



Case report

Perioperative management of a patient undergoing a novel mini-invasive percutaneous transcatheter left ventricular reconstruction procedure[☆]



Cedrick Zaouter MD, MSc^{a,*}, Claire Cornolle MD^b, Louis Labrousse MD^c,
Alexandre Ouattara MD, PhD^{a,d,e}

^aCHU de Bordeaux, Service d'Anesthésie-Réanimation II, F-33000 Bordeaux, France

^bDépartement de cardiologie 33600 Pessac, France

^cDépartement de chirurgie cardiaque et vasculaire 33600 Pessac, France

^dUniversité de Bordeaux, Adaptation cardiovasculaire à l'ischémie, U1034, F-33600 Pessac, France

^eUniversité de Bordeaux et INSERM, Biologie des maladies cardiovasculaires, U1034, F-33600 Pessac, France

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Abstract Survivors of myocardial infarction might have residual damage and higher risks of developing heart failure. This increasing complication encompasses up to 45% of all infarcts. As anesthesiologists we will have to perform anesthesia more frequently in patients with such challenging medical history schedule to undergo mini-invasive surgical procedures. We present the case of a 51-year-old man with severe heart failure post-myocardial infarction with multiple sclerosis undergoing a novel percutaneous transcatheter ventricular reconstruction via a left mini-thoracotomy. To guide the surgeon during the intervention we used a real-time 3D echocardiography, enlightening the fact that guidance is crucial for that kind of procedure. To lower postoperative pain and the inflammatory response we have administered successfully intravenous lidocaine, indicating that it is possible to avoid regional anesthesia in patients with multiple sclerosis scheduled for mini-invasive left ventricular reconstruction requiring a mini-thoracotomy.

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1. Intro

Deaths attributable to cardiovascular disease are declining. In fact, over the last 40 years considerable advances for the

treatment of myocardial infarction (MI) have allowed a significant reduction of mortality [1]. However, survivors of MI have residual myocardial damage and are exposed to higher risks of developing heart failure (HF) [2]. A recent review states that post-MI HF is an increasing complication [3] encompassing up to 45% of all infarcts [4]. Post-MI HF is characterized by akinetic, dyskinetic, and aneurysmal segments of the infarcted myocardium. These pathologic conditions are associated with an increased risk of death [5]. The current surgical approaches to face this burden aim at reshaping the heart by reducing its size and excluding the non-contractile heart. This allows a more physiological contraction

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* Corresponding author at: CHU Bordeaux, Service d'Anesthésie-Réanimation II, F-33000 Bordeaux, Avenue de Magellan, Pessac, 33604. France. Tel.: +33 557656866; fax: +33 557656811.

E-mail address: cedrick.zaouter@gmail.com (C. Zaouter).

eliminating the non-contractile portion of the left ventricle (LV). However, these surgical procedures require cardiopulmonary bypass (CPB) and a left ventriculotomy. Such requirements could jeopardize patients' survival because they could trigger important postoperative pro-inflammatory cascade and severe bleeding [6]. In order to improve patients' survival and offer a surgical treatment to a larger population that suffers from HF post-MI, a novel minimally invasive system designed to treat left ventricle remodeling has recently been proposed. This system, Less Invasive Ventricular Enhancement (LIVE), employs a transcatheter approach and uses implantable anchoring system devices [7]. To the best of our knowledge, this is the first report of the perioperative management of a patient with heart failure and multiple sclerosis (MS) undergoing a novel mini-invasive left ventricular reconstruction procedure via a mini-thoracotomy.

A written permission was obtained from the patient to allow the authors to report and publish details of the present case.

2. Case description

A 51-year-old man, 68 kg and 167 cm, with a history of hypertension, hypercholesterolemia and MS presented with NYHA class III heart failure (HF) and ischemic cardiomyopathy with a large anterior akinetic aneurysm. The latter was a classical type 1 anterior aneurysm that was secondary to a delayed myocardial infarction management, which occurred 4 years before presentation. A transthoracic echocardiography (TTE) examination revealed a LV apical thrombus formation with a 25–30% ejection fraction (EF). Optimal medical therapy including aspirin, angiotensin-converting enzyme inhibitors, β -blocker, furosemide and warfarin was initiated. Three months later, the TTE did not show the presence of a thrombus in the LV. Nonetheless, the LVEF remained lower than 35%. Thus, a cardioverter-defibrillator was implanted prophylactically to treat episodes of life threatening arrhythmias. During his successive follow-up, his clinical conditions were deteriorating. The TTE showed a LVEF of 30% associated with a persistent severe LV enlargement with an indexed left ventricular end-diastole dimension of 43 mm.m^{-2} . It is well known that such clinical conditions are associated with a dramatic reduction of LV contraction efficiency and could lead to severe congestive heart failure and life threatening arrhythmias. Therefore, the current practice recommends a surgical intervention [8] to impede the progressive myocardial detrimental LV remodeling and to improve patients' prognosis. The surgery consists of a left surgical ventricular reconstruction and aims at reshaping the abnormal cardiac geometry excluding the dyskinetic infarcted myocardial area changing the LV shape and restoring an effective myocardial contraction. However, surgical ventricular reconstruction encompasses severe risks, as this procedure requires a CPB with a cross clamp and a left ventriculotomy. Considering that the patient has

MS, these risks are greater since the inflammatory response, secondary to CPB and the stress surgically inducted, can trigger new neurological relapse of the underlying disease [9]. Therefore, planning to minimize these drawbacks we have offered the patient an exclusion of his myocardial aneurysm via a novel closed-chest mini-invasive technique also known as LIVE procedure. This technique is performed off-pump on a beating heart via a left mini-thoracotomy (Fig. 1). The description of the latter is explained elsewhere and is beyond the scope of this case report. Nevertheless, it is important to remind the readers that the success of the operation depends on the appropriate location and deployment of titanium anchors on the infarcted myocardium (Fig. 2). It is crucial that only the nonviable myocardium area is excluded. The correct insertion of the needle across the edge of the anterior infarcted wall segment and then across the edge of the ventricular septum scar is of the utmost importance for the success of the surgery. Thereby, the procedure is guided by both fluoroscopy and echocardiography. Hence, it is extremely important that the attending anesthesiologist performing the echocardiography know how to guide the surgeon during the advancement of the needle.

Prior arrival in the operating room, the patient received a premedication with oral midazolam 0.1 mg.kg^{-1} . In the operating room, he was monitored with a two-channel electrocardiogram, a pulse oximeter, an arterial line, a bispectral index monitor to reach and maintain BIS values within 40 and 60. Then, a large-bore peripheral IV catheter was inserted. In an effort to reduce the incidence of arrhythmias caused by the procedure that involve puncture of the myocardium, to lower postoperative pain and inflammatory response and avoid an exacerbation of patient's MS, intravenous lidocaine was used. Before induction an intravenous bolus of lidocaine 68 mg (1 mg.kg^{-1}) followed by a continuous infusion of lidocaine $1 \text{ mg.kg}^{-1}.\text{h}^{-1}$ for the whole procedure and during his intensive care unit (ICU) stay until extubation. Surgery was allowed inducing anesthesia via a total intravenous anesthesia-technique using target-controlled infusion models for both remifentanyl and propofol with a strategy specifically described for patients undergoing cardiac procedures [10]. A bolus of 0.2 mg.kg^{-1} of cisatracurium was injected to facilitate endotracheal tube insertion. The lungs were ventilated at normocapnia with a 50% FiO_2 . An oropharyngeal temperature probe allowed us to guarantee intraoperative normothermia between 36.0 Ct and 36.8 Ca with a 50% FiO_2 both remifentanyl and propofol with a strategy specifically described for patients undergoing cardiac procedures. In an end-tidal concentration of sevoflurane between 1.8% and 2.2%. A real-time 3D transesophageal echocardiography probe was inserted immediately after intubation and connected to the ultrasound Vivid9 machine (GE Healthcare device, Chalfont St Giles, UK). Before the surgical incision, a central line in the left subclavian vein was placed, leaving the right jugular vein available for the percutaneous transcatheter insertion. Prior insertion of such catheter 100 IU.kg^{-1} of unfractionated heparin were injected to attain an activated coagulation time (ACT)

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