Case Report

Contribution of remote monitoring to the early diagnosis of implantable cardioverter-defibrillator shocks in the patient with cardiac resynchronisation therapy

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ABSTRACT

We present the case of a 68-year-old man with coronary artery disease and a history of recurrent myocardial infarctions, having left ventricular ejection fraction 25% in NYHA functional class III. The patient received a biventricular cardioverter-defibrillator (ICD) Biotronik Lumax 340 HF-T in November 2008 from the primary prophylactic indication. Remote monitoring using the Biotronik Home Monitoring™ (HM) system was activated since device implantation. Up to April 2012 the patient received five shocks including 3 appropriate VF therapies and 2 inappropriate ICD shocks (due to T-wave oversensing and atrial flutter degenerating to VF after ATPs). All arrhythmic events were promptly detected by the HM system with a rapid consequent pharmacological and non-pharmacological intervention (radiofrequency catheter ablation of atrial arrhythmia and reprogramming the device). This case points out that prophylactic ICD implantation is a justifiable method for the prevention of arrhythmic death in high-risk patients and HM significantly helps in the early recognition of inappropriate ICD therapy.

1. Introduction

The issue of implantable cardioverter–defibrillator (ICD) shocks, whether appropriate or inappropriate, not only has an impact on the quality of patients’ life but it also affects mortality [1,2]. Therefore, one of the most beneficial effects of remote monitoring in ICD patients is early shock detection. We present a case where the Biotronik Home Monitoring™ (HM) system has helped in therapeutic decision with consequent significant reduction of inappropriate ICD shocks.

2. Case report

A 68-year-old man with coronary artery disease and a history of recurrent myocardial infarctions, with a left ventricular ejection fraction of 25% in NYHA functional class III, received a biventricular ICD Lumax 340 HF-T in November 2008. The indication for ICD implantation was the primary prophylactic according to ACC/AHA/ESC guidelines [3].

Since implanting the device, the patient has been continuously monitored by a HM system. He received the first ICD...
shock in June 2010 due to a T-wave oversensing leading to inappropriate detection in the ventricular fibrillation (VF) zone (Fig. 1). After T-wave oversensing suppression adjustment the oversensing problem did not occur again. In July 2011 an atrial flutter was revealed by HM, anticoagulation and antiarrhythmic therapy was initiated immediately at an extra follow-up. In September 2011 the patient had an episode in the ventricular tachycardia (VT) zone with repetitive antitachycardia pacing (ATP) therapies (Fig. 2). The last ATP induced VF and was resolved by the first ICD shock. According to the intracardiac electrogram (IEGM) sent by the HM, the tachycardia was caused by the atrial flutter with a 1:1 ventricular response (Fig. 3). Soon after, the patient underwent radiofrequency catheter ablation of the typical atrial flutter.

**Fig. 1** – Online IEGM of VF episode—transient T-wave oversensing is apparent.

**Fig. 2** – Online IEGM of VT episode (pre-detection period)—atrial arrhythmia with rapid ventricular response is wrongly detected as a VT by the device and burst therapy is initiated.
During a further follow-up, additional inappropriate ICD therapy did not occur. Nevertheless, another two VF episodes in October 2011 and one VF episode in February 2012 emerged (Fig. 4). IEGMs demonstrated proper detection and adequate successful therapy by the device.

3. Discussion

The breakthrough MADIT II (The Multicenter Automatic Defibrillator Implantation Trial) study has proven that patients with reduced left ventricular function after myocardial infarction are at higher risk of sudden cardiac death due to ventricular arrhythmias. Therefore, the use of ICD significantly improves survival among these patients [4]. Nonetheless, in 15% of patients inappropriate therapy occurs during the first year after implantation [5]. The main causes of the inappropriate therapy are: atrial fibrillation/flutter, supraventricular tachycardias including sinus tachycardia and inappropriate sensing. The risk of T-wave oversensing is reported to be higher in Biotronik devices compared to other manufacturers such as Guidant or Medtronic [6]. It can be explained by the different sensing algorithms among the manufacturers; however, further investigation in this field is needed.

Remote monitoring has been proven to be very useful in reducing inappropriate ICD shocks, mostly in the case of lead
failure and T-wave oversensing [7]. Furthermore, real-time telemetry of patients with atrial arrhythmias helps the physician to react early and optimize the drug and device therapy or to consider the indication of radiofrequency catheter ablation.

4. Conclusion

Since implantation, from November 2008 to April 2012, the patient received five ICD shocks in total – two inappropriate (due to T-wave oversensing and atrial flutter which, after several ATPs, degenerated toVF) and three appropriate VF therapies. This case points out that prophylactic ICD implantation is a justifiable method for the prevention of arrhythmic death in high-risk patients, however, potential complications must be taken into account, especially the risk of inadequate ICD therapy. The Biotronik HM system allows early arrhythmia detection by the IEGM evaluation, and, consequently, it enables quick pharmacological and/or non-pharmacological intervention.

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