



## Typical chest pain and precordial leads ST-elevation in patients with pacemakers – are we always looking at an acute myocardial infarction?

Tipičan bol u grudima i prekordijalna ST-elevacija kod bolesnika sa pejsmerkerima – Vidimo li uvek akutni infarkt miokarda?

Marina M Ostojić\*, Tatjana S Potpara\*<sup>†</sup>, Marija M Polovina\*, Mladen M Ostojić\*, Miodrag C Ostojić<sup>†</sup>

\*Clinic of Cardiology, Clinical Center of Serbia, Belgrade, Serbia; <sup>†</sup>Faculty of Medicine University of Belgrade, Serbia

### Abstract

**Introduction.** Electrocardiographic (ECG) diagnosis of acute myocardial infarction (AMI) in patients with paced rhythm is difficult. Sgarbossa's criteria represent helpful diagnostic ECG tool. **Case report.** A 57-year-old female patient with paroxysmal atrial fibrillation and a permanent pacemaker presented in the Emergency Department with prolonged typical chest pain and ECG recording suggestive for AMI. Documented ECG changes correspond to the first Sgarbossa's criterion for AMI in patients with dual pacemakers (ST-segment elevation of  $\geq 5$  mm in the presence of the negative QRS complex). The patient was sent to catheterization lab where coronary angiogram revealed normal findings. ECG changes occurred due to pericardial reaction following two interventions: pacemaker implantation a month before and radiofrequency catheter ablation of AV junction two weeks before presentation in Emergency Department. **Conclusion.** This case report points out to the limitations of proposed criteria that aid in the recognition of AMI in patients with underlying paced rhythm and possible cause(s) of transient electrocardiographic abnormalities.

### Key words:

pacemaker, artificial; myocardial infarction; pericarditis; heart conduction system; catheter ablation; diagnosis, differential.

### Apstrakt

**Uvod.** Elektrokardiografska (EKG) dijagnostika akutnog infarkta miokarda (AIM) kod bolesnika sa ugrađenim pejsmejerom je otežana. Za postavljanje adekvatne dijagnoze od pomoći su Sgarbossa EKG kriterijumi. **Prikaz bolesnika.** Bolesnica, stara 57 godina, primljena je u Urgentni centar sa tipičnim bolom u grudima i EKG promenama koje odgovaraju slici anteriornog AIM. EKG promene ispunjavale su prvi Sgarbossa kriterijum za AIM kod bolesnika sa pejsmejerom (ST elevacija  $\geq 5$  mm u odvodima sa negativnim QRS kompleksom). Bolesnica je upućena na hitnu koronarnu angiografiju kojom nisu nađene opstruktivne promene u koronarnim arterijama. Registrovane EKG promene nastale su kao posledica perikarditisa izazvanog prethodnim interventnim procedurama: implantacijom trajnog pejsmejkera i radiofrekventnom kateter ablacijom AV čvora izvršenim mesec dana i dve nedelje pred prezentaciju u Urgentnom centru. **Zaključak.** Ovaj prikaz bolesnika ukazuje na ograničenja Sgarbossa EKG kriterijuma za postavljanje dijagnoze AIM kod bolesnika sa pejsmejerom kao i na moguće uzročnike prolaznih EKG abnormalnosti.

### Ključne reči:

srce, veštačko usklađivanje ritma; infarkt miokarda; perikarditis; srce, provodni sistem; ablacija preko katetera; dijagnoza, diferencijalna.

### Introduction

The number of patients with pacemakers is constantly growing, and the standard ECG criteria for acute myocardial infarction (AMI) are of limited value in these patients, as acute myocardial injury can be masked by the presence of

paced QRS complexes. The Sgarbossa's criteria (e.g. GUSTO criteria) usually allow recognizing AMI in patients with pacemakers but localization of MI is still difficult or even impossible<sup>1</sup>. The undetermined type of AMI is recognized in 6.5% patients and intrahospital mortality is reported to be 11.8%<sup>2</sup>. There are three Sgarbossa's criteria: ST-

segment elevation of  $\geq 5$  mm in the presence of the negative QRS complex, ST-segment elevation of  $\geq 1$  mm in the presence of the positive QRS complex, and ST-segment depression of  $\geq 1$  mm in lead V1, V2 or V3<sup>1</sup>.

### Case report

We presented a 57-year-old female patient with paroxysmal atrial fibrillation (AF) and a permanent pacemaker admitted to the Coronary Care Unit due to prolonged typical chest pain and ECG recording suggestive for AMI.

The patient had the 7-year history of frequent, highly symptomatic paroxysms of AF despite active treatment with beta blocker, propafenone, flecainide, sotalol and, finally, amiodarone (in combination with beta blocker or verapamil). During propafenone treatment, several paroxysms of typical atrial flutter with fast ventricular response had occurred, and radiofrequency catheter ablation of atrial flutter was successfully performed. However, highly symptomatic frequent paroxysms of AF reoccurred, amiodarone was discontinued due to thyroid dysfunction

(hyperthyreosis), and the patient refused radiofrequency catheter ablation (RFCA) of pulmonary veins. At that point, transthoracic echocardiography (TTE) confirmed previous normal findings. Yet, AF symptoms were poorly controlled and the patient's quality of life was significantly impaired. Finally, we performed RFCA of atrioventricular (AV) junction, with permanent pacemaker (DDDR) implantation. A month following pacemaker implantation, RFCA of AV junction was performed without periprocedural complications. At discharge (4 days later), the patient was asymptomatic with ECG showing artificial pacemaker rhythm (Figure 1).

Two weeks later, the patient referred to emergency room with typical chest pain, fatigue and ECG abnormalities suggestive for AMI (ST elevation 1–5 mm with negative T waves in precordial leads V2–V6 and ST elevation in the inferior leads) (Figure 2).

Coronary angiography revealed normal findings (Figure 3), and over the next 10 days biochemical markers of myocardial necrosis remained within referent values: troponin I 0.029  $\mu\text{g/L}$ –0.018  $\mu\text{g/L}$  (normal  $< 0.04$   $\mu\text{g/L}$ ) and creatine kinase 125 U/L–

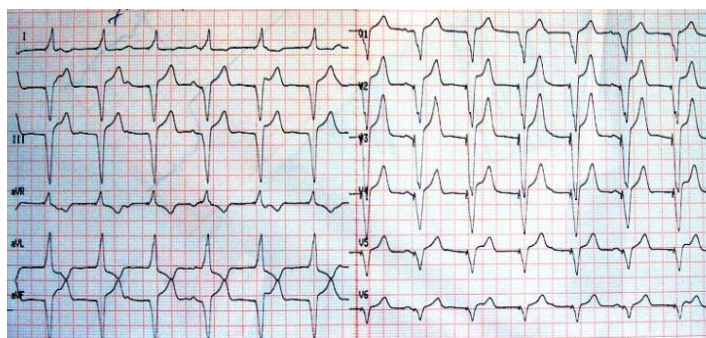


Fig. 1 – Electrocardiogram following atrioventricular node catheter ablation.



Fig. 2 – Electrocardiogram at admission to the Coronary Care Unit.

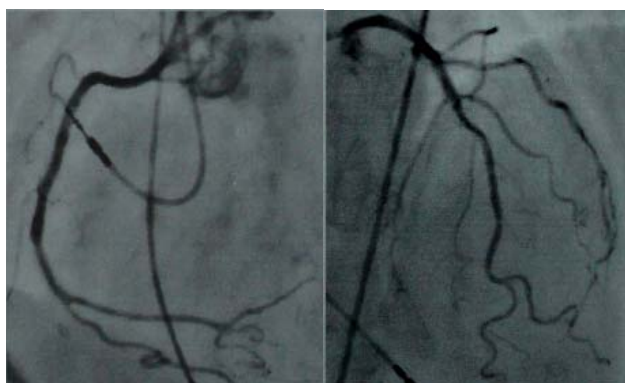


Fig. 3 – Coronary angiogram.

130 U/L (normal < 150U/L); TTE showed a localized non-homogeneous pericardial effusion of 4–10 mm along the right ventricular free wall (suggesting effusion in regression).

Other findings were normal, including chest radiography with pacemaker electrodes in the correct position (Figure 4).

At discharge, ECG abnormalities resolved (Figure 5), and TTE revealed only minimal pericardial effusion of 1–2 mm along the right ventricular free wall.

of spontaneous and totally paced beats<sup>3</sup>. However, symptoms of the presented patient and ECG changes occurred a month following pacemaker implantation, and two weeks post RFCA of AV junction. Pericardial reaction is a potential complication of invasive procedures such as pacemaker implantation or RFCA. Moreover, a recurrent chronic pericarditis may occur eventually leading to the development of large pericardial effusion or cardiac tamponade<sup>4</sup>. Myocardial microperforation with spontane-

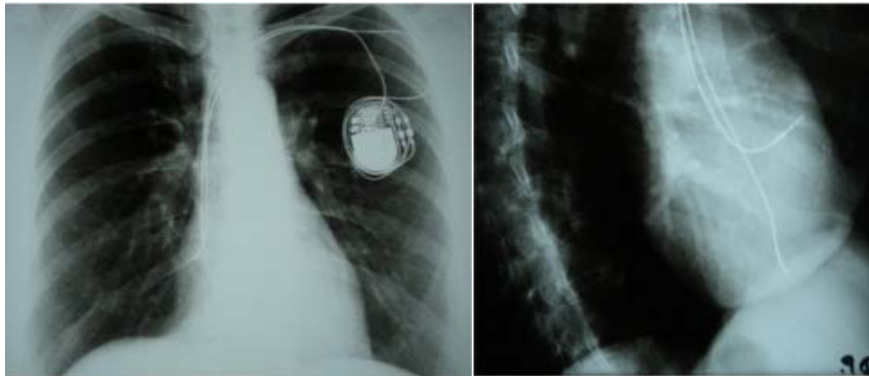


Fig. 4 – Chest radiography.

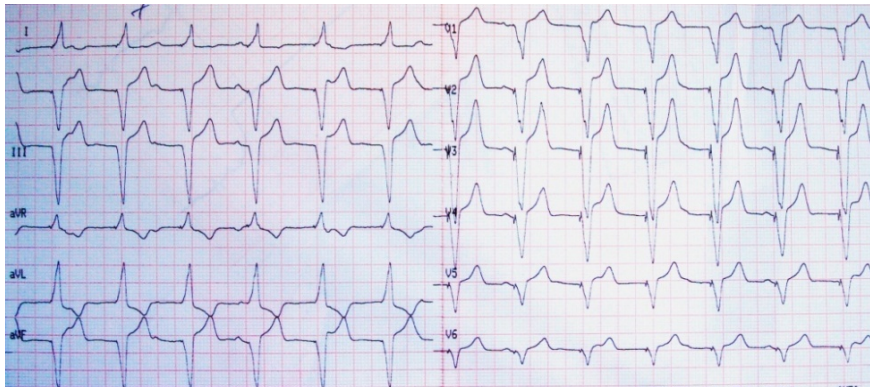


Fig. 5 – Electrocardiogram recording at discharge.

## Discussion

Electrocardiographic (ECG) evaluation of patients with permanent pacemakers and typical chest pain might be difficult.

This case report presented a female patient with typical chest pain and ECG suggestive for AMI, ultimately diagnosed with transient pericardial effusion and normal coronary angiogram.

In GUSTO trial with 26,003 AMI patients, ECGs of 17 patients with a pacemaker were analyzed and only one of Sgarbossa's criteria was relatively highly sensitive: ST-segment elevation of  $\geq 5$  mm in the presence of the negative QRS complex<sup>1</sup>. However, it should be underlined that these criteria, which compose the guidelines for ECG diagnosis of AMI in patients with ventricular pacing, were based on the analysis of only 17 patients selected from the trial.

In the presented patient ST-segment elevation of  $\geq 5$  mm in the presence of the negative QRS complex was documented, but she did not have AMI. In the literature, ST elevation was also interpreted as ventricular fusion due to the presence of a ventricular pacing artifact and the QRS complex being a hybrid

ous resolution of a small pericardial effusion has also been described<sup>4</sup>. The incidence of acute myocardial perforation with dual chamber pacemaker implantation is < 1%, while late perforation following device implantation is less well recognized and deemed to be rare<sup>5,6</sup>.

On the other hand, major complications of RFCA occur in approximately 3% of patients, and the overall incidence of myocardial perforation and pericardial effusion is unknown. A multicenter retrospective study of the European Radiofrequency Survey on 2,222 patients reported cardiac perforation in 0.72% of patients, and a clinically relevant pericardial effusion in only 12 patients<sup>7</sup>. The incidence of cardiac complications varied according to the experience of the center and the type of ablation. Indeed, there is a very low risk of serious complications with RFCA of AV junction<sup>8</sup>. Regarding the presented patient, pacemaker electrode placement had most probably caused a localized myocardial damage (and possible myocardial microperforation) which led to the pronounced late pericardial reaction with pericardial effusion (and possible hemopericardium) and ST-segment elevation in precordial leads.

## Conclusion

The interpretation of ECG abnormalities in patients with permanent pacemakers should be carefully undertaken, especially with the detailed insight into their history and recent inva-

sive procedures, if any. Application of Sgarbossa's criteria may be helpful, but further prospective studies are needed on a larger number of patients with permanent pacemakers to elucidate more reliable criteria for more accurate interpretation of ECG abnormalities.

## R E F E R E N C E S

1. *Sgarbossa EB, Pinski SL, Gates KB, Wagner GS.* Early electrocardiographic diagnosis of acute myocardial infarction in the presence of ventricular paced rhythm. *Am J Cardiol* 1996; 77(5): 423–4.
2. *Kochiadakis GE, Kalevros MD, Ikonominidis NE, Skolidis EI, Vardas PE.* Electrocardiographic diagnosis of acute myocardial infarction in the presence of ventricular paced rhythm. *PACE* 2001; 24(8): 1289–90.
3. *Karumbaiah K, Omar B.* ST-elevation myocardial infarction in the presence of biventricular paced rhythm. *J Emerg Med* 2013; 45(2): 35–40.
4. *Kautzner J, Bytynik J.* Recurrent pericardial chest pain: a case of late right ventricular perforation after implantation of a transvenous active-fixation ICD lead. *PACE* 2001; 24(1): 116–8.
5. *Chauban A, Grace AA, Newell SA, Stone DL, Shapiro LM, Schofield PM, et al.* Early complications after dual chamber versus single chamber pacemaker implantation. *PACE* 1994; 17(11 Pt 2): 2012–5.
6. *Barold SS, Center S.* Electrographic diagnosis of perforation of the heart by pacing catheter electrode. *Am J Cardiol* 1969; 24(2): 274–8.
7. *Hindricks G.* The Multicentre European Radiofrequency Survey (MERFS): complications of radiofrequency catheter ablation of arrhythmias. The Multicentre European Radiofrequency Survey (MERFS) investigators of the Working Group on Arrhythmias of the European Society. *Eur Heart J* 1993; 14(12): 1644–53.
8. *Marshall HJ, Harris ZI, Griffith MJ, Gammage MD.* Atrioventricular nodal ablation and implantation of mode switching dual chamber pacemakers: effective treatment for drug refractory paroxysmal atrial fibrillation. *Heart* 1998; 79(6): 543–7.

Received on September 16, 2013.

Revised on June 30, 2014.

Accepted on August 15, 2014.

Online First July, 2015.