



Endovascular treatment of traumatic thoracic aortic aneurysms: report of five cases and review of the literature

Travmatik torasik aort anevrizmalarında endovasküler tedavi:
Beş olgunun sunumu ve literatürün gözden geçirilmesi

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Endovascular stent-grafting of the aorta, as an alternative to open surgical techniques, is gaining in popularity everyday, especially in high-risk patients. Acute or chronic traumatic lesions of the descending aorta, especially after motor vehicle accidents, constitute such a group with a high-risk of morbidity and mortality. Here, we report the successful endovascular repair of acute and chronic traumatic thoracic aortic aneurysms after motor vehicle accidents in five patients.

Key Words: Endovascular treatment; thoracic aortic aneurysms; trauma.

Motorlu taşıt kazalarının giderek artan oranlarda karşımıza çıkması kalp ve büyük damar yaralanmalarının daha sık görülmesine yol açmaktadır. İnen aortanın gerek akut, gerekse kronik travmatik lezyonlarında endovasküler tedavi, bu konuda uzmanlaşmış merkezlerde düşük morbidite ve mortalite ile uygulanabilmektedir. Burada motorlu taşıt kazası sonrası akut veya kronik travmatik torasik aort anevrizması gelişen beş olgunun endovasküler stent-graft ile başarılı tedavisi anlatılmıştır.

Anahtar Sözcükler: Endovasküler tedavi; torasik aort anevrizmaları; travma.

More cases of heart and large vessel injuries are admitted to medical facilities in conjunction with the increasing number of traffic accidents per day. Fortunately, acute and chronic traumatic lesions of the descending aorta can now be treated via endovascular approach in specialized centers, with low morbidity and mortality rates.

Here, we report the successful endovascular treatment of five patients with acute and chronic traumatic thoracic aortic aneurysms after motor vehicle accidents.

CASE REPORTS

Case 1- The 31-year-old male patient was admitted to the emergency care unit of another hospital after a motor vehicle traffic accident. There was a left forearm fracture, a left femoral fracture and blunt thoracic injury. The patient was treated accordingly, and discharged in good condition 10 days later. Seventeen months later the patient applied to our hospital with the complaint of cough. Chest X-ray revealed a mass neighboring the descending thoracic aorta. Thoracic

computed tomography (CT) then showed the presence of a pseudoaneurysmatic dilatation of the thoracic aorta with a diameter of 51 mm, which was 23 mm distal to the ostium of the left subclavian artery. An aortography and a pelvic angiography were done for further evaluation of the dimensions of the aneurysmatic segment of the aorta and the iliofemoral arteries. Considering the anatomic location and properties, an endovascular approach was planned for the treatment of the aneurysm, which was thought to originate from a previous aortic injury during the accident.

The right femoral artery was prepared with an oblique incision in the inguinal area under general anesthesia. A pigtail catheter was inserted through the left axillary artery and then 7500 U heparin was administered intravenously. A superstiff exchange guide-wire (Back-up Meier®, Boston Scientific Corporation, MA, USA) was inserted through another pigtail catheter in the right femoral artery. A transverse arteriotomy was done to the right femoral artery, and then the 25 F stent-graft (Talent®, Medtronic, Minneapolis, MN,

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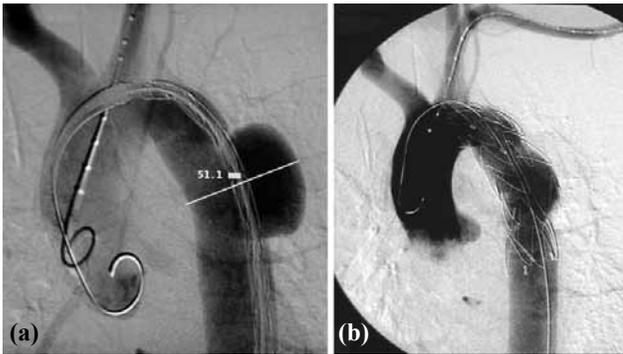


Fig. 1. Aortography during the procedure showing the pseudoaneurysmatic dilatation of the thoracic aorta. The self-expanding stent-graft is progressed but not released yet (a). Follow-up aortography of the same patient after the stent-graft is expanded. No endoleak is visualized (b).

USA) with its loading system were progressed till the aortic arch was over the guidewire (Fig. 1a). The sheath was pulled back and the self-expanding stent-graft was released. Follow-up angiography showed no leakage (endoleak) of contrast medium to the aneurysmatic sac (Fig. 1b). The femoral arteriotomy and the inguinal incision were then fixed. The patient was discharged on the 3rd postoperative day with no complication. Periodic CT angiography follow-ups were done, the most recent in the 18th month, and the patient is leading a normal life with no related problem.

Case 2- A 34-year-old male patient was followed for one day after a motorcycle accident in the emergency care unit of another hospital. After 96 months, opacity of the hilus of the left lung was noticed in the chest X-ray during a routine check-up through his company. The CT then revealed a 55 mm in diameter, 60 mm in length aneurysmatic dilatation of the descending thoracic aorta just distal to the aortic arch. Considering the location of the lesion, an endovascular approach was planned.

Like the previously-defined case, under general anesthesia, a left axillary pigtail catheter was inserted and the right femoral artery was prepared. The stent-graft was inserted through the right femoral artery under controlled hypotension and released, intentionally closing the ostium of the left subclavian artery. Follow-up angiography was done and the procedure was terminated. There was no problem related with the coverage of the left subclavian artery in the postoperative period.

Case 3- A 36-year-old male patient had been involved in a motor vehicle accident 10 days before. He was admitted to another medical center with a right zygomatic bone fracture, multiple rib fractures, and compression fractures of the lumbar vertebrae. He had had right pleural effusion, which was drained, and was

operated for the lumbar vertebral fractures. A laceration of the inferior vena cava was sutured. Tomography showed laceration of the anteroinferior tracheal side of the thoracic aorta and a pseudoaneurysm just distal to the left subclavian artery (Fig. 2a). The patient was referred to our hospital for endovascular treatment of the aortic pathology.

A pigtail catheter was inserted through the left axillary artery (Fig. 2b). The right femoral artery was prepared under general anesthesia. The stent-graft was inserted through the right femoral artery and released, intentionally overlapping the ostium of the left subclavian artery. After follow-up angiography, the procedure was terminated with success (Fig. 2c). There was no problem related with the coverage of the left subclavian artery. He was discharged in good condition on the 5th postoperative day.

Case 4- A 49-year-old female patient was admitted to our emergency department after being hit by a car. A curvilinear hypodense region in the distal aortic arch was recognized as an intimal flap showing an aortic dissection, together with the presence of a 1.2 cm intramural hematoma in the aortic arch and the proximal descending aorta. She also had multiple fractures of the extremities and the pelvis, and a first-grade splenic contusion.

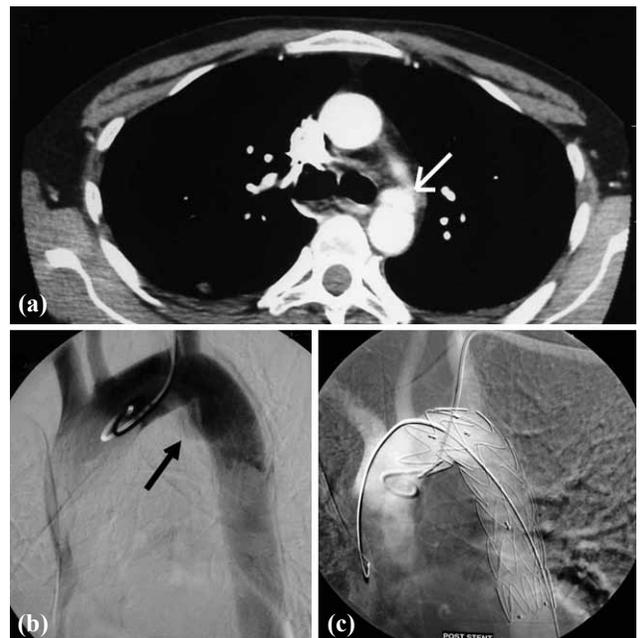


Fig. 2. Post-traumatic false aneurysm of the anterior surface of the proximal descending aorta (Arrow) (a). Aortography of the same patient during the endovascular procedure showing the pseudoaneurysm of the descending thoracic aorta (Arrow) (b). The same patient after the implantation of the stent-graft. Note that the left subclavian artery is intentionally covered to provide a more secure landing zone (c).

Via a right femoral approach, a 32 mm thoracic endovascular stent-graft was implanted under general anesthesia. She was followed in the intensive care unit (ICU) for the following two days and another four days in the ward. Her orthopedic interventions had been postponed until hemodynamic stabilization was achieved. She was then referred to another center for orthopedic surgery.

Case 5- Another 35-year-old male patient with a history of a traffic accident four years ago was being evaluated for dyspepsia when an aneurysm of the descending thoracic aorta was discovered incidentally. Thoracic magnetic resonance (MR) and CT angiographies revealed a 15x25 mm saccular aneurysm of the antero-medial aspect of the thoracic aorta 3 cm distal to the left subclavian arterial orifice. This aneurysm was noted to be protruding towards the posterior mediastinum, and indenting the esophagus on its left lateral side.

A 32 mm endovascular stent-graft was implanted through the right femoral artery. He was discharged after three days of hospital stay, the first day being in the ICU.

DISCUSSION

Endovascular approach, first used in the treatment of thoracic aortic aneurysms by the Stanford Group,^[1] can now be used in other pathologies of the thoracic aorta.^[2,3] There are several recent reports about the successful endovascular treatment of traumatic lesions of the descending thoracic aorta.^[4-8]

Traumatic thoracic aortic injuries are usually located distal to the left subclavian artery. Because of the presence of intercostal arteries, pleura and the ligamentum arteriosum, the descending aorta is fixed more rigidly than the aortic arch and the heart during its course through the vertebral sulcus. During a horizontal deceleration trauma, the descending and other parts of the aorta move at different speeds. As a result, the isthmus part of the aorta is under maximum stress, and thus may yield total or partial rupture of the vessel. Together with the accompanying multitrauma (craniocerebral, abdominal trauma, multiple bone fractures, etc.), thoracic aortic injuries present 80-90% mortality within the first hours.^[9,10] The conventional approach to thoracic aortic injuries is through a left posterolateral thoracotomy. The proximal aorta is clamped and cardiopulmonary or left atriofemoral bypass is necessary to prevent ischemic neurological and visceral complications. On the other hand, high-dose heparinization necessary for the bypass circulation may aggravate accompanying neurological, visceral or orthopedic injury. Furthermore, single-lung ventilation during thoracic aortic surgery in such a severely traumatized patient will complicate the course of the operation. Latest reports show that in aortic injuries due to blunt thoracic trauma, the early

surgical mortality is 15 to 30%, and paraplegia risk is 2 to 20%.^[11,12] It is also reported that in 1-2% of these patients, the acute stage is unrecognized and a pseudoaneurysm develops.^[9]

It is reported that, in 20% of motor vehicle accidents, the heart, and in another 15%, the thoracic aorta or the branches of the aortic arch are injured.^[9,13-15] Non-penetrating (blunt) thoracic aortic injuries are highly lethal. Most of these patients die within the first hour of the accident,^[9,10] and 50% of the survivors are lost within the first 72 hours.^[9,10,16] On the other hand, in 1 to 2% of the patients with traumatic rupture of the aorta, the case cannot be recognized and leads to formation of a pseudoaneurysm just like the first two cases reported herein.^[17]

The time elapsed between the trauma and diagnosis of a pseudoaneurysm may be quite variable. In a group of 10 patients operated for traumatic thoracic aortic aneurysms, Buket and colleagues^[18] reported this period to be between 1 day and 10 years. In a retrospective study of 413 patients by Finkelmeier and colleagues,^[17] in 60 patients followed-up without any surgical intervention, the survival rates in 5 and 10 years were 70% and 65%, respectively. To prevent late mortal complications such as rupture, dissection of the aorta, visceral emboli, or infection, intervention is recommended in symptomatic patients and when the aneurysm is shown to be growing radiologically.^[17,19-21] In chronic traumatic aneurysms of the distal aortic arch or the descending aorta, the location of the aneurysm may cause difficulties in performing the proximal anastomosis, especially if the vessel is also calcified, and ultimately, total circulatory arrest may be necessary.^[22]

Demers and colleagues,^[22] in a series of 15 patients with chronic traumatic thoracic aortic aneurysms, used first- and second-generation endovascular stent grafts and lost one patient due to an aorta-esophageal fistula. In another patient, they reported the thrombosis of the left subclavian artery. Rouseau and colleagues^[5] also reported a series of nine patients with chronic traumatic thoracic aortic aneurysms treated with stent-grafts. The time between trauma and intervention varied between 1 month and 25 years. One patient had thrombosis of the left subclavian artery, but there was no mortality in the 11- month follow-up period.

In our series, detailed tomographic and angiographic evaluation was done to determine the distance between the left subclavian artery and the beginning of the aneurysm and the size of the normal aorta. It was then decided that there was a secure landing zone for the stent-graft, and the patient was scheduled for the endovascular procedure. Still, in three of the patients, the stent-graft was installed especially to obstruct the left subclavian artery to have a more secure landing

zone. The anatomy and the diameters of the bilateral iliac and femoral arteries are also evaluated preoperatively to plan for the access and progression of the graft. During the procedure, the stent-graft was chosen to be 20% larger than the diameter of the normal segment of the aorta.^[23] Preferring self-expandable stent-grafts, thereby avoiding balloon dilatation, may prevent iatrogenic traumatization of the aortic segments within the landing zones.

Caronno and colleagues^[24] reported a series of 11 patients with intentional coverage of the left subclavian artery during endovascular stent-grafting of the thoracic aorta. They report no related complication afterwards. On the other hand, in a series of 58 patients by Schoder and colleagues,^[25] intentional overstenting of the left subclavian artery resulted in complete occlusion in 8 and partial in 24 patients. Among patients with left subclavian artery occlusion, 2 patients had major (1 paraplegia, 1 critical arm ischemia) and 3 minor (2 temporary vertebrobasilar symptoms, 1 transient arm claudication) complications. We did not experience any related problem after coverage of the left subclavian artery, and thus believe that prophylactic surgical maneuvers may not be necessary, as long as sufficient angiographic evaluation of the Willis' polygon is done. Such interventions should be considered as an elective measure after an endovascular aortic intervention only when intolerable signs or symptoms of ischemia occur.

These five cases together with the other reported similar cases show that endovascular treatment is a very good alternative to the conventional surgical management of patients with traumatic aortic aneurysm and dissections. We believe that as experience is gained in endovascular surgery, this type of surgery will be the first choice of treatment in traumatic aortic injuries, with less morbidity and mortality.

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