**Left ventricular sensing and pacing for sensing difficulties in internal cardioverter defibrillator therapy for arrhythmogenic right ventricular cardiomyopathy**

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Arrhythmogenic right ventricular cardiomyopathy (ARVC) is a disease where therapy with an internal cardioverter defibrillator (ICD) is frequently indicated, but the use of these devices is often challenged because of sensing dysfunction with low right ventricular sensing amplitude. We present the case of an ARVC patient in whom ICD sensing difficulties were overcome by the implantation of a coronary sinus lead for pacing and sensing.

**Case report**

We present the case of a 53-year-old man in whom arrhythmogenic right ventricular cardiomyopathy (ARVC) was diagnosed 10 years ago. Because of poorly tolerated sustained ventricular tachycardia (VT) at initial presentation, an ICD was implanted.

In the following years an ablation procedure was performed twice, because of recurrent VT storm. On both occasions, right ventricular (RV) dilatation with large areas of low amplitude signals was visualized with non-contact mapping (EnSite Array®).

Nine years after implantation the ICD was revised because of battery depletion and poor R-wave amplitude (1.4 mV). A new pacing/sensing lead (Medtronic 5076®) was positioned in the RV apex and a new ICD (Medtronic Virtuoso DR®) was implanted.

Despite good initial sensing (>8 mV), R-wave amplitude deteriorated to <1 mV within a month. A new ICD revision was planned.

**Procedure**

After opening of the pocket, leads, device, and connections between leads and device all appeared to be intact on inspection. Fluoroscopy failed to show any lead dislodgement or fracture. No acceptable pacing threshold/sensing amplitude was achieved when attempting to reposition both the existing and a new pacing/shock lead in different areas of the RV.

The procedure was then switched to placement of a coronary sinus lead. Via puncture of the left vena subclavia, the coronary sinus was engaged with an extended sheath and guided by a coronary sinus catheter. After pacification with occlusive venography two posterolateral branches were visualized. A bipolar pacing/sensing lead (Medtronic 4196®) was then successfully placed with the use of an extended internal sheath, and fixated in the second posterolateral branch with good lead impedance (872 Ω), left ventricular detection (6.1 mV), and pacing (1.2 V) thresholds. High output pacing failed to induce diaphragm stimulation. Defibrillation threshold testing showed correct sensing of ventricular fibrillation and a defibrillation threshold of 15 J. Shock impedance was 64 Ω.

**Follow-up**

In the following months after implantation, the patient remained free of inappropriate shocks and both telemonitoring (Medtronic Care Link®) and pacemaker evaluations kept on showing stable R wave amplitudes >5 mV (Fig. 1). Telemonitoring displayed an episode of non-sustained VT that was correctly identified by the ICD (Fig. 2).

**Discussion**

The indication for an ICD and its efficacy in the prevention of sudden cardiac death in high risk ARVC patients has been firmly established.¹⁻² But implantation of a device in these often young patients, exposes them to many years of device-associated risks and side effects.

Another challenge is the potential progression of this cardiac disease, defying the proper sensing of intrinsic activity in the RV. Studies show inferior short and long-term ICD R wave sensing in this population as opposed to other diseases.³⁻⁴

We present an alternative to a classical RV lead position in using a left coronary sinus lead for pacing and sensing modalities. The use of a bipolar lead is mandatory for correct detection of ventricular arrhythmia. In our opinion, this technique should certainly be considered in ARVC patients with difficult to overcome sensing problems, before choosing surgical implantation of an epicardial lead. Additionally, lead perforation, a complication feared in the ARVC patients with thinned myocardium, is virtually excluded by the use of this approach.

Left ventricular involvement, not infrequent in ARVC, might be a limiting factor for long-term success of a left coronary sinus lead. Further study is needed to investigate this issue.

Another consideration is the risk of lead dislodgement, most likely to the coronary sinus or the right atrium with undersensing of ventricular arrhythmia and potential risk of oversensing and inappropriate ICD therapy in the case of atrial arrhythmia. Although still

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not an uncommon event, the incidence of lead dislocation will probably further decrease in the future with technological progress and growing experience of cardiologists with the expanding use of cardiac resynchronization therapy-devices. Telemonitoring supports the safety issues at follow-up.

Conclusion
Right ventricular sensing problems are common in ARVC and are sometimes difficult to overcome in evolving myocardial disease. Left ventricular sensing/pacing by placement of a coronary sinus lead is an attractive alternative approach that might be considered as a first option when RV sensing difficulties are encountered.

Conflict of interest: none declared.

References