Coronary vein pacing with standard active fixation leads for cardiac resynchronization

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Left ventricle (LV) pacing lead position is often hampered by lead instability and dislodgment. Specific active fixation leads have been designed, yet their popularity has waned due to technical difficulties upon extraction. We report the successful use of standard screw-in active fixation leads in coronary venous circulation for LV pacing in three patients.

Introduction

We report three cases in which standard active fixation leads were used in the coronary venous circulation to provide left ventricle (LV) pacing in the context of cardiac resynchronization therapy (CRT).

Case 1

A 65-year-old male with idiopathic dilated cardiomyopathy (ejection fraction <30% on echocardiogram), heart failure NYHA class III, underwent a contra-lateral CRT-D implantation following full system explantation 1 week earlier due to infection. Prior LV lead implantation had been quite challenging (venography is depicted in *Figure 1A*). The use of a Medtronic Attain Starfix® lead (*Figure 1B*) was required due to passive lead (Medtronic Attain Bipolar®) instability (*Figure 1C*). Upon implantation of the new system, the use of the previous vessel was impossible due to fibrosis. The new target coronary sinus branch was quite large as depicted in the venography (*Figure 1D*), and as such the catheter would have been either very unstable like in the past implantation or too apical. Thus, we chose to attempt implantation of a regular active fixation lead (Medtronic CapsureFix Novus®), with success. The lead was implanted in a postero-lateral position, leaving the ring in a middle position (*Figure 1E*) with a good pacing threshold (1 V at 0.4 ms) and adequate sensing (R wave 13.2 V). No complications, namely pericardial effusion, were noted (*Figure 1F*). After a 4-year follow-up, including regular echocardiograms, no complications were ever uncovered, the pacing threshold remained stable (<1.5 V at 0.4 ms) and the patient classified as a responder, currently in NYHA class II.

Case 2

A 76-year-old patient with idiopathic dilated cardiomyopathy (ejection fraction <30%), heart failure NYHA class II, underwent CRT-D implantation. Again, standard passive fixation LV (Medtronic Attain Bipolar®) lead implantation was impossible due to catheter instability (venography is depicted in *Figure 2A* and passive fixation LV lead instability with spontaneous lead retraction is depicted in *Figure 2B* and *C*). Therefore, given our experience with Patient 1, the same technique using a standard active fixation lead (Medtronic CapsureFix Novus®) was used for implantation on a lateral vein (*Figure 2E*). Echocardiography ruled out complications, especially pericardial effusion (*Figure 2F*). At immediate and 1-year follow-up including echocardiography, pacing thresholds remain stable (<1.5 V at 0.4 ms), and no complications occurred.

Case 3

A 73-year-old male with ischaemic and valvular dilated cardiomyopathy underwent a multi-site CRT device implantation (Sorin Paradym SonR Tri-V®). Similar to patients 1 and 2, the target coronary vessel had a large venous caliper (*Figure 3A*). Given our past experience with patients 1 and 2, we chose to implant a standard active fixation lead (Biotronik Solia S60®), this time on a first intention basis. The lead was implanted successfully (*Figure 3B*). As in the other patients, repeat echocardiography was performed, ruling out cardiac effusion. Additionally, a CT angiography was carried out, very clearly demonstrating that the lead is facing the myocardium and also that there is no pericardial effusion (*Figure 3C* and *D*). At 6-month follow-up, pacing thresholds remain stable and no complications were uncovered.

Discussion

Anatomical variability among patients is common, and often presents the operator with significant challenges for LV lead implantation. This is especially true when the patient only has large coronary vessels suitable for appropriate LV lead positioning. In light of this obstacle, active fixation LV leads were designed (Medtronic Attain Starfix®). However, they have limitations: they are unipolar leads; in large vessels (as the one observed in Patient 3), they remain unstable in a suitable meso-basal target position; the fixation process requires retraction of the lead which may alter the previously evaluated threshold; and while we have successfully extracted three such leads, the extraction is very challenging. Thus, catheter's popularity has decreased.[1]

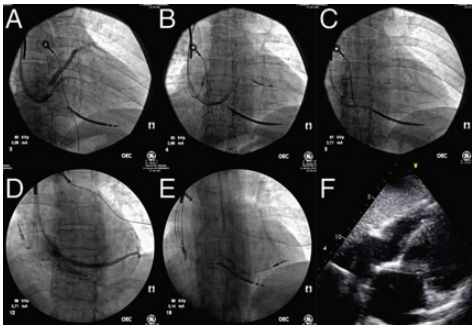

Figure 1 Initial venography (*A*); unstable passive fixation LV bipolar lead (6 F) (*B*); Medtronic Attain Starfix® lead (5.3 F) final position (*C*); venography after Medtronic Attain Starfix® lead explant depicting new target vessel (*D*); final standard active fixation lead position (*E*); and echocardiogram excluding pericardial effusion (*F*).

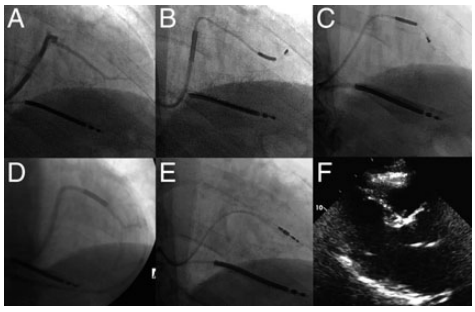

Figure 2 Selective venography of the lateral target vessel (*A*); final position of the LV bipolar lead (6 F) (*B*); spontaneous retraction of the LV bipolar lead (6 F) (*C*); guide catheter in the target vessel and venography (*D*); final standard active fixation lead position (*E*); and echocardiogram excluding pericardial effusion (*F*).

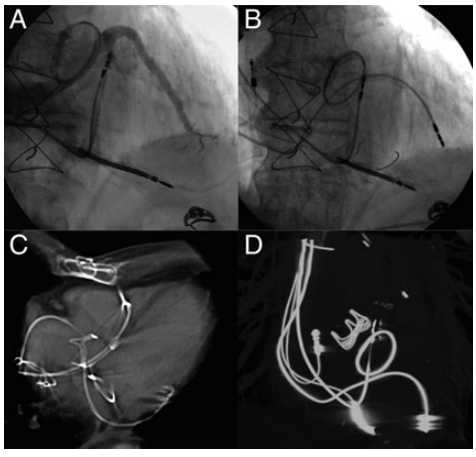

Figure 3 Selective venography of the lateral target vessel (*A*); final position of the LV bipolar lead (6 F) (*B*); CT angiogram depicting standard active fixation lead facing the myocardium and the absence of pericardial effusion (*C*); and CT angiogram depicting all four leads final position (*D*).

The use of standard screw-in active fixation leads in the coronary venous circulation has been limited to biatrial pacing for atrial fibrillation by pacing the left atrium in the coronary sinus. Despite its relatively limited experience, authors report stable pacing thresholds, without significant safety issues.[2,3]

This led us to try a similar technique, but on large venous tributaries rather than on the coronary sinus itself, given that the objective was CRT implantation. To deliver the lead, it is necessary to advance the guide catheter over a subselector into the target vessel (*Figure 2D*). Afterwards, the lead is advanced to the desired position with a soft stylet. Then, prior to the screw deployment, the stylet is slightly retracted and the lead is pushed, and therefore slightly tilted towards the myocardium due to the heart's convex shape, as clearly shown in the CT angiogram of Patient 3 (*Figure 3C*). Additionally, the fact that there was no pericardial effusion in any of the cases also confirms that the leads were indeed facing the myocardium.

The alternative to this approach would have been cardiac surgery for epicardial implantation of the LV lead or placing the lead in a less suitable position thereby compromising adequate resynchronization. By attempting this new technique, we sought to spare the patient the need for surgery or re-intervention. Had active fixation lead implantation been impossible, or had a complication requiring surgical extraction of the leads unfolded, the patient would have had to undergo surgery anyway. Therefore, when faced with the possibility of preventing a more invasive approach, we chose to attempt that first. Our results seem to have proved us right. These three cases demonstrate that the use of classic screw-in active fixation leads in large left coronary veins can be an effective and safe alternative to surgical epicardial LV lead implantation, when standard passive fixation LV lead implantation is impossible due to lead instability, and also avoiding apical lead positioning, which leads to inadequate resynchronization and increased diaphragmatic stimulation. Indeed, very recently, a new type of screw-in active fixation lead designed for the coronary venous circulation was introduced (Medtronic Attain Stability®), with limited experience so far, but good results.[4] We have also had experience with this new lead, and found repositioning after screw deployment quite difficult without damaging the vessel or the lead. On the contrary, we did not experience such a limitation with our technique. Thus, implantation of standard active fixation leads in the venous circulation is yet another tool in achieving adequate resynchronization and reducing non-responders' rate due to inadequate lead positioning.

Conflict of interest: none declared.

References

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