

Successful Recovery Using Surgical Intervention to Treat Ischemic Cardiomyopathy and Cardiogenic Shock

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We report here a successful case of recovery from cardiogenic shock resulting from ischemic cardiomyopathy, treated by using a left ventricular assist device (LVAD). The LVAD was successfully explanted at the time of simultaneous coronary artery bypass grafting and left ventricular restoration after recovery from end-organ dysfunction by LVAD support. (Ann Thorac Cardiovasc Surg 2010; 16: 52–54)

Key words: cardiogenic shock, ischemic cardiomyopathy, left ventricular assist device, left ventricular restoration

Introduction

Treatments for ischemic cardiomyopathy that include ventricular restoration, revascularization, pharmacotherapy, mechanical circulatory support, regenerative medicine, or heart transplantation must be tailored to each patient. In regard to ischemic cardiomyopathy and cardiogenic shock, the strategy of the treatment remains under debate. We report here on a patient who underwent left ventricular restoration (LVR) and coronary artery bypass grafting (CABG) after 74 days of support on a left ventricular assist device (LVAD) to treat ischemic cardiomyopathy complicated by cardiogenic shock.

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Case Report

A 49-year-old man was found lying flat in a train station, and his electrocardiogram revealed ventricular fibrillation when the emergency services arrived on the scene. Ventricular fibrillation was still refractory to frequent cardioversion when he was transported to an emergency hospital. He underwent intubation and continuous cardiac massage. An emergency coronary angiography was carried out immediately while percutaneous cardiopulmonary support (PCPS) was instituted. The total time of cardiac massage before the initiation of PCPS was 76 minutes. The coronary angiography detected 99% stenosis of the left anterior descending artery. The lesion was dilated, and a bare metal stent was implanted. After the rescue percutaneous coronary intervention, his heart started beating again. He underwent therapeutic hypothermia for 2 days under concomitant support with PCPS and intra-aortic balloon pumping. The PCPS was removed on day 6 after admission. The patient was extubated with no cerebral complications on day 14. However, he suffered acute renal failure requiring continuous hemodialysis filtration, and his hemodynamic status deteriorated, requiring high-dose intravenous inotropes. He was transferred to our hospital to receive more advanced treatment.

On arrival at our institution, his blood pressure, central

Table 1. Ischemic patients and success of LVAD removal

Authors	Patients	Weaning	Case	Cause	LVAD	Duration days	Outcome
Simon et al. ²⁾	80	2 (2.5%)	48y M	Post cardiectomy	Thoratec	42	Alive
			52y M	Post cardiectomy	Thoratec	61	Alive
Mancini et al. ³⁾	60	1 (1.7%)	47y M	Coronary artery disease	TCI	101	Sudden death
Leshnowar et al. ⁴⁾	110	1 (0.9%)	Unknown	Ischemic cardiomyopathy	Unknown	Unknown	Unknown

LVAD, left ventricular assist device; M, male.

venous pressure, mean pulmonary artery pressure, and cardiac index were 78/62 mmHg, 23 mmHg, 33 mmHg, and 2.1 L/min/m², respectively. This was regardless of intravenous high-dose dopamine, dobutamine, and norepinephrine. Laboratory data showed a serum creatinine level of 2.44 mg/dl, an AST of 146 U/liter, an ALT of 469 U/liter, and a BNP of 3,392 pg/ml.

Echocardiography revealed severe global hypokinesis with anteroseptal and anterior akinesis, an ejection fraction of 18%, and a left ventricular end-diastolic diameter of 63.3 mm. A decision to use LVAD (Toyobo Co. Ltd, Osaka, Japan) implantation was made. The LVAD was implanted in an area from the left ventricle to the ascending aorta under sternotomy. The LVAD was adjusted to an internal rate mode of 70 cycles/min. The patient's hemodynamic status improved, and he was weaned from hemodialysis on day 4 after the LVAD implantation. He was treated with angiotensin-converting enzyme inhibitor, carvedilol, amiodarone, and rehabilitation for the purpose of LVAD explantation. Myocardial scintigraphy using thallium-201 and technetium-99m tetrofosmin suggested viable myocardium in the infarct area except for the apical wall. Coronary angiography was performed on day 70 after the LVAD implantation. The coronary angiography showed 90% stenosis in the proximal segment of the left anterior descending artery and 75% stenosis in the obtuse marginal artery and akinesis of the anterior wall.

His heart function became tolerable as the LVAD assist rate came down. LVAD explantation, CABG (LITA-LAD, SVG-DI, SVG-OM), and LVR were performed on day 74 after the LVAD implantation. The technique for LVR was performed according to the Dor procedure to exclude the scar at the inflow cannulation site. A cardiopulmonary bypass was successful under the support of moderate inotropic support and intra-aortic balloon pumping. Postoperative myocardial scintigraphy suggested that an ischemic area was not detected. Furthermore, his symptoms improved up to the New York Heart Association functional class I. He is on a cardiac

rehabilitation program and was doing satisfactorily with normal renal function.

Discussion

We initiated LVAD support for a patient who had ischemic cardiomyopathy complicated by cardiogenic shock and end-organ dysfunction in hopes of his recovery from serious status. LVAD therapy has been widely used for patients with severe heart failure as a bridge to transplantation. It is well known that the use of LVAD occasionally improves ventricular function, and the device can be removed. The use as a bridge to recovery is predominantly reported in patients with acute myocarditis and peripartum cardiomyopathy.^{1,2)} On the other hand, in cases of dilated cardiomyopathy and ischemic cardiomyopathy, explantation of the device is difficult, and various refinements are required for its advancement. In Table 1, data extracted from other literature concerning LVAD used with ischemic patients show that the frequency of successful LVAD removal is quite low. In the United States and Europe, the purpose of LVAD therapy for ischemic cardiomyopathy is almost always as a bridge to transplantation.

Our case also indicated the possibility of heart transplantation as judged by his cardiac function and age. However, in Japan a shortage of donors has severely limited heart transplantation, so we need to use the bridge as a recovery strategy. Several reports of LVADs being used as a bridge to recovery from ischemic cardiomyopathy have been published in Japan. Gojo et al. reported on a novel therapy of mononuclear cell transplantation combined with a LVAD for severe ischemic heart failure.⁵⁾ Also, Matsumiya et al. reported the case of a patient with ischemic cardiomyopathy, cardiogenic shock, and end-organ dysfunction who underwent LVR and implantation of a LVAD as a scheduled operation actively aiming at using it as a bridge to recovery.⁶⁾

Since we concluded that heart transplantation was almost impossible in a patient with ischemic cardiomyopathy

because of a shortage of donors, we investigated whether to remove the LVAD after his general condition had improved as a result of its support. We judged that cardiac function could recover by revascularization because viable myocardium in the infarct area was confirmed by myocardial scintigraphy and by LVR to exclude the scar at the cannulation site. We first reported the unique strategy that radical surgery by LVR and CABG was performed after improvement of his cardiac function and general condition by LVAD support. This strategy might be useful in countries where heart transplantation is not as developed as it is in Japan.

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