

## A Surgical Case of Ventricular Septal Perforation after Repairing Left Ventricular Free Wall Rupture

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**A 78-year-old woman with diagnosis of acute myocardial infarction (AMI) in the anteroseptal area fell into cardiogenic shock suddenly just before starting percutaneous coronary intervention (PCI). Echocardiography showed left ventricular free wall rupture, then an emergent operation was performed by sutureless patch repair using collagen fleece with fibrinogen-based impregnation. Eight days later from the initial operation, the onset of ventricular septal perforation (VSP) was recognized. Fifteen days after, the infarct exclusion technique with endocardial patch was performed. She has been doing well 4 months after the operation without residual shunt. To our best knowledge, this is the first surgical case report that free wall rupture of left ventricle and VSP which are serious complications after myocardial infarction happened in succession. (Ann Thorac Cardiovasc Surg 2005; 11: 121–4)**

**Key words:** left ventricular free wall rupture, ventricular septal perforation, infarct exclusion technique

### Introduction

A ventricular septal perforation (VSP) and a free wall rupture of the left ventricle are serious complications such as pump failure after myocardial infarction.<sup>1)</sup> We report our surgical case of VSP occurring eight days after sutureless patch repair for blowout rupture of the left ventricular free wall, and discuss the optimal surgical strategy for this case.

### Case Report

A 78-year-old woman with severe chest pain was transferred to our hospital. Electrocardiography and echocardiography revealed acute myocardial infarction (AMI) in the anteroseptal area, so percutaneous coronary

intervention (PCI) was scheduled immediately. Just before starting PCI about 3 hours after being transferred to our hospital, the patient fell into cardiogenic shock suddenly. Echocardiography showed massive pericardial effusion and subepicardial hematoma of the anterior wall. After inserting an intra aortic balloon pump (IABP), an emergent operation was performed by a diagnosis of cardiac tamponade caused by left ventricular free wall rupture.

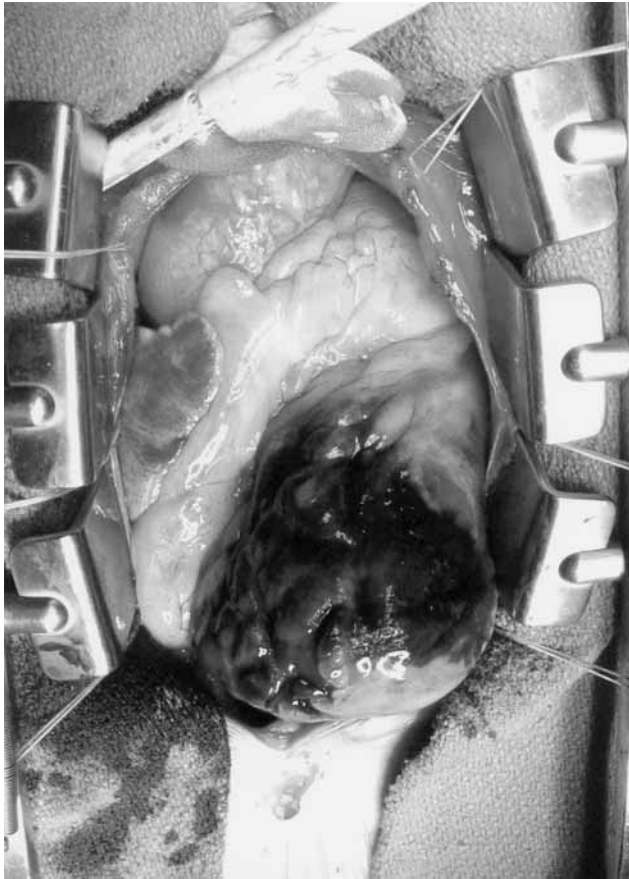
After pericardiotomy, blood gushed out and hemodynamics improved. When the heart was lifted carefully, a wide range of myocardial necrosis and epicardial hematoma from left ventricular free wall to apex was recognized (Fig. 1). In the restoration, the sutureless technique was applied for blowout type cardiac rupture with a small tear. A sutureless patch repair was performed using collagen fleece with fibrinogen-based impregnation (TachoComb<sup>®</sup>, Nycomed Pharma, Linz, Austria) and fibrin glue spray. Since the area of the tear was unknown, the fibrinogen-based impregnation sheet were placed over the whole epicardial hematoma and necrotic area (Fig. 2). The post-operative course was uneventful without re-rupture. The patient was weaned from a respirator three days after the operation and IABP was performed for four

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**Fig. 1.** Intraoperative view. A wide range of myocardial necrosis and epicardial hematoma from the free wall beyond the apex was recognized.



**Fig. 2.** Intraoperative view (restitution). Fibrinogen-based impregnations (TachoComb®) were placed over the entire necrotic and epicardial hematoma area. All sheets were covered in fibrin glue spray.

days. However, eight days after the initial operation, systolic murmur was auscultated. Color-Doppler echocardiography showed a shunt flow across the ventricular septum. Her hemodynamics gradually worsened and the systolic murmur increased. Pressure study by Swan-Gantz catheter at 11<sup>th</sup> post operative day showed mean right atrial pressure of 16 mmHg, pulmonary arterial pressure of 67/17 (35) mmHg and mean pulmonary capillary pressure of 18 mmHg with pulmonary-to-systemic flow ratio of 2.3. hence she underwent re-intubation with aggravation of a respiratory state. After insertion of the IABP, a operation was performed for VSP 15<sup>th</sup> days after the initial operation. A repeated midline re-sternotomy was performed. The pericardial adhesion was not dense, but diffuse, which was removed. Total cardiopulmonary bypass (CPB) was established by cannulation of the ascending aorta and direct bicaval cannulations. Moderate hypothermia was used, and a left ventricular vent was placed

through the right superior pulmonary vein. Myocardial protection was achieved by means of cold crystalloid cardioplegia delivered in an antegrade manner through the ascending aorta. A ventriculotomy was made through an incision in the infarcted anterolateral wall 5 cm in length parallel to the left anterior descending coronary artery, through which the ventricular septum was inspected. The VSP of 2.0 cm in diameter was found at the apical portion of the ventricular septum (Fig. 3). Firstly, the autologous pericardium was extracted. Then the autologous pericardial patch was sutured to the lower part of noninfarcted endocardium of the interventricular septum with a continuous 3-0 polypropylene suture. The patch was also sutured to the noninfarcted endocardium of the anterolateral ventricle at the base of anterior papillary muscle. The suture was brought outside of the ventricle and buttressed on Teflon felt strip felt applied to the epicardial surface of the left ventricle. After the left



**Fig. 3.** Intraoperative findings. A ventriculotomy was made in the apex of the left ventricle 5 cm from and parallel to the left anterior descending coronary artery. A VSP of 2.0 cm in diameter was found at the apical portion of the ventricular septum. (LV: left ventricle. RV: right ventricle.  $\Rightarrow$  : VSP)

ventricular cavity became excluded from the infarcted myocardium, the ventriculotomy was closed with horizontal mattress and over-and-over sutures, buttressed with Teflon felt strips. The patient was weaned from CPB easily. She required IABP for two days, inotropic drugs for four days and was extubated six days after the second operation. The postoperative echocardiography showed no residual shunt and she has been well 4 months after the operation.

## Discussion

A cardiac rupture in patients with AMI is the second most common cause of hospital death, after pump failure.<sup>1)</sup> Rupture of the left ventricular free wall accounts for 12 to 20 % of deaths due to AMI.<sup>2)</sup> This complication is always fatal and emergency surgery is the only available treatment.<sup>3)</sup> Under these conditions, which surgical treatment should be performed remains controversial. However, the goal of surgery is life saving by relieving the cardiac tamponade and closing ventricular rupture. In practice, it is usual that an operation is conducted within a few days after onset of AMI and low cardiac output greatly increases the surgical risk when the operation under the cardiac arrest is conducted. Moreover, repair of perforation by suture techniques raises the difficulty of sewing fragile myocardium. Fortunately, as our case was blowout type free wall rupture with a small tear, sutureless patch repair was feasible.

On the other hand, approximately 1 % of cases of AMI

are complicated by VSP.<sup>4)</sup> This mechanical complication usually occurs an average of two to three days after AMI, but may occur any time in the first two weeks when necrotic tissue is most abundant and the collateral coronary circulation is not well developed.<sup>5)</sup> In our case, there was also the choice of not undergoing an operation when it was diagnosed as VSP. Since there is a report that 85 % patients with acquired VSP or more will die within two months if treated conservatively,<sup>4,5)</sup> and the deterioration of hemodynamics was also accepted, then we enforced the operation irrespective of having just repaired the left ventricular free wall rupture.

The following points can be considered as the cause of VSP in our case. First, postoperative IABP reduces afterload and the wall stress of left ventricle. When using IABP further after a first operation for a long period, the development of VSP has been possibly prevented. Second, since the reperfusion therapy of the infarct-related coronary artery which limits ongoing necrosis and salvages the myocardium was not able to be performed at the first operation or PCI, the possibility that the necrosis of myocardium was advanced was presupposed. Even if these are the causes, to our best knowledge, this is the first surgical case report of VSP succeeding repair of left ventricular free wall rupture in the literature.

The first surgical repair of VSP complicating AMI by Cooley and associates was reported in 1956,<sup>6)</sup> since then, various reports have described the technical improvement and the good results in early closure of VSP.<sup>7,8)</sup> The debate concerning the medical versus surgical treatment of

postinfarction VSP has been resolved because those with early surgical treatment have an overall acceptable survival. The surgical difficulties associated with early repair of the VSP in friable myocardium may be related more to the duration after the AMI than to the duration after the actual septal rupture. Regarding the closing method of VSP, since the intensity of the myocardium of free wall and septum was indefinite, the infarct exclusion technique with endocardial patch was performed so that it would not leave residual shunt and to avoid future ventricular aneurysm formation. Since two weeks had passed after onset of AMI in our case which was preceded by repair of a free wall rupture, identification of normal myocardium were comparatively possible, and the infarct exclusion technique of the left ventricle was more securely and safely accomplished. Furthermore, since infarct exclusion technique probably avoided additional damage to an already dysfunctional right ventricle and remodeled the left ventricle by eliminating the dyskinetic infarcted left ventricle, it was considered that the weaning from CPB could be done comparatively easily in spite of the situation that the postoperative low cardiac output was considered. Moreover, as an other procedure in our case, Dor procedure may have been suitable operative technique too when considering the ventricular function of the long-term prognosis because enough time had passed from AMI onset and the VSP was located in the apical portion of ventricular septum.

## Conclusion

We reported a successful surgical case of VSP after repairing free wall rupture of left ventricle. This is the first

surgical case report that free wall rupture of left ventricle and VSP which are serious complications after AMI happened in succession.

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