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1 INTRODUCTION

The use of permanent pacemakers is a class I indication for the treatment of various bradyarrhythmias.1 Pacemakers have evolved from subcutaneous devices with surgically implanted epicardial leads to transvenously placed endocardial leads and more recently to leadless devices using Micra pacemakers (Medtronic; Minneapolis, MN, USA).

We present a unique case where a patient with a prior DDDR dual-chamber pacemaker presented with a malfunctioning right ventricle (RV) lead. The patient has significant sinus-node dysfunction and high grade atrioventricular (AV) block. We implanted a Micra AV leadless pacemaker to maintain AV synchrony by tracking paced atrial activity and providing ventricular pacing.

2 CASE HISTORY

A 92-year-old male with a past medical history significant for dementia, chronic kidney disease, high-grade AV block, and sinus node dysfunction with a dual-chamber DDDR pacemaker (Boston Scientific L101 pacemaker with Medtronic 5076 leads; implanted in 2015) presented to our institution with symptomatic bradycardia with high-grade AV block (Figure 1). Device interrogation revealed failure to capture in the RV lead with bipolar pacing, high RV pacing threshold with unipolar pacing, and high impedance suggesting lead fracture. The atrial lead function was normal. Given his advanced age, gait instability, and dementia, the decision was made to proceed with Micra AV pacemaker implantation, while programming his dual-chamber pacemaker to AAIR mode, thus maintaining AV synchrony by tracking paced atrial impulses and providing ventricular pacing.

Keywords
atrioventricular block, dual-chamber pacemaker, Micra AV, sinus node dysfunction

1 INTRODUCTION

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We present a unique case where a patient with a prior DDDR dual-chamber pacemaker presented with a malfunctioning right ventricle (RV) lead. The patient has significant sinus-node dysfunction and high grade atrioventricular (AV) block. We implanted a Micra AV leadless pacemaker to maintain AV synchrony by tracking paced atrial activity and providing ventricular pacing.

2 CASE HISTORY

A 92-year-old male with a past medical history significant for dementia, chronic kidney disease, high-grade AV block, and sinus node dysfunction with a dual-chamber DDDR pacemaker (Boston Scientific L101 pacemaker with Medtronic 5076 leads; implanted in 2015) presented to our institution with symptomatic bradycardia with high-grade AV block (Figure 1). Device interrogation revealed failure to capture in the RV lead with bipolar pacing, high RV pacing threshold with unipolar pacing, and high impedance (>3000 ohms) suggesting lead fracture. Atrial lead function was normal with no change since implantation; however, the atrial pacing threshold was 1.5 V at 0.4 milliseconds with bipolar pacing and 0.5 V at 0.4 milliseconds with unipolar pacing.

Given the unreliability of continuous unipolar ventricular pacing in this pacemaker-dependent patient, his high fall risk given his gait instability, elderly age, and prior RV lead failure, we felt that procedure and post procedure related complications of adding new RV lead will be significantly higher in our patient. Given these multiple factors, we felt that the best approach was to proceed with Micra AV pacemaker implantation while reprogramming his dual-chamber pacemaker to AAIR mode. The procedure was successful without any complications. Micra device interrogation findings at the time of
implantation were: impedance of 690 ohms, sensing: 12.2 mV, and pacing threshold: 0.5 V at 0.24 milliseconds. The patient’s dual-chamber pacemaker was programmed at AAIR 55/105 bpm with the leadless pacemaker programmed at VDD 45/105 bpm. The lower limit of the atrial rate was programmed faster than the RV lower rate to prevent pacemaker syndrome at rest or after premature ventricular contractions. Both device interrogations at 3-month follow-up revealed stable device numbers, 89% RA pacing, 99% RV pacing, with appropriate paced atrial rhythm tracking from the Mica device at 95% (Figure 2A,B,C).

3 | DISCUSSION

Pacemakers with transvenous leads are by far the most common approach when permanent therapy for bradycardia is needed. However, procedure-related complications, early and late leads malfunction, and venous access limitations are common, with higher complication rates in elderly patients.2,3

Patients with dementia might not be able to follow some activity restrictions after transvenous pacemaker. Prior study suggested that patients with cognitive impairment or dementia have similar post pacemaker implant complication rates when compared to patients without cognitive impairment or dementia.4 However another study suggested that elderly patients (>75 years old) with dementia have higher rates of complications after transvenous pacemaker lead placement.5

MICRA and MICRA AV are the only two approved leadless pacemakers in United States. These devices are placed in the RV via a femoral venous catheter. Both devices provide RV pacing only; however, the Micra AV can maintain reasonable AV synchrony using an accelerometer-based atrial sensing algorithm to track the patient’s sinus rhythm.6

The implantation of a permanent pacemaker improves the patient’s quality of life when they have various electrical conduction diseases. However, the quality-of-life benefits associated with dual-chamber pacing as compared with continuous ventricular pacing are most notable in those patients who have sinus node dysfunction.7 Advanced age is an independent risk factor for the development of most arrhythmias due to significant structural and electrical remodeling. Elderly patients will frequently require a dual-chamber pacing due to coexisting sinus node dysfunction, AV block, and His-Purkinje system disease.8

In the case described above, the mechanism of RV lead malfunction could be due to subclavian crush syndrome due to lead compression and entrapment between the first rib and clavicle. The management strategy for a malfunctioning RV lead is either new RV lead placement, if the subclavian vein is patent, and if not, then RV lead extraction and re-implantation of a new RV lead or implantation of a contralateral device and new transvenous leads with the abandonment of prior leads. Given the patient advanced age, comorbidities, our concerns as well as his family concerns of having another early lead failure, and the unreliability of continuous unipolar right ventricular pacing, the less traumatic approach in our opinion was to proceed with Micra AV pacemaker implantation, while reprogramming his old dual-chamber device to AAIR mode thus providing synchronous AV pacing with a hybrid approach.
FIGURE 2  (A) ECG from patient demonstrating unipolar atrial pacing from a dual-chamber pacemaker (AAIR mode) and ventricular pacing from a Micra AV leadless pacemaker. (B) Chest X-ray demonstrating a dual-chamber pacemaker with leads in the right atrium and right ventricle and Micra AV pacemaker in the right ventricle. (C) AV synchrony achieved with atrial and ventricular pacing using accelerometer-based atrial sensing algorithm of the Micra AV [Color figure can be viewed at wileyonlinelibrary.com]
4 | CONCLUSION

The Micra AV device can appropriately sense and track paced atrial activity. A hybrid pacing approach of prior implanted atrial lead and Micra AV is feasible in patients who require dual-chamber pacing. Such an approach should be considered in patients with a dual-chamber pacemaker who require RV pacing and have a malfunctioning RV lead and in patients with a single-chamber atrial pacemaker who later require ventricular pacing and have limited subclavian venous access or are at risk for lead dislodgment.

DATA AVAILABILITY STATEMENT

The data that support the findings of this case report are available on request from the corresponding author. The data is not publicly available due to patient privacy.

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REFERENCES


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