Lambda-like ST segment elevation in acute myocardial infarction – a new risk marker for ventricular fibrillation? Three case reports

Uniesienie odcinka ST o kształcie litery lambda w ostrej fazie zawału serca – nowy wskaźnik ryzyka wystąpienia migotania komór? Opis trzech przypadków

Piotr Kukla¹, Marek Jastrzębski², Jerzy Sacha¹, Leszek Bryniarski²

¹Department of Internal Medicine, H. Klimontowicz Specialistic Hospital, Gorlice
²1st Department of Cardiology, Collegium Medicum, Jagiellonian University, Kraków
³Department of Cardiology, Medical Center, Opole

Abstract

Sudden cardiac death (SCD) is responsible for almost 50% of all cardiac deaths in the U.S. The most common underlying cause of SCD is coronary artery disease, especially acute myocardial infarction (AMI). There are no publications concerning the shape of ST segment elevation in AMI and the risk of ventricular fibrillation (VF) or SCD. We present three cases with AMI and atypical ST segment elevation – ‘lambda-wave-like’ pattern, complicated with episodes of VF. This ECG pattern resembles the ST segment elevation shape in the type 1C Brugada syndrome. The ‘lambda-like’ ST segment elevation in AMI may identify patients with increased risk of VF or SCD.

Key words: ventricular fibrillation, ECG, lambda wave, acute myocardial infarction

Introduction

Sudden cardiac death (SCD) is responsible for almost 50% of all cardiac deaths in the U.S. [1]. Epidemiological studies have shown that SCD occurs in 0.36 to 1.28 per 1000 persons yearly [2]. The most common cause of SCD is coronary artery disease (CAD) [3].

Recently, Hu et al. showed that some mutations in the gene SCN5A (mutation G400A) could be associated with ventricular fibrillation (VF) and electrical storm during AMI [4]. However, data concerning the shape of ST segment elevation in AMI and the risk of VF or SCD are lacking. It is possible that some patients who suffer from AMI also have genetic abnormalities predisposing to dangerous ventricular arrhythmia, called channelopathies, and that these patients are at particularly high risk of developing VF during acute ischaemia. It may be speculated that the shape of the ST segment elevation or other ECG parameters may be different from that observed in AMI patients without genetic abnormalities.

One of the ST segment abnormalities described in the literature is a lambda-like ST segment pattern. It was first described by Riera et al. [5] and further characterised by Gussak and Bjerregaard in their editorial [6]. Riera et al. described a young man with characteristic ST segment elevation in AMI and atypical ST segment elevation – ‘lambda-wave-like’ pattern, complicated with episodes of VF. This ECG pattern resembles the ST segment elevation shape in the type 1C Brugada syndrome. The ‘lambda-like’ ST segment elevation in AMI may identify patients with increased risk of VF or SCD.

Address for correspondence:
Piotr Kukla MD, Klinika Chorób Wewnętrznych, Szpital Specjalistyczny im. H. Klimontowicza, ul. Węgierska 21, 38-300 Gorlice,
tel.: +48 18 355 32 00, e-mail: kukla_piotr@poczta.onet.pl
Received: 04 May 2008. Accepted: 21 May 2008.
Other interesting data were presented by Yan et al. [8, 9], who proposed the new concept, based on an experimental model, that ST segment elevation in AMI and Brugada syndrome share similar underlying mechanisms. Namely, the loss of the characteristic shape of the ‘spike and dome’ in the action potential in the epicardium leads to a transmural voltage gradient between the epicardium and the endocardium, which gives rise to a J wave. The main role is played by the Ito current, which is responsible for the prominent notch in the epicardial action potential [10]. The more prominent the notch which occurs between repolarisation phase 1 and phase 2 of the action potential, the greater the predisposition to complete loss of the dome-shape in the epicardium. This in turn causes a transmural voltage gradient throughout the whole of phase 2 of repolarisation, presenting as ST segment elevation on the surface ECG [11].

We present three patients with AMI and lambda-like atypical ST segment elevation, complicated with episodes of VF. In all these patients recurrent polymorphic VT and VF were observed, responding to a high dose of beta blockers but resistant to intravenous amiodarone.

Case 1
This male patient, aged 74 years old, was admitted to our institution because of acute coronary syndrome with ST segment elevation in V4-V6, I and aVL. Coronary angiography showed that the infarct-related artery was the first diagonal branch. We observed 7 episodes of VF within four hours. Amiodarone was ineffective, but metoprolol administered in bolus doses i.v. up to 30 mg diminished the arrhythmia and VF did not recur again. The characteristic pattern of ST segment elevation is shown in Figures 1 and 2.

Case 2
A 41-year-old man suffered from 3 episodes of VF. His admission ECG showed ST segment elevation in leads I, aVL and V2-V6. Coronary angiography did not reveal any significant coronary artery stenosis. Echocardiography showed left ventricular ejection fraction (LVEF) of 45%, increased LV diastolic diameter of 66 mm, hypokinetic anterior wall and anterior part of the interventricular septum as well as mitral insufficiency grade II/III. Ventriculography showed hypokinesia of the antero-

![Figure 1. Three left precordial leads with ‘lambda-like’ ST segment elevation in patient 1](image-url)
lateral LV and apical segment. The levels of necrotic enzymes were elevated; however, three DC shocks have to be taken into account when interpreting enzyme concentrations. The maximal creatine phosphate (CK) level was 11042 U/l, CK-MB max. was 407 U/l, and troponin I max. was 38.58 ng/ml. The ECG (precordial V1-V6 leads) recorded on admission is presented in Figure 3.

**Case 3**

An 82-year-old man was transferred to our institution from another hospital because of acute coronary syndrome with ST segment elevation, complicated by 4 episodes of VF. Coronary angiography showed subtotal occlusion of the proximal part of the left descending artery. A bare metal stent was implanted. Echocardiography showed LVEF of 33%, with akinesia of the mid and apical segments of the anterior LV wall and anterior part of the interventricular septum. Maximum values of necrosis markers were: CK – 3567, CK-MB – 666 U/l and troponin I >30 ng/ml. The ECG recorded on admission is presented in Figure 4, and the ECG obtained on the next day after PCI in Figure 5.

**Discussion**

The search for ECG markers of SCD and susceptibility to VF continues. In this report we present three patients with AMI and VF in whom ECG showed a peculiar lambda-like...
ST segment elevation. Further studies, including more patients and genetic assessment, are needed to clarify the possible value of this ECG abnormality in identification of patients at increased risk of VF during acute ischaemia.

This pattern of ST segment elevation was first described by Riera [5] and then named by Gussak ‘the Lambda wave’ [6]. These ECG peculiarities were associated with sudden cardiac death and cardiac asystole followed by short episodes of ventricular fibrillation.

Recent publications reported some similarities between mechanisms of ST segment elevation and the initiation of VF in AMI and the Brugada syndrome. Because the lambda wave was observed in a patient with VF and SCD, who had atypical Brugada syndrome, one can speculate that a similar ST pattern could be associated with VF in AMI.

Study limitations
No genetic studies were performed in our patients, so the possibility that they had channelopathies remains speculative.
References