CASE REPORTS

ST Segment Elevation in One Lead: A Case Report

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Background: We describe an unusual finding in an electrocardiogram showing ST-segment elevation not related to coronary artery stenosis, pericarditis, bundle branch block, or other well known disorders.

Case Presentation: A 60-year-old African American woman admitted for elective coronary artery bypass graft surgery. A temporary pacemaker with pacing wires was placed intraoperatively for prevention and treatment of postoperative bradyarrhythmia. One day following uneventful surgery, her electrocardiogram demonstrated marked ST segment elevation confined to lead V₆. These changes were comparable to tracings obtained from direct epicardial electrocardiogram, due to contact between the V₆ electrode and the temporary pacemaker ventricular lead wire.

Conclusion: Current-of-injury patterns are represented on surface electrocardiogram by deviations of the ST segment from the isoelectric baseline. The pacing wire causes direct localized epicardial current-of-injury, affecting the action potential and the resting membrane potentials of cardiomyocytes. Our case report demonstrates epicardial current-of-injury pattern obtained via surface rather than epicardial electrocardiogram, with surface leads as surrogates of epicardial tracing. Measurement of ST-segment shifts from the epicardial electrocardiogram has been shown to provide a more sensitive measurement of ischemia when compared to surface precordial ECG.

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INTRODUCTION

We describe an unusual finding in an electrocardiogram (ECG) showing ST-segment elevation localized to one precordial lead only.

CASE PRESENTATION

A 60-year-old African American woman had been admitted to the hospital for scheduled coronary artery bypass graft (CABG) surgery. Her medical history is pertinent for coronary artery disease and atrial fibrillation. She underwent uneventful surgery, in addition to routine placement of a temporary pacemaker intraoperatively.

Postoperative day 1, while the patient was asymptomatic, with unremarkable physical examination. A 12-lead ECG was obtained (*Fig. 1*). The ECG shows atrial fibrillation with rapid ventricular response at the rate of 138 beats per minute. Left-right electrodes reversal manifested as positive QRS complexes in aVR, and negative QRS complexes in lead I and aVL displaying false-right axis deviation. Nonspecific ST, T changes (lead II,

Figure 1. ECG demonstrating isolated ST-segment elevation in lead V₆

III, V₄, V₅). However, lead V₆ shows an odd pattern of marked ST elevation, revealing a “localized” current-of-injury pattern in V₆ due to possible contact between V₆ electrode and the temporary pacemaker ventricular lead wire.

Figure 2. ECG changes before (a) and after (b) manual placement of lead V₅ in contact with temporary pacing wire.

In order to confirm our notion, we performed a 12-lead ECG on a different patient who is also 1 day post-CABG surgery, with temporary pacemaker and pacing wires placed similarly (Fig. 2a). ECG readings were obtained in a normal fashion before and after manual placement of lead V₅ in touch with one of the pacing wires. The second ECG clearly demonstrated ST-segment elevation localized to V₅ this time (Fig. 2b), which was comparable to our original patient.

Our patient did well in the following days, and the temporary pacing wires were removed without the need for permanent pacemaker placement.

DISCUSSION

Temporary epicardial pacing wires have been routinely employed in cardiac surgery to augment cardiac output and/or to treat postoperative bradyarrhythmia.¹ They are implanted on the epicardium of the right ventricle and/or right atrium and brought to the skin through the anterior chest wall before chest closure.²

The pacing wire causes direct localized epicardial current-of-injury, affecting the action potential and the resting membrane potentials of cardiomyocytes. These changes create a voltage gradient between normal and ischemic zones, leading to current flow between these regions during both systole and diastole of cardiac cycle, termed "systolic current of injury" and "diastolic current of injury," respectively. These "currents-of-injury" are represented on the surface ECG by deviations of the ST segment from the isoelectric baseline. The polarity and magnitude of these changes depend upon the location and the severity of the insult.³

This current of injury pattern is also observed particularly during ECG-guided pericardiocentesis, when the aspiration needle hits the epicardium.⁴ However, in needle injury (during pericardiocentesis) or in pacemaker-lead injury, the current of injury pattern will be localized (like V₆ in our case, Fig. 1), while in pericarditis or in ischemia it will be evident in multiple ECG leads. Although the ST-segment elevation could be trivial in a surface ECG, an epicardial ECG will demonstrate an ST-segment elevation that is much more readily appreciated, of greater magnitude, along with an increase in the R-wave amplitude.

In conclusion, collectively, unlike other common causes of transient or permanent injury patterns manifesting in ST-segment deviation seen in two or more adjacent ECG leads, ST-segment elevation confined to one precordial lead is an unusual finding in surface ECG, and should prompt the search for an odd possibility, such as the accidental contact between ECG electrode and ventricular epicardial pacing wire. Our case report demonstrates epicardial current-of-injury pattern obtained via surface electrocardiogram, with surface leads as surrogates of epicardial tracing.

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