Successful Endovascular Treatment of Traumatic Thoracic Aortic Injury Complicated by Severe Pelvic Hemorrhage

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A 25-year-old woman committed suicide with a high-rise fall and presented hypovolemic shock caused by blunt thoracic, abdominal injury. Enhanced computed tomography scan showed the pelvic hemorrhage and the transection of the descending thoracic aorta. After urgent transcatheter arterial embolization to stabilize bleeding from pelvic fracture, the thoracic aortic injury was treated with endovascular aortic repair using a Gore TAG endograft. She recovered from her injuries, and there was no evidence of endoleak in the follow-up computed tomography scan. In the treatment of traumatic aortic injury with associated severe injuries, the management of bleeding from associated injuries is important.

Keywords: TEVAR, multiple trauma, traumatic aortic injury

Introduction

Although traumatic aortic injury is a rare condition in multiple trauma, it is the second highest cause of posttraumatic death.1) Because traumatic aortic injury usually occurs in the high energy accident such as traffic accident or fall, it is associated with a high incidence of severe accompanying injuries in head, chest, abdomen and limbs.2–4) These associated injuries can make an early open surgical intervention unfeasible in patients with traumatic aortic injury. Endovascular repair of traumatic thoracic aortic injury with a stent graft is a suitable alternative means of managing this difficult condition, especially being combined with the timely control of bleeding from associated injuries. Advantages of endovascular repair include the absence of cardiopulmonary bypass and the low-dose systemic heparinization. We present a successful treatment for a patient of traumatic thoracic aortic transaction complicated by severe pelvic hemorrhage.

Case Report

A 25-year-old female committed suicide with a high-rise fall of 15 m and presented hypovolemic shock caused by blunt thoracic, abdominal injury to our emergency department. Upon admission, vital signs were respiratory rate of 30/min, blood pressure of 48/38 mmHg, and pulse rate of 136/min. Breath sounds were decreased on the left. She had a Glasgow Coma Scale score of E2; V2; M4. Standard advanced trauma life support with an endotracheal intubation for protection of the airway, fluid resuscitation with normal saline and blood transfusion for unstable hemodynamic status and essential survey of images was conducted. Diagnostic studies revealed multiple left rib fractures, a left hemotorax, vertically unstable pelvic fracture, a left acetabulum fracture and bilateral calcaneal fractures. The enhanced computed tomography demonstrated an arterial bleeding in the pelvis and a traumatic thoracic aortic transection with hemothorax, mediastinal hematoma (Fig. 1). A tube thoracostomy was performed in the emergency department and 290 ml of hemorrhagic pleural effusion was derained. After

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Received: February 13, 2014; Accepted: August 4, 2014
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that, there was no continued bleeding from the left pleural space, but her hemodynamics was still unstable. From this situation, active bleeding in the pelvis was thought to affect her hemodynamics adversely.

The patient was immediately taken to the hybrid operating room for a transcatheter arterial embolization for the pelvic bleeding and a thoracic endovascular aortic repair (TEVAR). A 4-French sheath was placed in the right femoral artery. Angiography demonstrated the extravasation of contrast medium from a branch of the right lateral sacral artery (Fig. 2). Then, embolization of the right lateral sacral artery was performed by using gelatin sponge particles and a flower coil. Subsequently, TEVAR was performed. A 7-French sheath was placed in the left femoral artery and a low-dose heparin (100 IU/kg) was administered. An arch aortogram demonstrated a contained transection of the proximal descending aorta, approximately 2.0 cm distal to the left subclavian artery. A GORE TAG endograft (26 mm 10 cm; W.L. Gore & Associates, Flagstaff, Arizona, USA) was deployed covering from the origin of the subclavian artery to the proximal descending thoracic aorta. Postdeployment aortography revealed a good placement of the device, no extravasation, and complete exclusion of the injured aorta. The operation times of pelvic embolization and TEVAR were 17 min and 36 min, respectively. A follow-up computed tomography scan of the chest on postoperative day 9 revealed the good position of the endograft and no extravasation of contrast medium (Fig. 3). The patient was eventually discharged without a serious sequel.

**Discussion**

In recent years, endovascular stent graft repair has been widely used in the treatment of thoracic aortic aneurysm. Because endovascular stent graft repair is less invasive than open aortic repair, it has become an established option in the treatment of acute aortic dissection and traumatic aortic injury.

Although blunt thoracic aortic injury accounts for less than 1% of trauma admission, it remains the
second leading cause of death from blunt trauma after head injury.\textsuperscript{2} Of the patients that survive to reach medical care, half will die within 24 h.\textsuperscript{7} Traditionally, the blunt traumatic aortic injury has been repaired through a left thoracotomy using the cardiopulmonary bypass with heparinization. In patients with additional severe injuries, open repair of a thoracic aortic injury are still associated with significant mortality. A previous study in the United States reported a 14\% mortality with open repair and an overall paraplegia rate of 8.7\%.\textsuperscript{3} Endovascular stent graft repair has emerged as an attractive alternative that addresses some of the limitations associated with traditional open surgery in this complex patient population.

In the recent meta-analysis of comparative studies, endovascular repair for traumatic aortic injury showed 39\% reduction in relative risk of mortality and 66\% reduction in relative risk of spinal cord ischemia when compared with open repair.\textsuperscript{8} From these evidence, the clinical practice guideline of the Society for Vascular Surgery suggests endovascular repair for traumatic aortic injury in patient with anatomical suitability.\textsuperscript{9} Especially in hemodynamic unstable patients of traumatic aortic injury, an urgent endovascular aortic repair is required.

However, the associated severe injuries can make an early surgical intervention unfeasible in patients with traumatic aortic injury, even if endovascular aortic repair would be used. Okada, et al. suggested that accompanying injuries in the limbs, spine, and pelvis make the clinical outcome worse in patients with blunt traumatic aortic injury.\textsuperscript{4} And they advocated that the control of bleeding from other injuries is necessary before an aortic repair procedure. In this case, the patient had a significant arterial bleeding from pelvic fracture in addition to the traumatic aortic rupture. To manage the arterial bleeding in the pelvis, we performed the preceding transcatheter arterial embolization, followed by endovascular aortic repair in a hybrid operating room. Indeed, the role of transcatheter arterial embolization in the management of a patient with pelvic fracture is still under discussion. Bassam, et al. reported that external fixation showed a higher failure rate of bleeding control than angiographic embolization in the patients with severe pelvic fractures.\textsuperscript{10} We performed selective embolization of the right lateral sacral artery by using gelatin sponge particles and an additional complex helical coil. The procedure could have been performed within acceptable time and it did not significantly delay the treatment for a traumatic thoracic aortic transection.

**Conclusion**

In the treatment of traumatic aortic injury with the associated severe injuries, the management of bleeding from associated injuries is very important. We provide the successful treatment of the traumatic thoracic aortic transection with severe pelvic hemorrhage by the combination of a preceding transcatheter arterial embolization and a following endovascular aortic repair.

**Disclosure Statement**

The authors have no conflict of interest.

**References**