

Successful Treatment of Traumatic Late Rupture of Thoracic Aorta: Case Report

Travmaya Bağlı Geç Torasik Aorta Rüptürünün Başarılı Tedavisi

Mehmet KALENDER,^a
Ayşe Gül KUNT,^a
Mehmet TAŞAR,^a
Hayat GÖKMENGİL,^a
Okay Güven KARACA,^a
Ata Niyazi ECEVİT,^a
Osman Tansel DARÇIN^a

^aClinic of Cardiovascular Surgery,
Konya Education and Research Hospital,
Konya

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Yazışma Adresi/Correspondence:
Mehmet KALENDER
Konya Education and Research Hospital,
Clinic of Cardiovascular Surgery, Konya,
TÜRKİYE/TURKEY
ka97084@yahoo.com

ABSTRACT A 72-year-old female presented with late traumatic rupture of thoracic aorta. She became symptomatic at the third month after the trauma. Patient was admitted to nephrology clinic with acute renal failure dependent on new-onset hemodialysis. Complete blood counts revealed progressive fall in hematocrit levels. Computerized tomography showed restricted hematoma around the upper thoracic aorta. Upper thoracic aorta, after subclavian artery was stented in usual manner (Thoracic endovascular aortic repair-TEVAR). The patient was discharged without any complications, but she still needs hemodialysis.

Key Words: Trauma; thoracic aorta; stent graft

ÖZET Yetmiş iki yaşında kadın hasta, torasik aortada travmaya bağlı geç rüptür ile başvurdu. Hasta travma sonrası üçüncü ayda semptomatik oldu. Nefroloji kliniğine akut böbrek yetmezliği ile başvuran hasta hemodiyalize alındı. Takiplerinde hematokrit değerlerinde progresif düşme olması üzerine yapılan bilgisayarlı tomografi, üst torasik aortada sınırlı hematomu ortaya koydu. Subklaviyan arter distalinden torasik aortaya stent greft implante edildi (Thoracic endovascular aortic repair-TEVAR). Hemodiyaliz ihtiyacı devam eden hastada ek komplikasyon izlenmedi ve hasta taburcu edildi.

Anahtar Kelimeler: Travma; torasik aorta; stent

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Seventy to 90% of patients with acute aortic rupture following blunt trauma die at the scene of injury or before reaching the operating room.¹⁻³ Those who survive usually have a contained aortic rupture and require mostly emergent intervention to control mediastinal hemorrhage. Actually, ruptured thoracic aortic aneurysm is more common in older patients and has a high early postoperative mortality, ranging from 24%⁴ to 42,1%⁵ In this subgroup of elderly patients, mortality has been reported as 50% when operation was performed on the emergency basis.⁶ In this setting, endovascular stent grafting is a less invasive treatment for descending aortic pathologies and may be considered as an alternative to conventional surgical repair.

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CASE REPORT

A 72-year-old female was admitted to emergency room with left flank pain, weakness, nausea and vomiting. In physical examination, there was no other pathological finding. Laboratory showed high urea/creatinine and low hematocrit levels. Patient had new-onset hemodialysis for acute renal insufficiency. Deep questioning revealed a trauma 3 months before (fell down from a chair). After further examination, thoraco-abdominal computerized tomography (CT) revealed hematoma around the upper thoracic aorta, there was no accompanying aneurysm but CT revealed severe aortic wall calcification (Figure 1). After all, the patient was admitted to the operation room to have thoracic endovascular aortic graft stenting to upper descending aorta (Figures 2A, 2B). The patient was placed in a supine position. Both groins and the entire abdomen were prepped and draped. Thoracic endovascular aortic repair (TEVAR) was performed under local anesthesia and with mild sedation. Right femoral artery cutdown was performed. The patient was heparinized for a target activated clotting time ≥ 200 sec. This level of anticoagulation was maintained throughout the procedure, until the femoral artery cutdown was repaired and distal pulses were verified. A 6F sheath was used for contralateral femoral artery. Prior to device deployment, the systolic blood pressure was brought down to 100 mmHg. Patient had a safe landing zone distal to left

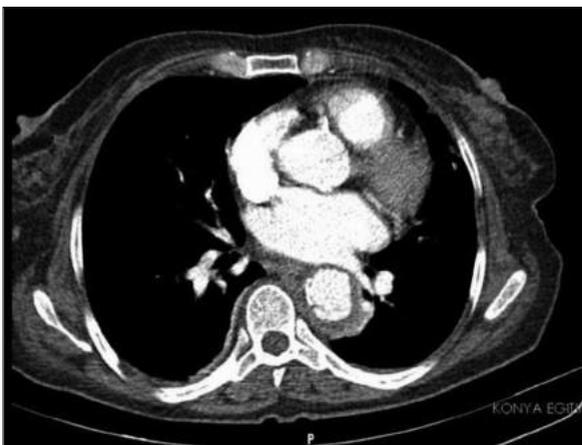


FIGURE 1: Computerized tomography: Rupture of upper thoracic aorta with limited hemorrhage.



FIGURE 2A: Computerized tomography: Stent replacement in thoracic aorta.



FIGURE 2B: Anteroposterior X-ray: stent replacement located in upper thoracic aorta.

subclavian artery, therefore 130 x 33 mm sized thoracic stent graft was implanted to descendant aorta 1 cm distal to left subclavian artery. Control angiogram was performed to reconfirm positioning of stent and to ensure lack of endoleak. Femoral artery was repaired primarily. Distal pulses were examined and they were similar to preoperative baseline. Heparin was reversed. There was no endoleak in the postoperative period on CT. The patient was discharged on postoperative fourth day. However, she is still on hemodialysis.

DISCUSSION

The mechanism whereby aortic injury or rupture is produced varies with the type of force. A direct force that results in fracture or displacement of one of the dorsolumbar vertebrae may cause rupture of the aorta by shearing action. Indirect force apparently acts through production of increased intravascular pressure. It has been demonstrated

experimentally that such a pressure may exceed 1000 mmHg without causing rupture. An apparently normal human aorta has been ruptured by an aortic pressure of 2070 mmHg.¹

It is still a challenging topic to choose a proper approach to severely diseased and atherosclerotic aorta in elderly patients, presenting with ruptured thoracic aortic aneurysm or ruptured type B aortic dissection. In this high-risk polymorbid group of elderly patients, endovascular approach has favoring results. Several groups published encouraging results after implantating endografts urgently in patients with thoracic aortic aneurysms and type B dissections.^{7,8} Conventional open surgery, using cardiopulmonary bypass, has a high mortality rate ranging between 17 and 29% in elective cases, but mortality can be as high as 50%, when surgery is performed on an urgent basis.^{5,9,10} Parallel to the literature, we had preferred TEVAR to avoid complications of open surgery.

As in most of the cases, stent graft implantation can be performed through the femoral arteries under local anesthesia. Advantages of graft stenting, especially in the elderly and/or polymorbid population are as follows: Pulmonary complication rate is reduced by avoiding intubation and/or ventilation and hypotension caused by the induction of general anesthesia is minimized, which is detrimental especially in multifocally atherosclerotic diseased patients.¹¹ In a recent review carried out by the American Society for Vascular Surgery, including 7768 patients reported, the mortality and morbidity rate in patients submitted to endovascular treatment for thoracic aortic injuries was dramatically lower (9%) in comparison to those treated surgically (19%) or medically (46%) with a $p < 0.01$. In addition, the risk of spinal cord ischemia and end-stage renal disease has showed a higher incidence in the surgical group in comparison to endovascular approach (respectively 5% and 3%) with a $p = 0.01$, similar to graft and pulmonary infection.^{12,13} Some problems regarding the endovascular treatment remain unsolved.^{13,14} First challenging topic in a patient with hypovolemia and/or hemodynamic collapse and/or early resuscitation and in young patient is correct sizing of the aorta. The choice of an inad-

equate graft led to more than 10% early complication rate, as migration or collapse. These data are confirmed by the Second American Association for the Surgery of Trauma (AAST) that reported an alarmingly high risk (20%) of device-related complications and included 18 patients (14%) with endoleak treated with repeat TEVAR or endograft explantation and open descending thoracic aorta repair.¹⁵ Although the anatomic lesions in trauma are frequently limited in a short segment, in young patients in whom a 1 cm increase is reached between 20 and 80 years, fate of thoracic aortic graft is not known yet. The long-term results are not known due to small number of large reports in the literature. The fate of thoracic endograft positioned in a young patient, in a small aortic size, is not clear. In our case, the patient was old and was not in hypovolemic shock, therefore graft sizing was easy for this case.

Second topic to consider is use of intraoperative anticoagulation. Endograft placement advantages to avoid heparin in acute patients with other associated traumas, and limit its use only in stable or chronic conditions. In contrast, we used anticoagulation in a reasonable amount (5000 IU) to reach target activated clotting time (≥ 200 sec).

A third thing to consider is the low incidence rate of spinal cord ischemia. It is probably due to the short segment covered by the endograft: Generally the distal part of the aortic arch or the proximal part of the descending aorta. Therefore, the critical zone that includes the segment between T& and L1 is rarely involved by the procedure. This is the case also in our case, and we did not experience spinal cord ischemia. For this reason, no spinal cord drainage was carried out. Moreover, the temporary interruption of perfusion to the spinal cord related to aortic cross-clamping during open repair and systemic hypotension that may complicate thoracotomy have been implicated as factors responsible for the higher incidence of spinal cord ischemia as compared with TEVAR.

The last point of this approach is the coverage of the left subclavian artery. It is not easy in emergency to carry out a correct evaluation of the Willis

circulation and of the dominant vertebral artery; furthermore, in all the cases when the left subclavian artery is mandatorily covered, an angiography must be performed to visualize either the posterior circulation or the left subclavian artery revascularization by the vertebral artery. Generally there is no need in deploying a plug, because there is no aneurismal pathology and the lesion is not atherosclerotic in most cases. Supporting the literature, our case was not aneurysmatic and left subclavian artery was not covered.

CONCLUSION

Emergency thoracic endovascular stent grafting in elderly patients with traumatic thoracic aortic rupture is a less-invasive and safe procedure to control hemorrhage. It avoids the necessity of extracorporeal circulation and aortic cross-clamping.

Conflict of Interest

Authors declared no conflict of interest or financial support.

REFERENCES

- Parmley L, Mattingly T, Manion W, Jahnke EJ Jr. Non-penetrating traumatic injury of the aorta. *Circulation* 1958;17:1086-101.
- Hunt JP, Caker CC, Lentz CW, Rutledge RR, Oller DW, Flowe KM, et al. Thoracic aorta injuries: management and outcome of 144 patients. *J Trauma* 1996;40(4):547-55.
- Prêtre R, Chilcott M. Blunt trauma to the heart and great vessels. *N Engl J Med* 1997;336(9):626-32
- Crawford ES, Hess KR, Cohen ES, Coselli JS, Safi HJ. Ruptured aneurysm of the descending thoracic and thoracoabdominal aorta: analysis according to size and treatment. *Ann Surg* 1991;213(5):417-25.
- Mastoroberto P, Chello M. Emergency thoracoabdominal aortic aneurysm repair: clinical outcome. *J Thorac Cardiovasc Surg* 1999;118(3):477-81.
- Huynh TTT, Miller CC, Estrera AL, Porat EE, Safi HJ. Thoracoabdominal and descending thoracic aortic aneurysm surgery in patients aged 79 years or older. *J Vasc Surg* 2002;36(3):469-75.
- Buz S, Zipfel B, Mulahasanovic S, Pasic M, Weng Y, Hetzer R. Conventional surgical repair and endovascular treatment of acute traumatic aortic rupture. *Eur J Cardiothorac Surg* 2008;33(2):143-9.
- Lachat M, Pfammatter T, Witzke H, Bernard E, Wolfensberger U, Künzli A, et al. Acute traumatic aortic rupture: early stent-graft repair. *Eur J Cardiothorac Surg* 2002;21(6):959-63.
- Safi HJ, Miller CC 3rd, Subramaniam MH, Campbell MP, Iliopoulos DC, O'Donnell JJ, et al. Thoracic and thoracoabdominal aortic aneurysm repair using cardiopulmonary bypass, profound hypothermia, and circulatory arrest via left side of the chest incision. *J Vasc Surg* 1998;28(4):591-8.
- Crawford ES, Crawford JL, Safi HJ, Coselli JS, Hess KR, Brooks B, et al. Thoracoabdominal aortic aneurysms: preoperative and intraoperative factors determining immediate and long-term results of operations in 605 patients. *J Vasc Surg* 1986;3(3):389-404.
- Melnitchouk S, Pfammatter T, Kadner A, Dave H, Witzke H, Trentz O, et al. Emergency stent-graft placement for hemorrhage control in acute thoracic aortic rupture. *Eur J Cardiothorac Surg* 2004;25(6):1032-8.
- Chiesa R, Zangrillo A, Alfieri O, Melissano G, Coselli JS. Endovascular versus open surgical treatment of thoracic aorta injuries. In: *Proceedings of the 3rd International Congress, Aortic Surgery and Anesthesia "How to Do It"*. Milano, Italy 2010. p.148-53.
- Mattox KL, Wall MJ Jr. Historical review of blunt injury to the thoracic aorta. *Chest Surg Clin N Am* 2000;10(1):167-82, x.
- Demetriades D, Velmahos GC, Scalea TM, Jurkovich GJ, Karmy-Jones R, Teixeira PG, et al. Blunt traumatic thoracic aortic injuries: early or delayed repair—results of an American Association for the Surgery of Trauma prospective study. *J Trauma* 2009;66(4):967-73.
- Moainie SL, Neschis DG, Gammie JS, Brown JM, Poston RS, Scalea TM, et al. Endovascular stenting for traumatic aortic injury: an emerging new standard of care. *Ann Thorac Surg* 2008;85(5):1625-9.