



## CASE REPORT

# Ventricular tachycardia induced by pacing algorithm designed to avoid atrial fibrillation



David Roque\*, Nuno Cabanelas, João Augusto, Francisco Madeira, Hugo Vasconcelos, Carlos Morais

Serviço de Cardiologia, Hospital Professor Doutor Fernando da Fonseca, EPE, Amadora, Portugal

### KEYWORDS

Ventricular tachycardia;  
Pacemaker algorithm;  
Non-competitive atrial pacing

**Abstract** A patient with a dual chamber pacemaker was admitted to the emergency room after out-of-hospital cardioversion for syncopal sustained monomorphic ventricular tachycardia. Device interrogation revealed an abnormally timed ventricular spike after a ventricular premature beat at the beginning of the event, caused by a pacemaker algorithm designed to avoid atrial fibrillation, non-competitive atrial pacing. Despite the absence of significant coronary lesions, in the setting of a vulnerable substrate – a hypokinetic and hyperechogenic region of ventricular myocardium – an upgrade to a dual-chamber implantable cardioverter-defibrillator was performed, and substrate ablation was planned.

© 2020 Sociedade Portuguesa de Cardiologia. Published by Elsevier España, S.L.U. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

### PALAVRAS-CHAVE

Taquicardia ventricular;  
Algoritmo de pacemaker;  
Pacing auricular não competitivo

### Indução de taquicardia ventricular por algoritmo de pacemaker de prevenção de fibrilhação auricular

**Resumo** Doente com pacemaker de dupla câmara é admitido no Serviço de Urgência após uma cardioversão fora do hospital por episódio sincopal secundário a taquicardia ventricular monomórfica mantida. A interrogação do dispositivo revelou um spike ventricular inapropriado após uma extrasístole ventricular no início do evento, provocado por um algoritmo de pacemaker desenhado para evitar fibrilhação auricular – o *non-competitive atrial pacing* (NCAP). Apesar da ausência de lesões coronárias significativas, no contexto de substrato vulnerável – uma região hipocinética e hiperecogénica de miocárdio ventricular – upgrade para cardiodesfibrilhador implantável (CDI) bicamaral foi realizado e ablação de substrato planeada.

© 2020 Sociedade Portuguesa de Cardiologia. Publicado por Elsevier España, S.L.U. Este é um artigo Open Access sob uma licença CC BY-NC-ND (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

\* Corresponding author.

E-mail address: [roque.866@hotmail.com](mailto:roque.866@hotmail.com) (D. Roque).



retrograde (ventriculoatrial) conduction (Figure 2b). Due to the VPB and the post-ventricular atrial refractory period (PVARP) extension algorithm being programmed on, the retrograde atrial activity was sensed as a refractory atrial event. As the patient had suffered paroxysmal AF episodes, the device's non-competitive atrial pacing algorithm (NCAP)<sup>1</sup> (Medtronic, Minneapolis, MN, USA) had also been switched on. This algorithm is designed to avoid pacing in the atrium in the vulnerable period after a premature beat, which could potentially induce AF. So, when an atrial refractory event is sensed, a 300-ms window is opened, during which no atrial pacing is delivered (Figure 2c). Atrial pacing then resumes (Figure 2d). Concomitantly, to avoid excessive variation in ventricular cycles due to the NCAP delay, after the atrial stimulus, although a paced atrioventricular interval begins at the programmed value, the ventricular stimulus is delivered earlier, nominally 30 ms after the atrial stimulus (Figure 2e). In this particular case, the combination of these two algorithms induced a short-long-short sequence, which together with a probable vulnerable substrate induced sustained monomorphic VT (Figure 2f). Considering hemodynamically unstable VT started by a properly timed extra stimulus provided by the device, and the clues favoring the existence of a vulnerable myocardial

substrate, with an electrocardiogram showing a ventricular tachycardia whose morphology suggests originated in the hypokinetic region identified in the echocardiogram, an upgrade to a dual-chamber implantable cardioverter-defibrillator was performed and VT ablation was planned.

## Conclusion

This case shows how, in the appropriate setting, a normally functioning pacemaker, with modern algorithms designed to avoid adverse events, can also be proarrhythmic.

## Conflicts of interest

The authors have no conflicts of interest to declare.

## Reference

1. Medtronic. 27th March 2013. Non-competitive atrial pacing (NCAP) feature. Retrieved from: <https://www.medtronicacademy.com/features/non-competitive-atrial-pacing-ncap-feature>