Editorial

http://dx.doi.org/10.4070/kcj.2013.43.6.368
Print ISSN 1738-5520 • On-line ISSN 1738-5555

kcj
Korean Circulation Journal

False Positive ST-Segment Elevation Myocardial Infarction

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Acute ST-segment elevation myocardial infarction (STEMI) is a serious disease in clinical practice. The rapid and accurate diagnosis of this critical illness can lead to prompt reperfusion, and it enables the reduction of cardiac ischemic damage and results in improved subsequent outcomes. The shorter the time to reperfusion, the greater the benefits.[1] The American College of Cardiology/American Heart Association STEMI guidelines recommend primary percutaneous coronary intervention for the treatment of STEMI with a door-to-balloon time of less than 90 minutes.[2] Therefore, the prompt and accurate diagnosis of STEMI is an important issue. In the diagnosis of STEMI, the 12-lead electrocardiogram (ECG) is an indispensable diagnostic tool directing the emergent management of patients with acute STEMI. However, a variety of other conditions aside from STEMI can cause ST-segment elevation on the ECG.[3][4] Several recent studies have found a frequency of false-positive catheterization laboratory activation. Indeed, a false-positive STEMI diagnosis is relatively common in community practice.[5-8] One of these studies reported that the prevalence of false-positive cardiac catheterization laboratory activations was between 9.2-14%.[6] In another study, the prevalence of false-positive STEMI diagnosis was 10.4% and the characteristics and prognosis in patients with a false-positive STEMI diagnosis in an emergency department was investigated.[9] In this study, false-positive STEMI diagnosis patients had a lower incidence of typical chest pain or chest tightness. Inferior ST-segment elevation (STE) occurred more often in patients with true-positive STEMI, whereas, diffuse STE was more often observed in the patients with a false-positive STEMI diagnosis. The total height of STE was lower in false-positive STEMI diagnosis patients, excluding five patients of marked STE just after cardiopulmonary resuscitation. Concave STE and no reciprocal ST-segment depression occurred more often in the false-positive STEMI diagnosis patients.

In accord with these studies, Bae et al.[10] reported the etiologies and predictors of a false-positive diagnosis of STEMI. Four hundred and fifty five consecutive patients (62±13 years, 345 males) with a presumptive diagnosis of STEMI from August 2008 to November 2010 were analyzed. In this study, a false-positive diagnosis of STEMI was made in 34 patients (7.5%) with no responsible coronary artery lesion. The common causes of the false-positive diagnoses were coronary spasm, left ventricular hypertrophy, myocarditis, early repolarization, and previous MI, as well as stress-induced cardiomyopathy. In multivariate logistic regression analysis, symptom-to-door time >12 hours, presenting symptoms other than chest pain, the absence of Q wave, and the absence of reciprocal ECG changes were independent predictors of a false-positive diagnosis of STEMI.

False-positive STEMI diagnosis patients are often encountered by physicians in daily clinical practice. The ECG finding often leads to unnecessary cardiac catheterization laboratory activations. It is associated with an unwanted increment of medical costs and procedural risks. Therefore, endeavors to distinguish false-positive STEMI from true-positive STEMI are necessary and meaningful. An attempt to assess the etiologies and prevalence of false-positive STEMI diagnosis in Korea is an outstanding endeavor. As the authors suggest, there were differences in the prevalence and etiologies of false-positive STEMI diagnoses in Western countries. However, more inquiry is required through the design of a multi-center prospective study and enrolled large population. Any factors that help to increase diagnostic accuracy should be concerned with issues such as making a comparison to a previous ECG if it is available, STE morphology like convex and concave patterns, and any presence of combined arrhythmia.

Bae et al.[10] considered a coronary spasm as likely leading to a false

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• The authors have no financial conflicts of interest.

positive STEMI diagnosis. However, the elevation of cardiac enzyme from a spasm of the coronary artery is defined as a type 2 myocardial infarction in the universal definition of AMI, as reported by the European Society of Cardiology/American College of Cardiology Foundation/American Heart Association/World Health Federation Task Force.[11] Therefore, a coronary spasm should be considered as an AMI, not false STEMI. AMI due to a coronary spasm is one of the causes of myocardial infarction with normal coronary arteries. Myocardial infarction with normal coronary arteries (MINCA) is an important subtype of myocardial infarction. Interest and awareness of MINCA has increased recently because of the frequent use of coronary angiography. Kang et al.[11] reported that the incidence of a near-normal coronary angiogram in patients who present as AMI was 4.4% in the Korean Acute Myocardial Infarction Registry. Although they included not only STEMI but also non-STEMI, the patients with near-normal coronary angiograms had similar clinical outcomes and prognoses to one- or two-vessel diseased patients presenting with an AMI. Therefore, we should not overlook false-positive STEMI diagnosis patients. It is imperative to uncover the underlying causes of AMI in near-normal coronary angiogram patients, to allow for the initiation of appropriate treatment.

We cannot always rule out a false-positive STEMI using only an interpretation of an ECG. However, there are some useful tips for increasing positive predictive value and specificity. First, a combination of factors proven to be independent predictors of true-positive STEMI may be helpful. For example, a combination of STE morphology and reciprocal ST depression increased the predictive value in another study.[9] Second, echocardiography is helpful to distinguish false-positive STEMI from true-positive STEMI. When the ECG is not diagnostic of STEMI, early detection of the presence or absence of wall motion abnormalities using echocardiography can aid in management decisions such as whether the patient should receive reperfusion therapy.

In conclusion, studies intended to minimize false-positive STEMI diagnoses are clinically important. However, we should keep in mind that an overemphasis on false-positive STEMI diagnosis may risk the underestimation of true-positive STEMI, potentially leading to fatal prognoses.

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