Limitations of the past and latest evolutions of home monitoring: arrhythmia electrograms transmitted automatically improve the efficacy of remote monitoring

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ABSTRACT. Background: Telemetric surveillance systems are part of a well-accepted and evolving field in the care of cardiac patients. Especially in patients with implanted cardioverter-defibrillators (ICD), they are well established and their usefulness and reliability have been shown in several clinical trials. Currently, three generations of Home Monitoring™ (HM, Biotronik GmbH & Co. KG, Berlin, Germany) are commercially available. Methods: This paper presents three cases demonstrating the various limitations of the first and second generations of HM and the way they can be overcome by the third generation. Results: In the first case, atrial flutter was misinterpreted by the device and classified as ventricular tachycardia (VT). Thus, in the online IEGM, supraventricular tachycardia was identified, and the short IEGM strip and lack of transmitted atrial signals of the dual-chamber device necessitated an appointment for ICD interrogation, to clarify the diagnosis and propose further treatment. The second case is that of a patient in whom a VT was ineffectively treated by anti-tachycardia pacing (ATP) and continued with longer cycle length, leading to syncope. A second-generation HM device with online-IEGM misleadingly appears to indicate successful treatment. The third case demonstrates correct detection and therapy of a fast VT by an ICD of third-generation HM type. The online IEGM now gives all information needed for complete telemetric assessment. Conclusions: Home Monitoring (HM) is a helpful remote surveillance tool for the early detection of both arrhythmias and technical problems. As shown, the first two generations had limitations which the patient must take into account when using the system. These limitations have been overcome in the third generation, making Home Monitoring more self-sufficient and reliable.

INTRODUCTION

Home Monitoring™ (HM, Biotronik GmbH & Co. KG, Berlin, Germany) is a remote surveillance system for pacemakers, ICD and CRT devices, and is capable of patient-independent daily data transmission (1-5).

The first-generation devices were limited to the transmission of reports giving information on lead integrity, with counters and graphs of arrhythmia detection at several therapy zones. The second-generation devices sent a short online-IEGM strip, displaying data up to seven seconds before arrhythmia detection. Today, the third-generation devices have the capability of displaying high-resolution IEGMs showing three morphology and three marker channels, lasting up to 30 seconds before detection and up to 14 seconds after therapy delivery, until the arrhythmia is classified as terminated. The third-generation devices also display a multitude of heart failure parameters, especially the models for CRT.

This paper presents two problematic cases of second-generation Home Monitoring episodes, showing the pitfalls and limitations of the system, and one case of a third-generation device, demonstrating the superiority of the longer IEGM strip for correct diagnoses, thus overcoming the limitations of the second-generation devices.
CASE 1

This patient suffers from ischemic cardiomyopathy, with an ejection fraction of 30%. In April 2006, the disease became symptomatic, with sustained ventricular tachycardia that was terminated preclinically with amiodarone. Acute ischemia was ruled out. A left ventricular aneurism was diagnosed, caused by a past, clinically unapparent, occlusion of the LAD. Other diseases include a metabolic syndrome with manifest diabetes, as well as paroxysmal atrial fibrillation. An ICD (Biotronik Lumos DR-T™) was implanted for secondary prophylaxis.

Two weeks after hospital discharge, a Cardio Report giving information about arrhythmia detection in the VT-1 zone was sent by the HM device. The IEGM and episode details displayed online are given in Figure 1, which shows the arrhythmia detection in the VT-1 zone. Correctly, no therapy was delivered, as VT-1 is programmed as a monitoring zone and the arrhythmia spontaneously stopped shortly after redetection. The online-IEGM strip shows atrial markers preceding the ventricular markers in every heart action. This generation of HM is capable of displaying ventricular IEGM only. Thus, atrial signals cannot be analysed online. Obviously, misdetection of a supraventricular tachycardia had occurred. For further evaluation, the patient was called in, so that the device could perform interrogation. The holter-IEGM corresponding to the online-IEGM is shown in Figure 2. Diagnosis of atrial flutter with irregular conduction to the ventricles was obvious. The SMART-algorithm™ (see bottom of Fig. 1) is activated in this two-chamber device, for the most reliable differentiation between ventricular and supraventricular arrhythmias. In the first line of Figure 2, the arrhythmia is correctly