



## Case Report

# Dynamic ECG change from de Winter to Wellens - Rare ECG change in acute coronary syndrome



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## ABSTRACT

A 70-year-old male complained of chest pain. His electrocardiogram (ECG) revealed the De Winter pattern, which indicates left anterior descending artery occlusion. His symptoms spontaneously resolved within 30 min. This time, his ECG showed Wellens's sign. It is rare to see a change from De Winter to Wellens in one patient.

**Learning objectives:** Recognize de Winter's and Wellens' electrocardiogram (ECG) patterns as high-risk ECG for acute coronary syndrome (ACS), specifically related to left anterior descending artery lesions. Obtain serial ECGs in ACS patients to detect newly emerging changes in the coronary artery.

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## Introduction

A 12-lead electrocardiogram (ECG) is essential to diagnose acute myocardial infarction (AMI). According to the current recommendation, ST-segment elevation myocardial infarction (STEMI) is defined as myocardial infarction with ST-segment elevation at the J-point in at least two contiguous leads [1,2]. There exist several characteristic ECG changes that are red flag signs of severe ischemia without ST-segment elevation. De Winter syndrome and Wellens' sign are the two representative examples [2,3]. Physicians must recognize not only ST-segment elevation but also these characteristic ECG changes.

De Winter pattern is a sign of proximal left anterior descending artery (LAD) occlusion. It consists of upsloping ST-segment depression and tall T waves. This specific ECG change is reported to be rare and is recorded about 90 min after symptom onset [4]. Occasionally, de Winter's ECG spontaneously changes into STEMI [2,5]. On the other hand, Wellens' sign is characterized by deeply inverted T waves in leads V<sub>1</sub>–V<sub>4</sub>. This sign indicates critical narrowing of proximal LAD but not the total

occlusion [6]. Both De Winter's pattern and Wellens' sign are characteristic ECG patterns associated with the ischemia of the LAD. However, it is rare to observe a change from one to the other in the same patient. Here, we report a rare case whose ECG changed from de Winter to Wellens over a short period.

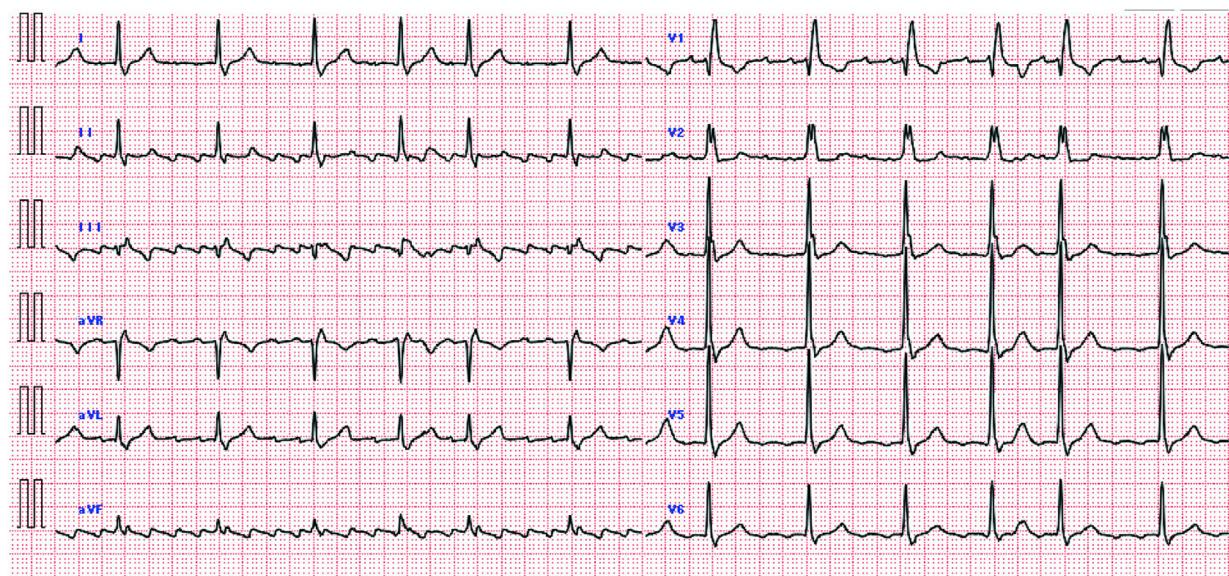
## Case report

A 70-year-old male underwent an 18F-fluorodeoxyglucose positron emission tomography/computed tomography (FDG-PET/CT) study for evaluation of his oropharyngeal cancer. His past medical history was notable for chronic atrial flutter, diabetes mellitus, and hypertension. His ECG showed atrial flutter and complete right bundle branch block (Fig. 1). He smoked one pack of cigarettes daily for 45 years. He had no family history of cardiovascular disease. During the FDG-PET/CT, he complained of chest pain, which lasted for 30 min. Soon after the FDG-PET/CT had finished, ECG, transthoracic echocardiography (TTE), and blood tests were done. His vital signs were as follows: blood pressure 134/77 mm Hg, pulse rate 90 beats per minute, respiratory rate 22, and oxygen saturation 97 % while the patient was breathing ambient air. The jugular vein was not distended. Heart rhythm was irregular, with no murmurs. The ECG revealed upsloping ST-segment depression followed by tall symmetrical T waves in leads V<sub>3</sub>–V<sub>6</sub> and a slightly elevated ST-segment in lead aVR (Fig. 2A). These findings are characteristic of de Winter

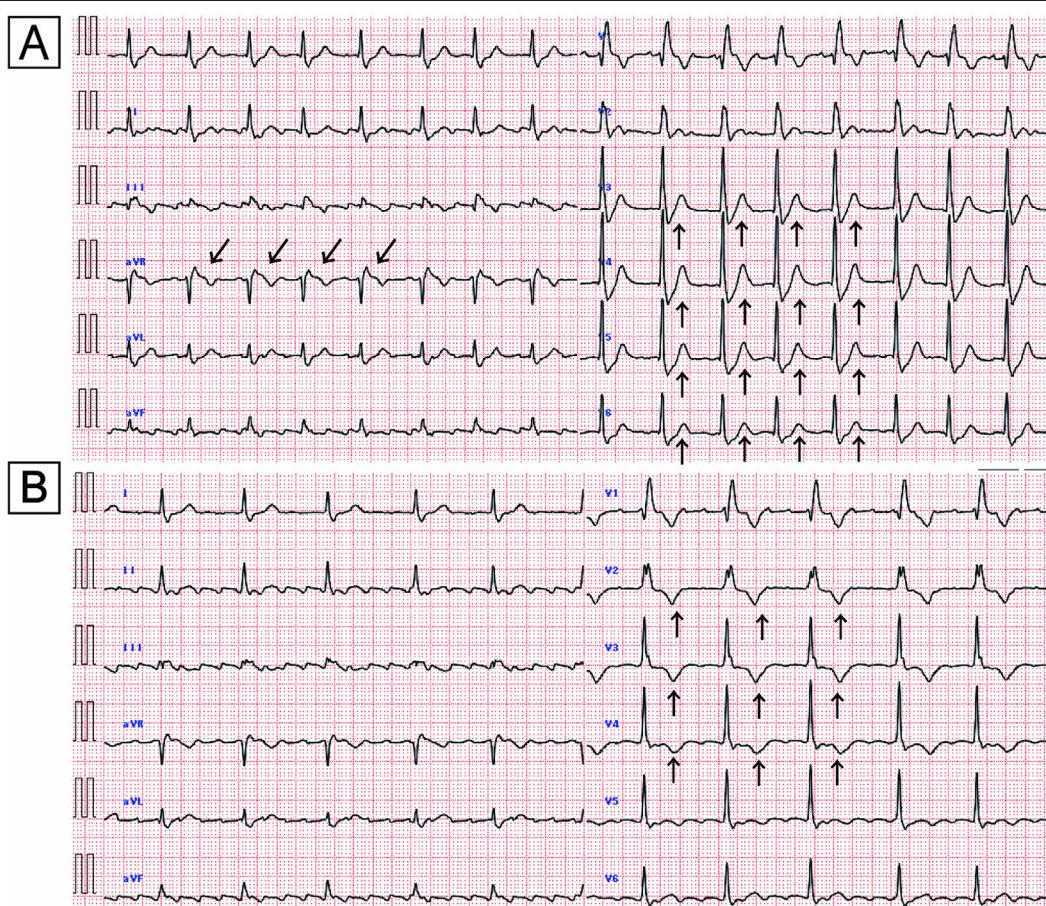
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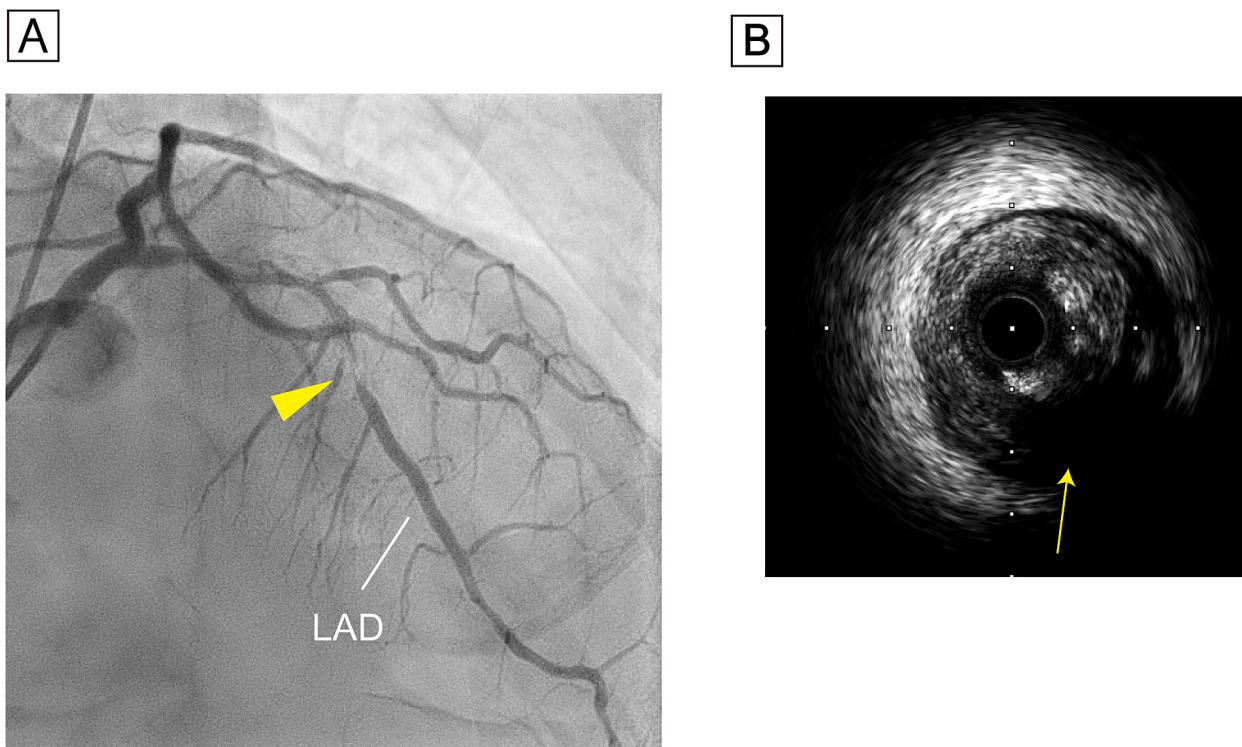
<sup>1</sup> Dr. Hiroaki Kitaoka and Dr. Toru Kubo are members of the editorial team of *Journal of Cardiology Cases*.



**Fig. 1.** The previous 12-lead ECG (5 months before). ECG showed atrial flutter and complete right bundle branch block.



**Fig. 2.** The 12-lead ECGs after admission. **(A)** The 12-lead ECG on admission revealed atrial flutter, complete right bundle branch block, and upsloping ST-segment depression followed by tall symmetrical T waves (vertical arrow). A slightly elevated ST-segment in lead aVR was noted (diagonal arrow). This is a de Winter's pattern. **(B)** ECG recorded 4 h later showed inverted T waves in leads V<sub>1</sub>-V<sub>4</sub>, so called Wellens' pattern (vertical arrow).



**Fig. 3.** Coronary angiography and intravascular ultrasound. (A) Coronary angiography revealed a severe stenosis of the LAD (arrow head). (B) Intravascular ultrasound showed low attenuation plaque in the LAD without heavy calcification (arrow). LAD, left anterior descending artery.

syndrome [2]. TTE displayed severe hypokinesis of the anteroseptal wall. The value of high-sensitivity cardiac troponin T was 0.029 ng/mL (normal range,  $\leq 0.014$  ng/mL).

He was admitted to our cardiology department under diagnosis of acute coronary syndrome. We did not recognize that the patient's ECG showed de Winter pattern initially. At the time of consultation, we considered that he had a non-ST-elevation acute coronary syndrome. In addition, the patient's symptoms were completely relieved when we examined him. Based on these factors, we decided not to proceed to immediate coronary angiography (CAG) but to perform it within 24 h instead. His following ECG, recorded 4 h later, had dramatically changed (Fig. 2B). This time, ECG showed deeply inverted T waves in leads V<sub>1</sub>–V<sub>4</sub>. These findings are consistent with Wellens sign, which indicates a critical narrowing of LAD but not the total occlusion [6]. On the next day, CAG was done, and it revealed a severe stenosis of the mid portion of the LAD. Intravascular ultrasound identified atherosclerotic plaque without heavy calcification (Fig. 3A, B). Percutaneous coronary intervention was performed with a drug-eluting stent (3.0 × 48 mm everolimus-eluting stent). He was put on dual antiplatelet therapy, statin, angiotensin-converting enzyme inhibitor, and beta-blocker. Follow-up echocardiography revealed an improvement of left ventricular wall motion.

## Discussion

Here, we report an interesting case in which the ECG changed from de Winter's to Wellens'.

De Winter pattern was originally described as a rare ECG sign of proximal LAD occlusion [4]. The criteria of de Winter's pattern are as follows: (1) 1–3 mm upsloping ST-segment depression at the J point in leads V<sub>1</sub>–V<sub>6</sub>, (2) tall positive symmetrical T waves, (3) QRS complexes usually not widened or slightly widened, (4) loss of precordial R-wave progression in some cases. The above findings are reported to be recognized in about 2 % of anterior AMI cases [4]. De Winter's ECG pattern is

usually recorded within 90 min of symptom onset, and a follow-up ECG sometimes shows a change into anterior ST-segment elevation [3,5]. Therefore, de Winter syndrome should be recognized as STEMI equivalent [2,3,5]. Zhao et al. reported a case in which the ECG changed from STEMI to de Winter's associated with reperfusion [7]. It indicates that these ECG changes are not fixed but change dramatically depending on the coronary artery pathophysiology. On the other hand, Wellens' syndrome is known as a red flag sign for acute coronary syndrome. It indicates a critical narrowing of proximal LAD [6]. There are two types of Wellens' ECG. One shows deeply inverted T waves and the other shows biphasic T waves in precordial leads [2]. Different from de Winter's pattern, Wellens syndrome can develop over a span of days to weeks [8].

In AMI patients who have not received reperfusion therapies, early inverted T waves are known to be a marker of spontaneous recanalization of the culprit artery [9]. In our case, the patient's symptoms completely resolved with appearance of T wave inversion. Zhu et al. reported a case in which an ECG evolved from de Winter into Wellens associated with spontaneous recanalization [10]. Similar to Zhu's case, we speculate our patient's ECG changed not into STEMI but into Wellens' pattern due to spontaneous recanalization of LAD. Indeed, CAG showed a severe stenotic lesion of LAD but not the total occlusion.

## Conclusion

De Winter and Wellens are characteristic ECG patterns associated with the ischemia of the LAD. Both carry the name of a Dutch cardiologist. It is rare to observe a change from one to the other in the same patient in a short period.

## Consent statement

Written informed consent was obtained from the patient.

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None.

## Declaration of competing interest

The authors declare that there is no conflict of interest.

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