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CASE REPORT
Coronary heart disease

The de Winter electrocardiogram pattern in a 52-year-old-male: a case report

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Background The 12-lead electrocardiogram (ECG) remains the primary test for diagnosis of acute myocardial infarction (MI) secondary to acute coronary occlusion or near occlusion, with insufficient collateral circulation. Decisions regarding urgent reperfusion are based on whether or not there's new ST-segment elevation. The de Winter ECG pattern is a distinct ECG pattern without any ST-segment elevation, it may be missed by anyone unfamiliar with it.

Case summary We present a case whose chief complaint was severe central chest pain, the patient was diagnosed with acute MI secondary to a culprit lesion in the left anterior descending artery, despite the ECG not meeting standard STEMI criteria. After the ECG's significance was recognized by paramedics, the patient received immediate percutaneous coronary intervention with stenting and was discharged home after a brief hospital admission.

Discussion In some cases, acute MI presents with ECG features that do not meet the standard criteria for STEMI diagnosis. The de Winter ECG pattern is one such example. This pattern should be immediately recognizable to those responsible for the activation of the catheterization laboratory, physicians, and paramedics included.

Keywords de Winter • STEMI equivalent • Electrocardiograph • Case report

Learning points

- Rarely, the ECG in anterior myocardial infarction may not meet standard STEMI criteria. The de Winter ECG pattern should be considered when evaluating patients with acute coronary syndromes.
- The de Winter ECG pattern should be immediately recognizable to those responsible for the activation of the catheterization laboratory, physicians, and paramedics included.

Introduction

The 12-lead electrocardiogram (ECG) remains the primary test for diagnosis of acute myocardial infarction (MI) secondary to acute coronary occlusion or near occlusion, with insufficient collateral circulation. The presence of new ST-segment elevation is diagnostic for acute MI and directs reperfusion therapy.[1] The de Winter ECG pattern is a distinct ECG pattern without any ST-segment elevation, it may be missed by anyone unfamiliar with it.[2] Despite this ECG pattern not fulfilling standard criteria for STEMI diagnosis, it is considered a 'STEMI equivalent' by many authors.[2–5]

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Ambulance paramedics play a crucial role in the early activation of the catheterization laboratory through transmission of the ECG to the destination hospital and interventional cardiologist.[6] In recent years, several ECG patterns have emerged that do not meet the standard STEMI criteria but may indicate coronary occlusion or near occlusion, the de Winter ECG pattern is one such pattern.[3] In the case presented here, paramedics recognized the de Winter ECG pattern, transmitted the 12-lead ECG, administered pharmacotherapy, and transported the patient to a hospital capable of performing emergent angiography and percutaneous coronary intervention. The patient was found with a culprit lesion in the left anterior descending (LAD) artery during angiography.

Timeline

Day/time	Event
Day 1	
15:00	Sudden onset of severe chest pain
15:45	Ambulance attendance and electrocardiogram transmission to destination hospital and interventional cardiologist
16:15	Ambulance at destination hospital
17:15	Emergent coronary angiography showed 95% stenosis of the left anterior descending artery with 95% stenosis of the distal right coronary artery
Day 2	Echocardiogram showed normal left ventricular ejection fraction (LVEF) (60%) and hypokinesis of the left ventricular anterior wall
Day 3	Patient discharged home

Case presentation

A 52-year-old-male developed sudden onset, crushing chest pain, an ambulance was called immediately. The patient also presented with dyspnoea, diaphoresis, and nausea. The patient had experienced similar chest pain in the days preceding the event. The patient had a positive family history and he was a smoker, otherwise, the patient had no past medical history. The patient presented alert with heart rate 68/min, blood pressure 129/83, respirations 18/min, oxygen saturations 97% with skin that was cool, pale, and clammy.

The pre-hospital 12-lead ECG shows a sinus rhythm with ST-segment depression at the J-point continuing into tall, positive symmetrical T waves in leads V1 to V6—changes consistent with de Winter ECG pattern (*Figure 1*).

The patient was treated by paramedics with oral aspirin 300 mg, sublingual and transdermal glyceryl trinitrate, and intravenous morphine 7.5 mg. The ECG was transmitted to the emergency department and interventional cardiologist from the patient's house along with verbal notification. Intravenous heparin 4000 units were administered by intensive care paramedics following consultation with an emergency physician.

The patient received emergent coronary angiogram revealing 95% stenosis of the LAD artery with 95% stenosis of the distal right coronary artery (RCA) (*Figure 2A*). Mild stenosis of the left circumflex artery was also present. Thrombus aspiration was performed and eptifibatide administered, a 3.5 × 18 mm drug eluting stent (DES) was inserted into the LAD artery with an excellent final result (*Figure 2B*) and resolution of the de Winter ECG pattern (*Figure 3*). Initial troponin was 1000 ng/L with a peak of 8000 ng/L. Echocardiogram showed normal LVEF (60%) and hypokinesis of the left ventricular anterior wall. The patient was discharged on Day 3 with aspirin 100 mg, prasugrel 10 mg, bisoprolol 5 mg, perindopril 2.5 mg, and atorvastatin 80 mg.

Discussion

The 12-lead ECG remains the primary test for diagnosis of acute MI. The ECG criteria for STEMI diagnosis is new ST-segment elevation at

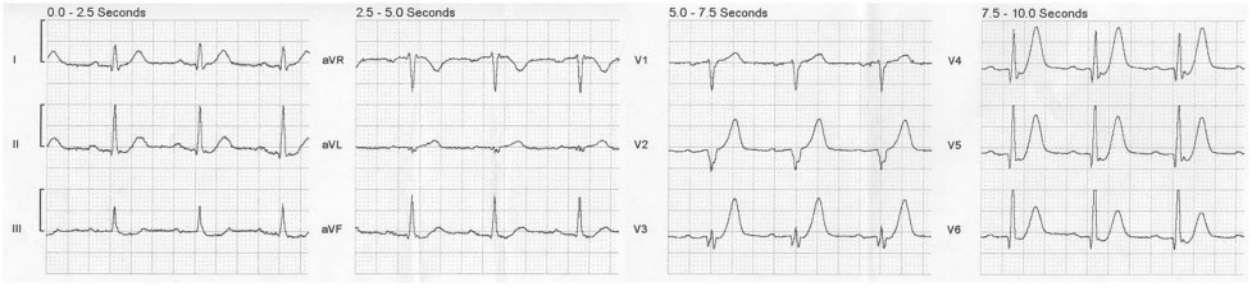

Figure 1 The de Winter electrocardiogram pattern. ST depression at the J-point continuing into tall, positive symmetrical T waves in leads V1 to V6.

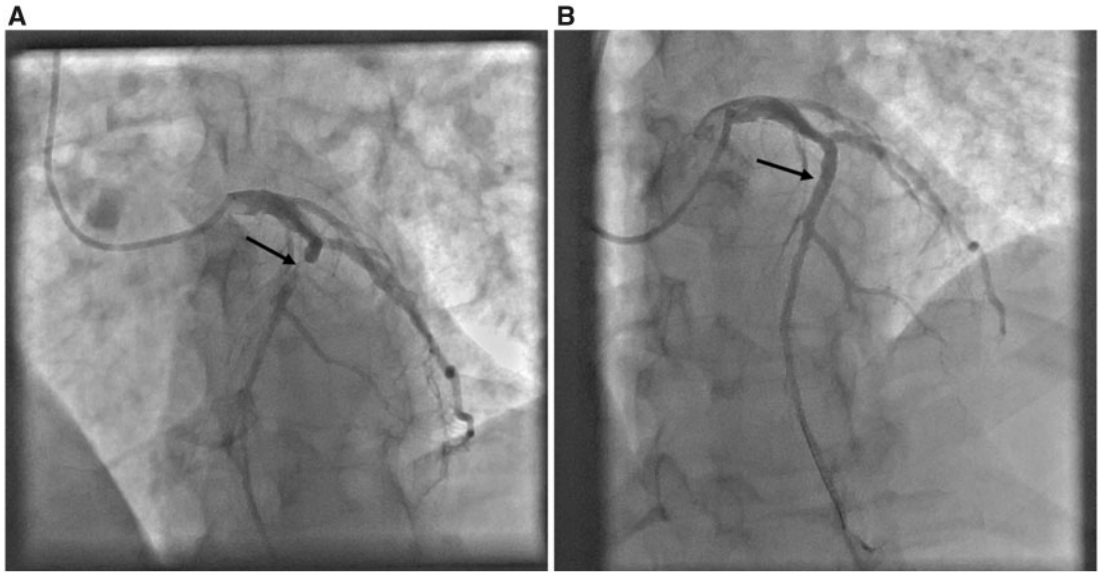

Figure 2 (*A*) Coronary angiogram showing proximal left anterior descending lesion with TIMI 1 flow. (*B*) Coronary angiogram after left anterior descending stenting showing TIMI 3 flow.

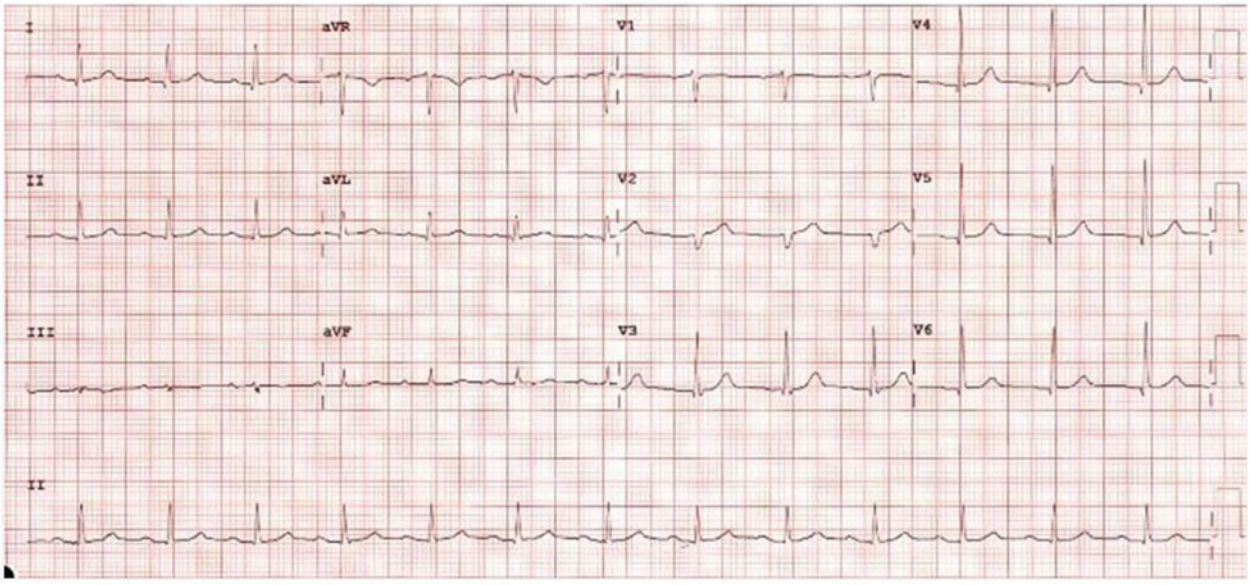

Figure 3 This electrocardiogram, acquired shortly after reperfusion, shows the resolution of the de Winter electrocardiogram pattern.

the J-point, relative to the PQ junction, in two contiguous leads with the cut-points: ≥0.1 mV (1 mm) in all leads other than leads V2 and V3 where the following cut-points apply: ≥0.2 mV (2 mm) in men ≥40 years; ≥0.25 mV (2.5 mm) in men <40 years, or ≥0.15 mV (1.5 mm) in women.[1]

First described in 2008, the de Winter ECG pattern is an atypical ECG feature that indicates a culprit lesion in the LAD artery.[7] It is characterized by ST-segment depression at the J-point with upsloping ST-segments continuing into tall, symmetrical T waves in the precordial leads. Significantly, ST-segment elevation is absent. In an observational study of 1890 patients who underwent angiography for anterior MI the incidence of the de Winter ECG pattern was 2%.[2]

Originally, the de Winter pattern was described as static and its resolution seen only after reperfusion, however, evidence exists that the pattern may be dynamic and present as a temporary phenomenon in some cases. Goebel *et al.*[8] describe a case where the ECG

initially displayed the de Winter pattern, however, evolved to meet standard STEMI criteria prior to reperfusion. Ayer and Terkelsen[9] describe a case where the de Winter pattern developed in the catheterization laboratory at the time of reperfusion after the ECG originally met standard STEMI criteria.

The de Winter pattern is seen more often in patients that are younger, male and suffer hypercholesterolaemia. A wraparound LAD artery is present in 50% of patients that display the de Winter pattern.[2] The patient described here was found with 95% stenosis of both the LAD artery and the RCA, possibly simulating the effect of a culprit lesion in a wraparound LAD artery. The de Winter pattern's accuracy has been evaluated in a systematic review. The pattern had a positive predictive value of 95.2% (95% confidence interval: 76.2–99.9%), 100% (69.2–100%), and 100% (51.7–100%) in three retrospective diagnostic studies.[10]

Conclusion

The ECG remains the primary tool to identify acute MI and guide reperfusion therapy. Rarely, the ECG in anterior MI may not meet standard STEMI criteria. The de Winter ECG pattern should be considered when evaluating patients with acute coronary syndromes. This pattern should be immediately recognizable to those responsible for the activation of the catheterization laboratory, physicians, and paramedics included.

Supplementary material

Supplementary material is available at *European Heart Journal - Case Reports* online.

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Slide sets: A fully edited slide set detailing this case and suitable for local presentation is available online as Supplementary data.

Consent: The authors confirm that written consent for submission and publication of this case report including image(s) and associated text has been obtained from the patients in line with COPE guidance.

Conflict of interest: none declared.

Lead author biography

Matthew Di Toro is an intensive care paramedic for Ambulance Victoria, based in the western metropolitan region of Melbourne, Australia. Matthew has worked as a paramedic for Ambulance Victoria for 13 years. His interests include ECG changes in the setting of acute ischaemia as well as unusual case presentations across medicine. Matthew enjoys the challenges that come with the pre-hospital environment, particularly solving clinical and logistical problems in novel situations and deteriorating patients.

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