

Successful Rescue from Cardiac Arrest in a Patient with Postinfarction Left Ventricular Blow-Out Rupture: “Extra-Pericardial Aortic Cannulation” for Establishment Total Cardiopulmonary Bypass

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ABSTRACT

We report a quick and simple technique to establish cardiopulmonary bypass (CPB) in a left ventricular (LV) blow-out rupture. A 74-year-old woman with a diagnosis of acute myocardial infarction suddenly collapsed and lost consciousness. A venous-arterial extracorporeal membrane oxygenation (ECMO) device was inserted by femoral cannulation. Emergent median sternotomy was performed. The pericardium was not opened first, and the thymus was divided to expose the ascending aorta just above the pericardial reflection. After placing two purse-string sutures on the distal ascending aorta, a 7-mm aortic cannula (Terumo, Tokyo, Japan) was inserted. The pericardium was then incised. A large volume of blood was expelled from the pericardial space, and CPB was initiated with suction drainage. A two-stage venous drainage cannula was then inserted from the right atrial appendage without hemodynamic collapse. After cardiac arrest, closure of ruptured LV wall and concomitant coronary artery bypass grafting were performed. The patient was weaned from CPB with an intra-aortic balloon pump (IABP) and the previously inserted venous-arterial ECMO. Extra-pericardial aortic cannulation is an effective and reproducible method to prepare for CPB in emergent cases of LV rupture.

INTRODUCTION

Postinfarction LV free wall rupture, or “blow-out rupture,” is a catastrophic complication of acute myocardial infarction [Moreno 2000]. Although emergent surgical intervention is necessary, the mortality of the LV blow-out rupture is still high [Moreno 2000; Kato 2013]. The emergent establishment of CPB is necessary to stabilize the hemodynamics. Here, we present a successful case to rescue a patient with LV blow-out rupture, despite preoperative cardiopulmonary

arrest. We adopted a quick and simple technique to establish total CPB in a patient with LV blow-out rupture through a median sternotomy.

CASE AND TECHNIQUE

A 74-year-old woman was admitted to our hospital with a diagnosis of acute myocardial infarction. She suddenly collapsed and lost consciousness. Electrocardiogram demonstrated pulseless electrical activity. After ineffective cardiopulmonary resuscitation, a venous-arterial ECMO device was inserted by femoral cannulation. Echocardiography demonstrated moderate pericardial effusion. Emergent coronary angiography demonstrated total occlusion of the left anterior descending artery. A diagnosis of acute myocardial infarction and LV rupture was made, and an emergent operation was performed. The mediastinum was exposed through a median full sternotomy. The pericardium was not opened first because pericardiotomy could induce hemodynamic collapse due

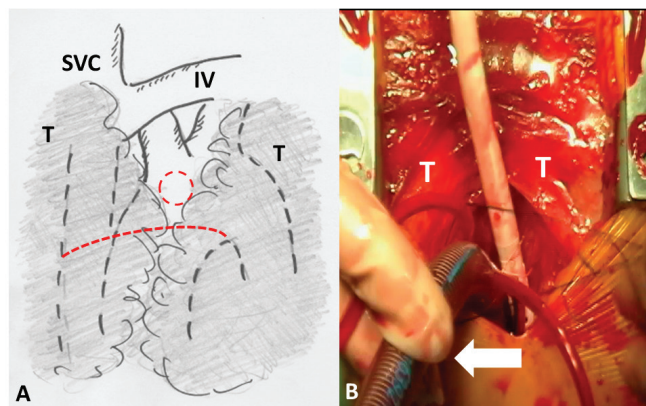


Figure 1. A, The schema of “extra-pericardial aortic cannulation.” The thymus (T) was divided at the midline to expose the ascending aorta. Two purse-string sutures (red dotted circle) were placed on the distal ascending aorta just above the pericardial reflection (red dotted line). Also noted: superior vena cava (SVC) and innominate vein (IV). B, Intraoperative photograph of the patient’s head (head is on the downside). A 7-mm aortic cannula (arrow) was inserted from the ascending aorta between the divided thymus (T).

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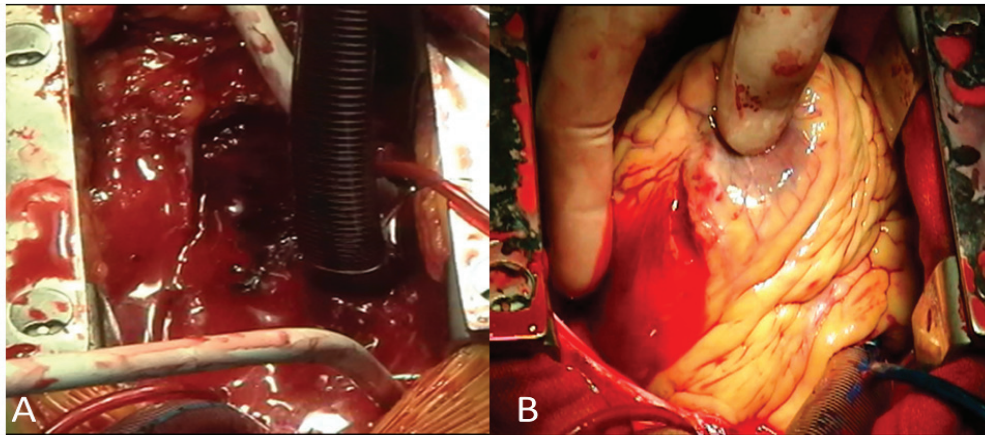


Figure 2. A, After the pericardiotomy, a large amount of blood was expelled, and cardiopulmonary bypass was initiated with suction drainage. A venous drainage cannula (arrow) was consequently inserted from the right atrial appendage. B, Active bleeding from the anterior wall was clearly detected.

to blood loss. The thymus was divided at just above the level of the pericardial reflection to expose the ascending aorta. After placing two purse-string sutures on the distal ascending aorta (Figure 1A), a 7-mm aortic cannula (Terumo, Tokyo, Japan) was inserted (Figure 1B). The pericardium was then incised (Figure 1B). A large volume of blood was expelled from the pericardial space, and CPB was initiated with suction drainage. A two-stage venous drainage cannula was then inserted from the right atrial appendage (Figure 2A). Total CPB was successfully established. The flow rate of the venous-arterial ECMO device was maintained at low flow (approximately 0.5 L/min). Active bleeding from the anterior wall of the LV was detected (Figure 2B). After cardiac arrest with cardioplegic solution, coronary artery bypass grafting with a great saphenous vein graft to the left anterior descending artery and linear closure of the LV were performed. The patient was weaned from CPB with an IABP and the previously inserted venous-arterial ECMO device. She was successfully weaned from the venous-arterial ECMO device on postoperative day (POD) six. The total venous-arterial ECMO device running time was 111 hours. IABP was removed on POD nine. She was extubated on POD 16. Oral Warfarin and aspirin was initiated. Postoperative echocardiography showed 34 percent ejection fraction without any thrombus in the LV. Unfortunately, acute cerebral infarction occurred on POD 37. She became hemiplegic and was transferred to another hospital for further rehabilitation.

DISCUSSION

Although successful surgical repair cases have been reported [Kato 2013], the mortality rate following postinfarction LV blow-out rupture is still high compared with oozing type [Moreno 2000]. The application of a venous-arterial ECMO device is one of the quick and easy ways to stabilize the hemodynamics with such a critical condition [Sakamoto 2012]. However, it is sometimes difficult to maintain

the flow volume of a venous-arterial ECMO device during active bleeding. In the present case, the hemodynamics was stabilized to some extent by a venous-arterial ECMO device and an IABP was inserted from the femoral artery and right femoral vein, preoperatively. But total CPB, consisting of a venous reservoir with a suction system, was necessary to repair LV rupture. We performed a median sternotomy and extra-pericardial aortic cannulation to avoid immediate blood loss after pericardiotomy. A pitfall to this technique is to not open the pericardium when dissecting the thymus. Therefore, it is important to expose the ascending aorta just above the pericardial reflection prior to the pericardiotomy. Placing two purse-string sutures and aortic cannula insertion were performed in routine fashion. After the pericardiotomy, CPB could be initiated using the inserted aortic cannula and suction drainage without hemodynamic collapse. A right atrial cannula subsequently was inserted to establish total CPB. This technique is a simple, reproducible, and safe way to establish total CPB. This method also is applicable for any kind of bleeding from the heart either with or without a venous-arterial ECMO device. The femoral artery is another good candidate for an emergent arterial cannulation site [Ayyash 2011]. However, central cannulation is considered preferable to maintain antegrade perfusion in order to avoid retrograde embolic complications, or malperfusion. More importantly, in emergent situations, both femoral arteries often are occupied by a venous-arterial ECMO device, IABP, and arterial monitoring. In the present case, we inserted the percutaneous venous-arterial ECMO device and IABP via femoral artery and vein before emergent surgery and successfully stabilized the hemodynamics. Therefore, we performed a median sternotomy and safely established CPB. Unfortunately, on POD 37, the patient developed acute cerebral infarction, which was not associated with operative procedures because of the delayed fashion. In conclusion, we report a successful case to rescue a patient with LV blow-out rupture, despite preoperative cardiopulmonary arrest. Extra-pericardial aortic cannulation is a quick and simple method to prepare for CPB before pericardiotomy in emergent cases of LV rupture.

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