Emergent Surgical Repair of Left Ventricular Rupture After Blunt Chest Trauma

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A 63-year-old man presented with sudden cardiac shock due to cardiac rupture after a blunt chest trauma. We emergently repaired 2 rupture sites with the sandwich technique. This technique maintained the ventricular geometry, and minimized impairment of cardiac function. (Ann Thorac Surg 2014;98:e35–6) © 2014 by The Society of Thoracic Surgeons

Ventricular rupture due to blunt chest trauma directly worsens the systemic hemodynamic status. It is commonly diagnosed at the postmortem examination. We report herein a successful surgical treatment of a left ventricular rupture caused by a traffic accident.

A 63-year-old male was transferred to the emergency department of Saitama International Medical Center about an hour after a motor vehicle accident. On admission he was drowsy with relatively stable hemodynamic status. The electrocardiogram showed a ST elevation in V2 to V5 leads. The patient’s creatinine kinase and MB isozyme were elevated to 1,031 U/L and 154 U/L, respectively. No pericardial effusion was detected by focused assessment with sonography for trauma. However, his arterial pressure suddenly dropped to 60 mm Hg at systole. Contrast-enhanced computed tomography revealed a pseudoaneurysm of the left ventricular apex and cardiac tamponade (Fig 1). Multiple rib fractures and hemothorax were also detected. The patient was then transferred to the operating room. During the induction of anesthesia, the patient’s hemodynamics progressively deteriorated. His chest was opened through a median sternotomy. The anterior wall of the left ventricle had broad blunt damage. There was oozing from the apical pseudoaneurysm and a blow-out ventricular rupture at the anterobasal portion. A cardio-pulmonary bypass was started, immediately. Under cardiac arrest, the left ventricle was repaired by endocardial and epicardial Hemashield (Boston Scientific, MA) patches for each site. After placement of the mattress stitches penetrating the ventricular wall, an endocardial patch was inserted through the rupture site (Fig 2), and then an epicardial patch was placed by the same stitches. Hemostasis was achieved by manual compression and TachoSil (Nycomed, Linz, Austria) under the mechanical circulatory support.

Fig 1. Preoperative contrast-enhanced computed tomography revealed pseudoaneurysm of the left ventricle at the apical portion.

Fig 2. Two round-shaped Hemashield patches were prepared to cover the rupture site. After placing several mattress stitches of 4-0 polypropylene penetrating the ventricular wall from the inside, the endocardial patch was inserted into the ventricular cavity. The stitches were placed through the epicardial patch, and were tied not too tightly, so to maintain the shape of the patch and to fit with the inner and outer surface.
On the second day, reoperation for removal of a hematoma was performed, and hemostasis was confirmed (Fig 3). An intraaortic balloon pump was stopped a week after the initial operation, and the patient’s postoperative course was uneventful. Four weeks later, he was discharged from the hospital without neurologic deficit.

Comment
The right atrium is the most frequently ruptured chamber [1, 2], while diagnosis of ventricular rupture of a living patient is very rare. Contusion due to severe precordial impaction to the chest wall or compression between the spine and the anterior chest wall has been postulated as the mechanism for rupture. The myocardium was reported to be vulnerable, especially in the end-diastolic phase of the cardiac cycle [3]. The mortality rate of a ventricular rupture is extremely high, even if the patient arrives at hospital with vital signs. Brathwaite and colleagues [1] have reported that in 32 patients with traumatic cardiac rupture there were no survivors in the 14 patients with right or left ventricular rupture. Rapid diagnosis and surgical treatment are essential for survival. Massive pericardial effusion is the primary findings of cardiac rupture. In addition, elevation of creatinine kinase MB or troponin I was occasionally found [4].

Our patient arrived at the emergency room with relatively stable vital signs. A blowout rupture occurred in the operating room 3 hours after admission. The favorable clinical outcome can be attributed to such slow disruption of the ventricular wall. He had a broad myocardial contusion, and a repair of 2 rupture sites was necessary. We presume that linear closure of both rupture sites would have a considerable risk of cutting of any damaged tissue by the stitches and low cardiac output associated with a small ventricular cavity. Therefore, we utilized a sandwich technique with endocardial and epicardial patches. The patches were trimmed so large that geometry of the left ventricle could be preserved (Fig 3). Hemostasis was achieved by intraventricular pressure on the inner patch and clotting in the space between the 2 patches. Consequently, tension on the suture line could be minimized.

In conclusion, traumatic left ventricular rupture could be successfully treated by prompt diagnosis and appropriate perioperative management. We believe that the sandwich technique is useful and applicable for a patient having 2 cardiac ruptures.

References