthermore, Gorgels et al. elaborated the electrophysiological mechanism underlying this ECG changes with the resulting behavior of the subendocardial and subepicardial action potentials based on the likely subendocardial ischemia [8]. However, coronary angiogram in de Winter's group showed occlusion of the proximal left anterior descend coronary artery with TIMI flow 0 or 1 in most patients (86%), which most probably suggested transmural myocardial ischemia rather than subendocardial ischemia. Some authors postulated that collateral circulation or ischemic preconditioning might protect the myocardium from transmural ischemia. In short, the exact pathophysiological explanation of de Winter T-wave remains inconclusive and requires further exploration.

In conclusion, our case demonstrates that the de Winter T-wave consisting of junctional ST-depression with tall symmetrical T-waves is not exclusively associated with LAD occlusion and can also occur in a patient with an acute occlusion of OM. It is hypothesized that the position of this peculiar ECG pattern on the standard 12-lead electrocardiogram may be helpful in locating the criminal artery. Emergency physicians, ambulance staff, cardiologists and all involved in STEMI networks should familiarize themselves with this unusual ECG pattern and consider transferring patients for urgent angiography and subsequent reperfusion therapy.

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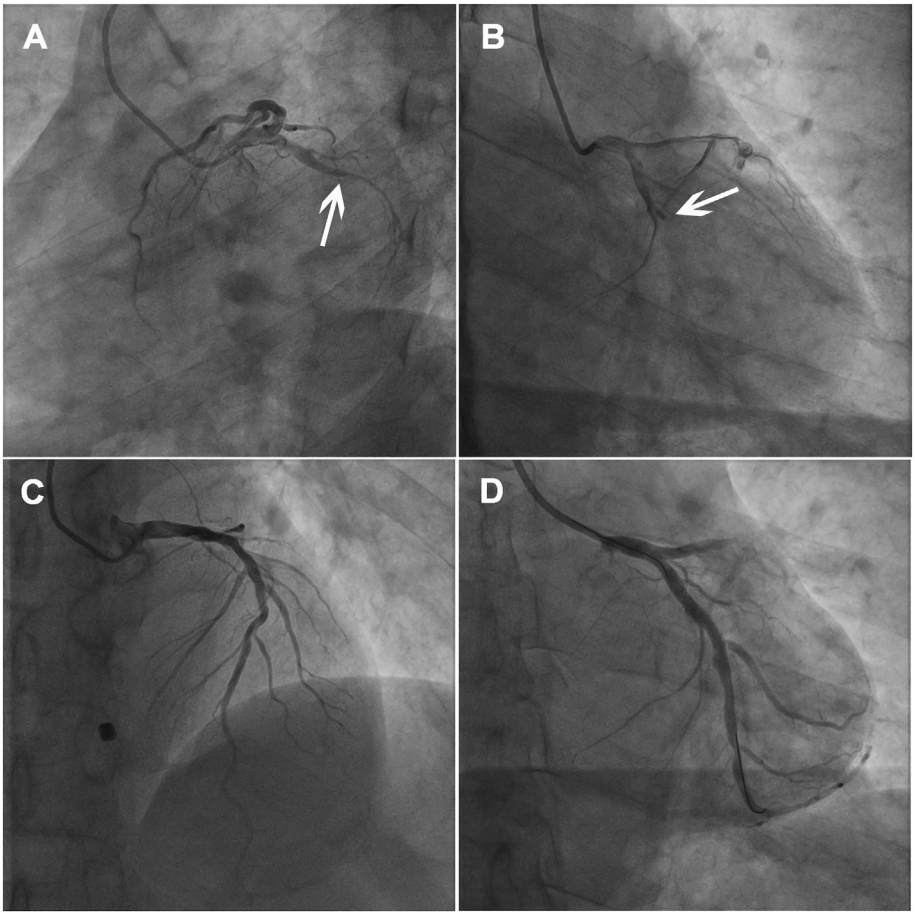

Fig. 2. Coronary angiography shows proximal occlusion of the obtuse marginal artery (white arrow) in oblique anterior left caudal (A) and caudal (B) views, and nonsignificant stenosis in LAD (C). Coronary angiography after the angioplasty shows a very well developed OM with TIMI-3 flow (D).

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