

**Case
Report**

Long-term Extracorporeal Membrane Oxygenator Support in Resuscitation for Intractable Hibernating Myocardium after Coronary Artery Bypass Grafting

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We report our experience of long-term extracorporeal membrane oxygenator (ECMO) support to resuscitate a 62-year-old man who had critical three-vessel disease of coronary artery complicating intractable hibernating myocardium (HM) and sudden cardiogenic shock. Intra-aortic balloon pump and ECMO were deployed to restore the circulatory support while emergent revascularization surgery was performed.

The patient was weaned from ECMO successfully after 15 days of support and discharged with recovered left ventricular function. ECMO is effective in resuscitation of patients with cardiogenic shock and HM. To our knowledge the present case necessitated the longest term of ECMO support to get rid of HM.

Keywords: extracorporeal membrane oxygenator, hibernating myocardium, resuscitation

Introduction

Revascularization of dysfunctional but viable myocardium in patients with chronic ischemic heart disease may offer both a functional improvement of the myocardium and a prognostic benefit.¹⁾

Extracorporeal membrane oxygenator (ECMO) has been conducted for cardiogenic shock since the early 1970s and has been proven to improve the survival rate of such patients.²⁾ ECMO rapidly restores systemic perfusion and prevents further injury to organs, serving as a short-term cardiopulmonary support.

We report our successful experience of the 15-day use of ECMO in supporting a 62-year-old man with cardiogenic shock and intractable hibernating myocardium associated with coronary artery disease.

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Case Report

A 62-year-old man with history of hypertension, hyperlipidemia, chronic obstructive pulmonary disease and uncontrolled diabetes mellitus (HbA1c 10.7) was admitted to our hospital because of congestive heart failure for 1 month. UCG revealed diffuse, severe hypokinesis of the left ventricle, low cardiac output (ejection fraction (EF) 35%) and thin left ventricular wall (7mm) of left anterior descending area. He was collapsed soon after admission and immediately resuscitated. ECMO and intraaortic balloon pumping (IABP) was administered to stabilize his vital signs because of uncontrolled ventricular fibrillation. Via percutaneous cannulation of the femoral artery and vein, the ECMO worked smoothly and restored the hemodynamic within 40 minutes after collapse. Coronary angiography revealed critical three-vessel disease (total occlusion of right coronary artery and left anterior descending artery and severe stenosis of the distal circumflex artery). However, there were no signs of acute myocardial infarction in blood test or ECG. Under ECMO support, a beating heart coronary bypass surgery was emergently performed. The left internal thoracic artery was anastomosed to the left anterior descending artery, and the second obtuse marginal branch of the left

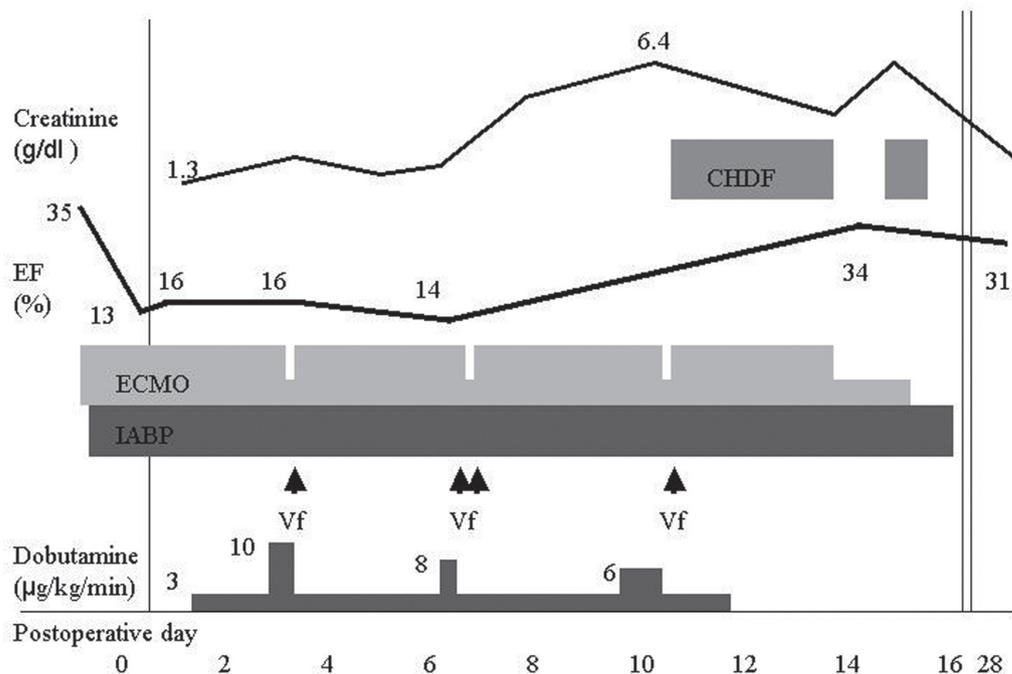


Fig. 1 Postoperative course.

EF: Ejection fraction; ECMO: extracorporeal membrane oxygenator; IABP: intraaortic balloon pumping; Vf: ventricular fibrillation; CHDF: continuous hemodiafiltration

circumflex artery and the posterior descending branch of right coronary artery were bypassed to the ascending aorta using saphenous vein grafts. The operation time was 3 hours 58 minutes and the blood pressure and the cardiac output remained stable under ECMO throughout the operation. After bypass surgery, myocardial hibernation and left ventricle dysfunction were identified using intraoperative transesophageal echocardiography (EF: preoperative 14% to postoperative 16%) and the patient was kept with ECMO support for postoperative cardiac assistance.

We failed several times to wean from ECMO due to low cardiac output and arrhythmia during 2 weeks after surgery. Left ventricle systolic function was improved suddenly (EF 32%) and weaned from ECMO successfully after 15 days of support (**Fig. 1**).

Rehabilitation of the patient was continued to recover from hemiplegia due to perioperative stroke. The patient was discharged three months after the operation. During the 6 months of follow up, the patient remained in the functional class I status as classified by the New York Heart Association.

Discussion

Chronic ischemic left ventricular dysfunction is present in a number of clinical syndromes in whom myocardial revascularization results in an improvement of left ventricular function, patients functional class and their survival. Early diagnosis of and treatment of viability is essential.³⁾

The most effective diagnostic tool to identify hibernation, is under discussion, as are the factors which influence the degree of functional recovery of these myocardial segments of the left ventricle after CABG.⁴⁾ Stress echocardiography with determination of segmental left ventricular wall-thickness, motion and diastolic/systolic wall thickness increase and MRI measuring 'late-enhancement' are able to give a prediction of postoperative ventricular improvement.⁵⁾

We could not afford for our emergent case to perform these invasive methods. The patient had no signs of acute myocardial infarction and echocardiography revealed thin myocardial wall thickness. There were no reasons that caused left ventricle dysfunction except hibernation

due to coronary artery disease. On the basis of these conditions, hibernating myocardium could be diagnosed.

Revascularization of hibernation results in an improvement of regional and global LV systolic function; remodeling is reversed, survival is increased,⁶⁾ and there is a decrease of the composite of myocardial infarction, heart failure, and unstable angina. Dysfunctional myocardial segments have been shown to improve function immediately post-operatively with no further change 8 days after CABG.⁷⁾

A sudden improvement of left ventricle function was shown in this case after 15 days of ECMO support. The duration of hibernation and the severity of myocardial blood flow reduction are also important factors in determining the rate of recovery.⁸⁾ Long term of hibernation might relate to terrible preoperative conditions, uncontrolled diabetes mellitus and congestive heart failure for 1 month.

ECMO is now the first choice for temporary or short-term cardiopulmonary support in various situations because of its simplicity and mobility.²⁾ It can provide circulatory support from the critical preoperative stage throughout the operative period of the beating heart CABG to the postoperative stage in the intensive care unit. Postoperative complications may be avoided with more experience and initiation of ECMO earlier to shorten the duration of shock, as well as more delicate tissue management and hemostasis.

It is difficult to wean the patient from ECMO more than a week after revascularization for coronary artery disease. This is the first report of a patient with hibernating myocardium who was weaned from ECMO two weeks after revascularization.

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