Abolition of diaphragmatic stimulation and restoration of left ventricular pacing by nonsurgical withdrawal of the left ventricular lead: Report of two cases

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Introduction

In recent decades, cardiac resynchronization therapy (CRT) has been established as a key tool for treating heart failure patients with left ventricular (LV) systolic dysfunction and cardiac dyssynchrony. The failure of LV stimulation, which is associated with functional and prognostic worsening, is a potential complication of CRT, and may be due to different causes, including coronary sinus lead dislodgement or the presence of left phrenic nerve stimulation.

The objective of this report is to show how 2 cases of failure of LV stimulation were resolved. A case of coronary sinus lead dislodgement is described, followed by a case of intractable phrenic nerve stimulation. Both cases were treated with the partial percutaneous withdrawal of the lead.

Case report

Case 1

The first patient was a 52-year-old man with ischemic dilated cardiomyopathy, with the onset of heart failure in 2012. Though the patient received medical therapy and percutaneous coronary intervention (3-vessel disease, stent implantation in mid–left anterior descending artery, and first obtuse marginal branch), he remained in NYHA functional class III. Owing to the presence of severe LV dysfunction (LV ejection fraction [LVEF] 33%) and left bundle branch block, a CRT defibrillator was implanted. The implantation was uneventful and appropriate thresholds were obtained (RV: 0.5 V at 0.4 ms; LV: 0.9 V at 0.2 ms). The patient improved his functional class and LV function, with an LVEF of 50%, and remained stable during the follow-up. At 26 months following device implantation, a lack of LV stimulation was detected, with thresholds above 6 V at 0.5 ms. The distal displacement of the LV lead was observed in the chest radiograph. The LV lead was repositioned via the femoral vein access. The pacing lead was tractioned with a loop snare (Needle's Eye Snare Retrieval Set LR-NES002, Cook Medical) and was partly extracted, resulting in regaining of myocardial stimulation with an adequate threshold, without phrenic stimulation (Figures 1 and 2). During the 12-month follow-up, thresholds were slightly increased (2.6 V at 1 ms) but stable, with appropriate biventricular stimulation (Figure 3).

Case 2

The second patient was an 83-year-old man with a history of coronary heart disease who underwent coronary artery bypass graft in 1990 (3 aortocoronary bypass grafts). The patient remained stable until 2010, when he was admitted with heart failure with severe LV dysfunction. During his hospitalization, the patient developed a high-degree atrioventricular block that led to the implantation of a CRT pacemaker. During the follow-up, the patient exhibited diaphragmatic stimulation, which was initially managed by reprogramming the device. Four years after implantation, disabling phrenic stimulation was observed, which was not manageable by reprogramming. Again, distal dislodgement of the LV lead was noted. A new intervention was required to resolve the problem. An Agilis Nxt SML CURL SJM 408309 sheath (St Jude Medical, St. Paul, MN) was selected because its tip can be shaped into a strong curve for use as a snare. We encircled the body of the lead, located at the level of the right atrium, and pulled it gently but firmly in the femoral direction. The characteristics of the sheath made it possible to perform this maneuver quite easily and effectively. LV stimulation was achieved with a threshold of 1.8 V at 0.4 ms without phrenic stimulation. After the procedure, the thresholds remained stable, with appropriate biventricular stimulation, with no recurrences of phrenic stimulation and with functional class improvement over the 12-month follow-up (Figure 3).

Discussion

CRT has been associated with improvement in prognosis and morbidity in heart failure patients with LV dysfunction.

KEYWORDS Cardiac resynchronization therapy; Diaphragmatic stimulation; Heart failure; Lead dislodgement; Noninvasive treatment; Resynchronization

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KEY TEACHING POINTS

- Left ventricular lead dislodgement is a potential serious complication of cardiac resynchronization therapy. It may cause failure of myocardial stimulation, leading to functional worsening.
- Phrenic nerve stimulation may be disabling. Though in some cases it may be manageable by reprogramming the device, it could require the repositioning of the pacing lead.
- Partial percutaneous withdrawal of the coronary sinus lead is feasible and safe. This intravascular procedure could minimize the potential of infections in patients requiring lead repositioning.
- Both cases shown in the present article demonstrate that nonsurgical repositioning of stimulation leads may be accomplished even years after the implantation of the device.

Seven out of 10 patients will clinically benefit from resynchronization therapy,[1] with a reduction in heart failure hospitalizations, morbidity, and mortality and an improved quality of life. CRT is associated with some complications, such as lead dislodgement and phrenic nerve stimulation, leading to therapy failure.[2] This may require surgical intervention and the opening of the generator pocket, which involves the added risk of device infection.[3–5]

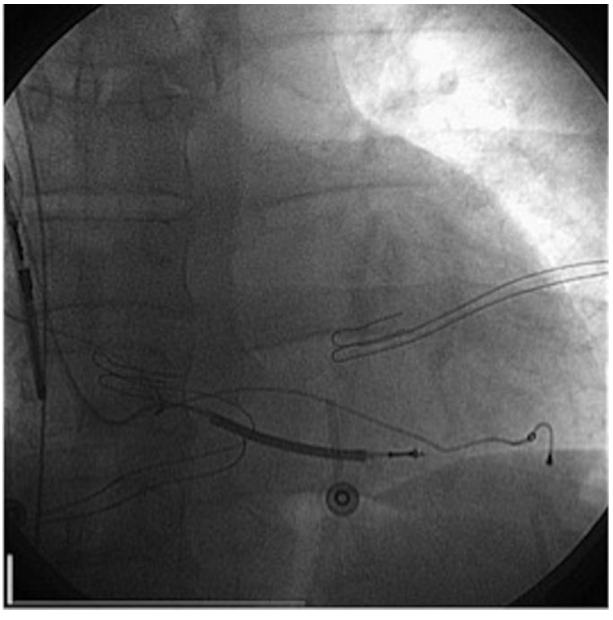

Figure 1 Initial position of the leads. Distal displacement of the coronary sinus lead is observed.

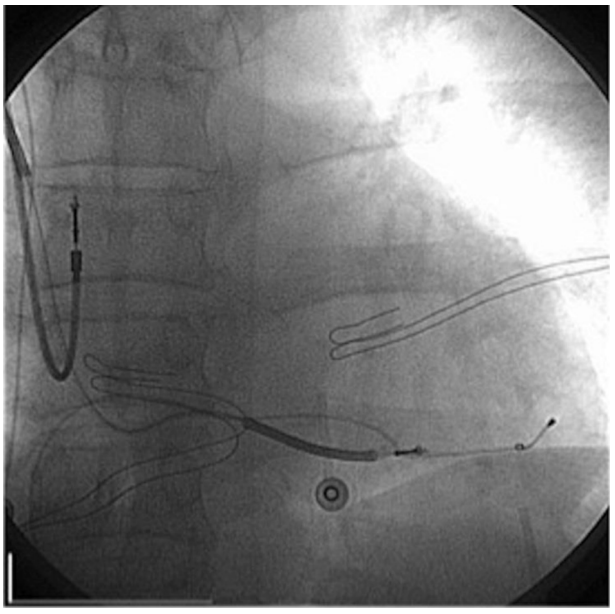

Figure 2 Final position of the leads. Following the replacement of the coronary sinus lead by means of traction with a loop snare, adequate stimulation is obtained, with a normal threshold and without phrenic stimulation.

Some authors have shown that the coronary sinus lead may be relocated safely in a significant proportion of cases during the first 6 months following implantation, and it can be easily withdrawn with manual traction.[6,7]

We carried out a partial retraction of the LV lead via a percutaneous approach so as to reduce the risk of infection and other complications, as previously reported in a case of diaphragmatic stimulation.[8] This procedure has been performed only twice (the 2 cases reported in this article). The options available were discussed extensively with the patients and an informed consent was signed by both. This technique may eliminate the need for a new procedure to extract the failing lead and implant a new one in patients with heart failure, who are more prone to hemodynamic decompensation throughout the procedure. It is often easier to extract an LV lead by simple traction, compared to right chamber leads, but it is not uncommon for the process to require complex tools and techniques to achieve complete lead extraction. The procedure is also dangerous, as hemothorax, pneumothorax, severe bleeding, severe hemodynamic impairment, torn cardiac chambers and veins, and other complications may occur. Moreover, problems frequently arise during the reimplant procedure, as the coronary sinus and tributary veins may incur damages that preclude a new access to the same or a nearby vein to reimplant the LV lead, in many cases making it impossible to implant a new CRT system.[9]

As this technique may involve pulling the lead to a more proximal situation inside the coronary vein, we believe this kind of procedure should be used only when a lead has dislodged farther into the vein, and not when the migration has gone closer to the ostium. Therefore, it would not be

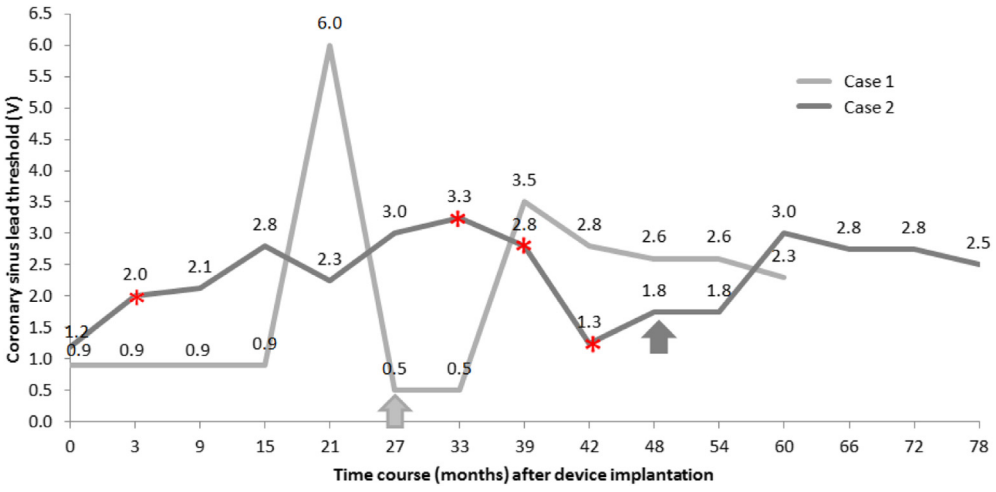

Figure 3 Time course of the coronary sinus lead thresholds after the device implantation. The arrows indicate the time of the percutaneous procedure with the replacement of the coronary sinus lead, while asterisks (*) indicate the onset of phrenic stimulation in case 2. In case 1, thresholds are stable after implant, until a sudden increase occurs owing to lead dislocation, which is corrected by replacing the lead. In case 2, the thresholds are acceptable, but the presence of phrenic stimulation (*), despite reprogramming the device, requires the replacement of the coronary sinus lead, after which phrenic stimulation does not recur.

deemed useful to extract leads from a very basal position, as even a partial extraction would likely dislodge the lead completely, leaving its full distal portion inside the coronary sinus. Furthermore, as the partial extraction may increase instability, further dislodgement is possible at some point. If this does occur (and we did not experience it in our patients), it would only represent a return to the same situation faced when the initial procedure was performed. In the 2 present cases, the procedure was carried out effectively in the presence of diaphragmatic stimulation as well as LV lead dislodgement, even though the device implantation was performed more than 2 years earlier. Both procedures were carried out efficaciously and uneventfully, avoiding phrenic stimulation and achieving stable stimulation thresholds in the short and mid term.

Conclusion

Our experience suggests that this approach is very simple and easily performed. Moreover, with this method, the development of infections as complications of a conventional surgery may be virtually abolished. It may be considered in selected patients presenting with problems with LV lead stimulation, when the lead has been distally displaced. However, long-term safety should be assessed with a longer follow-up.

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Appendix

Supplementary data

Supplementary data associated with this article can be found in the online version at https://doi.org/10.1016/j.hrcr.2017.11.005.

References

1. Yu CM, Wing-Hong Fung J, Zhang Q, Sanderson JE. Understanding nonresponders of cardiac resynchronization therapy—current and future perspectives. J Cardiovasc Electrophysiol 2005;16:1117–1124.
2. Jastrzebski M, Bacior B, Wojciechowska W, Czarnecka D. Left ventricular lead implantation at a phrenic stimulation site is safe and effective. Europace 2011;13:520–525.
3. Landolina M, Gasparini M, Lunati M, et al. Long-term complications related to biventricular defibrillator implantation: rate of surgical revisions and impact on survival: insights from the Italian Clinical Service Database. Circulation 2011;123:2526–2535.
4. Johansen JB, Jorgensen OD, Moller M, Arnsbo P, Mortensen PT, Nielsen JC. Infection after pacemaker implantation: infection rates and risk factors associated with infection in a population-based cohort study of 46299 consecutive patients. Eur Heart J 2011;32:991–998.
5. Biffi M, Moschini C, Bertini M, et al. Phrenic stimulation, a challenge for cardiac resynchronization therapy. Circ Arrhythm Electrophysiol 2009;2:402–410.
6. De Martino G, Orazi S, Bisignani G, Toscano S, Messano L, Parisi Q, Santamaria M, Pelargonio G, Dello Russo A, Bellocci F, Zecchi P, Crea F. Safety and feasibility of coronary sinus left ventricular lead extraction: a preliminary report. J Interv Card Electrophysiol 2005;13:35–38.
7. Gurevit O, Nof E, Carasso S, Luria D, Bar-Lev D, Tanami N, Eldar M, Glikson M. Programmable multiple pacing configurations help to overcome high left ventricular pacing thresholds and avoid phrenic nerve stimulation. Pacing Clin Electrophysiol 2005;28:1255–1259.
8. Herweg B, Barold SS. Abolition of diaphragmatic pacing by nonsurgical retraction of a left ventricular lead. Pacing Clin Electrophysiol 2009;32:1105–1106.
9. Cronin EM, Wilkoff BL. Coronary sinus lead extraction. Heart Failure Clin 2017;13:105–115.