New method for cardiac resynchronization therapy: transapical endocardial lead implantation for left ventricular free wall pacing

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Coronary sinus lead placement for transvenous left ventricular (LV) pacing in cardiac resynchronization therapy (CRT) has a significant failure rate at implant and a significant dislocation rate during follow-up. For these patients, epicardial pacing lead implantation is the most frequently used alternative. The aim of this case report is to describe a fundamentally new approach for the endocardial LV lead implantation. An epicardial lead implantation was planned, but after thoracotomy, extensive pericardial adhesions were found. An active fixation lead was placed into the LV cavity using the standard Seldinger technique through the LV apex. After an uneventful post-operative period at the 3- and 6-month follow-up visits, the patient had effective CRT with unchanged pacing parameters. In conclusion, this is the very first report showing feasibility of transapical LV lead implantation.

Introduction

Coronary sinus lead placement for transvenous left ventricular (LV) pacing in cardiac resynchronization therapy (CRT) has a considerable failure rate at implant and a significant dislocation rate during follow-up. In order to improve the cardiac function, alternative approaches are necessary for these patients. The aim of this paper is to show a fundamentally new approach—the transapical CRT—for the endocardial LV lead implantation.

Case presentation

A 72-year-old male had multiple dislocations of his coronary sinus LV lead. Epicardial lead implantation was planned, but during this attempt extensive pericardial adhesions were found. On the basis of significant experience with transapical cannulation techniques, which are widely used in heart surgery (transapical left ventricular assist device (LVAD) cannula implantation, transapical aortic valve implantation, alternative valved conduit implantation between the apex and the thoracic aorta, and decompression cannula or alternative aortic cannula application during different kind of heart surgeries), transapical implantation of an endocardial pacing lead was decided. An active fixation lead was placed into the LV cavity using a simple puncture and standard Seldinger technique through the LV apex. Bleeding from the ventricle was controlled with two 5/0 monofilament purse-string sutures around the puncture point (Figure 1). Using a 'J' shaped guide wire, the tip of the lead was positioned and fixed into the mid-lateral segment of the LV under fluoroscopy guidance. Pacing parameters were assessed and were found to be optimal. The lead was conducted through the chest wall near the apex into a subcutaneous tunnel up to the pocket of the previously implanted device. As the patient was anticoagulated before the procedure because of his impaired LV function, therefore, reintroducing the oral anticoagulation did not result in extra burden to the patient. The target anticoagulation level is identical to mechanical valve prostheses. The final result is shown in Figure 2. After an uneventful post-operative period at the 3- and 6-month follow-up visits, the patient had effective CRT with unchanged pacing parameters.

Discussion

The coronary sinus lead placement for transvenous LV pacing in CRT has a failure rate at implant and at short-term follow-up between 10 and 15%.1 To achieve CRT, alternative methods are necessary for these patients. Epicardial pacing lead implantation is the most frequently used alternative; however, it requires heart surgery. Reaching the target area and pacing, the most delayed segment of the lateral wall, could be difficult and even impossible because of intrathoracic location and anatomy of the dilated LV. In this approach, pericardial adhesions—what we also found in
Transapical implantation of pacing lead

Figure 1  Intraoperative photo of minithoracothomy approaching the apical region of the heart, showing transapical lead insertion into the left ventricle.

Figure 2  Chest X-ray obtained before hospital discharge. (A) Right anterior oblique, 30°; (B) antero-posterior (AP); and (C) left anterior oblique, 45° views. The locations of the left ventricular free wall endocardial active fixation pacing lead at the apex and in the lateral wall are marked by arrows.

this patient and which are not rare in this group of patients—can hide the location of epicardial coronary vessels. Moreover, epicardial pacing seems to be less optimal than endocardial pacing. Activation sequence originating from the endocardial surface is advantageous, as greater aortic and mitral time velocity integral, LV shortening fraction, and greater improvement in the regional electromechanic delay have been reported in patients with endocardial pacing when compared with those with epicardial pacing. There is some experience with endocardial leads implanted through the atrial septum passing through the mitral valve to achieve this. We strongly believe, in contrast, that additional risks are not negligible. When a foreign body enters from the right atrium into the left side of the heart, in a close and permanent contact with the mitral valve, it definitely increases the risk for infective endocarditis, involving the mitral valve itself.

The transapical endocardial lead implantation is minimally invasive and does not involve the mitral valve; therefore, the risk for mitral valve endocarditis is significantly reduced. Furthermore, transapical access allows manipulation of the lead in the LV cavity. This is done under the guidance of fluoroscopy. Theoretically, any segment of the LV can be stimulated, which is the biggest advantage when compared with the currently used alternatives. Obviously, large-scale studies are required to investigate the clinical value of this technique. In contrast, until these results will be available, this pacing modality can be used as a last resort for troubled patients if standard CRT implantation fails.

Conflict of interest: none declared.

References