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A minimally invasive all-in-one approach for patients with left anterior descending artery disease and atrial fibrillation

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Abstract

The efficacy and safety of thoracoscopic atrial fibrillation (AF) ablation and minimally invasive direct coronary artery bypass grafting have been previously reported. Herein, we describe the successful combination of both procedures in a high-risk patient with symptomatic drug-refractory paroxysmal AF and a proximal left main stenosis. This innovative procedure offers patients an all-in-one, truly minimally invasive approach to treat AF and left anterior descending artery disease. Based on our initial experience, the procedure is safe and feasible.

Keywords: Atrial fibrillation • Ablation • Coronary artery bypass grafting • Minimally invasive • Minimally invasive direct coronary artery bypass grafting

ABBREVIATIONS

AF	Atrial fibrillation
LAD	Left anterior descending artery
LITA	Left internal thoracic artery
MIDCAB	Minimally invasive direct coronary artery bypass grafting
PCI	Percutaneous coronary stenting

INTRODUCTION

In patients with atrial fibrillation (AF), surgical AF ablation should be considered concomitant to valve or coronary artery bypass surgery [1]. Over the past decades, minimally invasive modifications of complex cardiac operations have been performed safely and efficaciously [2]. Thoracoscopic AF ablation is associated with higher efficacy than percutaneous ablation, especially in patients with persistent AF [3]. Minimally invasive direct coronary artery bypass grafting has favourable outcomes compared with percutaneous coronary stenting (PCI) and can be applied for patients with single-vessel coronary artery disease of the left anterior

descending artery (LAD), or as a component of hybrid coronary therapies involving PCI [4].

PATIENT INFORMATION

The patient was a 67-year-old woman with severe kidney disease (3 rejected renal transplants), severe peripheral vascular disease (Fig. 1A), hypertension and suffered a recent ischaemic stroke during AF. She was hospitalized with a non-ST elevation myocardial infarction and known with paroxysmal AF for 9 months (CHA₂DS₂-VASc = 6).

DIAGNOSTIC ASSESSMENT

Coronary angiography showed a severe proximal left main stem stenosis with adequate flow communication between the LAD and the circumflex artery distal to the stenosis (Fig. 1B). Left ventricular function was impaired [left ventricular ejection fraction (LVEF) 49%], the left atrium (LA) dilated [left atrial volume index (LAVI) 65, 2 ml/m²] but there was no significant valvular disease. The logistic EuroSCORE II was 13.5%. After discussion with our heart and dedicated rhythm team, a combined left thoracoscopic

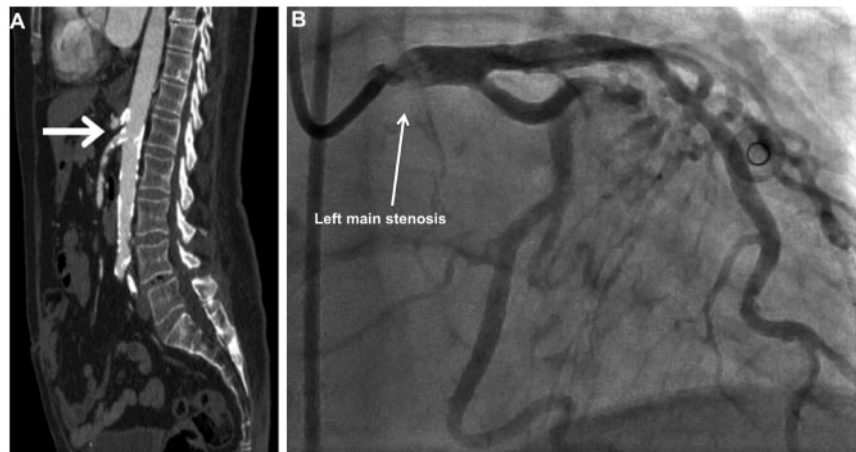


Figure 1: (A) Computed tomography scan showing a calcified aorta, and coeliac and superior mesenteric arteries. (B) Coronary angiogram showing left main stenosis.

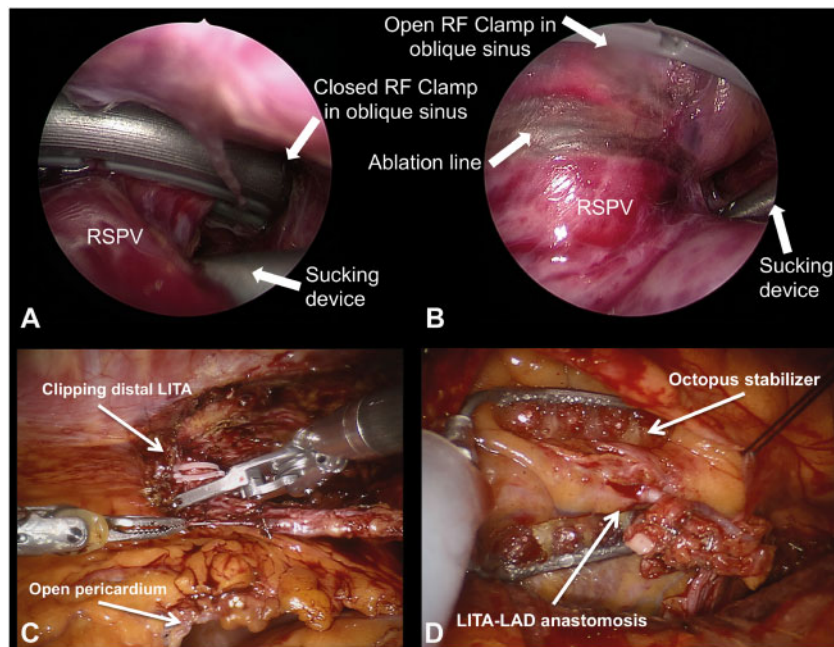


Figure 2: (A) Antral isolation of the right pulmonary veins using a bipolar RF clamp. (B) Obtained ablation lesion. (C) Clipping of distal LITA. (D) Off-pump LITA-LAD anastomosis. LITA: left internal thoracic artery; LAD: left anterior descending artery; RF: radiofrequency; RSPV: right superior pulmonary vein.

AF ablation and minimally invasive direct coronary artery bypass grafting was preferred over median sternotomy because of patient frailty.

INTERVENTIONS

The absence of thrombi in the LA appendage was confirmed and selective right lung ventilation was installed. After introducing a camera and 2 5-mm working ports in the left second, fourth and sixth intercostal space, posterior LA wall isolation was performed consisting of antral left and right (Fig. 2A, B) pulmonary vein (PV) isolation [bipolar radiofrequency (RF) clamp, AtriCure] and a roof and inferior line (Coolrail, AtriCure). Since isolation of the right PVs during single right lung ventilation temporarily blocks the passage of oxygenated blood into the LA, preoxygenation, by

augmenting the ventilator's oxygen supply to 100%, is started prior to the right PV ablation. Next, the left-curved RF clamp is positioned around the right PVs coming from below in the oblique sinus and guided by the red rubber glide path (Lumitip, AtriCure). During closure of the RF clamp during ablation, a small-to-significant drop in blood pressure (varying between patients) can occur. Therefore, recovery of the systolic blood pressure >100 mmHg was ensured between consecutive ablations. Finally, exclusion of the LA appendage (Atriclip Pro, AtriCure) was performed. After electrical cardioversion, entrance and exit block of all PVs and the box lesion was documented.

Next, the thoracoscopic ports were exchanged for robotic ports and left internal thoracic artery harvesting was performed (Da Vinci Robot, Intuitive Surgical). The left internal thoracic artery was divided distally after systemic heparinization (150 IU/kg, Fig. 2C). After small anterolateral thoracotomy, a soft tissue

retractor (Alexis, Applied Medical) was used for exposure. A rib spreader was only used to mount the minimally invasive stabilizer (Octopus Evolution, Medtronic, MN, USA). The LAD was exposed, stabilized and the anastomosis was performed manually off-pump (Fig. 2D).

FOLLOW-UP AND OUTCOME

After a total operative time of 224 min and extubation in the operating room, the patient stayed a day in the intensive care unit. The total hospital stay was 10 days. Further recovery was uneventful besides a period of AF with successful electrical cardioversion to sinus rhythm and a urinary tract infection. The patient was discharged home in sinus rhythm on Sotalol 80 mg/12 h.

DISCUSSION

A combination of minimally invasive procedures can maximize the benefits associated with such procedures. In this case report, we describe a successful case of combined minimally invasive direct coronary artery bypass grafting and surgical AF ablation. Contrary to a previous report [5], we describe for the first time AF ablation with LA appendage occlusion via left thoracoscopy only in combination with robotic left internal thoracic artery harvesting. Although an approach including PCI and catheter ablation would have been more conservative, we believe that in this case a surgical approach has important benefits. First, since there is a good communication between the LAD and the Cx artery, a left internal mammarian artery (LIMA)-LAD will adequately address the left main stem stenosis with very good long-term results. Moreover, a PCI of this left main stenosis also encompasses an important risk. Finally, although the patient has 'paroxysmal' AF, thoracoscopic AF ablation has a clear advantage over

catheter ablation in terms of success rate in this case, given the comorbidities and LA dilatation [3].

The presented innovative procedure is patient-friendly and avoids the complications associated with bilateral or repeated procedures. Although a LIMA-LAD with concomitant AF ablation via sternotomy probably would be achieved in a shorter operation time, our procedure avoids the sequelae of cardiopulmonary bypass and sternotomy. Since it is a true minimally invasive procedure, less pain and a faster recovery are to be expected. We believe that this technique is of interest to every institution with an interest in arrhythmia and coronary artery disease. The patient's treatment options should be discussed within the heart team to improve patient care and minimize patient suffering.

Conflict of interest: Mark La Meir is consultant for Atricure. Other authors have nothing to disclose.

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