

Endovascular Approach for the Treatment of a Distal Aortic Arch Aneurysm in a Nonagenarian Patient

Petroula Nana¹, Konstantinos Spanos¹, Konstantinos Mpatzalexis¹, Aikaterini Koutsothymiou², Eleni Arnautoglou², Miltiadis Matsagkas¹

¹Department of Vascular Surgery, Faculty of Medicine, School of Health Sciences, University of Thessaly, Larissa, Greece

²Department of Anesthesiology, Faculty of Medicine, School of Health Sciences, University of Thessaly, Larissa, Greece

Abstract:

Elder patients with thoracic aortic aneurysms could safely be treated endovascularly, with a reasonable morbidity and mortality rate. Our aim is to present a patient with a large aortic arch aneurysm treated with endovascular means and a synchronous carotid-subclavian bypass. Due to his good condition, a 93-year old male with a 10cm aneurysm of the distal aortic arch underwent an endovascular repair, using a thoracic endograft and 1 parallel graft to the left common carotid artery, associated with a synchronous carotid-subclavian bypass and an occlusion of the subclavian artery with plug. The initial postoperative CTA presented a minor gutter endoleak, while the patient was discharged without any further complications. One year later, he is continuing a normal life.

INTRODUCTION

Endovascular management of descending thoracic aorta diseases (TEVAR) is recommended as the standard of treatment, irrespectively of patients' risk factors, as it is associated with lower mortality and morbidity rate, compared to conventional surgical repair.^{1,2} However, complex endovascular repair may be associated with higher mortality in elder patients and age ≥ 80 years may be an independent predictor for higher early all-cause mortality.³ Herein, we report a case of a 93-year-old male suffering from a large symptomatic thoracic aortic aneurysm treated using a parallel graft and simultaneous carotid-subclavian bypass. This report has been approved by the Ethics Committee of the Hospital.

CASE REPORT

A 93-year old male, with a history of a previous open surgical repair of a descending thoracic aortic aneurysm (15 years ago at the mid portion of the descending aorta) and a known 80mm aortic arch aneurysm suffered acute and recurrent episodes of intense thoracic pain. The patient had previously denied any surgical treatment. Furthermore, his medical history was significant for hypertension, dyslipidemia, mild chronic obstructive pulmonary disease (FEV1 84%) and atrial fibrillation (AF) under treat-

ment with direct oral anti-coagulant. Cardiologist evaluation revealed no acute heart disease and the ejection fraction was preserved (50%). Computed tomography angiography (CTA) revealed a distal aortic arch aneurysm with a maximum diameter at 96mm, associated to a proximal para-anastomotic aneurysm and severe aortic tortuosity (Figure 1). Taking in account his age and co-morbidities, an endovascular approach was decided. The aneurysm included left subclavian artery (LSA) and the distance from left common carotid artery (CCA) was 9 mm. A parallel graft technique (chimney TEVAR) was decided for the preservation of the left CCA and a carotid-subclavian bypass with a plug deployment at the orifice of the LSA, thus the proximal landing zone was 18 mm up to innominate artery.

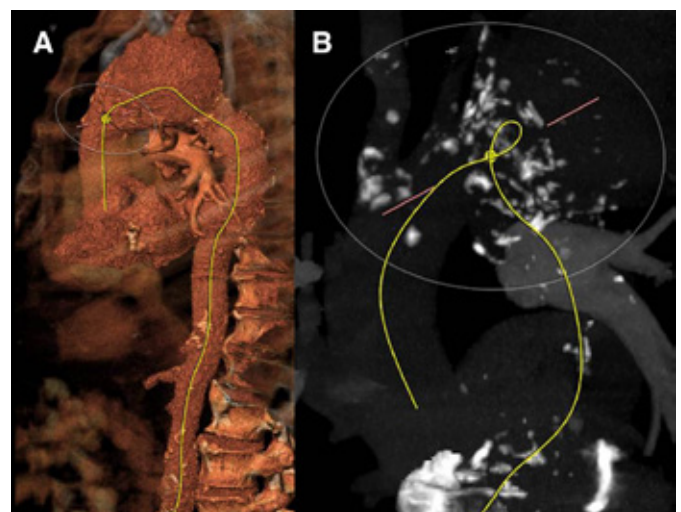


Figure 1. A large aortic arch aneurysm was detected in the pre-operative computed tomography angiography (Panel A). In antero-posterior view, an extreme tortuosity of the aorta was revealed, making the decision making and endovascular treatment more demanding (Panel B).

Author for correspondence:

Miltiadis Matsagkas, MD, PhD, FEBVS

Professor of Vascular Surgery, Department of Vascular Surgery, Medical School, University of Thessaly, Mezourlo, Larissa, Greece

Tel: +30 2413501739

E-mail: milmat@gmail.com

ISSN 1106-7237/ 2019 Hellenic Society of Vascular and Endovascular Surgery Published by Rotonda Publications
All rights reserved. <https://www.heljves.com>

Initially, a carotid-subclavian bypass was constructed through a transverse cervical access, using a 6mm polytetrafluoroethylene (PTFE) graft (Propaten, Gore, Delaware, USA). After the accomplishment of the bypass, two thoracic endografts and 1 stent graft were used for aneurysm exclusion and left CCA preservation in order to achieve adequate sealing. The extreme aortic tortuosity was confronted using a through and through guidewire from the right axillary to the left common femoral artery and mild tension was used to achieve adequate endograft deployment. Guidewire advancement was challenging and finally a snare from below up to the aortic arch was used to accomplish the through and through maneuver. (Figure 2) A thoracic endograft (Relay 44x44x200mm, Bolton Medical, Florida, USA) was inserted proximally while a covered balloon expandable stent graft (10x57mm, Be-Graft, Bentley, Innomed, Germany) was deployed into the left common carotid artery, through a direct carotid puncture. Relining using a self-expanding 12x60mm stent was applied to enforce the main stent graft (E-Luminexx, Bard, New Jersey, USA). A second thoracic graft (46x46x200mm, Valiant, Medtronic, USA) was deployed distally to achieve complete sealing. The procedure was completed through a percutaneous puncture of the left brachial artery and the insertion of a 14x10mm plug (Amplatzer, Abbott, Illinois, USA) at the orifice of the LSA.

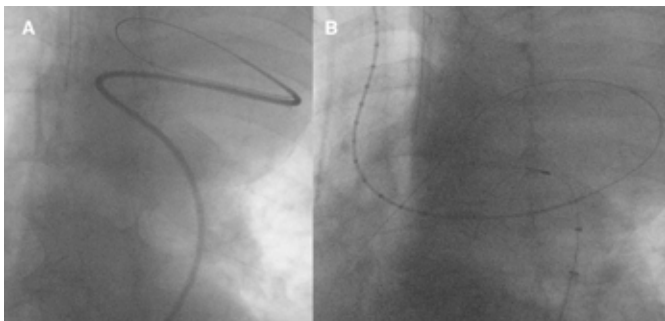


Figure 2. Guidewire advancement may be challenging in elder patients due to aortic anatomy (Panel A). In this case, the use of snare was inevitable to achieve the passage of the through and through guidewire (Panel B).

Completion angiography showed no endoleak while left CCA stent and left carotid-subclavian bypass were patent. Intra-operatively the patient was transfused using 1 red blood cell unit. Median contrast used was estimated at 100 ml and radiation exposure 289mGy. The total duration of the operation was 300min. The patient was transferred to the ward under close monitoring. The 4th post-operative day, a rapid AF, with cardiac decompensation and dyspnea, was detected and the patient was transferred to the cardiology department. Medical management was effective and pre-discharged CTA showed exclusion of the aneurysm sac, patent parallel graft and by-pass as well as a minimal gutter endoleak (Figure 3). Finally, the patient was discharged the 10th post-operative day in a good general condition. A close surveillance with clinical re-evaluations and laboratory exams confirmed the uneventful later post-operative period.



Figure 3. First-month follow-up with computed tomography angiography revealed aneurysm stabilization and endografts patency (Panel A). A carotid-subclavian bypass and a plug occlusion of the left subclavian artery were used to prevent spinal cord ischemia by preserving collaterals patency (Panel B).

After a 30-day rehabilitation program, the patient had completely recovered at his daily routine. A non-contrast CTA revealed the stabilization of the sac and the adequate graft deployment. No further complication was recorded during the 1st year of follow-up. The patient denied a CTA imaging surveillance. Clinical and laboratory evaluation were in order.

DISCUSSION

Current guidelines for the management of descending thoracic aorta disease have not specified a life-expectancy or age limit in order to provide endovascular treatment for TAA.¹ However TEVAR should be considered as the first line treatment option in cases of favorable anatomy even in patients unfit for open surgery.¹ TEVAR seems to be beneficial in terms of mortality in elective and urgent cases with a 5-year survival rate at 62.5% in intact aneurysms.² In urgent cases, one third of patients will survive after a treated ruptured thoracic aneurysm during the mid-term follow-up.² In this case, due to high comorbidity and the presence of a large symptomatic aneurysm, an endovascular approach was decided and accomplished after a detailed pre-operative risk assessment.

Spinal cord ischemia (SCI) affects 5-year survival and the mortality rate is estimated at 20% for patients that survived the early post-operative period.⁴ The prevention of spinal cord ischemia is mandatory in patients undergoing a long coverage of the aorta and preventive measures are indicated in these cases.¹ Advanced age may be associated with aortic and spinal artery atheromatosis, which may affect neurological outcomes after thoracic aorta repair.⁵ Along this line, elder patients may be considered as a high risk group of SCI. In this case, LSA preservation was decided using a carotid-subclavian bypass, as its initial coverage was inevitable in order to achieve a safe proximal sealing zone. Taking in account that (1) extra-thoracic bypass surgery is safe and effective in the form of debranching, (2) a carotid-carotid bypass has a primary patency at 88%, (3) further bypass to the LSA could affect patency and (4) the increased the risk of total occlusion of all supra-aortic vessels in case of bypass thrombosis, a hybrid procedure using a parallel graft for the preservation of the left CCA was decided.^{6,7}

Current endovascular experience has shown that non-

genarians with a good functional status may be successfully treated and benefit from a median survival of 56.2 months.⁸ Patient selection is mandatory in this fragile group.⁸ In this case, the patient was in a very good general status and had an active daily routine. Even in technical terms, an endovascular approach in elder patients may be challenging due to the special anatomic characteristics, as aortic tortuosity.⁹ In this case, a through and through guidewire from the right axillary to the left femoral artery was needed to achieve the successful and safe deployment of the endograft. An individualized approach is mandatory in order to select these elder patients that may benefit of an endovascular repair as complications are acceptable but significantly greater than in younger patients.¹⁰

Untreated descending thoracic aortic aneurysms are related with high rupture rate and a low 5-year survival, while age and non-treatment approach are related to higher rupture risk.¹¹ Open surgical repair in patients elder than 70 years old is associated with higher morbidity in comparison to younger patients.¹² In cases with complex aortic anatomy and need for extended endovascular treatment, a high post-operative complication and mortality rate of more than 25% may be suspected.¹³ In any case, endovascular repair is associated with significantly lower morbidity and mortality than surgery, reflecting that minimal approaches may be a safer option in high risk elder patients.¹⁴ In this case, despite the technical success, the patient needed a long hospitalization of 10 days due to post-operative complications that were managed conservatively. After the initial period, the patient recovered completely and regained his initial daily routine.

CONCLUSION

Endovascular aortic aneurysm repair seemed safe and feasible in this case. Elder patients may be treated with minimally invasive techniques, achieving a reasonable morbidity and mortality rate.

No conflict of interest.

REFERENCES

- 1 V. Rimbau V, Böckler D, Brunkwall J, Cao P, Chiesa R, Coppi G, et al. Management of Descending Thoracic Aorta Diseases. Clinical Practice Guidelines of the European Society for Vascular Surgery. *Eur J Vasc Endovasc Surg.* 2017;53:4-52
- 2 Hellgren T, Wanhainen A, Steuer J, Mani K. Outcome of endovascular repair for intact and ruptured thoracic aortic aneurysms. *J Vasc Surg.* 2017;66:21-8.
- 3 Makaloski V, Kölbel T, Rohlffs F, Behrendt CA, Law Y, Debus ES, et al. Early Outcomes After Branched and Fenestrated Endovascular Aortic Repair in Octogenarians. *Eur J Vasc Endovasc Surg.* 2018;56:818-25.
- 4 New PW, McFarlane CL. Survival following spinal cord infarction. *Spinal Cord.* 2013;51:453-6.
- 5 Tubbs RS, Blouir MC, Romeo AK, Mortazavi MM, Cohen-Gadol AA. Spinal cord ischemia and atherosclerosis: a review of the literature. *Br J Neurosurg.* 2011;25:666-70.
- 6 Ozsvath KJ, Roddy SP, Darling RC 3rd, Byrne J, Kreienberg PB, Choi D, et al. Carotid-carotid crossover bypass: is it a durable procedure? *J Vasc Surg.* 2003;37:582-5.
- 7 Gombert A, van Issum L, Barbati ME, Grommes J, Keszei A, Kotelis D, et al. Extra-Thoracic Supra-aortic Bypass Surgery Is Safe in Thoracic Endovascular Aortic Repair and Arterial Occlusive Disease Treatment. *Eur J Vasc Endovasc Surg.* 2018;55:861-6.
- 8 Lee GK, Ullery BW, Lee JT. Elective EVAR in nonagenarians is safe in carefully selected patients. *Ann Vasc Surg.* 2014;28:1402-8.
- 9 Fiorucci B, Tsilimparis N. Successful TEVAR with a Through and Through Guidewire in an Extremely Tortuous Aorta. *Eur J Vasc Endovasc Surg.* 2017;53:532.
- 10 Wigley J, Shantikumar S, Hameed W, Griffin K, Handa A, Scott DJ. Endovascular aneurysm repair in nonagenarians: a systematic review. *Ann Vasc Surg.* 2015;29:385-91.
- 11 Masuda Y, Takanashi K, Takasu J, Aoyagi Y, Morooka N, Watanabe S, et al. Unoperated thoracic aortic aneurysms: survival rates of the patients and determinants of prognosis. *Intern Med.* 1992;31:1088-93.
- 12 Okita Y, Ando M, Minatoya K, Tagusari O, Kitamura S, Nakajima N, et al. Early and long-term results of surgery for aneurysms of the thoracic aorta in septuagenarians and octogenarians. *Eur J Cardiothorac Surg.* 1999;16:317-23.
- 13 Timaran DE, Knowles M, Ali T, Timaran CH. Fenestrated endovascular aneurysm repair among octogenarians at high and standard risk for open repair. *J Vasc Surg.* 2017;66:354-9.
- 14 Locham S, Faateh M, Dakour-Aridi H, Nejjim B, Malas M. Octogenarians Undergoing Open Repair Have Higher Mortality Compared with Fenestrated Endovascular Repair of Intact Abdominal Aortic Aneurysms Involving the Visceral Vessels. *Ann Vasc Surg.* 2018;51:192-9.