Endovascular Treatment for Traumatic Aortic Rupture

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Traumatic aortic rupture is at the present time considered a life-threatening condition that requires emergent surgical intervention. Conventional surgical repair carries a certain risk of mortality and morbidity. Since the introduction of aortic stent-graft, endovascular repair has gradually become a new alternative surgical approach for treating traumatic aortic rupture. We hereby present the first case of a successful endovascular repair for traumatic aortic rupture in the Taiwan area.

Key Words: Traumatic aortic rupture • Stent graft • Endovascular repair

Traumatic aortic rupture is commonly caused by blunt chest injury resulting from high-speed acceleration and deceleration during traffic accidents. It is an extremely rare but life-threatening traumatic condition that kills nearly 75%-80% of the victims instantaneously due to free aortic wall rupture.¹ If the patients reach the hospital alive, aggressive medical treatment for the control of blood pressure and an emergent surgical approach is necessary to save their lives. However, conventional surgical approach with thoracotomy and interposition graft repair is associated with a considerable rate of operative mortality ranging up to 19%² and many complications, including perioperative bleeding, respiratory failure, infection, and paraplegia — the most serious complication.

In recent years, endovascular repair for traumatic aortic rupture has been increasingly advocated with the rapid development of aortic stent-graft. The application of thoracic aortic stent-graft was very recently approved in the Taiwan area by the Department of Health, R.O.C., in November 2006. We hereby present the first patient who underwent successful thoracic aortic stent-graft repair for traumatic aortic rupture in the Taiwan area.

CASE REPORT

A 65-year-old female patient was struck by a truck from behind when she was riding a motorcycle in December 2006. She was brought to the emergency room (ER) of Taipei Mackay Memorial Hospital. She arrived at the hospital with stable vital signs. After detailed physical examinations, she was found to have only facial lacerations. However, chest computer tomography (CT) revealed a fractured left rib, liver laceration, partial transection of the distal aortic arch, and left hemothorax. She was admitted to the intensive care unit (ICU) at Taipei Mackay Memorial Hospital for blood pressure control.

One week later, she was transferred to our institute for surgical treatment for partial distal aortic arch transection. Another chest CT performed upon her arrival revealed aggravation of left hemothorax (Figure 1). To prevent free wall rupture of the aortic arch, we arranged for emergent application of thoracic aortic stent-graft.

The 4-cm incision wound was deepened over the
right inguinal area, and the common femoral artery was looped for bleeding control. The left common femoral artery was prepared as a route for contrast injection. One piece of proximal component Zenith TX2 thoracic aortic stent-graft with a size of $34 \times 157$ mm was then introduced via the right common femoral artery after loading 3000 U heparin, keeping active clotting time (ACT) above 200 seconds. The proximal landing zone was preset between the left common carotid and the left subclavian artery, and the distal landing zone was deployed 12 cm distal to the left subclavian arteries, around the level of the 7th thoracic spine. The systolic blood pressure was lowered down to less than 80 mmHg to prevent the “windsock” effect and distal migration during stent graft deployment with nicardipine (a short active calcium channel blocker). To extend the proximal safe landing zone, the left carotid orifice had to be partially compromised after deployment; an 8-mm U shape vascular graft was anastomosed between bilateral carotid arteries with left proximal carotid end ligated to ensure adequate blood supply to the left cerebrum, which was continuously under the monitor of INVOS 5100 transcranial cerebral oxymeter (Somanetics Corp., Troy, USA). The whole procedure was smooth with shorter operative time (153 min) and less blood loss (200 c.c). Post-surgical ICU stay for one night. Three days later, repeated chest CT revealed successful obliteration of the aortic rupture without any types of endoleak (Figure 2). The patient

**Figure 1.** Axil-view chest CT: (a) Before operation: It reveals tear of the aortic wall of the distal arch with moderate amount of left pleural effusion; (b) Post operation: sealed and repaired aorta after stent grafting.

**Figure 2.** Sagittal-view chest CT: (a) Before operation: transection with intimal flap adjacent to the left subclavian artery; (b) Post operation: complete obliteration of the aortic rupture without endoleak. The stent-graft can be visualized around the thoracic aorta as high-density metal rings.
recovered smoothly and was discharged 10 days later without any sequelae.

DISCUSSION

Acute aortic rupture is a very rare traumatic condition, with an average of 2.2 cases per center per year reported in North America.\(^1\) It is often associated with other life-threatening injuries since it mostly occurs in serious traffic accidents. Traditional repair with thoracotomy and the interposition graft replacement of the injured aorta requires a circulatory assistance device to reduce the incidence of paraplegia after the operation. However, the use of circulatory assistance device requires systemic heparinization, and this will probably aggravate other associated injuries due to the bleeding tendency post heparinization.\(^3\) Therefore, conventional open repair for acute traumatic rupture is associated with a considerable rate of perioperative mortality and morbidity.

The first case of successful endovascular treatment for traumatic aortic rupture in the world was reported in 1997. Subsequently, more than 300 patients with aortic rupture who underwent endovascular repair were reported.\(^3\) Marcheix et al. deployed thoracic aortic stent-grafts in 33 patients with traumatic aortic isthmus rupture. Aortic pseudoaneurysms were successfully occluded in 30 patients (a success rate of 90.9%). Five patients sustained early complications, including paraplegia in one, thrombosis of the left brachial artery in two, and pseudoaneurysm of the left brachial artery in two. No perioperative mortality occurred. The midterm results were also excellent and without death or major complications during the follow-up period.\(^3\) Pratesi and his colleagues also performed endovascular treatment for traumatic rupture in 11 patients with 100% technical success rate. Only one patient died of respiratory failure, but no major complications were noted perioperatively as well as during the follow-up period.\(^1\) The endovascular treatment for acute traumatic aortic rupture offers major advantages over conventional open repair in that no circulatory assistance device is required and it does not result in large thoracotomy wounds that may exacerbate respiratory failure, particularly after major trauma and possible massive bleeding associated with interposition graft repair especially after systemic heparinization under extracorporeal assist. We think all these factors contribute to achieve the excellent results of endovascular treatment for traumatic aortic rupture.

To the best of our knowledge, this is the first case of a life-saving application used in traumatic aortic transection in the Taiwan area.

Although the indication for endovascular application on acute traumatic aortic transection still has not reached the final consensus, this experience has demonstrated that stent grafting will be a good alternative option for acute traumatic aortic rupture, particularly that associated with multiple traumas, and bleeding tendency which cannot tolerate systemic heparinization and extracorporeal support.

REFERENCES