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Surgical Treatment of Post-Infarction Left Ventricular Free Wall Rupture: Three Cases Review

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Left ventricular free wall rupture (LFWR) is rare, but is one of the most serious complications of myocardial infarction and is associated with high mortality. Several operative techniques have been attempted, but early diagnosis and prompt surgical management are crucial for a positive patient outcome. We report three cases of LFWR successfully treated with surgical methods.

Key words: 1. Myocardial infarction
2. Heart rupture
3. Heart ventricles
4. Surgical procedures

CASE REPORTS

Left ventricular free wall rupture (LFWR) is rare but one of the most serious complications of myocardial infarction, and is associated with high mortality. Early diagnosis and prompt surgical management are crucial for a positive patient outcome. We report three cases of LFWR successfully treated with surgical methods.

1) Case 1

A 66-year-old her patient was admitted to the emergency department with chest pain and dyspnea. His initial vital signs were a blood pressure of 94/63 mmHg with a pulse rate of 111 beats/min. Electrocardiographic (ECG) findings showed ST elevation in leads II and III and ST depression in lead V2. A chest X-ray showed increased pulmonary vascular markings suggestive of pulmonary edema. His serum troponin-I levels were elevated. Echocardiography showed regional wall motion abnormalities of the lateral wall, and the left ventricular (LV) ejection fraction was less than 30%. Emergency cardiac catheterization showed total occlusion of the mid-portion of the left anterior descending artery (LAD) and 75% focal stenosis of the diagonal branch ostium. There was also total occlusion of the distal left circumflex artery (LCX). Up to 50% diffuse luminal irregularity was observed from the proximal to the distal right coronary artery (RCA). An intra-aortic balloon pump (IABP) was inserted due to the patient developing cardiogenic shock during cardiac catheterization. Three days later, the patient went into cardiac arrest after IABP removal. IABP and extracorporeal membrane oxygenation (ECMO) were instituted. Echocardiography showed cardiac tamponade, indicating that LFWR had occurred. An emergency operation was performed.

The operation was performed with a median sternotomy

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with a cardiopulmonary bypass (CPB) after the heartbeat stopped. The LV rupture site was observed in the LV lateral wall. The rupture site was directly repaired with two pledgeted 4-0 polypropylene interrupted sutures. Bioglue was applied over the sutured rupture site and bovine pericardium was used to cover the site. Coronary artery bypass grafting was performed with the saphenous vein graft to the LAD, diagonal branch, obtuse marginal (OM) branch, and proximal RCA. The patient was successfully weaned from the CPB and transferred to the intensive care unit.

On the first postoperative day, bleeding control was performed. On the third postoperative day, ECMO was removed. On the fourth postoperative day, the IABP was removed. However, a brain computed tomography (CT) was performed due to weakness of the left side. The brain CT showed an acute infarction involving the right mid-cerebral artery territory. Anticoagulation was started. Continuous renal replacement therapy was applied from the fifth to seventh postoperative days due to acute renal failure. The patient was extubated on the 10th postoperative day. On the 16th postoperative day, the patient complained of abdominal pain. Acute cholecystitis was diagnosed. Percutaneous transhepatic gallbladder drainage was performed due to septic shock. The patient was transferred to the department of rehabilitation on the 41st postoperative day and discharged on the 105th postoperative day. The patient has been followed up for 5 years and has not developed any other complications.

2) Case 2

An 88-year-old female patient was admitted to the emergency department with loss of consciousness. She had only been treated for hypertension (HTN). Her initial vital signs were stable except that her body temperature had decreased to 32.8°C. Her blood pressure dropped suddenly to 67/23 mmHg. Septic shock was suspected and early goal-directed therapy was started. However, ECG findings showed T-wave inversion in leads V4-6, II, III, and aVF. Her serum troponin-I level was elevated, and echocardiography showed regional wall motion abnormalities of the lateral wall and pericardial effusion. Emergency cardiac catheterization showed total occlusion of the LCX and OM branches. The echocardiography was suggestive of a LV pseudoaneurysm and increased

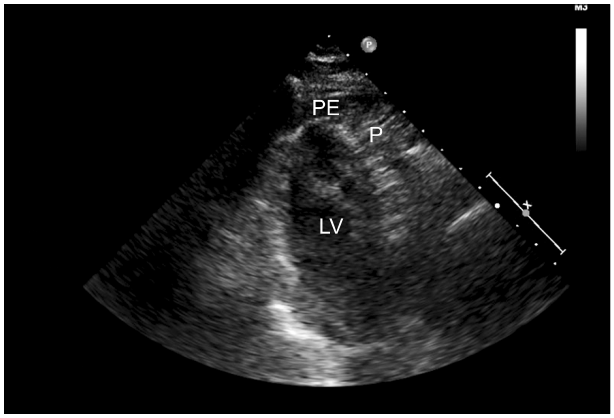

Fig. 1. The echocardiographic finding (apcial 2 chamber view) of the patient 2 showing the psuedoaneurysm (P) of mid anterolateral wall of left ventricular (LV) wall with moderate amount pericardial effusion (PE).

pericardial effusion (Fig. 1). An emergency operation was decided upon, with the suspicion of a concealed LV rupture.

The operation was performed with a median sternotomy. After an inverted Y-shaped pericardiotomy, the hematoma was removed and irrigation was performed. Under CPB, multiple rupture points were observed in the LV lateral wall. The rupture was directly repaired with Prolene 5-0 continuous sutures. Aseptic industrial glue was applied and a Teflon patch was used to cover the rupture site. Furthermore, the bovine pericardium was sutured with 5-0 polypropylene running sutures with a 2-cm-long lateral margin. Tisseel (Baxter Healthcare, Deerfield, IL, USA) was injected between the bovine pericardial patch and the epicardium to enhance the compressing sutured tear point and to prevent blood leakage. Tachocomb (Nycomed Pharma, Linz, Austria) was placed over the suture site. The patient was successfully weaned from CPB and transferred to the intensive care unit (ICU).

On the second postoperative day, the patient was extubated. On the third postoperative day, the patient was reintubated because of desaturation and dyspnea, and extubated again on the fourth postoperative day. On the 10th postoperative day, the patient was transferred to the general ward. The patient was discharged on the 17th postoperative day.

3) Case 3

A 48-year-old male patient was admitted to the emergency

department with loss of consciousness. Initial vital signs were a blood pressure of 74/52 mmHg with a pulse rate of 124 beats/min. The ECG findings showed lateral wall myocardial infarction. The patient had been treated for diabetes mellitus and HTN without any history of angina pectoris or myocardial infarction. His serum troponin-T level was elevated and echocardiography and chest CT showed hemopericardium and LFWR. Emergency cardiac catheterization showed total occlusion of the distal LCX with thrombolysis in myocardial infarction score 0 flow and a thrombus. An IABP was inserted and an emergency operation was performed.

The operation was performed with a median sternotomy. The pericardium was dilated, and old blood-colored fluid gushed out when the pericardium was opened. A large amount of hematoma was observed behind the LV side. Under CPB, after the heartbeat stopped, the hematoma was removed. There was no active bleeding and a definite rupture point. A section of LV free wall about 5×6 cm in size had developed a hematoma, and bloody oozing was observed in the central area of the hematoma. TachoComb was applied to the hematoma, and caution was taken to ensure that any visible margins of the hematoma were covered. Fibrin glue and Surgicel (Ethicon Inc., Sommerville, NJ, USA) were applied for reinforcement. The patient was successfully weaned from CPB and transferred to the ICU.

On the second postoperative day, the IABP was removed without any complications. The patient was transferred to the general ward on the sixth postoperative day. Due to monoplegia of the right leg, a brain magnetic resonance imaging was performed, which showed multiple embolic infarctions in the bilateral cortical border zone. Warfarin was started. Follow-up echocardiography showed thinning of the basolateral LV to the mid-wall and a focal absence of middle portion of the lateral wall reinforced with Tachocomb, as well as minimal pericardial effusion. The patient was discharged on the 18th postoperative day.

DISCUSSION

LFWR is a life-threatening complication of myocardial infarction. The incidence is 2% to 4% after acute myocardial infarction, and mortality has been reported to range from 12% to 20% [1].

Old age, being female, experiencing the first myocardial infarction or transmural infarction, a high systolic blood pressure, an absence of heart failure before rupture, prolonged angina, delay of hospitalization, excessive in-hospital physical activity, a lower body mass index, and a longer time to reperfusion are all reported to be risk factors of LFWR [2]. Early intervention reduces the infarct size and incidences of ventricular rupture [2].

Two types of rupture have been noted based on intraoperative findings. In blow-out type ruptures, a macroscopic tear or defect in the epicardium with free communication between the LV cavity and the pericardial space can be seen; in oozing type ruptures, no macroscopic tears can be detected [3].

Patients can present with any of the following: chest pain, syncope, jugular vein distention, hypotension, arrhythmias, nausea, or pulsus paradoxus. A sudden onset of shock, hemodynamic instability due to cardiac tamponade, or cardiac arrest can occur. Our patients also each showed a different presentation, specifically, delayed rupture 3 days after acute myocardial infarction presenting as cardiac arrest, concealed rupture resulting in pseudoaneurysm and misdiagnosis as septic shock, and an oozing type rupture accompanied by embolic stroke and altered mental state.

Echocardiography is the diagnostic method of choice for LFWR. A localized pericardial effusion over the infarcted akinetic area is the most common echocardiographic finding in cases of LFWR. Echogenic ‘specks’ within the effusion and visible wall defects are other signs of LFWR [4]. Contrast echocardiography is helpful in the direct visualization of myocardial tears and in demonstrating the extent of a pseudoaneurysm [5].

The definitive treatment for LFWR is emergency surgical repair. Various operative techniques have been applied, including pericardial patch placement with biological glue or epicardial sutures, infarctectomy with patch placement and ventricular wall reconstruction, pledgeted sutures without infarctectomy, and pericardial, Dacron, Goretex, or Teflon patches adhered with biologic glue or sutures [6]. Sutureless techniques include gelatin-resorcin-formalin (GRF glue: Cardial, Saint-Etienne, France) applied to a bovine pericardial

Table 1. Data of the patients who underwent operations for left ventricular free wall rupture

Characteristic	Patient no.		
	1	2	3
Age (yr)	66	88	48
Gender	Male	Female	Male
Type of rupture	Blowout	Blowout	Oozing
Date of operation	8/2007	10/2011	12/2011
Operative method	Direct closure and patch reinforcement	Direct closure and patch reinforcement	Sutureless technique with TachoComb
Outcome	Survival	Survival	Survival
Coronary artery bypass graft	+	-	-
Operative time (min)	135	131	103
Cardiopulmonary bypass time (min)	117	117	61
ICU stay (hr)	969	233	105
Hospital stay (day)	109	17	18
Follow up duration (mo)	62	8	6
Early complications	Postoperative bleeding, cerebral infarction, acute renal failure, septic shock due to cholecystitis	None	Cerebral infarction
Late complications	None	None	None

patch (Impra, Tempe, AZ, USA) [7] and collagen fleece with fibrinogen-based impregnation (Tachocomb; Nycomed Pharma, Linz, Austria) [8]. Some authors have suggested that, under CPB, bypassing all major coronary arteries empirically prior to closing the defect is necessary because of the association of multivessel disease [1].

This paper reviewed two cases of direct closure with bovine pericardial patch reinforcement for blowout-type LFWR and one case of a sutureless technique with TachoComb for oozing-type LFWR at Samsung Medical Center (Table 1). All of the methods were successfully performed without any operative mortality. The first and third patient had early postoperative complications and the second patient had no early postoperative complications, even though she was of old age and a female patient who had been treated for HTN. The postoperative course of the first patient was the worst because the diagnosis was delayed to the third hospital day and cardiac arrest occurred after IABP removal.

In conclusion, LFWR is rare, but one of the most serious complications of myocardial infarction, and is associated with high mortality. The surgical treatment of LFWR remains challenging. We report three cases of LFWR successfully treated with surgical management without mortality. Early diagnosis and prompt surgical intervention can increase patient survival.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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