

Subtle Changes in Electrocardiogram Progressing to Myocardial Infarction: a Case Report

*Corresponding Author:

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Abstract

An inverted T wave that occurs in an isolated area of the electrocardiogram is called an isolated T wave inversion (TWI) or an isolated inverted T wave. Such T-wave changes can occur in healthy individuals without any evidence of heart disease, but are also seen in patients with coronary artery disease. We report a case of inverted T wave that progressed to myocardial infarction.

Case

A 48-year-old man with hypertension and smoking presented to the emergency department with chest pain on the left side and behind the sternum about 30 minutes ago. The pain was described as continuous with nausea and without shortness of breath or sweating. The patient's vital signs were stable.

The initial electrocardiogram obtained from the patient showed isolated TWI in lead aVL (Figure 1). The patient was transferred to a monitoring bed in the emergency department. Aspirin 325 mg and atorvastatin 40 mg were prescribed.

Later, the patient started sweating and shortness of breath. A serial ECG taken 60 minutes later from the patient showed ST-segment depression in leads V1-V3 (Figure 2).

The initial troponin was borderline, but a second test 3 hours later showed an increase. Clopidogrel 300 mg, intravenous infusion of nitroglycerin and heparin 4000 units were given as intravenous bolus. Then heparin infusion of 12 U/kg/hr was started. Due to the lack of angiography, the patient was transferred to a center with equipment. Catheterization performed showed significant LAD occlusion.

Discussion

An isolated TWI in the aVL lead is not an early sign of coronary artery occlusion. While T-wave inversion in lead aVL has low diagnostic value for predicting LAD lesions regardless of other T-wave changes, isolated T-wave inversion in lead aVL has high specificity. 4 The LAD supplies blood to a large part of the heart and in the presence of obstruction puts a large area of the myocardium at risk and therefore it is important to identify this slight change in the ECG.

For hospitals that do not have on-site catheterization facilities, thrombolytics may be needed as a bridge to definitive therapy. Chest pain and ECG findings may improve in patients receiving thrombolytic therapy. However, these patients require cardiac catheterization within 24 hours of presentation. Early diagnosis and treatment of patients with worrisome presentation and isolated TWI in lead aVL may save a life.

Keywords: mild electrocardiogram changes; inverted T wave; myocardial infarction

Introduction

An inverted T wave that occurs in an isolated area of the electrocardiogram is called an isolated T wave inversion (TWI) or an isolated inverted T wave. Such T-wave changes can occur in healthy individuals without any evidence of heart disease, but are also seen in patients with coronary artery disease. In asymptomatic patients with no history of cardiovascular disease or related risk factors, isolated TWIs are unlikely to indicate advanced coronary artery disease.

TWIs can be transient. Transient causes include hypokalemia, early stages of hypertrophic cardiomyopathy, hyperventilation, and transient ischemia due to coronary spasm.¹ Even anxiety and fear have been described in association with transient TWI.

However, a study by Farhan et al in the evaluation of patients with chronic stable angina showed that TWI in the aVL lead was highly associated with significant lesions of the left anterior descending artery (LAD), usually in its middle part.² A cautionary note is that 14% of electrocardiograms in this study that showed this isolated finding were all interpreted as normal by doctors. But this finding should not be considered normal in association with chest pain because it may be the first visible finding in ST-segment elevation myocardial infarction.

Case report

A 48-year-old man with high blood pressure and long-term smoking presented to the emergency department with chest pain on the left side and behind the sternum about 30 minutes ago. The pain was described as continuous with nausea and without shortness of breath or sweating. The vital signs were as follows:

BP: 145/85, HR: 88/min, RR: 24/min, SpO₂: 95% (room air)

The initial electrocardiogram taken from the patient and shown in Figure 1 showed isolated TWI in lead aVL. Due to the continued significant chest pain and ECG findings, the patient was transferred to a monitoring bed in the emergency department. Aspirin 325 mg and atorvastatin 40 mg were prescribed.

Later, the patient started sweating and shortness of breath. The serial ECG, which was taken 60 minutes later from the patient and you can see it in figure number two, showed ST-segment depression in leads V1-V3.

The initial troponin was borderline, but a second test 3 hours later showed an increase. Clopidogrel 300 mg, intravenous infusion of nitroglycerin and heparin 4000 units were given as intravenous bolus. Then heparin infusion of 12 U/kg/hr was started. Due to the lack of angiography, the patient was transferred to a center with equipment. Catheterization performed revealed a significant LAD occlusion, which was resolved with a balloon.

Conclusion

The 12-lead electrocardiogram is an essential tool for the diagnosis of acute coronary syndrome (ACS) because ST-T changes on the ECG reflect myocardial ischemia and myocardial necrosis after myocardial ischemia. Based on the diagnosis and prediction of ischemic lesions using ECG, cardiologists can provide early therapeutic intervention for patients with ACS. It has been reported that T1 wave inversion in lead aVL is a reciprocal change of inferior wall infarction, mostly due to right coronary artery lesions. However, several recent small studies have shown that T-wave inversion in lead aVL is associated with left anterior descending (MLAD) lesions in the middle segment.⁴ An isolated TWI in lead aVL is not an early sign of coronary artery occlusion. In a survey by Hassen et al., only 25% of

physicians diagnosed isolated TWI in lead aVL as abnormal, although emergency physicians were better at diagnosing it than other specialties.³ This study showed that angiography performed specifically to evaluate STEMI indicated Correlation of middle LAD lesion with TWI with sensitivity of 88%, and positive predictive value of 81% for lesions of middle LAD greater than 50%. Patients with similar ECG findings who underwent coronary angiography for other reasons showed a sensitivity of 65%, a positive predictive value of 83%, and a specificity of 67% for mid-LAD lesions with 70% or greater involvement. While T-wave inversion in lead aVL has low diagnostic value for predicting LAD lesions regardless of other T-wave changes, isolated T-wave inversion in lead aVL has high specificity. ⁴ The LAD supplies blood to a large part of the heart and in The presence of obstruction puts a large area of the myocardium at risk and therefore it is important to identify this slight change in the ECG.

For hospitals that do not have on-site catheterization facilities, thrombolytics may be needed as a bridge to definitive therapy. Chest pain and ECG findings may improve in patients receiving thrombolytic therapy. However, these patients require cardiac catheterization within 24 hours of presentation. Early diagnosis and treatment of patients with worrisome presentation and isolated TWI in lead aVL may save a life.

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