Detecting Transient Myocardial Ischemia in the Context of Acute Coronary Syndrome in the Emergency Department

Delta Map Analysis of Body Electrocardiographic Surface Mapping

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Diagnosing regional myocardial ischemia (TRMI) remains a challenge in patients presenting with acute chest pain. It is well recognized that early definitive clinical diagnosis can be difficult. Tests including the 12-lead ECG and troponin levels improve diagnostic certainty, but many patients present to the emergency department with acute chest pain too early for a reliable troponin result and show no acute change in ECG.

The 12-lead ECG, though undoubtedly useful, provides information only from a limited window of body surface electric activity. Thus it has well-described limitations in the diagnosis of (1) right ventricular and/or posterior infarction, (2) transient myocardial ischemia, and (3) patients with left bundle-branch block. Given the clear-cut evidence of outcome benefit for both aggressive early pharmacological and revascularization treatment in acute coronary syndromes, novel techniques for reliable detection of such patients are potentially of substantial clinical value.

Body surface mapping (BSM) is an electrocardiographic technique that uses multiple anterior and posterior thoracic

Figure 1. The 12-lead ECG demonstrating nonspecific changes.
sampling points to provide a more comprehensive picture of cardiac electric activity. Conventionally, 4 maps are constructed after BSM assessment that analyze QRS and ST-segment change and generate isointegral and isopotential maps. These have been shown to be superior to the 12-lead ECG for detecting myocardial infarction.\(^1,2\)

For the detection of TRMI, by contrast, the Delta subtraction map, in which 1 map is acquired during ischemic pain and 1 when there is no pain and only ST change between the 2 maps is displayed, shows potential diagnostic value. Initial data demonstrated that the Delta map technique could detect TRMI in patients undergoing angioplasty in isolated single-vessel disease.\(^3\) We present a case that illustrates the diagnostic utility of the BSM Delta map in a patient presenting to the emergency department with intermittent acute cardiac pain without changes on the conventional ECG.

A 75-year-old hypertensive man presented with retrosternal chest pain that had commenced 90 minutes after a round of golf. His admission ECG showed inverted T waves in aVL but no significant ST shift (Figure 1). BSM recordings were taken (1) when the patient complained of pain of 10/10 severity and (2) when he was pain-free 20 minutes afterward, after the administration of sublingual nitrate. A Delta subtraction map was constructed from these 2 recordings by displaying ST-segment change of at least 1 mm between the pain and no-pain recordings. A Delta subtraction map was constructed from these 2 recordings by displaying ST-segment change of at least 1 mm between the pain and no-pain recordings. This method has been previously described by our group in detail.\(^3,4\) The Delta map demonstrated a region of transient ischemia posteriorly (Figure 2). Moreover, using the Delta map, his ischemic burden was calculated and was found to be high. Troponin was measured at 4.04 ng/mL. The patient underwent emergency coronary angiography and was found to have an acute occlusion of the circumflex artery corresponding to the ischemic territory detected by the Delta map (Figure 3A). There was also a 60% to 70% stenosis of the right coronary artery. The circumflex artery was successfully reopened and stented with an excellent angiographic result (Figure 3B). The patient was discharged with no complications.

This case illustrates the superior diagnostic utility of the Delta map compared with 12-lead ECG in a patient presenting with intermittent acute cardiac pain caused by an acutely inflamed coronary plaque, which is known to be associated with dynamic thrombotic occlusion. Further data are required.

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None.

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**References**

Figure 3. A, Angiogram in right anterior oblique projection demonstrating total occlusion of the proximal aspect of the circumflex artery. Arrowhead indicates level of lesion. B, Angiogram in anterior posterior caudal projection after angioplasty and stent of the circumflex artery.
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