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Acute Coronary Syndrome Manifesting Dynamic Electrocardiographic Changes

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ABSTRACT

We present a patient with acute coronary syndrome manifesting dynamic evolution from an anterior ST-segment elevation myocardial infarction electrocardiographic pattern to the de Winter electrocardiographic pattern suggestive of severe residual myocardial ischemia owing to a partially recanalized but still subtotally occluded culprit artery. Emergency percutaneous coronary intervention was successfully performed.

1 | Case Description

A 28-year-old male patient, a cigarette smoker with no known medical history, presented to an affiliated hospital due to one hour of squeezing substernal chest pain associated with ischemic electrocardiographic (ECG) changes. The ECGs presented in Figure 1 were recorded ten minutes apart. Treatment was composed of loading doses of aspirin (300 mg) and ticagrelor (180 mg) and a single 2 mg intravenous bolus dose of morphine sulfate.

What is your working diagnosis based on the ECG findings and what would you do next?

2 | Discussion

Coronary artery thrombosis is a dynamic process occurring simultaneously with thrombolysis, and causing intermittent changes in epicardial coronary artery patency whose tracking by serial or continuous ECG recordings can provide insights into pathophysiological mechanisms and inform therapeutic decisions. Our patient's ECG was compatible with acute anterior ST-segment elevation (STE) myocardial infarction (MI) (Figure 1A) developing into the de Winter pattern (Figure 1B), therefore, prompting referral for emergency coronary angiography. The patient was still experiencing chest pain upon arrival at our hospital, but an ECG was not recorded at that time. Vital signs were normal and cardiopulmonary examination was overall unremarkable. Coronary angiography showed a total thrombotic occlusion of the proximal left anterior descending (LAD) artery, which was successfully tackled by culprit lesion stenting (Figure 2 and Video 1). Serum levels of CK and CK-MB isoenzyme peaked at 7577 U/L (reference value: 26–145 U/L) and 662.6 U/L (reference value: 0–25 U/L), respectively. Echocardiography revealed a left ventricular ejection fraction of 45% and hypokinesia of the LAD artery-dependent myocardium. The patient was discharged home after a 5-day uneventful

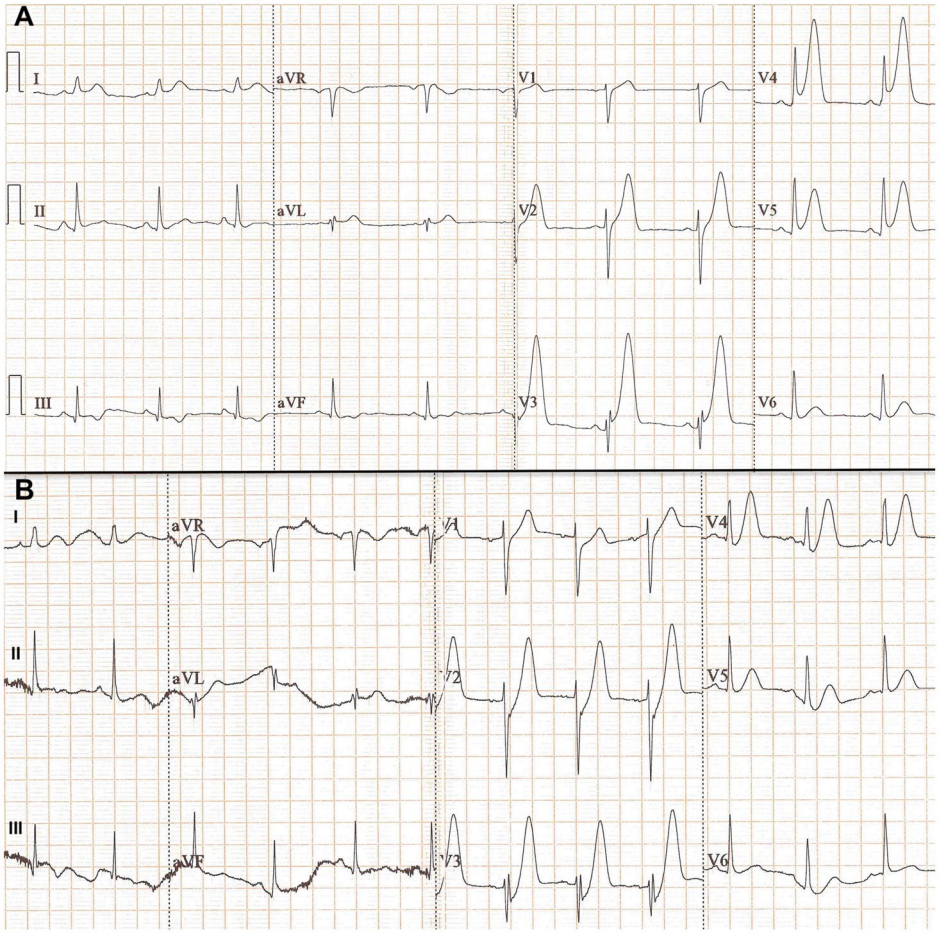


FIGURE 1 | (A) Twelve-lead electrocardiogram (ECG) showing symmetric and tall T waves in leads V2 through V5 with a preceding 0.25 mV junctional ST-segment elevation (STE) in lead V3 and ≥ 0.1 mV junctional STE in leads V4 and V5, indicating acute anterior wall myocardial infarction (MI). Lead V1 shows non-junctional, obliquely straight STE followed by a T wave that is not tall. Note the fragmented QRS complexes (rSr') in leads V3 and aVL. (B) ECG showing symmetric and tall T waves in leads V2 through V4 with a preceding ≥ 0.1 mV upsloping ST-segment depression (de Winter pattern). Note that the maximum STD (0.4 mV) is recorded in lead V2 that is considered to represent (together with lead V3) the "core" of the injury and predict a culprit left anterior descending artery. The T wave in lead V5 which is preceded by an isoelectric ST-segment, is not tall (> 1.0 mV) but broad-based and shows a fast-ascending slope, a morphology that can be seen in patients with acute myocardial ischemia. Note the fragmented QRS complexes in leads V2 (notched S) and V3 (rSr').

hospital course on guideline-recommended medical therapy including at least 1-year of dual antiplatelet therapy. He was subsequently lost to follow up.

The de Winter ECG pattern comprises at least 0.1 mV junctional upsloping ST-segment depression in the precordial leads followed by tall, symmetrical T waves and has been described as a static pattern in about 2% of patients presenting with anterior wall MI owing to acute occlusion of the proximal LAD artery [1]. However, the static nature of this ECG pattern has been questioned in subsequent publications documenting it in a dynamic form, that is evolving into an STE MI ECG pattern and vice versa depending on the status of the culprit lesion/artery. The prevailing opinion to date, is that the de Winter ECG pattern, owes to a subtotally occlusive stenosis producing very severe subendocardial ischemia, which ultimately becomes occluded producing STE [2]. Alternatively, the presence of collateral circulation or even preconditioning, may modulate the electrophysiological response of the myocardium to ischemia, also precluding especially the subepicardium from becoming ischemic, therefore, explaining the

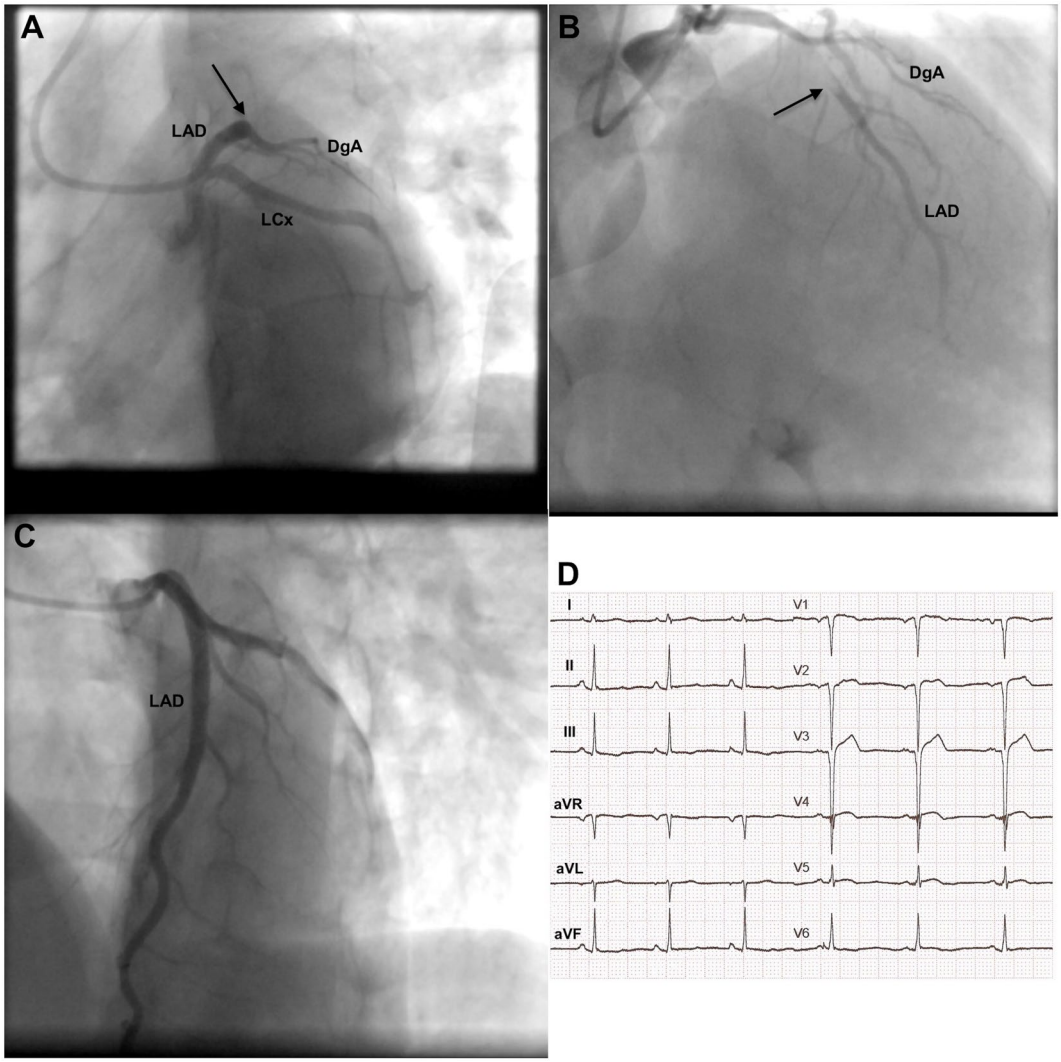
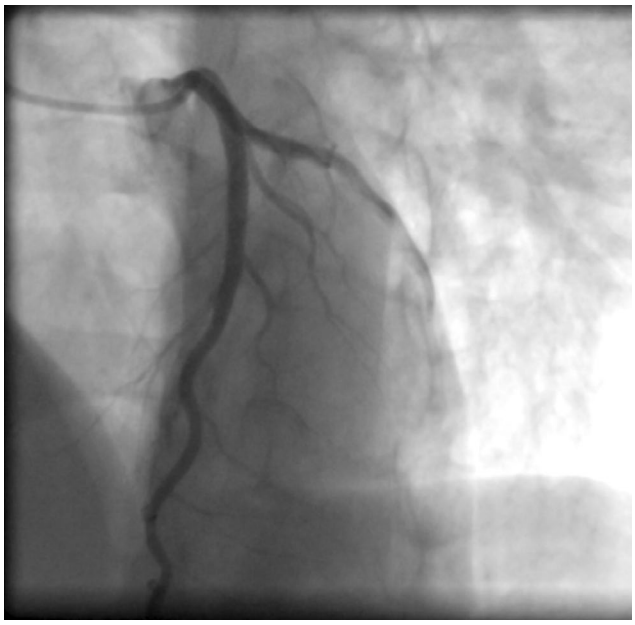


FIGURE 2 | (A) Conventional coronary angiographic image at a left anterior oblique (LAO)-caudal view depicting a total proximal occlusion (arrow) of the left anterior descending (LAD) artery. Collateral circulation to the territory of occluded culprit artery was not demonstrated. The left circumflex (LCx) and diagonal (DgA) arteries are also shown. (B) Conventional coronary angiographic image at a right anterior oblique-cranial view depicting a spontaneously incompletely recanalized LAD artery showing a Thrombolysis in Myocardial Infarction (TIMI) flow grade II and a filling defect (arrow) consistent with thrombus at the site where the artery was previously totally occluded. (C) Conventional coronary angiographic image at a LAO-cranial view depicting a good result after culprit lesion stenting. (D) Twelve-lead electrocardiogram recorded about one hour after percutaneous coronary intervention showing signs of evolving anterior myocardial infarction.

absence of STE despite an occlusion of the LAD artery, manifesting with a static de Winter ECG pattern [3]. The evolutionary de winter ECG pattern documented in our patient, likely occurred at the time of spontaneous reperfusion of a totally occluded LAD artery, reflecting ongoing ischemia from a subtotally occlusive residual stenosis. Given the finding of a totally occluded LAD artery, the de Winter ECG pattern very likely evolved back to an STE MI ECG pattern which was missed because an ECG was not recorded either upon patient's arrival at our hospital or immediately before angiography. Patients presenting with acute coronary syndrome manifesting the de Winter ECG pattern should be treated as suffering an STE MI equivalent [1–3].



VIDEO 1 | Conventional coronary angiography at a left anterior oblique-cranial view depicting a good result after culprit lesion stenting. Video content can be viewed at https://onlinelibrary.wiley.com/doi/10.1002/ccr3.70571

Author Contributions

Andreas Y. Andreou, MD. (Conceptualization: Lead; Data curation: Lead; Investigation: Lead; Writing – original draft: Lead; Writing – review and editing: Lead).

Consent

Written informed consent for publication of Clinical Images was not obtained from the patient or the relatives after all possible attempts were made because none of them could be traced. The information provided in the article has been sufficiently anonymized so that neither the patient nor anyone else could identify the patient.

Conflicts of Interest

The author declares no conflicts of interest.

Data Availability Statement

The data underlying this article are available in the article and in its online supplementary material.

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