Herzschr Elektrophys 2020 · 31:228–231
https://doi.org/10.1007/s00399-020-00682-y
Received: 19 March 2020
Accepted: 12 April 2020
Published online: 2 May 2020


David Pilecky[1] · Robert Fischer[1] · Tanja Wiesinger[1] · Michael Gröbner[1] · Mate Vamos[2] · Dietmar Elsner[1]

[1] Department of Internal Medicine III, Klinikum Passau, Passau, Germany

[2] 2nd Department of Medicine and Cardiology Center, University of Szeged, Szeged, Hungary

# Anterior wall ST-elevation myocardial infarction in biventricular paced rhythm

## Electronic supplementary material

The online version of this article (https://doi.org/10.1007/s00399-020-00682-y) contains supplementary material, which is available to authorized users.

## Medical history

The case of a 78-year-old male patient with known ischemic cardiomyopathy who presented with acute retrosternal chest pain and hypotension is reported. The patient had undergone cardiac resynchronization therapy with defibrillator (CRT-D) upgrade with implantation of an epicardial left ventricular (LV) lead in a basolateral position 2 years previously (**Fig. 1**). Subsequent atrioventricular node ablation was performed due to atrial fibrillation refractory to pharmacological treatment and symptomatic heart failure.

## Observations

The patient's electrocardiogram (ECG) on admission (**Fig. 2b**) showed atrial fibrillation and permanent biventricular pacing at 70 bpm, as well as loss of R-wave in V3 and new 0.2–0.4 mm discordant ST-elevations in V3–V5 without reciprocal ST-depression. Since these ST-abnormalities were not seen on the previous routine ECG recording (**Fig. 2a**), STEMI was suspected. Urgent bed-side echocardiography strengthened the diagnosis by revealing akinesia of the api-

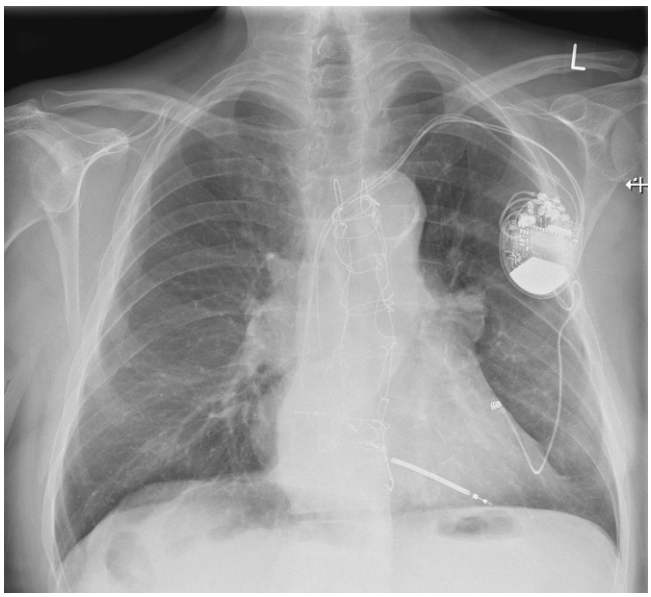


**Fig. 1** ◀ Chest X-ray after implantation of a cardiac resynchronization therapy with defibrillator system with epicardial left ventricular lead

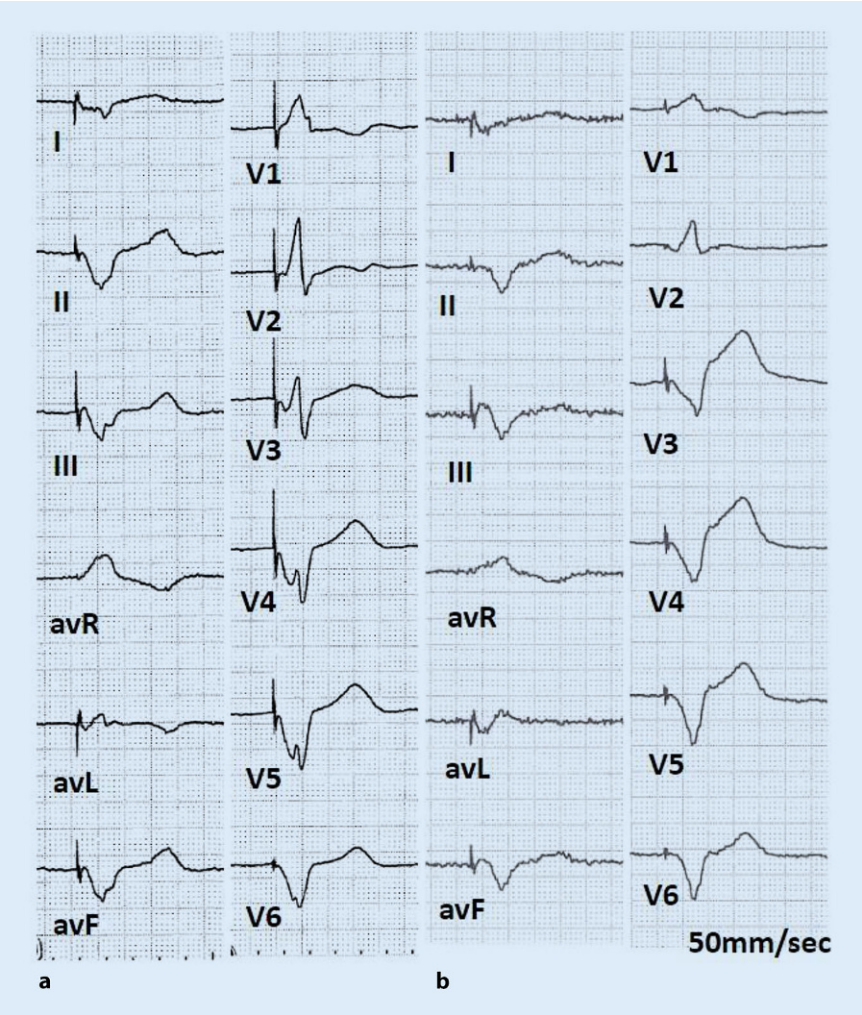


**Fig. 2** ▲ Previous routine follow-up electrocardiogram (ECG) (**a**) and ECG at presentation (**b**)

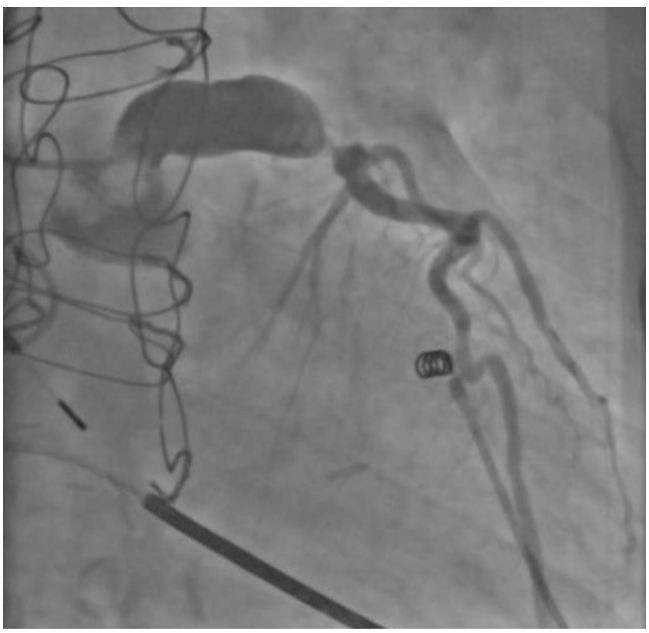

**Fig. 3** ◀ Coronary angiogram showing a left main coronary aneurysm and subtotal occlusion of the left anterior descending artery (right anterior oblique 14°, caudal 15°)

cal, anterior, and anteroseptal segments (Video 1).

## Therapy and its course

After administration of aspirin, heparin, and morphine, symptoms were alleviated. Emergent cardiac catheterization demonstrated an aneurysmal left main and subtotal occlusion in the proximal part of the left anterior descending artery (LAD) with delayed flow (Fig. 3) as the culprit lesion. Percutaneous coronary intervention (PCI) with placement of a drug-eluting stent in the proximal LAD was successfully performed. ECG changes regressed completely after PCI. Laboratory tests showed a marked increase in levels of cardiac enzymes (peak troponin I > 125 ng/ml) and the patient developed cardiogenic shock. He was treated accordingly and was discharged from hospital 13 days later.

## Discussion

The diagnosis of STEMI can be challenging in the presence of ventricular pacing due to the modified depolarization and repolarization pattern of the myocardium. In the setting of right ventricular pacing, ST-elevation >1 mm concordant with QRS complex and discordant ST-segment elevations >5 mm have been shown to be the most specific ECG changes, albeit with low to moderate sensitivity[1]. For this reason, modified Sgarbossa criteria have been developed for the diagnosis of STEMI in left bundle branch block [2], which relate the extent of discordant ST elevation to the size of the S wave and may also apply for right ventricular pacing. Due to a lack of systematic studies and varying QRS morphology depending on lead position and stimulation timing, the diagnosis of myocardial ischemia can be more difficult in the case of biventricular pacing. In certain cases, temporary inhibition of pacing in non-pacemaker-dependent patients or switching to right ventricular stimulation can be attempted to promote early diagnosis. There are only three published case reports of STEMI in biventricular paced rhythm [3–5]. These all describe cases of anterior/anterolateral STEMI, where concordant ST-elevations with reciprocal ST-depressions and/or discordant ST-elevations in leads with negative QRS complexes were present. To the authors' knowledge, this is the first report of ECG abnormalities associated with myocardial infarction in a patient with a CRT system and epicardial LV lead. In the current case, only discordant ST-elevations of less than 5 mm but more than 25% of the S wave were seen. Typical symptoms and comparison of the admission ECG with a previous follow-up ECG facilitated the correct diagnosis. Although no total coronary occlusion was present at the time of cardiac catheterization, the clinical presentation, echocardiography, and cardiac enzyme kinetics were together indicative of transmural ischemia. Further research is warranted to determine ECG criteria for STEMI in biventricular and/or epicardial paced rhythm.

## Abstract · Zusammenfassung

Herzschr Elektrophys 2020 · 31:228–231 https://doi.org/10.1007/s00399-020-00682-y


D. Pilecky · R. Fischer · T. Wiesinger · M. Gröbner · M. Vamos · D. Elsner

### Anterior wall ST-elevation myocardial infarction in biventricular paced rhythm

**Abstract**

There is a lack of evidence on electrocardiographic criteria for ST-elevation myocardial infarction (STEMI) in patients with biventricular paced rhythm. In all previous case reports of STEMI in biventricular paced rhythm, concordant ST-elevations and/or discordant ST-elevations >5 mm were present. This report describes the case of a patient with anterior STEMI and discordant ST-elevations of less than 5 mm during biventricular stimulation with epicardial left ventricular lead and highlights the importance of comparing the electrocardiogram to previous recordings when STEMI is suspected.

**Keywords**

Cardiac resynchronisation therapy · Biventricular stimulation · Myocardial ischemia · Electrocardiography · Sgarbossa criteria · Epicardial lead

### ST-Hebungs-Myokardinfarkt der Vorderwand bei biventrikulär stimuliertem Rhythmus

**Zusammenfassung**

Bezüglich der elektrokardiographischen Diagnosekriterien eines ST-Hebungs-Myokardinfarkts (STEMI) während biventrikulärer Schrittmacherstimulation liegt keine klare Evidenz vor. In allen vorherigen Fallberichten über STEMI bei biventrikulärer Schrittmacherstimulation wurden konkordante ST-Hebungen und/oder diskordante ST-Hebungen >5 mm beschrieben. Unsere Kasuistik schildert den Fall eines Patienten mit STEMI der Vorderwand und diskordanten ST-Hebungen <5 mm während biventrikulärer Stimulation mit epikardialer linksventrikulärer Sonde und betont, wie wichtig es bei Verdacht auf STEMI ist, das Elektrokardiogramm mit früheren Aufzeichnungen zu vergleichen.

**Schlüsselwörter**

Kardiale Resynchronisationstherapie · Biventrikuläre Stimulation · Myokardischämie · Elektrokardiographie · Sgarbossa Kriterien · Epikardiale Sonde

**Corresponding address**

**Dr. med. David Pilecky**
Department of Internal Medicine III, Klinikum Passau
Innstraße 76, 94032 Passau, Germany
pileckyd@gmail.com

## Compliance with ethical guidelines

**Conflict of interest.** D. Pilecky, R. Fischer, T. Wiesinger, M. Gröbner, M. Vamos and D. Elsner declare that they have no competing interests.

For this article no studies with human participants or animals were performed by any of the authors. For images or other information within the manuscript which identify patients, consent was obtained from them and/or their legal guardians.

## References


1. Sgarbossa EB, Pinski SL, Gates KB, Wagner GS (1996) Early electrocardiographic diagnosis of acute myocardial infarction in the presence of ventricular paced rhythm. GUSTO-I investigators. Am J Cardiol 77:423–424
2. Smith SW, Dodd KW, Henry TD, Dvorak DM, Pearce LA (2012) Diagnosis of ST-elevation myocardial infarction in the presence of left bundle branch block with the ST-elevation to S-wave ratio in a modified Sgarbossa rule. Ann Emerg Med 60:766–776
3. Ukena C, Mahfoud F, Buob A, Bohm M, Neuberger H-R (2012) ST-elevation during biventricular pacing. Europace 14:609–611
4. Karumbaiah K, Omar B (2013) ST-elevation myocardial infarction in the presence of biventricular paced rhythm. J Emerg Med 45:e35–40
5. Pandit A, Hakim F, Chandrasekaran K, Srivathsan K (2014) ST segment elevation myocardial infarction in biventricular paced rhythm. Heart Lung Circ 23:e184–187



Herzschr Elektrophys 2020 · 31:238
https://doi.org/10.1007/s00399-016-0438-2
Online publiziert: 30. Mai 2016





**Marcus Wiemer**

Klinik für Kardiologie und Internistische Intensivmedizin, Johannes Wesling Klinikum, Minden, Deutschland


# RETRACTED ARTICLE: Differenzierung von „Misunderstanding“ und „Mismanagement“

This article has been retracted by the Publisher as it was published accidentally without consent of the Editor in Chief.


## Korrespondenzadresse

**PD Dr. med. Marcus Wiemer**
Klinik für Kardiologie und Internistische Intensivmedizin, Johannes Wesling Klinikum
Hans-Nolte-Str. 1, 32429 Minden, Deutschland
marcus.wiemer@muehlenkreiskliniken.de