

Harbinger of infarction

Wellens syndrome electrocardiographic abnormalities in the emergency department

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Emergency department (ED) physicians often see patients with symptoms, such as chest pain or dyspnea, of a potential underlying cardiac cause for which standard investigations fail to reveal an acute ominous process. Patients are often discharged or referred for outpatient investigation, such as exercise stress testing (EST), based on correct recognition of cardiac risk factors. However, nonspecific electrocardiographic abnormalities might be misinterpreted.

Case description

A 79-year-old woman with a history of asthma and hypertension presents to the ED complaining of increasing shortness of breath (SOB) and productive cough for the past 3 days. She denies chest pain, syncope, presyncope, hemoptysis, abdominal pain, or nausea and vomiting. Her respiratory rate is 20 breaths/min; oxygen saturation is 88% on room air. Vital signs are otherwise within normal limits and she is afebrile. Results of routine bloodwork, including troponin testing, are unremarkable; a chest x-ray scan shows chronic hyperinflation without active intrathoracic pathology. Results of an electrocardiogram (ECG) are interpreted as “nonspecific T-wave abnormalities” (Figure 1). No previous ECG is available for comparison. The clinical impression is a chronic obstructive pulmonary disease exacerbation and is managed accordingly. The next morning her SOB has improved and she is discharged. She returns within 24 hours with increasing SOB and develops central chest pain while in the ED. Another ECG is completed (Figure 2).

While the patient’s second ECG (Figure 2) demonstrates an obvious ST-segment elevation myocardial infarction (MI) in the anterior leads, a closer inspection of her initial ECG (Figure 1) reveals anterior lead T-wave abnormalities in keeping with Wellens syndrome.

Wellens syndrome

Patients with Wellens syndrome (or *left anterior descending [LAD] coronary T-wave syndrome*) show a collection of ECG findings most commonly recognized as deeply inverted T waves across the anterior precordial leads, often while asymptomatic. In 1982, de Zwaan et al first demonstrated that these ECG abnormalities correlated with high-grade lesions of the LAD artery in patients with unstable angina.¹

Box 1 shows the criteria for Wellens syndrome.

Wellens syndrome is represented by 2 different types of T-wave abnormalities, both suggesting substantial

“preinfarction” lesions. Physicians working in the ED must be alert for deeply inverted T waves across the anterior precordial leads; however, this finding might only represent 75% to 80% of Wellens syndrome cases; the remaining 20% to 25% show much more subtle findings of smaller biphasic T waves across the anterior leads, most commonly leads V₂ to V₃ and occasionally leads V₁ and V₄ to V₆.²

While the differential diagnosis for T-wave inversions is broad, abnormalities found in Wellens syndrome are particularly concerning because they often occur in asymptomatic patients, they might pseudonormalize in those presenting with cardiac chest pain or dyspnea, and they will not typically elevate cardiac enzymes. The

Figure 1. Electrocardiographic interpretation: Sinus with a first-degree atrioventricular block; right atrial enlargement; left ventricular hypertrophy, ST-segment elevation in leads V₂-V₃ (approximately 1 mm); biphasic T waves in leads V₂-V₄; and U waves in leads V₂-V₄.



Figure 2. Anteroseptal ST-segment elevation myocardial infarction



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Box 1. Criteria for Wellens syndrome

Criteria for Wellens syndrome include the following:

- Previous history of angina
- Minimal or no elevation of cardiac enzymes
- Minimal or no ST-segment elevation (< 1 mm)
- No loss of precordial R-wave progression
- No pathologic Q waves
- Biphasic or deeply inverted T waves in leads V₂-V₃ but sometimes found in leads V₁ and V₄-V₆

concern is that ECGs might be interpreted as “nonspecific ST-segment or T-wave changes” in patients with identified risk factors for coronary artery disease who are then sent for outpatient EST.³

Numerous cases in the literature describe patients with these ECG abnormalities sent for EST who experience fatal MI during testing.^{2,4,5} As cardiac enzyme test results are often negative or within the upper limit of normal, ECG interpretation might be the only clue to the safest disposition of these patients. These ECG abnormalities can be found in a range of patients, including those as young as 39 years of age⁶ and those with previously stented LAD lesions or recurrent Wellens syndrome.⁷

While medical management might alleviate symptoms, these lesions often progress quickly to MI of a large territory of the anterior wall; in the original study, 75% of patients who received medical management without cardiac catheterization progressed to MI in a mean of 8.5 days.¹ If these patients are identified in the ED, they should be sent for cardiology consultation and should not be discharged or sent for EST. These ECG abnormalities alone, even if symptoms resolve, warrant cardiac catheterization.⁵

While the pathophysiology of Wellens syndrome ECG manifestations in relation to proximal LAD lesions is not fully understood, and it has been suggested that development of T-wave inversion with resolution of symptoms represents a phase of reperfusion, a relationship between ECG repolarization abnormalities and left ventricular myocardial edema has also been proposed; this might explain cases of T-wave abnormalities similar to those in Wellens syndrome associated with reversible left ventricle dysfunction, such as Takotsubo cardiomyopathy or intracranial bleeding, rather than just nonreversible ischemic damage.⁸

Regardless of the underlying mechanism, ED physicians must consider the ECG manifestations of Wellens syndrome in determining the safest disposition of patients being assessed for coronary artery disease.

Case resolution

The patient’s condition deteriorates. She becomes hypotensive and is intubated owing to impending respiratory failure. She is taken for cardiac

catheterization and the results show a critical lesion of the proximal LAD, which is stented. She is admitted to the critical care unit and is discharged after an uneventful recovery.

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Competing interests

None declared

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BOTTOM LINE

- Emergency department physicians need to be familiar with the electrocardiographic (ECG) manifestations of Wellens syndrome.
- Wellens syndrome represents a preinfarction state, and these ECG abnormalities should be seen as harbingers of impending large-territory infarction.
- Owing to the high risk of myocardial infarction during exercise stress tests that might result in cardiac arrest and death, a patient who presents with these ECG abnormalities should not be discharged or sent for stress tests without consultation with a cardiologist.

POINTS SAILLANTS

- Les médecins à l’urgence doivent être familiers avec les manifestations du syndrome de Wellens à la lecture d’un électrocardiogramme (ECG).
- Le syndrome de Wellens représente un état préalable à un infarctus et ces anomalies à l’ECG devraient être considérées comme des précurseurs d’un infarctus imminent couvrant une large superficie.
- Étant donné le risque élevé d’un infarctus du myocarde durant les épreuves d’effort pouvant entraîner un arrêt cardiaque et la mort, un patient dont l’ECG présente de telles anomalies ne devrait pas recevoir son congé ou être envoyé pour subir une épreuve d’effort sans consulter un cardiologue.

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