

Complicated Holter tracing with an incidence of inappropriate mode switch due to sensing abnormalities in a patient with dual-chamber pacemaker

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Abstract

24-hour Holter monitoring of a 59 year-old man with DDDR pacemaker (programmed mode: DDD) implanted for sick sinus syndrome with paroxysmal atrial fibrillation was performed one month after implantation, due to palpitations. Several episodes of rapid pacing of decreasing rate were detected. Intracardiac recording stored in the pacemaker memory had shown episodes of atrial lead oversensing, which led to the mode switch, resulting in DDIR mode. Signals which caused oversensing were not seen in Holter tracing. (Cardiol J 2011; 18, 1: 94–96)

Key words: DDD pacemaker, Holter monitoring, mode switch, atrial oversensing

Introduction

A 59 year-old male patient who had been implanted with the Medtronic Kappa KDR 901 DDDR pacemaker for symptomatic sick sinus syndrome, underwent 24-hour Holter monitoring (24HM) due to palpitations, which occurred one month after implantation, especially when he moved his left arm. Programmed pacemaker (PM) parameters during 24HM are shown in Table 1. 24HM revealed: numerous episodes of atrial fibrillation (AF) lasting from seconds to minutes, with the ventricular rate from about 70 beats/min to 150 beats/min, numerous premature supraventricular complexes and dual chamber pacing — DDD: Ap-Vp and As-Vp.

Several ECG stripes recorded in 24HM monitoring could not be explained with PM programmed parameters. The examples are shown in Figures

1–3. Episodes started from rapid ventricular pacing, which could not be explained by the preceding ventricular rate, or by apparent atrial activity, which potentially might have triggered ventricular pacing. Ventricular pacing was of continuously decreasing rate, and then some beats with sequential pacing started and continued with decreasing rate as well. Episodes ended with the supraventricular (sinus?) beat and with markedly lower heart rate thereafter. In a few episodes, some artifacts difficult to precise analysis could be seen.

The PM was interrogated with a programmer and 12 episodes of the high atrial rate with subsequent mode switch interventions were revealed. Analysis of the stored EGMs showed that detected high atrial rate episodes were actually due to atrial oversensing (Fig. 4). The patient's description of events suggested that oversensing episodes and

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Table 1. Pacemaker parameters during Holter monitoring.

Parameter	Value
Mode	DDD
Lower rate	60 bpm
Upper tracking rate	130 bpm
Paced AV delay	150 ms
Sensed AV delay	120 ms
Post ventricular atrial blanking	180 ms
PVARP	AUTO
Minimum PVARP	410 ms
Pacemaker mediated tachycardia intervention	Off
Mode switch	On, 140 bpm
Atrial lead amplitude/sensitivity	3.5 V (0.4 ms)/0.5 mV; unipolar/unipolar
Ventricular lead amplitude/sensitivity	3.5 V (0.4 ms)/2.8 mV; unipolar/unipolar

PVARP — post ventricular atrial refractory period

subsequent mode switch interventions were caused by the sensing of the skeletal muscles activity due to the unipolar-sensing programmed device. The decreasing rate of pacing was due to DDIR mode, which is routinely activated in Medtronic DDD pacemakers, as the result of the mode switch intervention, regardless of whether the sensor was activated before the intervention, or not. Since oversensing was caused by the patient’s physical activity, the sensor was activated just after the mode switch, and then (due to the halt of activity) deceleration occurred, resulting in a decrease of the pacing rate.

The problem was solved by reprogramming both atrial and ventricular sensitivity to bipolar. Thereafter, it never recurred.

Discussion

Only a few papers have assessed the function of the single and double chamber pacemakers in the early post-implantation period [1, 2]. In the presented

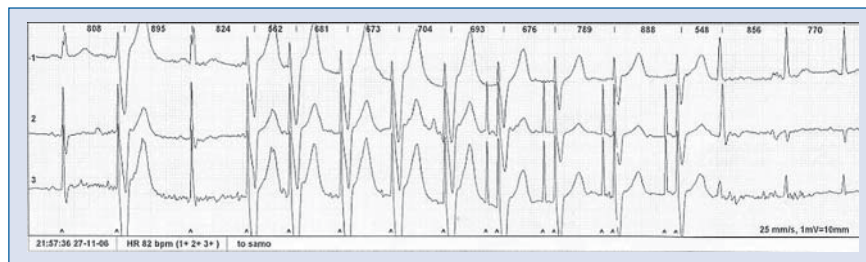


Figure 1. The beginning of the episode, with rapid ventricular pacing in spite of sufficient cardiac automaticity and conduction, then decreasing pacing rate; some inconclusive artifacts preceding the episode and occurring during the first part of the episode can be seen.



Figure 2. The beginning of the episode.



Figure 3. The end of the episode.

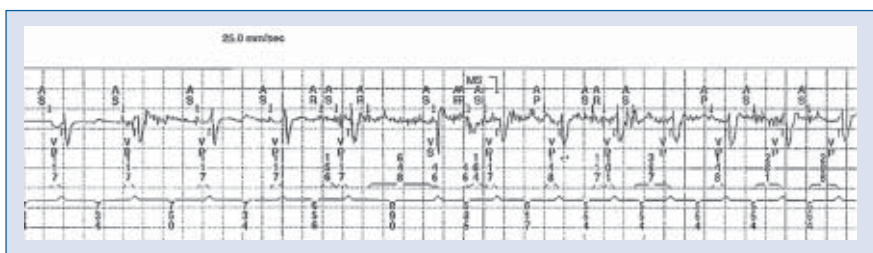


Figure 4. Intracardiac recording from the pacemaker memory — the oversensing episode with the subsequent mode switch (marked as an “MS”) can be seen.

case, 24HM was a helpful tool, allowing more adequate programming.

Normally, mode switch is interpreted as a surrogate marker of the total AF duration and their recurrence. However, in our patient it was used in an inappropriate manner due to oversensing [3, 4]. It seems reasonable that in modern PM, sensing in atrial lead should be bipolar. It has been reported that oversensing of ventricular far-field signals (tail end of the QRS complex) represents one the commonest causes of false positive mode switching, whereas this is rarely caused by miopotentials, as in our case [4].

The additional goal of PM implantation, beyond treating arrhythmias, is to improve the quality of life, and in our patient this goal was not achieved after implantation [5]. Only 24HM and intracardiac stored electrograms helped to solve the problem and helped the patient.

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