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Irregular ventricular tachycardia underdetected by implantable cardioverter defibrillator device

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Abstract

A case of sustained monomorphic ventricular tachycardia underdetected by a single chamber implantable cardioverter defibrillator because of RR interval irregularity is presented. The programmed stability criterion is responsible for the underdetection. Special attention must be paid when it comes to programming this detection parameter. (Cardiol J 2008; 15: 281–283)

Key words: irregular ventricular tachycardia, implantable cardioverter defibrillator, amiodarone

Case report

Ischemic heart failure has been associated with the increased risk of lethal ventricular tachyarrhythmias. Implantable cardioverter defibrillator (ICD) is an established treatment, for the primary and/or the secondary prevention of sudden arrhythmic death in these patients. In ICD detection algorithms, the stability criterion of consecutive RR intervals should be programmed very carefully for the prevention of inappropriately delivered therapies by the device, especially in patients with concomitant supraventricular irregular tachyarrhythmias.

We present a patient with ischemic heart failure, left bundle branch block in the basal surface ECG and known paroxysmal atrial fibrillation under amiodarone therapy. A single chamber ICD device (Biotronik, Belos VR) was implanted for secondary prevention after an episode of hemodynamically unstable sustained monomorphic ventricular tachycardia (SMVT). The device has been programmed for a three-zone therapy, slow ventricular tachycardia (VT) (130 to 171 bpm), fast VT (171 to 214 bpm) with the stability interval set at ± 20 ms and ventricular fibrillation (VF). The counter of detection was set at 26 and at 16 RR intervals in the slow and fast VT zone, respectively.

In the slow VT zone, the programmed therapy consisted of 2 antitachycardia pacing schemes (burst type with 6 consecutive pulses) each containing 3 sequences, followed by cardioversion. In the fast VT zone, the programmed therapy consisted of cardioversion sequences (the first attempt was set at 7 J). In the VF zone, the programmed therapy consisted of defibrillation shocks (the first shock was set at 20 J, and the remaining shocks were set at 30 J).

During a 24 hours ambulatory ECG recording, an episode of SMVT (Fig. 1) occurred at a mean initial rate of 150 bpm, with unstable RR intervals (Fig. 2A, B). The ICD device was unable to detect this irregular rhythm in the slow VT zone. Afterwards, this ventricular rhythm was accelerated to a faster but regular SMVT (180 bpm) (Fig. 2C), which was detected in the fast VT zone. The programmed cardioversion therapy of 7 J was followed by degeneration of the fast VT to VF and the sinus rhythm was finally restored after two consecutive shocks of 20 J and 30 J, respectively (Fig. 1).

In order to eliminate underdetected irregular VT episode in the future, the stability interval was reprogrammed to ± 40 ms, based on the calculated mean values of the RR intervals differences during the recorded tachycardia.

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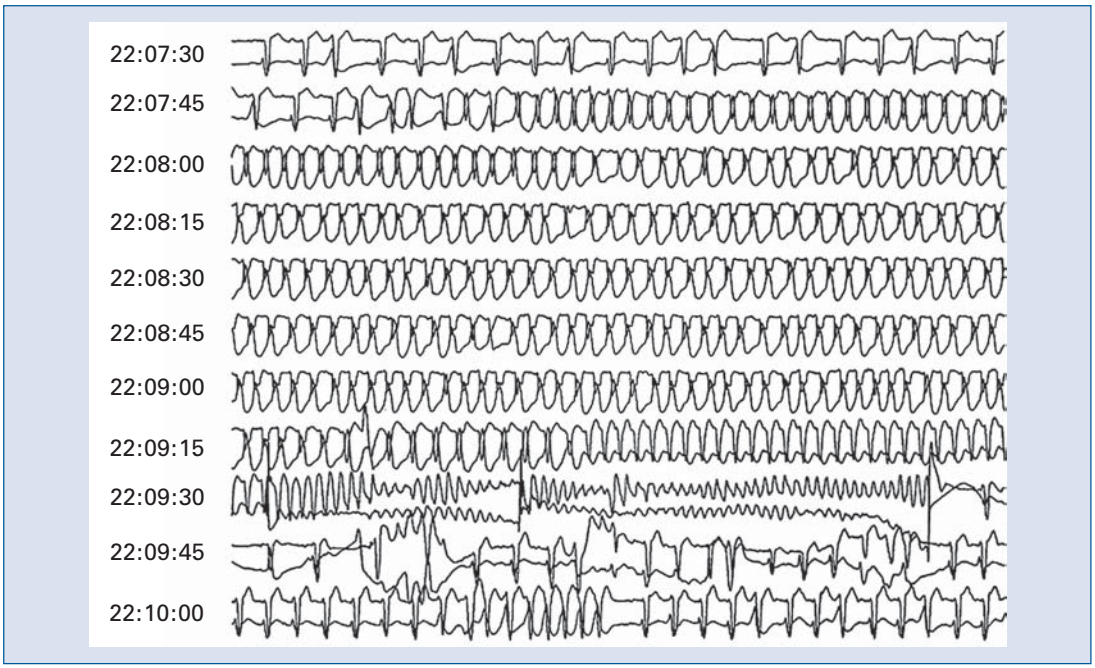

Figure 1. A 24 hours ambulatory ECG recording (dual channel) in an ICD recipient, showing an undetected episode of irregular ventricular tachycardia, lasting about 1.5 min. This rhythm was then accelerated to a faster but regular ventricular tachycardia followed by cardioversion, which led to the degeneration of ventricular tachycardia to ventricular fibrillation. Finally, the sinus rhythm was restored after two consecutive delivered shocks of 20 J and 30 J, respectively.

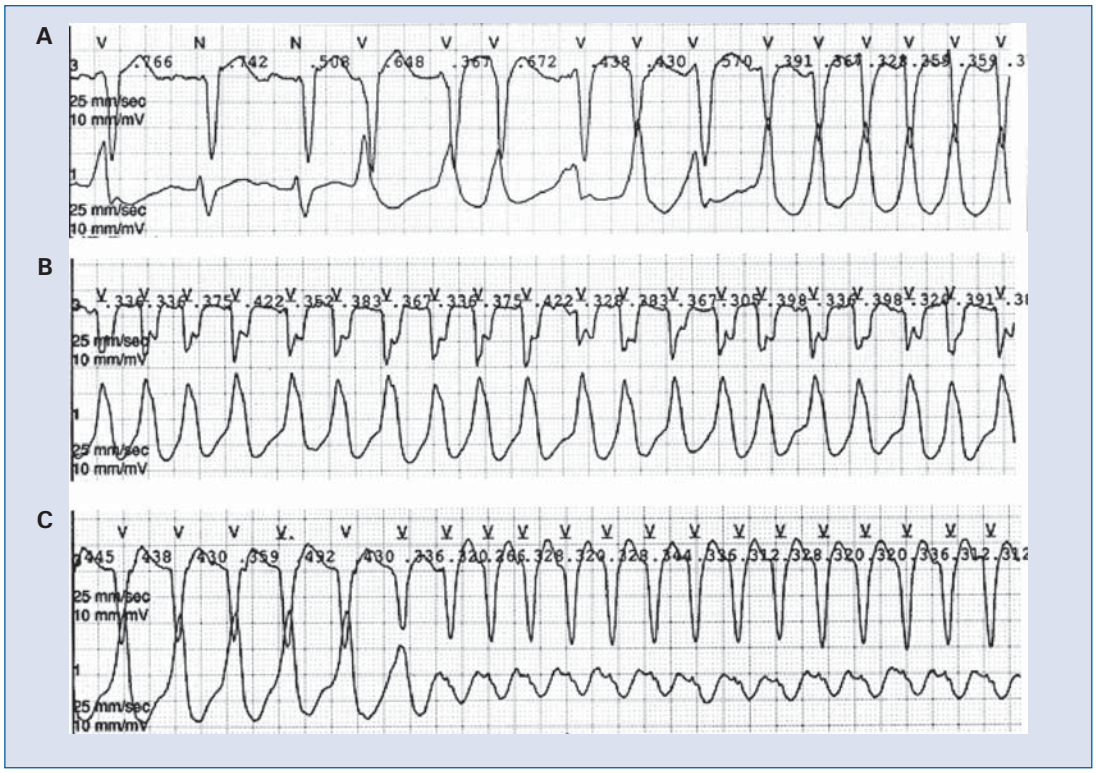

Figure 2. A. Initiation of a slow ventricular tachycardia; **B.** Ongoing slow ventricular tachycardia with irregular cycle length intervals; **C.** Acceleration of the slow and irregular ventricular tachycardia to a faster but regular cycle length interval form.

Discussion

The cycle length of SMVT is usually stable. Stabilization of the cycle length occurs after 10 to 20 beats from the initiation of the arrhythmia [1]. In addition, irregularity in the cycle length during ongoing VT has been observed in 20% of episodes [2].

In ICD devices, a programmed stability interval of 50–60 ms combined with a number of 12 to 16 RR intervals has the ability of a proper detection over 90% of irregular VT episodes [3]. The probability of RR intervals irregularity increases in slower VT as well as in patients under antiarrhythmic therapy [4–6]. The underlying mechanism of cycle length irregularity is not well understood. Rate dependent changes in the electrophysiologic properties of the arrhythmogenic substrate (conduction velocity, refractory period) may contribute to the prescribed irregularity.

Given that the aforementioned underdetection was due to the programmed stability criterion, special attention must be paid when it comes to programming this detection parameter.

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