

CASE REPORT

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Quadripolar Left Ventricular Lead in a Patient with CRT-D Does Not Overcome Phrenic Nerve Stimulation

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Abstract: Effective cardiac resynchronization therapy (CRT) requires an accurate atrio-biventricular pacing system. The innovative Quartet lead is a quadripolar, over-the-wire left ventricular lead with four electrodes and has recently been designed to provide more options and greater control in pacing vector selection. A lead with multiple pacing electrodes is a potential alternative to physical adjustment of the lead and may help to overcome high thresholds and phrenic nerve stimulation (PNS).

Keywords: Quartet lead, heart failure, biventricular pacing

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Case Report

A 47-year-old patient with history of worsening non-ischemic dilated cardiomyopathy was admitted to our hospital for the evaluation for primary prevention of sudden cardiac death (SCD). The patient has Brady-Tachy syndrome (BTS) by permanent atrial fibrillation since 2005, severe LV dysfunction with LVEF 17%, but no ventricular dyssynchrony and QRS duration 100 ms. The patient was symptomatic (NYHA functional Class III) despite optimal recommended medical therapy.¹ To address a class I indication for permanent ventricular pacing² in this patient we elected to perform biventricular stimulation (cardiac resynchronization therapy; CRT) with defibrillator (CRT-D) to prevent cardiac desynchronization.³

CRT with defibrillator (CRT-D) implantation was performed by transvenous approach. We chose a new quadripolar transvenous lead (Quartet lead, Multipolar Quartet™ 1458Q, St. Jude Medical), because of its capabilities to manage a high pacing threshold and PNS instead of needing to reposition the lead.^{4,5}

The venogram of the coronary sinus (CS) indicated an anterior lateral vein and a good lateral and posterior vein (Fig. 1). The lateral vein was selected as the target and the quadripolar LV lead was placed there. All pacing configurations and pulse durations were tested with PNS present in 10/10 options. The other target vein for the quadripolar LV lead was the posterior vein

with origin in the proximal portion of the CS. This position of the lead shown also PNS present in 10/10 options. The quadripolar LV lead was relocated in to the last target anterior lateral vein (Fig. 2). PNS was observed and ten different LV pacing configurations were tested. PNS did not occur during pacing from only one of the four electrodes and the LV pacing configuration was programmed accordingly: distal 1-mid 2. During the pre-discharge follow-up the patient presented with PNS. All pacing configurations and pulse duration were tested with PNS present in 10/10 options. PNS was not affected by body position and was also observed in the supine and left lateral positions. The follow-up visits at 3- and 6-months showed PNS and an increased threshold without significant change in other measurements.

Discussion

Although cardiac resynchronization therapy (CRT) has been demonstrated to be an effective treatment for heart failure patients, up to 30% to 40% of the patients do not show a favourable response.⁶ Location of the left ventricular (LV) pacing lead is one of the determinants of success. The implantation procedure includes several challenging technical issues and strongly depends on the highly variable anatomy of the coronary sinus and tributaries.⁶ The optimal position of the LV pacing lead is the site of latest



Figure 1. A coronary sinus venogram indicated an anterior lateral vein and a good lateral vein.

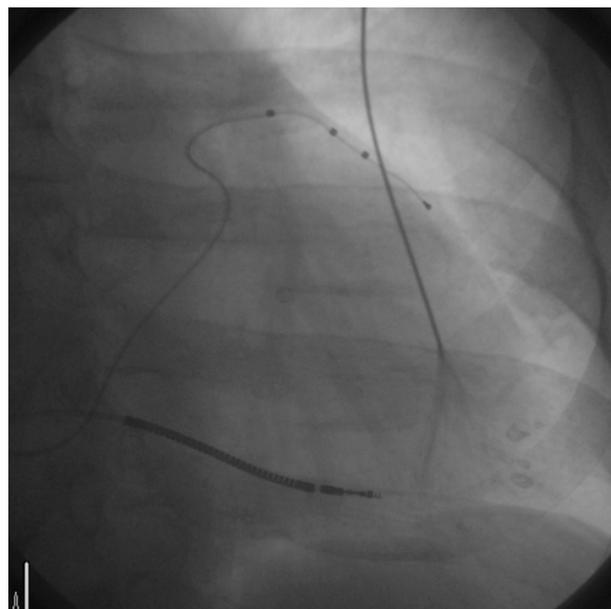


Figure 2. Final position of quadripolar left ventricular lead in anterior-lateral vein.



activation in the left ventricle, which enables effective resynchronization. Furthermore, PNS occurs in 37% of CRT patients at implant or follow-up. PNS can affect, and in some cases limit, the long-term success of CRT.⁷ To address this common problem, the manufacturers of CRT devices offer a range of configurations aimed at preventing PNS. A quadripolar LV lead has recently been designed which provides more programming configurations and may help to overcome high thresholds and PNS.^{4,5} There are several publications concerning quadripolar electrode implantation which show elimination of PNS, but the optimal LV pacing configuration should be determined on the basis of individual patient testing.^{4,5,8} Here we have reported a case in which the use of the quadripolar left ventricular lead pacing depended on the highly variable anatomy of the coronary sinus and resulted in the occurrence of stable PNS at 3- and 6-months. In this case, even 10/10 configurations could not prevent occurrence of PNS. To our knowledge, this is the first case which demonstrated this uncommon event.

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Disclosures

This manuscript has been read and approved by all authors. This paper is unique and is not under consideration by any other publication and has not been published elsewhere. The authors and peer reviewers of this paper report no conflicts of interest. The authors confirm that they have permission to reproduce any copyrighted material. Written consent was obtained from the patient or relative for publication of this study.

References

1. Epstein AE, DiMarco JP, Ellenbogen KA, et al. ACC/AHA/HRS 2008 Guidelines for Device-Based Therapy of Cardiac Rhythm Abnormalities: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Writing Committee to Revise the ACC/AHA/NASPE 2002 Guideline Update for Implantation of Cardiac Pacemakers and Antiarrhythmia Devices): developed in collaboration with the American Association for Thoracic Surgery and Society of Thoracic Surgeons. *Circulation*. 2008;117(21):e350–408.

- Gregoratos G, Abrams J, Epstein AE, et al. ACC/AHA/NASPE 2002 Guideline Update for Implantation of Cardiac Pacemakers and Antiarrhythmia Devices—summary article: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (ACC/AHA/NASPE Committee to Update the 1998 Pacemaker Guidelines). *J Am Coll Cardiol*. 2002;40:1703–19.
- Func RC, Blanc JJ, Mueller HH, Schade-Brittinger C, Bailleul C, Maisch B; BioPace Study Group. Biventricular stimulation to prevent cardiac desynchronization: rationale, design, and endpoints of the ‘Biventricular Pacing for Atrioventricular Block to Prevent Cardiac Desynchronization (BioPace)’ study. *Europace*. 2006 Aug;8(8):629–35.
- Forleo GB, Della Rocca DG, Papavasileiou LP, Di Molfetta A, Santini L, Romeo F. Left ventricular pacing with a new quadripolar transvenous lead for CRT: early results of a prospective comparison with conventional implant outcomes. *Heart Rhythm*. 2010 Sep 28.
- Shetty AK, Duckett SG, Bostock J, et al. Initial Single-Center Experience of a Quadripolar Pacing Lead for Cardiac Resynchronization Therapy. *Pacing Clin Electrophysiol*. 2011 Jan 5.
- Bax JJ, Bleeker GB, Marwick TH, et al. Left ventricular dyssynchrony predicts response and prognosis after cardiac resynchronization therapy. *J Am Coll Cardiol*. 2004;44:1834–40.
- Biffi M, Moschini C, Bertini M, et al. Phrenic stimulation: a challenge for cardiac resynchronization therapy. *Circ Arrhythm Electrophysiol*. 2009;4: 402–10.
- Thibault B, Karst E, Ryu K, Paiement P, Farazi TG. Pacing electrode selection in a quadripolar left heart lead determines presence or absence of phrenic nerve stimulation. *Europace*. 2010 May;12(5):751–3.

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