**Case Report**

**Stent placement to stabilize the left ventricular lead in the coronary sinus**

Satoki Fujii MD¹, Hiroshi Tasaka MD¹, Toru Kawakami MD¹, Kazuaki Mitsudo MD¹, Sou Takenaka MD²

¹Department of Cardiology, Kurashiki Central Hospital
²Department of Cardiology, Yokohama General Hospital

Recently, cardiac resynchronization therapy (CRT) has been established as an effective treatment for drug-resistant heart failure with left ventricular dyssynchrony in patients with a New York Heart Association class (NYHA) of III-IV. Many cases have already been treated with CRT in Japan, however, some challenges still remains, such as difficult placement of the left ventricular (LV) lead at the target site, high threshold values even after successful placement of the LV lead, and the need to reposition of the LV lead due to diaphragmatic stimulation regardless of an appropriate threshold value. In particular, those cases with high threshold values at a distal site or those in which the lead is placed at a proximal site because of diaphragmatic stimulation are prone to lead dislodgement, and re-operation may be required. We report on a patient in whom stabilization of the LV lead was obtained by placing a coronary stent in the coronary sinus wall which resulted in an improved clinical course. (J Arrhythmia 2008; 24: 162–165)

**Key words:** cardiac dyssynchrony, cardiac resynchronization therapy, threshold, diaphragmatic stimulation, lead dislodgement

**Introduction**

In recent years cardiac resynchronization therapy (CRT) has been used successful to decrease the mortality and morbidity in heart failure patients with cardiac dyssynchrony.¹,² At present, the most widely used method for left ventricular (LV) lead placement involves a transvenous LV lead placement via the coronary sinus (CS) into a tributary branch. Lead dislodgement is a common cause for a re-operation, and continues to be a frequently experienced problem despite advances in the equipment and operator techniques.

**Case report**

The patient was a 63-year-old male who underwent repeated treatments for dilated cardiomyopathy over several years. He developed drug-refractory non-sustained ventricular tachycardia accompanied by hemodynamic aggravation in 2003 and underwent implantation of an implantable cardioverter defibrillator (ICD). He became dependent on right ventricular pacing, and his cardiac function gradually worsened in the presence of β-blockers and amiodarone. He developed heart failure and became resistant to medical treatment in early 2007. Since
echocardiography detected apparent left ventricular dyssynchrony, he was admitted for surgery to exchange his ICD with a cardiac resynchronization therapy defibrillator (CTR-D), and the operation was performed in June 2007.

As shown in Figure 1, contrast imaging via a guiding catheter inserted into the main vessel of the coronary sinus (great cardiac vein), 2 branches, the lateral and posterolateral, were visualized. (Panel A: RAO view, Panel B: LAO view)

Form suddenly changed and the threshold was re-evaluated and we found that pacing failure occurred in the LV. A chest X-ray revealed an apparent dislodgement of the LV lead. We suggested an epicardial pacing lead placement to the patient but he refused, and a re-operation for transvenous lead placement procedure was performed on the following day. We obtained the patient’s written informed consent before the procedure stating that a stent could be used to stabilize the lead in the CS if an appropriate lead placement became impossible. The in-hospital medical ethics committee approved this trial. As the echocardiography just after the first operation revealed that the dyssynchrony had not sufficiently resolved with the lead placement in the posterolateral branch, in this procedure a lateral branch with the largest lag time was selected for placement. A 4-Fr. Attain® OTW unipolar lead (4193, Medtronic, Shoreview, MN, USA) was used to place the lead at a more distal site, which was achieved, but diaphragmatic stimulation occurred again. Several centimeters along that site were assessed. However, all sites were deemed inappropriate for placement because of either a bad stimulation threshold value or the induction of diaphragmatic stimulation. Therefore, we drew the lead back to a more proximal site and assessed the stimulation threshold and presence of diaphragmatic stimulation. The LV stimulation threshold was good at 1.8 V with a 0.5 ms pulse width, and no diaphragmatic stimulation was detected at maximum voltage. We could not position the lead at the site since it dropped into the main vessel after several minutes. This prompted us to stabilize the lead by means of a 2.0 × 20 mm MicroDriver® coronary stent.
which was dilated, at a site about 3 cm proximal to the tip electrode of the lead, at 8 atmospheres. The lead was affixed to the CS wall as shown in Figure 3.

No lead dislodgement, threshold elevation or diaphragmatic stimulation has been observed 6 months after the operation. The patient’s subjective symptoms have been abated, and a chest X-ray revealed an reduction in the cardio-thoracic ratio from 62% to 53% and echocardiography found improvement of LV dyssynchrony.

Discussion

Although recent improvements in the shape and material of LV leads have made delivery easier than before, the problem of diaphragmatic stimulation still remains and lead dislodgement occurs in 6–14 percent of all cases.3–5) We often encounter the following dilemma: the lead is placed at the target site and a good threshold value is obtained but diaphragmatic stimulation forces us to abandon the site. Even when diaphragmatic stimulation can be resolved by adjusting the position from a middle to more proximal site, lead dislodgement into the main vessel may occur as in this case. Considering that the prognosis in many patients indicated for CRT-D is very poor without it, lead placement failures must be avoided by all means. A high probability of lead dislodgement would have been predicted for the second operation if a coronary stent had not been used for the lead stabilization. Epicardial lead placement would be another option that could have been considered in this patient, but our patient refused it because he thought it would be too invasive to tolerate. Although the previous failed procedure and disadvantages of this new method were explained to him, the patient gave us his prior
written informed consent after the in-hospital medical ethics committee had approved this trial procedure.

Main disadvantages of lead stabilization using a coronary stent are lead damage, coronary venous obstruction by thrombosis, and inability of re-positioning or extraction.

Of the above disadvantages, lead damage can be prevented by avoiding the use of a coronary stent which is far bigger than the vascular diameter or applying an excess pressure load in diastole. This patient has been free from any abnormal lead impedances or pacing failure after 6 months of follow-up. Regarding coronary venous obstruction, it would be unlikely for myocardial necrosis to occur because the coronary venous blood circulates mutually at the distal anastomosis site, even when the coronary venous flow becomes obstructed at the stent placement site. The biggest challenge would be a combination of re-positioning of the lead and its extraction which is likely to occur and difficult to prevent when this stent method is used. The possibility of successfully extracting a stented lead is still unknown. At present, the long-term stability and safety of this method is also unclear.

To the extent of our knowledge, there is only one case report that presented the utilization of a coronary stent to stabilize the lead in the CS.6) In this report, the same problem was pointed out and remained an unresolved problem. Future development of leads which can be stabilized directly to the blood vessel is greatly anticipated.

References