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Case Report

Starfix lead extraction: Clinical experience and technical issues

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ABSTRACT

Transvenous lead extraction (TLE) of the Starfix coronary sinus (CS) active-fixation lead may be challenging, due to undeployment of fixation lobes and venous occlusion. We report our experience in Starfix TLE, in comparison with previous data.

A 78-year-old male, implanted in 2009 with Starfix lead, was referred to our institution for TLE, due to infective endocarditis with lead-associated vegetations. The tip of Starfix lead was located in distant, anterior position, in the great cardiac vein, close to patent left internal mammary artery-to-left anterior descending artery anastomosis, and first-choice surgical removal had a prohibitive operative risk.

Conventional dilatation beyond CS ostium, as well as the use of a standard delivery catheter, was ineffective. An off-label modification of the delivery, by cutting the distal soft tip, was successful. However, the tip of the lead fragmented and was trapped in the innominate vein. Then a gooseneck snare grasped the fragment, allowing complete retrieval.

TLE of Starfix leads may be particularly challenging, especially when its tip is located in a distant anterior location. In these cases, important help may be obtained by dilatation within the CS, by means of conventional or modified delivery catheters. Only experienced operators, sometimes with non-conventional techniques, should perform TLE of Starfix leads.

<**Learning objective:** TLE of Starfix leads may be challenging, particularly when the tip is located in a distant anterior position. Dilatation with conventional tools may be precluded. In these cases modifications of the delivery catheters may be useful. Surgery should be avoided as first-choice procedure; only experienced operators, sometimes with non-conventional techniques, should perform TLE of Starfix leads.>

Introduction

Implantation of left ventricular (LV) leads through coronary sinus (CS) may be challenging. The general cardiologist, indeed, should also be acquainted with the stability issues of the leads used for resynchronization and to the difficulties and risks related to the extraction of active-fixation coronary sinus leads.

Dislodgements of LV leads account for 4–10% of cases, with threshold worsening, loss of capture, phrenic nerve stimulation, and inadequate cardiac resynchronization therapy (CRT). Technology improvements were developed to maintain adequate stability, and active fixation leads were introduced (Attain Starfix OTW LV Lead, Model 4195, Medtronic, Minneapolis, MN, USA) (Fig. 1). First experience with such leads was reported in 2007 [1], with only 0.7% dislodgement rates at 2-year follow-up [2], and improved success rate of CRT. However, the difficulty of using such LV active fixation leads was confirmed, particularly with respect to transvenous lead extraction (TLE), even in recently implanted leads [1,2].

Case report

A 78-year-old male patient was referred to our institution for TLE, due to pocket infection with lead-associated vegetations.

In 1991 the patient suffered inferior myocardial infarction and underwent surgical revascularization with left internal mammary artery (LIMA) anastomization to left anterior descending (LAD). In 2009, due to depressed ejection fraction with inducible ventricular tachycardia, he was implanted with single chamber implantable cardioverter-defibrillator; a double coil passive fixation shock lead was used (Sprint Quattro, Model 6944, Medtronic Inc.). From

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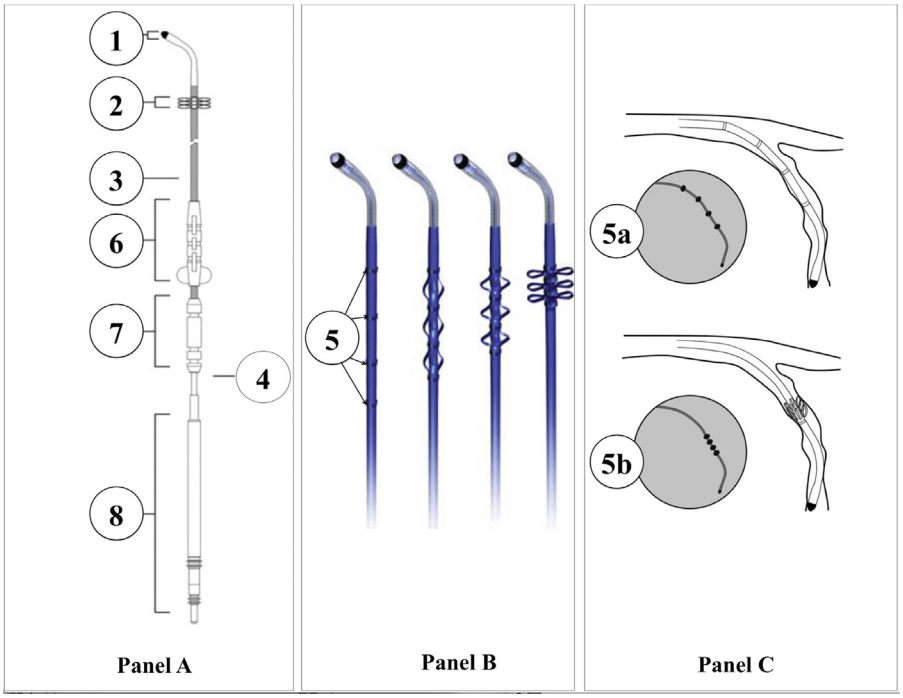

Fig. 1. Technical representation of the Starfix lead, with fixation lobes undeployed and deployed. Considering the anatomy of the coronary sinus, understanding how the fixation mechanism acts, and how deployed fixation lobes can cause occlusion of the coronary sinus, is easily allowed. Fibrosis and adherences can further ensue, so making lead extraction very risky and difficult. You can see the steroid-eluting tip (Panel A, 1), followed by three series of four polyurethane lobes each (A, 2). They can be deployed by advancing the push tubing along the lead (A, 3), so increasing the external diameter from the 5-French caliber of the lead body (A, 4) up to up to 24-French. Four radiopaque platinum–iridium indicator rings (Panel B, 5) on each side of the series of lobes can be seen under fluoroscopy to mark the extent of lobe undeployment (Panel C, 5a) and deployment (Panel C, 5b). Also shown in scheme, Panel A: standard fixation sleeve (6), lead sewing sleeve (7) and IS-1 unipolar connector (8). Panel B shows schematic representation of progressive deployment of fixation lobes, and Panel C the scheme of the Starfix lead within the target venous branch of the coronary sinus, immediately after attainment of the target vein, with lobes undeployed (5a, fluoro scheme within the circle) and deployed (5b, fluoro scheme within the circle). The pullback of the tubing should be able to undeploy lobes, but frequent drawbacks occur, due to failure of the mechanism itself, and/or fibrosis within and around lobes.

January 2011 the patient experienced relapsing pocket skin dehiscence, with exposure of the can and lead. The absence of systemic involvement was accepted, by the referring physicians and in contrast to expert consensus [3], as warranting two local repair procedures, first with relocation of the exposed lead and pulse generator, and then with generator replacement and preservation of the lead. Even so, due to worsened heart failure with left bundle branch block, in November 2011 the device was upgraded to biventricular (Concerto II CRTD D 294 TRK, Medtronic), with only a new LV lead for permanent atrial fibrillation. Lateral and postero-lateral CS branches were not suitable for implantation, and stability issues resulted in the choice of an active fixation lead (Attain Starfix LV OTW Lead, Model 4195, Medtronic Inc.), which was anteriorly located in the mid-portion of the great cardiac vein (GCV). The procedure was complicated by pocket hematoma, requiring surgical revision 1 month later. In June 2014, new skin erosion was evident, with further exposure of one lead. Transesophageal echocardiography disclosed filiform images along the transatrial segment of both right ventricular and CS leads, finally and clearly convincing the colleagues of the need for TLE.

After admission to our center, coronary angiography showed proximal occlusion of the native coronary arteries, with myocardial perfusion due completely to a patent LIMA-to-LAD anastomosis. Myocardial perfusion single-photon emission computed tomography disclosed a wide irreversible infero-lateral defect, and a small partially reversible apical defect. Therefore, the only viable myocardial tissue was located in the anterior position, perfused through the LIMA-to-LAD graft.

Cardiac surgeons excluded surgical lead extraction as first-choice procedure, due to expected difficulty and risk of removing a lead implanted in close proximity with a working LIMA-to-LAD anastomosis (Fig. 2, Panel A).

TLE was performed under local anesthesia in the electrophysiology laboratory, with a cardiac surgery team on active duty and with support of an anesthesiologist and his equipment.

First, the Sprint Quattro lead was extracted with conventional polypropylene Byrd mechanical dilators (Cook Vascular Inc., Vandergrift, PA, USA), up to the 11.5-French inner XL "white" one. A subsequent selective retrograde CS venography disclosed an occlusion at the mid portion of the main CS (Fig. 2, Panel B). The LV lead was cut, and a long standard CS stylet (Model 6054, 0.016″, 110 cm, Medtronic) was inserted and secured with ties. Advancing the push tubing of the Starfix along the lead body resulted in a partial undeployment of the proximal lobes only. A manual traction attempt was ineffective; therefore, dilatation was performed along the LV lead using the inner 7.0-French and 8.5-French XL Byrd dilators, with the bevel stopping immediately after CS entrance. A 57-cm long 7-French CS delivery (Attain Command CS Cannulation Catheter, Model 6250VI-57S, Medtronic) was advanced over the LV lead near the origin of the GCV (Fig. 2, Panel C; Video 1). Then the soft tip collar of the delivery was cut [4], in order to produce a greater pushing force along the lead. This off-label modified delivery was able to reach the proximal series of the fixation lobes, resulting in their further undeployment (Fig. 2, Panel D; Video 1). The distal end of this modified delivery was firmly anchored to the proximal lobes, allowing repeated traction to be effective in extracting the lead from the CS (Video 1). During