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CASE REPORT

WILEY

The De Winter-like electrocardiogram pattern associated with multi-vessel disease

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Abstract

Background: The de Winter ECG pattern was described by upsloping ST-segment depression in leads V1-V6, tall and symmetrical T waves in precordial leads. The ECG pattern is regarded to be associated with occlusion of the left anterior descending (LAD) artery.

Methods: One patient with de Winter ECG pattern was included. The 12-lead ECG of patients with chest pain showed upsloping ST-segment depression up to 3 mm at the J point in leads V2-V6; tall symmetrical T waves in leads V2-V4; 1mm J point elevation in lead aVR; ST-segment depression 1mm in I, aVL leads and inverted T waves in the inferior leads. The ECG was showed the de Winter pattern.

Results: The ECG was showed the de Winter pattern. CAG was performed, which showed the normal left main; 60%-80% LAD stenosis; 50%-60% ostial right coronary artery(RCA) stenosis; and 90% stenosis of the vessel at middle segment. Both proximal and middle RCA vascular lesions were dilated and successfully inserted with drug-eluting stents, respectively.

Conclusion: Our case the ECG was showed horizontal ST depression with tall T waves in leads V2-V4 (maximal ST depression in lead V4) while only ST depression in leads V5-V6, which may result from multivessel disease.

KEYWORDS
de Winter ECG pattern, multi-vessel disease

1 | CASE REPORT

An 81-year-old male patient with hypertension was admitted to our hospital with chest pain for 10 days and aggravation for 2 days. Chest pain occurred several times a week, and each time lasted about 20 min for self-relief, accompanied by chest tightness and palpitation. His heart rate was 104 bpm, his blood pressure was 118/66 mmHg, and his respiratory was 23 breaths/min with normal cardiac and lung examination. Laboratory tests showed troponin I levels 6.13 ng/ml (normal 0–0.09 ng/ml), creatine kinase 353.1 U/L (normal 25–200 U/L), creatine kinase-MB levels 15.34 ng/ml (normal 0–5 ng/ml). The echocardiogram showed regional wall motion abnormalities in inferior and posterior territories. The 12-lead electrocardiogram (ECG) of patients with chest pain showed upsloping ST-segment depression up to 3 mm at the J point in leads V2–V6; tall symmetrical T waves in leads V2–V4; 1 mm J point elevation in lead aVR; ST-segment depression 1 mm in I, aVL leads and inverted T waves in the inferior leads (Figure 1). The ECG was showed the de Winter pattern. Coronary angiography (CAG) was performed which showed the normal left main;

Chunfang Wang the first authorship.

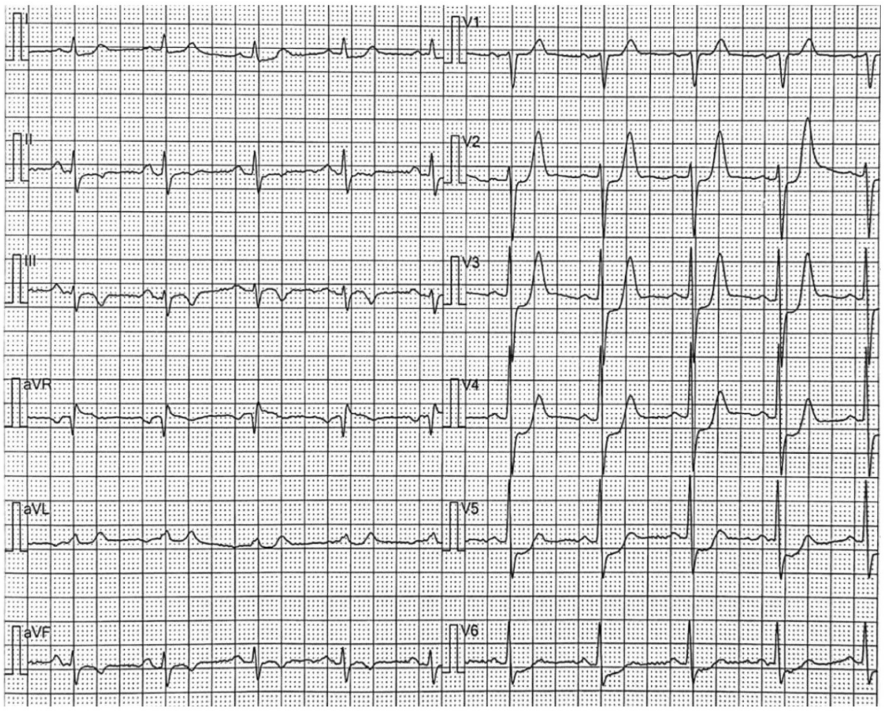

FIGURE 1 Twelve-lead ECG of the patient. The ECG showed upsloping ST-segment depression at the J point from V2 to V6, I and aVL; tall symmetrical T waves in leads V2–V4 together with a J point elevation in the lead aVR

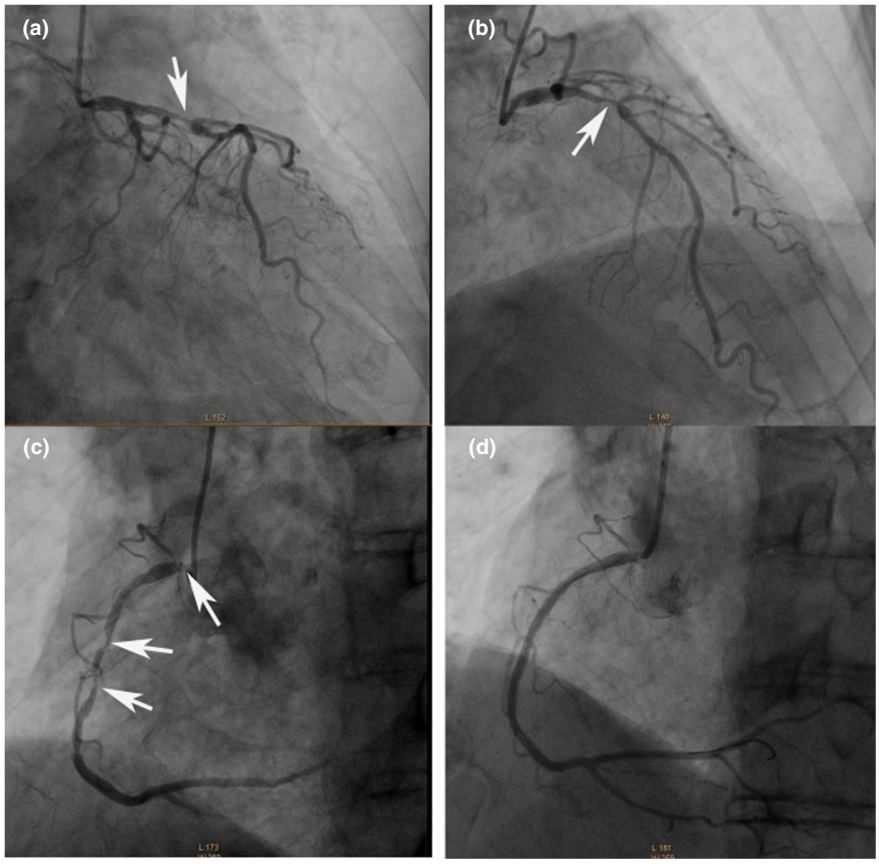

FIGURE 2 Coronary angiography. The coronary angiography showed that the 60%–80% LAD stenosis ((a and b) white arrow); 50%–60% ostial right coronary artery (RCA) stenosis; and 90% stenosis of the vessel at the middle segment ((c) white arrow), after stents placement (d)

60%–80% left anterior descending (LAD) stenosis; 50%–60% ostial right coronary artery (RCA) stenosis, and 90% stenosis of the vessel at the middle segment. Both proximal and middle RCA vascular lesions were dilated and successfully inserted with drug-eluting stents, respectively (Figure 2). After stent placement, the ECG was reviewed, and the ECG showed that the ST-segment depression was 0.5–1 mm in leads V4–V6. T wave changed from flat to upright in lead V6. Inverted T waves were shown in the inferior leads (Figure 3). The patient was discharged without any signs of complications.

2 | DISCUSSION

(de Winter et al., 2008) first described de Winter ECG pattern. The diagnostic criteria for de WInter include (i) a 1–3 mm upsloping ST-segment depression at the J point in leads V1–V6 with tall, positive symmetrical T waves; (ii) QRS complex usually not wide or only slightly widened; (iii) in some patients, a loss of precordial R wave progression; and (iv) a 1–2 mm ST-segment elevation in aVR (Huang et al., 2022). The de Winter ECG pattern is regarded as a high-risk ST-segment elevation myocardial infarction (STEMI), for which emergency is recommended (Neumann et al., 2019).

The de Winter ECG pattern has a high predictive value (95.2%–100%) for acute occlusion of the LAD artery (Karna et al., 2019). However, in recent years, more and more de Winter cases have been reported that diseased vessels are not associated with LAD artery. (Chen et al., 2020) reported a case in which the left circumflex coronary artery was the target vessel of de Winter changes. (Demarchi et al., 2021) described a de Winter pattern caused by a large diagonal branch culprit lesion rather than LAD. (Ghaffari et al., 2021) reported a de Winter ECG pattern in which the RCA was complete thrombotic occlusion. (Liu et al., 2022) reported a de Winter ECG pattern of acute total left main occlusion. Different from the above, as far as I know, we are the first to report a case of de Winter with multi-vessel disease. The CAG showed 60%–80% LAD stenosis; 50%–60% ostial RCA stenosis, and 90% stenosis of the vessel at the middle segment. Both LAD and RCA had lesions. The echocardiogram showed regional wall motion abnormalities in inferior and posterior territories. The de Winter ECG pattern associated with LAD disease consistently presents with ST depression followed by positive T waves in the precordial leads and maximal ST depression is usually found in lead V2 or V3 (Wang et al., 2021). Maximal ST depression in leads V4–V5 and inverted T waves in leads V5–V6 may indicate a global subendocardial ischemia ECG pattern suggestive of the left main coronary artery or three-vessel disease (Zhan et al., 2020b). In our case, the maximal ST depression in leads V4–V5 and flat T wave in lead V6 may indicate multi-vessel disease.

The electrophysiological mechanism of de Winter ECG pattern is unclear. The theoretical explanation of de Winter ECG pattern includes an anatomical variant of the Purkinje fibers with endocardial conduction delay or lack of activation of sarcolemmal adenosine triphosphate-sensitive potassium channels by ischemic ATP depletion (Zhan et al., 2020a). This case is classified as a multi-vessel disease, ischemia mirror reflection may also be one of the reasons for this type of ECG performance.

The current number of cases in de Winter is relatively small, and we hope our cases provide more evidence for de Winter. De Winter ECG in patients with acute chest pain is an equivalent risk syndrome of STEMI, which should arouse extensive attention of clinicians. Enhanced recognition of this type of ECG by emergency physicians is critical to improving the prognosis of these patients.

3 | LIMITATIONS

In our case, the ECG was showed horizontal ST depression with tall T waves in leads V2–V4 (maximal ST depression in lead V4) while only ST depression in leads V5–V6 which may result from the multi-vessel disease. The CAG showed both LAD and RCA had lesions. CAG is

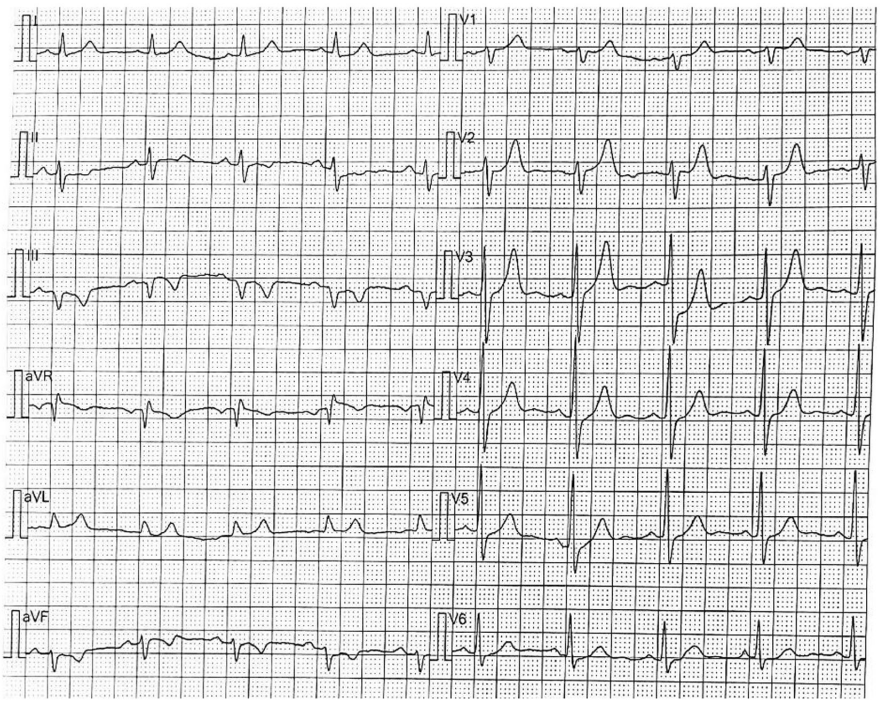

FIGURE 3 Twelve-lead ECG of the patient after stent placement. The ECG showed that the ST-segment depression was 0.5–1 mm in leads V4–V6

currently the gold standard for the diagnosis of coronary heart disease. However, CAG can only show the anatomical stenosis degree of the diseased vessels, but cannot evaluate the physiological function of coronary artery stenosis. Fractional flow reserve (FFR) is an accepted standard for coronary artery functional stenosis, a guide for percutaneous coronary interventional therapy, and an important indicator to guide revascularization strategies and the clinical prognosis of patients (Tonino Pim et al., 2009; De Bruyne et al., 2014; Xaplanteries et al., 2018). Unfortunately, the FFR test was not performed in our case due to limited conditions. We were unable to perform vascular functional tests on LAD and RCA to further define their stenosis.

AUTHOR CONTRIBUTIONS

CW performed the collection of data and wrote the manuscript. JW performed the literature search. HY guaranteed the integrity of the entire study. All authors have read and approved the manuscript and reviewed the literature.

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CONFLICT OF INTEREST

The authors declare no potential conflicts of interest.

DATA AVAILABILITY STATEMENT

All data are available and can be provided if requested.

ETHICAL APPROVAL

This case report has been conducted according to the standards of the Declaration of Helsinki.

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