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Combined Minimally Invasive Pulmonary Vein Isolation, Left Atrial Appendage Excision and Cardiac Resynchronization Therapy for Heart Failure: Case Report

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ABSTRACT

A 76-year-old male with ischemic cardiomyopathy presented with heart failure symptoms in the absence of angina. Several hospitalizations were required due to heart failure exacerbation and paroxysmal atrial fibrillation. Electrocardiography and tissue synchronization imaging confirmed ventricular dyssynchrony, requiring biventricular pacing. After a failed attempt of percutaneous placement of the left ventricular lead, a novel minimally invasive approach was indicated. It consisted of left ventricular epicardial lead placement, microwave pulmonary vein isolation, and left atrial appendage excision through bilateral minithoracotomies. The postoperative recovery was unremarkable, with reestablishment of the ventricular synchrony and regular rhythm.

INTRODUCTION

Atrial fibrillation (AF) occurrence is not irrelevant in patients with significant impairment of left ventricular systolic function [Stevenson 1999]. It is well known that heart failure is a powerful predictor of the development of AF, and both are independently responsible for decreased survival [Wang 2003].

On the other hand, about 30% of patients [Stevenson 1995] with heart failure have intraventricular conduction delay. Dyssynchronous ventricular contraction is inefficient, leading to as much as 20% loss of myocardial stroke work. Several prospective studies [Linde 2003, Young 2003] have provided evidence of the benefit of cardiac resynchronization therapy in improving ventricular function, exercise capacity, and quality of life. This communication illustrates the novel approach of addressing atrial fibrillation and ventricular dyssynchrony through a minimally invasive surgical procedure.

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CASE REPORT

A 76-year-old male has had a long-standing history of coronary artery disease, with previous myocardial infarction. Cardiac catheterization done at the time of the ischemic event evidenced occlusion of the left dominant circumflex artery. The patient has experienced progressive symptoms of congestive heart failure for 9 months, currently in New York Association functional class III. Two hospitalizations were required in the same time period, due to heart failure exacerbation and newly diagnosed paroxysmal atrial fibrillation. The patient denies angina.

The last two-dimensional echocardiography showed an ejection fraction of 23% and left ventricular end-diastolic diameter of 6.9 cm. There were segmental wall motion abnormalities on lateral, septal, and inferior segments. The mitral valve was structurally normal, but with 2+ regurgitation due to annular dilatation.

Electrocardiogram showed sinus bradycardia, left bundle branch block with QRS duration of 198 ms. Tissue synchronization imaging confirmed inter- and intraventricular dyssynchrony involving septal and inferior segments.

Myocardial viability studies (dipyridamole stress test and cardiac positron emission tomography scan) identified metabolic defects consistent with scar, involving about 33% of the left ventricle lateral and inferior walls.

Due to heart failure symptoms despite optimum medical management, the patient fit candidacy for biventricular pacing with implantable cardioverter defibrillator. However, implantation of the left ventricular lead through the coronary sinus was technically demanding. Despite the initial success, there was early lead dislodgement and subsequent diaphragmatic stimulation. Thus, the patient was referred to surgical placement of left ventricular lead and to treat the paroxysmal atrial fibrillation at the same time.

SURGICAL TECHNIQUE

The patient was placed in a supine position with the torso rotated to the right (45° angle). A skin incision, 4 cm long, was made over the 3rd left intercostal space mid-axillary line

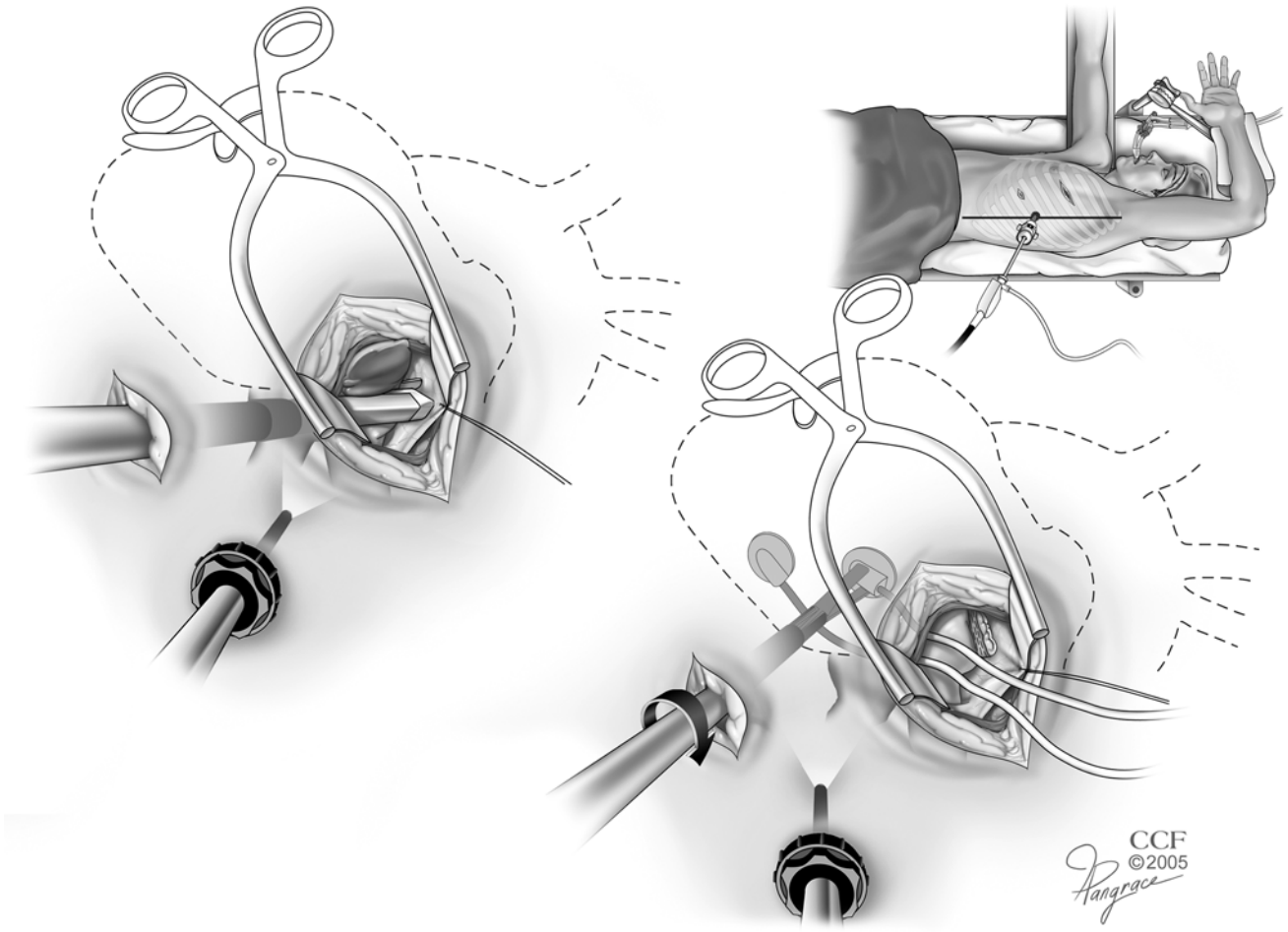

Figure 1. Patient position for left-sided minithoracotomy with thoracoscopic assistance (right upper quadrant); stapling of the left atrial appendage through separate stab wound incision (left upper quadrant); left ventricular epicardial lead placement using thoracoscopic grasper (lower right quadrant).

(Figure 1). The minithoracotomy was completed, and the adherent left lung was dissected free and retracted posteriorly. The pericardium was opened anteriorly to the phrenic nerve. The left pulmonary veins and the left atrial appendage were easily identified. The former was encircled and ablated using a microwave energy source (Microwave Ablation Device Flex 4, Guidant Corp., Santa Clara, CA). The left atrial appendage was excised (Figure 1) using an Endogia stapler with bovine pericardium strips as a reinforcement (Endogia universal 60-4,8, Tyco Healthcare Group, Norwalk, CT; Peri-Strips Dry, Synovis Surgical innovations, St. Paul, MN) through another small stab wound incision located more posteriorly (5th intercostal space mid-axillary line). Then, electrophysiological mapping and tissue Doppler echocardiography assured that the best pacing site was the posterolateral wall. Two screw-in pacing leads (Medtronic Model 5071 Pacing Lead, Minneapolis, MN) were implanted (Figure 1) with the assistance of a thoracoscopic grasper (Medtronic Model 10626, Minneapolis, MN). After the leads have been placed and assessment was made with a pacing system analyzer for thresholds <1 V, leads were then tunneled to the pacemaker generator pocket. The lead with the lowest threshold was connected. After adequate hemostasis was achieved, a number 10 Jackson-Pratt drain was placed and the incision was closed.

The patient was re-prepped and re-draped and positioned in a supine position with the torso rotated to the left (30º angle). A 4 cm long right anterior thoracotomy was completed over the 4th intercostal space anterior axillary line (Figure 2). The right pulmonary veins were carefully dissected free from soft tissues and pericardial reflections. They were subsequently encircled and ablated using the same microwave system (Figure 2). A Jackson Pratt drain was inserted in the pleural cavity and the incision was closed. The total operating time was 2 hours and 30 minutes.

The patient was extubated in the operating room. His postoperative convalescence was unremarkable, in normal sinus rhythm with QRS duration of 148 ms. He was uneventfully discharged home on the 5th postoperative day. At 3 months follow-up, the patient is in NYHA functional class I, and regular rhythm.

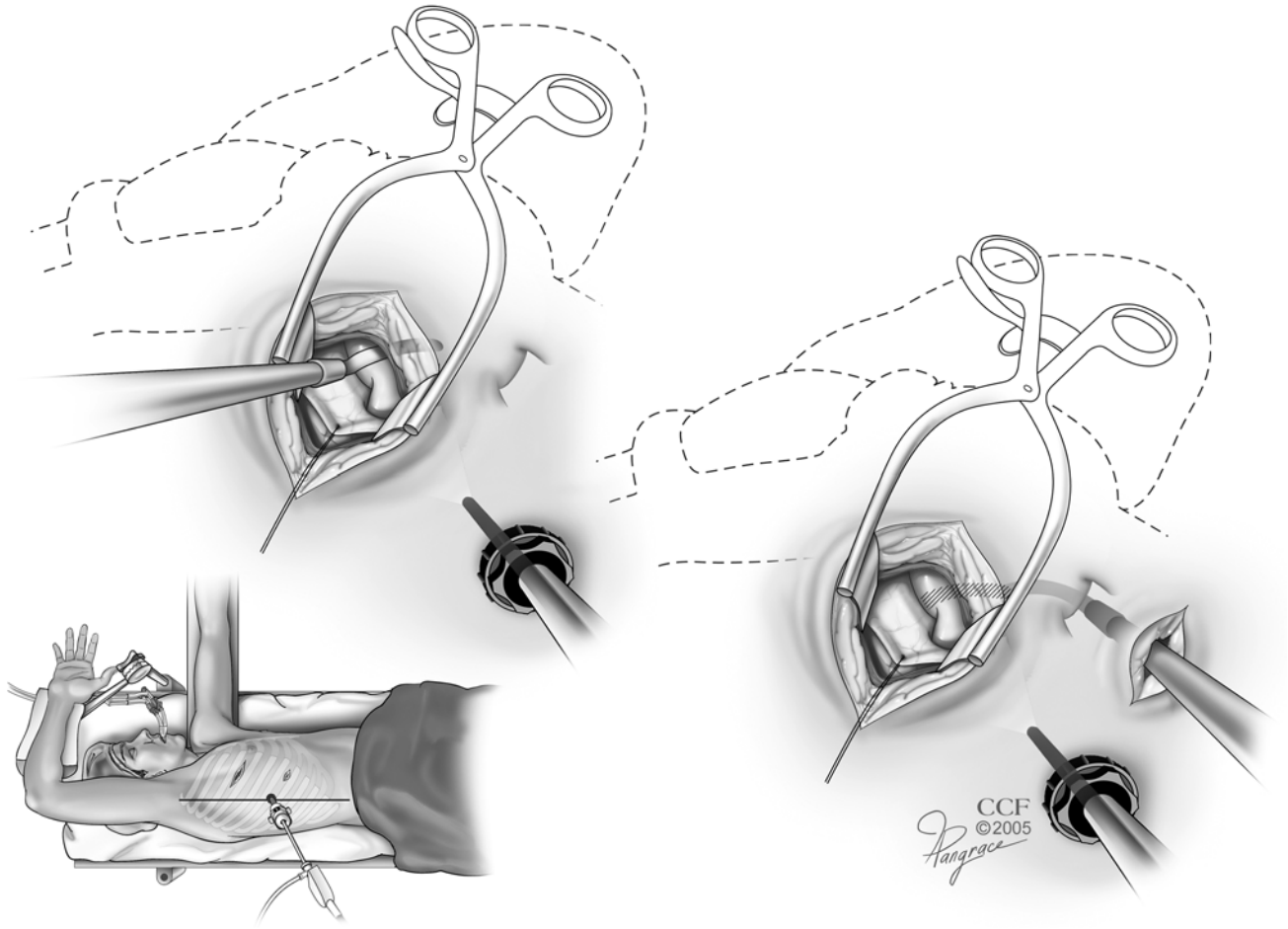

Figure 2. Patient position for right-sided minithoracotomy with thoracoscopic assistance (left lower quadrant); right pulmonary veins isolation showing the microwave ablation performed through the minithoracotomy anteriorly (left upper quadrant), and through a separate stab wound incision posteriorly (lower right quadrant).

DISCUSSION

Pulmonary vein isolation and left atrial appendage excision is a recommended strategy for paroxysmal AF patients, with about 80% long-term cure rate [Gillinov 2003]. Alternative ablation energy sources, such as microwave, cryothermy, and radiofrequency, have simplified the surgical treatment of AF. Their capacity of producing transmural lesions and in determining comparable results has been shown. Our choice in this particular case was the microwave ablation due to its favorable design to minimally invasive procedures. In addition, stapling the left atrial appendage was feasible through a minimal access, eliminating the main source of embolization in patients with AF.

Regarding ventricular dyssynchrony, previous studies [Navia 2005] have shown the safety and efficacy of minimally invasive surgical institution of biventricular pacing in this fragile population. As illustrated here, transvenous implant of the left ventricular lead through the coronary sinus is a demanding procedure, requiring long fluoroscopic times and associated with about 10% early failure rate. Epicardial lead placement is often a rescue procedure in those patients, and has some advantages related to its safety, shorter implant time, allowing wide selection of the best pacing site.

Although two mini-thoracotomies were required in order to complete all the lesion sets, the approach proved to be highly effective, with short procedure time. The postoperative recovery was unremarkable, with successful establishment of cardiac resynchronization and no new episodes of AF. This minimally invasive surgical approach may be a valuable alternative to heart failure patients without indication for correction of the primary structural heart disease.

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