

Endovascular Repair of a Giant False Lumen Iliac Aneurysm Following an Acute Type B Aortic Dissection

Petros Chatzigakis MD, PhD, Vasileios Katsikas MD, MSc, George Geropapas MD, MSc, George Kopadis MD, PhD

Vascular Surgery Department, General Hospital of Athens "Georgios Gennimatas", 154 Mesogeion Avenue, 156 69, Athens, Greece

Abstract:

Endovascular treatment is the first-line intervention for a complicated acute type B aortic dissection; however, the ideal approach is still under research. We present a case of a 47-year-old patient who presented in the emergency complaining of intense pain in his left lower quadrant over the last 48 hours. His computed tomography angiography revealed a complicated acute type B aortic dissection that extended to his left common iliac artery where the formation of a 10.6 cm aneurysm of the false iliac lumen caused the entire collapse of the ipsilateral true lumen. Following the deployment of a thoracic stent graft, scaffolding was built on a later stage utilizing a bare metal stent for the visceral aorta along with a system of stentgrafts for the infrarenal aorta and the iliac arteries. The decompression of the false lumen and the exclusion of the aneurysm induced a positive aortic remodelling.

Keywords: Aorta, Dissection, Endovascular Repair, Stentgraft

INTRODUCTION

The treatment of complicated acute type B aortic dissection (cATBAD) is a complex procedure, as the frailty of the aorta and the extension of the disease preclude the open repair while the unique pattern of the dissecting membrane imposes an individual approach where various endovascular techniques are combined¹. Herein, we present a quite challenging case of cATBAD where a mixture of the available contemporary endovascular techniques was enrolled to engage the elimination of the false lumen (FL). Informed consent was obtained from the patient before publishing his images and history; therefore, approval by the institutional review board was waived.

CASE PRESENTATION

A 47-year-old male patient presented to the emergency department, complaining of a sudden onset of intense pain in his left lower quadrant over the last 48 hours. Being a non-smoker and having no relevant medical history, his physical examination revealed a pulsatile mass in his left suprainguinal region and an absence of arterial pulses in his ipsilateral lower limb. However, arterial signals were audible upon Doppler ultrasound examination, and he was full ambulatory. Following an unremarkable blood exam, his ultrasound showed an

aneurysm of his left common iliac artery; therefore, a computed tomography angiography (CTA) was conducted which exhibited a complicated acute type aortic B dissection (Figure 1a). Having the intimal tear at the distal end of the upper part of his descending thoracic aorta, the dissection had extended bilaterally up to his right common iliac artery (CIA) and left external iliac artery (EIA) respectively where the FL of his left common iliac artery had formed a giant aneurysm of 10.6 cm. The true lumen (TL) of his left common iliac artery was completely collapsed by the aneurysm causing the malperfusion of his left lower limb (Figure 1b). Regarding visceral and renal perfusion, it was maintained exclusively through the TL. The patient was haemodynamically stable with well-controlled blood pressure; however, taking into consideration the risk of impending rupture, a decision was made to urgently treat the patient following a consecutive approach. Hence, under general anaesthesia, on a first stage, his right common femoral artery (CFA) was exposed and after gaining access to the TL of his thoracic aorta, a tapered thoracic stentgraft 36-32x209mm (Zenith Alpha, Cook) was successfully deployed covering the proximal entry point of the FL (Figure 1c). Following the procedure, the pulsatile mass in his left suprainguinal region was still present upon physical examination and the pulses in his left lower limb were not restored; however, no ischaemic symptoms were noticed.

On a second stage, after five days, under general anaesthesia, according to the PETTICOAT (provisional extension to induce complete attachment) technique, an aortic bare metal stent (BMS) 46x186mm (Zenith Dissection, Cook) was deployed through his right CFA, in his thoracic aorta, covering proximally the last two struts of the previous stentgraft and landing distally to his infrarenal aorta. Subsequently, a semi-compliant molding balloon 46mm (Reliant, Medtronic) was consecutively inflated across the scaffolding, trying to rupture the dissection membrane according to the STABILISE

Author for correspondence:

Emmanouil Barmparessos MD, MSc

Vascular Surgery Department, General Hospital of Athens "Georgios Gennimatas", 154 Mesogeion Avenue, 156 69, Athens, Greece

Tel: +30 6946519511, fax: +30 2132033470

E-mail: ebarbaressos@gmail.com

ISSN 2732-7175 / 2022 Hellenic Society of Vascular and Endovascular Surgery Published by Rotonda Publications
All rights reserved. <https://www.heljves.com>

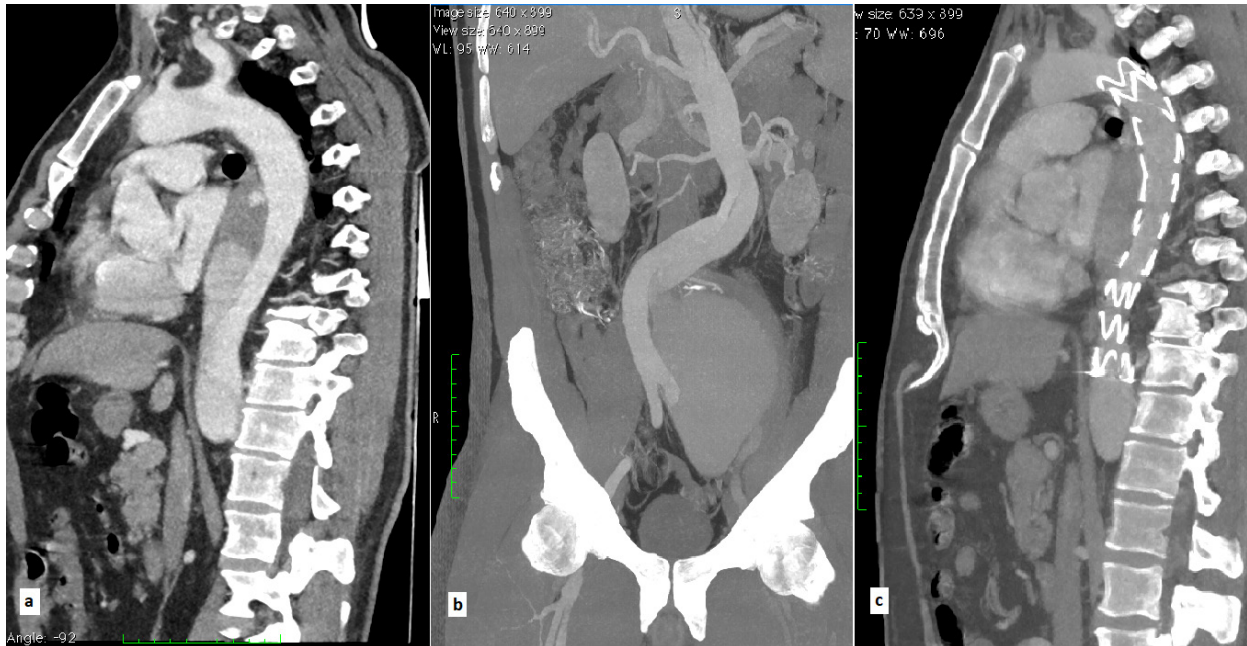


Figure 1. a) Preoperative Computed Tomography Angiography (CTA) on a sagittal plane. The intimal tear is located distal to the upper part of the descending thoracic aorta. b) Preoperative CTA scan on a frontal plane showing the 10.6 cm false lumen aneurysm of the left common iliac artery. c) Postoperative CTA scan. The thoracic stentgraft has sealed the entry point.

(Stent-assisted balloon-induced intimal disruption and relamination) technique. Then, a guidewire from his right CFA was advanced across the aortic bifurcation into the TL of his left CIA and was retrieved by his left CFA, using a snare catheter (EN Snare, Merit). Having access to the aortic TL from his bilateral CFA, an aortic cuff 28x58mm (Zenith Alpha, Cook) was delivered at his infrarenal aorta inside the distal part of the BMS and was followed by deploying a system of double D-shaped endografts 30x90mm (Altura, Lombard) which overlapped the aortic cuff, covered CIAs bilateral and reached his left EIA after the delivery of an iliac stentgraft extension 13x65mm (Altura, Lombard), similar to extended PETTICOAT technique.

The patient revived from the surgery; however, his pulsatile mass was not eliminated and although arterial signals were present upon doppler examination, his pulses distal to his left leg yet were not restored. A new CTA revealed a partial thrombosis of the proximal part of the FL; nonetheless, the persistent perfusion of the FL considerably constrained the expansion of the TL and still poured the aneurysm. Moreover, the left iliac extension was severely pressurized by the FL aneurysm inducing significant stenosis and a type Ib endoleak, at his right CIA, exaggerated the FL perfusion in combination with the patent lumbar arteries, at the level of aortic bifurcation (Figure 2).

Upon a third stage, under general anaesthesia, aortic stentgrafts 59x14mm (BeGraft, Bentley) were deployed by a kissing technique into the previous D-shaped endografts and a combination of balloon angioplasty 14x60mm (Atlas, Bard) along with stenting 13,5x40mm (Fluency plus, Bard), resolved the severe stenosis at his left iliac extension. Finally, the Ib endoleak was obliterated by deploying a bell-bottom stentgraft 16-27x100mm (Excluder, Gore) at the right CIA. Immediate af-

ter the procedure, the pulsatile mass was eradicated and the pulses to his left leg were restored.

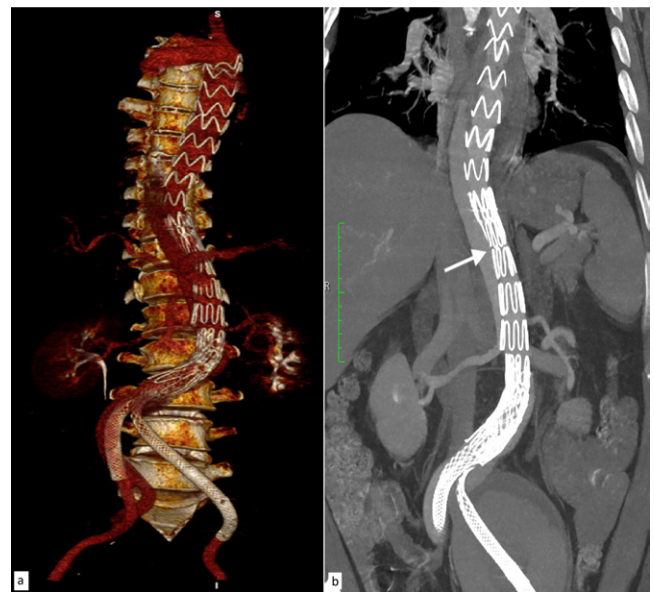


Figure 2. CTA scan after the second procedure. a) 3D reconstruction. The persistent flow in the false lumen is apparent and reinforced by the type Ib endoleak of the right iliac axis b) Frontal plane. The white arrow shows how the expansion of the true lumen is constrained by the false lumen. Other findings include the severe stenosis of the left iliac extension at the aortic bifurcation and the partial perfusion of the aneurysmal sac.

Following an unremarkable postoperative course, a new CTA showed adequate expansion of the aortic TL, depressurized FL with persistent flow due to his patent lumbar arteries and almost complete thrombosis of his aneurysm (Figure 3).



Figure 3. 3D reconstruction of the CTA after the final procedure. a) Frontal plane which exhibits the residual flow of the false lumen, the sufficient expansion of the true lumen and the exclusion of the left common iliac aneurysm. b) Right lateral view showing the positive aortic remodelling.

Upon a nine-month follow-up, the patient remains asymptomatic. Duplex scan failed to show perfusion of the aneurysm

and a new CTA exhibited a positive remodelling of the aorta where the total volume of the aneurysmal sac has significantly reduced (Figure 4). Nevertheless, the persistent slow flow of the FL necessitates vigilance and regular surveillance.

DISCUSSION

Complicated acute type B aortic dissection (cATBAD) is a rare, albeit lethal condition. The reported incidence of type B aortic dissection is 15 per 100,000 patients per year and 25% of the acutely presented are complicated with the in-hospital mortality being as high as 50%². Although the reported risk factors for inducing an intimal tear are mainly arterial hypertension, advanced age, previous aortic pathology and drug or strenuous activity which induce increased shear stress, none of the aforementioned was related to our patient’s history. Given his age, an underline connective tissue disorder is possible³.

There has been a consensus that thoracic endovascular repair (TEVAR) should be the initial approach for cATBAD with the open repair being the alternative option². However, there has been recently an increasing amount of evidence supporting that adjuvant techniques are necessary to promote optimal aortic remodelling⁴. TEVAR can seal the proximal entry tear and considerably decrease the pressure of the FL by redirecting the blood flow into the TL. Therefore, the size of the TL will be restored, and the FL will be thrombosed. However, the formation that the distal aorta will follow after TEVAR is unknown since the FL usually extends to the abdominal aorta and across the aortic bifurcation like in our case. It is also known that in most cases, several intimal defects across the aorta preserve the FL flow⁵. Moreover, the continuous oscillation of the dissecting lamella, following the cardiac cycle impedes the FL thrombosis. Persistent flow into the FL in the absence of a reentry point or outflow vessels would cause the rapid growth of the aortic diameter which is consistent with the evidence supporting that partial distal FL thrombosis is an independent predictor of late mortality⁶.

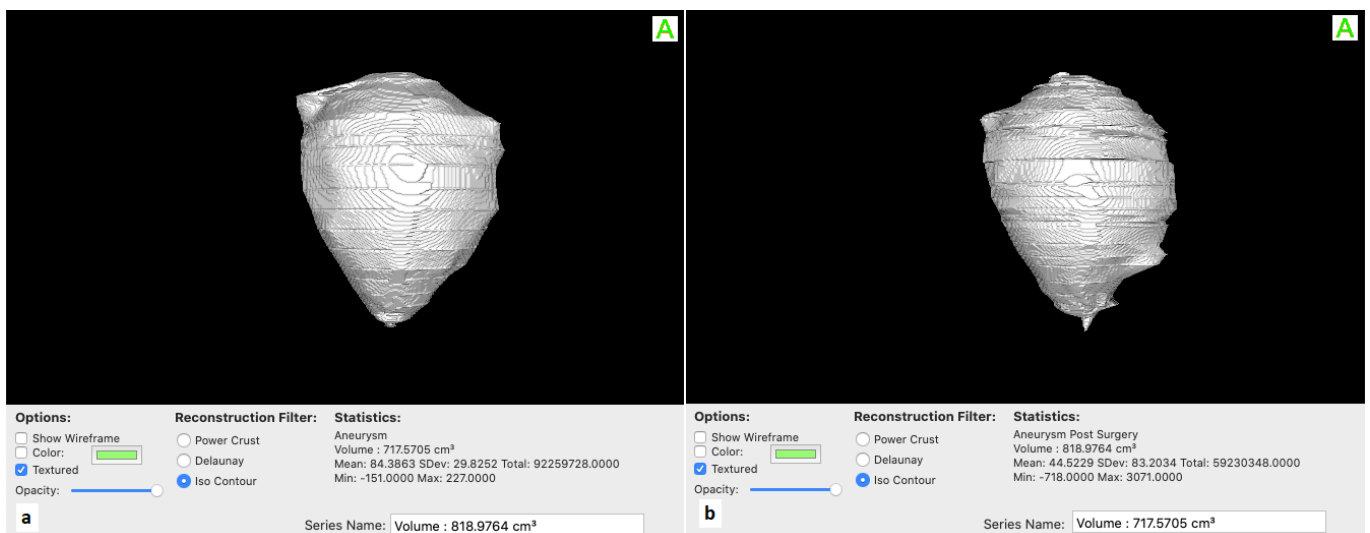


Figure 4. Segmentation of the false lumen common iliac aneurysm and comparison of the volume of the Region of Interest (ROI). a) On the preoperative CTA scan, the volume of the aneurysm is 818.97cm³. b) On the 9-month follow-up CTA scan, the volume of the aneurysm has considerably decreased at 715.57cm³.

Bertoglio et al. reviewed the recent literature regarding the use of the PETTICOAT technique and demonstrated overall 30-day mortality of 4,9% and 90.2% clinical success. Although TL and FL significantly and favourably altered across the studies, the FL continued to decrease in the thoracic aorta but remained stable in the abdominal aorta⁷.

Regarding our case, following the initial TEVAR, we deployed an aortic BMS distal to the thoracic stentgraft supporting the TL and fixing the lamella against the wall of the FL. The inflation of the semi-compliant balloon inside the stents attempted to increase the fixation by rupturing the dissecting membrane which is known as STABILISE technique. Melissano et al. assessed the latter technique in a case series reporting encouraging outcomes by comparing the preoperative with the postoperative volumes of the TL and FL in the follow-up⁶.

Trying to address the remodelling of the aorta beyond the aortic bifurcation, we utilized a modified type of the extended PETTICOAT technique that Kazimierczak et al. had recently described⁵. They presented in a case series of 17 patients with cATBAD, the deployment of parallel stentgrafts at the aortic bifurcation to increase the infrarenal radial force of the previously implanted aortic BMS, seal the distal entry points and promote the relamination of the membranes in the common iliac arteries. We slightly change their technique and by being more similar to the covered endovascular reconstruction of aortic bifurcation (CERAB) technique, an aortic infrarenal covered stent was deployed inside the BMS and was followed by a system of D-shaped endografts at the level of aortic bifurcation which helps to endure the expansion of the TL with fewer gutters and better haemodynamic behaviour⁸. However, a second pair of kissing stentgrafts was also necessary to fully expand the infrarenal aortic TL and along with the ballooning and stenting of the left iliac extension counteracted the pressure of the FL.

Our patient remains asymptomatic after nine months of the procedure. His last CTA revealed persistent slow perfusion of the sac in a delayed phase similar to type II endoleak and as is already recommended by the guidelines, life-long imaging surveillance is essential to reassure the optimal aortic remodeling².

CONCLUSION

Cases of complicated type B aortic dissection tend to have unique anatomical characteristics which necessitate an individual approach. Careful planning and proper adoption of the available techniques will promote the desirable aortic remodeling which still evolves after the treatment making the sur-

veillance a crucial aspect of the total management.

Prior presentation: The current case report was presented online, on 14/12/21, at a meeting of the Hellenic Society of Vascular Surgery (HSVES iMeeting)

Acknowledgements: None

Conflict of Interest: None declared

REFERENCES

- 1 Hofferberth SC, Foley PT, Newcomb AE, Yap KK, Yii MY, Nixon IK, et al. Combined proximal endografting with distal bare-metal stenting for management of aortic dissection. *Ann Thorac Surg.* 2012 Jan;93(1):95-102.
- 2 Rimbau V, Böckler D, Brunkwall J, Cao P, Chiesa R, Coppi G, et al. Editor's Choice - Management of Descending Thoracic Aorta Diseases: Clinical Practice Guidelines of the European Society for Vascular Surgery (ESVS). *Eur J Vasc Endovasc Surg.* 2017 Jan;53(1):4-52.
- 3 Evangelista A, Isselbacher EM, Bossone E, Gleason TG, Eusanio MD, Sechtem U, et al. Insights From the International Registry of Acute Aortic Dissection: A 20-Year Experience of Collaborative Clinical Research. *Circulation.* 2018 Apr 24;137(17):1846-1860.
- 4 Nienaber CA, Kische S, Zeller T, Rehders TC, Schneider H, Lorenzen B, et al. Provisional extension to induce complete attachment after stent-graft placement in type B aortic dissection: the PETTICOAT concept. *J Endovasc Ther.* 2006 Dec;13(6):738-46.
- 5 Kazimierczak A, Rynio P, Jędrzejczak T, Samad R, Rybicka A, Gutowski P. Aortic Remodeling After Extended PETTICOAT Technique in Acute Aortic Dissection Type III B. *Ann Vasc Surg.* 2020 Jul;66:183-192.
- 6 Melissano G, Bertoglio L, Rinaldi E, Mascia D, Kahlberg A, Loschi D, et al. Satisfactory short-term outcomes of the STABILISE technique for type B aortic dissection. *J Vasc Surg.* 2018 Oct;68(4):966-975.
- 7 Bertoglio L, Rinaldi E, Melissano G, Chiesa R. The PETTICOAT concept for endovascular treatment of type B aortic dissection. *J Cardiovasc Surg (Torino).* 2019 Feb;60(1):91-99.
- 8 Groot Jebbink E, Grimme FA, Goverde PC, van Oostayen JA, Slump CH, Reijnen MM. Geometrical consequences of kissing stents and the Covered Endovascular Reconstruction of the Aortic Bifurcation configuration in an in vitro model for endovascular reconstruction of aortic bifurcation. *J Vasc Surg.* 2015 May;61(5):1306-11