

# A Case of Type B Aortic Dissection: The Role of Transesophageal Ultrasound Guidance in Thoracic Endovascular Aortic Repair

Giancarlo Trimarchi, Giovanni Benedetti<sup>1</sup>, Cataldo Palmieri<sup>1</sup>, Antonio Rizza<sup>1</sup>

Department of Clinical and Experimental Medicine, Cardiology Unit, University of Messina, Messina, <sup>1</sup>Department of Cardiology and Cardiac Surgery, Fondazione Toscana G. Monasterio, Massa, Italy

## Abstract

Thoracic endovascular aortic repair (TEVAR) plays a central role in managing acute and chronic aortic pathologies. With the advancement of transcatheter structural heart procedures, echocardiography has become a key in procedural guidance. Despite consensus on its use for cardiac interventions, ultrasound assistance in aortic procedures is not widely standardized. A 71-year-old obese man with chronic type B aortic dissection underwent a TEVAR procedure, using a single-branched aortic stent graft (Endovastec™ Castor™) and with transesophageal ultrasound guidance. The preprocedural assessment confirmed the presence of aortic dissection of the descending thoracic aorta with a posterior true lumen (TL) and an anterior false lumen (FL), normal aortic valve anatomy and function, normal left ventricular function, absence of intracavity thrombus, and absence of aortic plaques that could prevent the optimal implantation of the stent graft. During the procedure, a transesophageal echocardiogram (TEE) monitored the positioning of the guide wires, the arrival of the catheter of the thoracic endoprosthesis, and then the implantation of this at the level of the aortic arch and the descending thoracic aorta. Postprocedure TEE evaluation underlined full stent-graft deployment without leaks and successful exclusion of FL with the beginning of thrombosis. Angiography confirms the exclusion of the aneurysm and the absence of endoleaks. This clinical case demonstrates how transesophageal echocardiographic guidance can improve the TEVAR procedure by minimizing fluoroscopy time, contrast medium use, and enabling a better assessment of the dissection anatomy with real-time monitoring of both the TL and the FL. In conclusion, TEE can serve as an auxiliary intraoperative imaging tool to provide good information before, during, and after the procedure, increasing the success and safety of the TEVAR.

**Keywords:** Aortic dissection, transesophageal echocardiography, transthoracic endovascular aortic repair

## INTRODUCTION

Thoracic endovascular aortic repair (TEVAR) is a recognized therapeutic option for the management of both complicated acute or chronic aortic dissections, other acute aortic syndromes, and descending aortic aneurysms.<sup>[1,2]</sup>

Over the last decades, the development and acceptance of transcatheter structural heart procedures have made echocardiography an unquestionably fundamental tool for procedural guidance.<sup>[3]</sup>

Although there is general agreement regarding the use of periprocedural Transesophageal echocardiogram (TEE) in structural cardiac interventions like mitral valve interventions or left auricular appendage closure, ultrasound assistance

is still not widely accepted and standardized as an addition to interventional procedures on the aorta.<sup>[4]</sup> This case report provides an example of transesophageal ultrasound guidance in the TEVAR procedure in a man with type B aortic dissection.

**Address for correspondence:** Dr. Giancarlo Trimarchi, Department of Clinical and Experimental Medicine, University of Messina, AOU G.Martino, Via Consolare Valeria 1 98125, Messina, Italy. E-mail: giancarlo.trimarchi18@gmail.com

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

**For reprints contact:** WKHLRPMedknow\_reprints@wolterskluwer.com

**Submitted:** 12-Oct-2023  
**Accepted:** 29-Oct-2023

**Revised:** 28-Oct-2023  
**Published:** 20-Nov-2023

**How to cite this article:** Trimarchi G, Benedetti G, Palmieri C, Rizza A. A case of type B aortic dissection: The role of transesophageal ultrasound guidance in thoracic endovascular aortic repair. *J Cardiovasc Echography* 2023;33:148-52.

### Access this article online

#### Quick Response Code:



**Website:**  
<https://journals.lww.com/JCEG>

**DOI:**  
10.4103/jcecho.jcecho\_64\_23

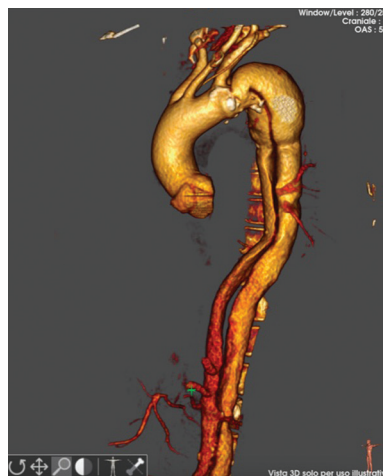
## CASE REPORT

A 71-year-old obese man was diagnosed with an acute type B aortic dissection in August 2018 through a thoracic angio-computed tomography (CT) scan, managed with medical therapy and routine follow-up, according to current guidelines.<sup>[2]</sup> His medical history includes hypertension, ulcerative colitis, type 2 diabetes, obesity (body mass index 31.7 kg/mq), and hyperuricemia. At discharge, the descending thoracic aorta was 43 mm at its point of maximum dilatation.

After a period of slow progression and clinical stability, in May 2023, an angio-CT scan [Figure 1] showed an increase in the ectasia of the descending thoracic aorta, which at the point of maximum dilatation reached 55 mm of anteroposterior diameter and 55 mm of laterolateral diameter, 4 mm more than the previous check performed 6 months ago. Considering the growth of the aneurysm's size, the indication was to proceed with TEVAR. As the extent of the dissection was just beneath the left subclavian artery (LSA) origin with a limited landing zone, we used a single-branched aortic stent graft (Endovastec™ Castor™) [Figure 2] to exclude entry tear, to preserve the LSA by using branch section and to prevent types Ia and II endoleaks and prosthesis migration.<sup>[4]</sup>

The procedure was carried out under general anesthesia, with TEE guidance and fluoroscopy. All arterial accesses were obtained by percutaneous technique, according to Seldinger. The TEE confirmed the presence of aortic dissection of the descending thoracic aorta with a posterior true lumen (TL) and an anterior false lumen (FL) [Figure 3]. A 6 F pigtail catheter was inserted into the ascending aorta through a right radial arterial route for aortic angiographies. This was followed by securing a 10 F access to the right femoral artery, paired with the initial implantation of dual percutaneous closure mechanisms, subsequently upgraded to 24 F. An 8 F access into the left brachial artery was then established. A wire was subsequently routed from the brachial entry point to the femoral one. After being captured with a gooseneck, it was outsourced, creating a brachial-femoral loop. A multipurpose catheter was then guided along the guidewire. Consequentially, an ultra-stiff guidewire (0.035") was navigated through the femoral access toward the ascending aorta. The guide preloaded with the branch is introduced into the multipurpose catheter and advanced to the origin of the LSA (in parallel with the stiff guide). The correct positioning of the guides and catheters into TL was carefully monitored using TEE [Figures 4 and 5].

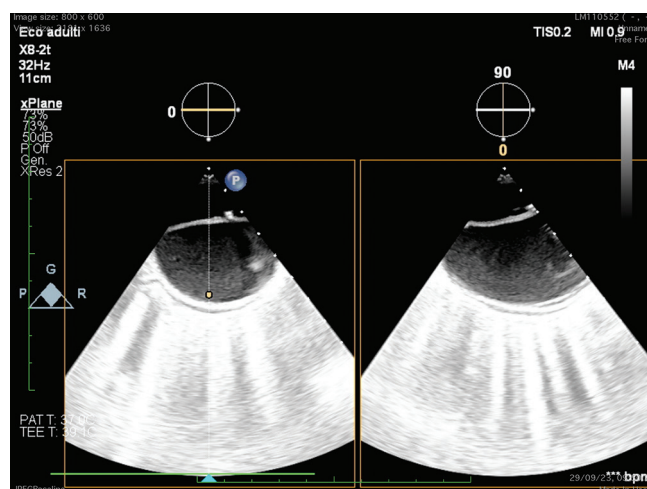
The positioning and release of a Castor 34 mm × 28 mm × 200 mm stent graft with a 14 mm × 25 mm branch for LSA, was carried out entirely under ultrasound guidance [Figure 6]. TEE was useful to assess the correct positioning of the endoprosthesis, its proper expansion, and the early thrombotic formation in the FL [Figures 7 and 8]. Angiography, at the end of the procedure, confirms the correct endoprosthesis sealing at the level of the proximal portion of the descending aorta and the branch adhesion to the walls of



**Figure 1:** Preoperative three-dimensional volume rendering computed tomography angiography reconstruction of the thoracic aorta showing Type B aortic dissection



**Figure 2:** Single-branched aortic stent graft (Endovastec™ Castor™)



**Figure 3:** Transesophageal two-dimensional X-Plane view on thoracic aorta showing a Type B aortic dissection with a posterior true lumen and an anterior false lumen. TEE: Transesophageal echocardiogram

the vessel with the exclusion of the aneurysm (FL) and the absence of endo-leak [Figure 9].

The patient was discharged on the 2<sup>nd</sup> day after the procedure in good clinical condition and with good hemodynamic compensation, without complications during the postoperative course.

## DISCUSSION

Endovascular management is a key treatment for complicated and high-risk type B dissection.<sup>[1]</sup> TEVAR's purpose is to cover the primary entry and remodel the aorta by expanding the TL at the FLs expense, thereby redirecting flow to the TL. This

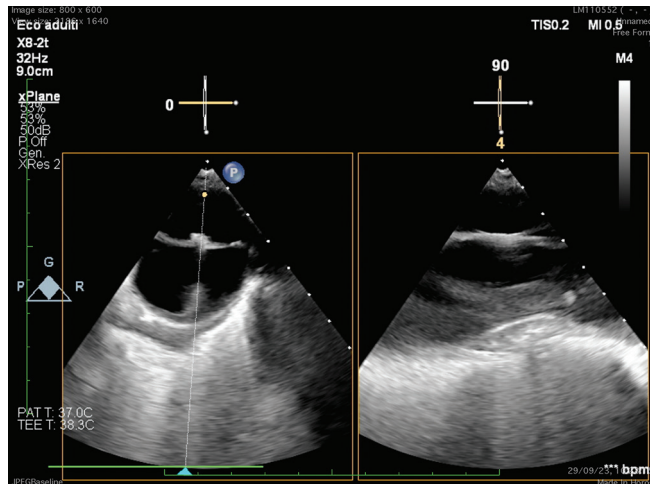
corrects distal malperfusion and protects against long-term aneurysmal degeneration of the distal aorta.<sup>[2]</sup>

TEVAR is typically conducted through femoral artery access using a large device carrying a self-expandable stent graft. It is guided through fluoroscopy, with a stiff guidewire in TL. TEE provides additional intraoperative imaging, helping increase the procedure's success and safety by supplying information before, during, and after the intervention.<sup>[5]</sup> Preprocedural TEE should focus on confirming the underlying aortic condition and giving an estimated measure of the aortic dimensions and flows in TL and FL. It is crucial to assess the proximal ascending aorta before starting the endovascular procedure to ensure it is not involved.<sup>[6]</sup>

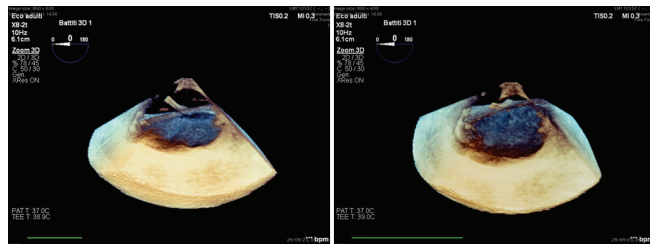
If feasible, the supra-aortic vessels should be evaluated for the existence of aortic plaques whose presence could hinder the fit of the stent graft and promote leaks after a TEVAR procedure.<sup>[7]</sup> Most TEVAR procedures are carried out under general anesthesia and TEE is generally well accepted by patients and does not cause any delay in the procedure.<sup>[8]</sup>

Before any stent-graft implantation, TEE is essential for accurately determining TL and putting the wires within it during the TEVAR procedure, while fluoroscopy alone may not be able to accurately confirm wire placement and movement along the TL, especially when there is a spiral path involved. In addition, TEE makes it simple to validate the exact location of a separate pig-tail catheter inside the TL when it is needed for angiography or progressing the stent graft. As a result, each time a catheter or wire is introduced, TEE can verify its location along the aorta while the operator manipulates.<sup>[9]</sup>

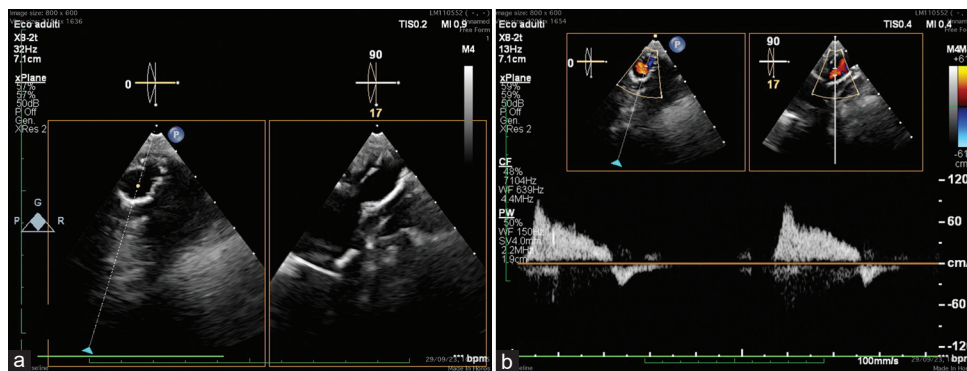
After stent-graft implantation, TEE can help ascertain its full deployment as well as the successful exclusion of the FL or aneurysmal sac. A “smoke” phenomenon visible in the FL is a positive indicator, signifying the beginning of thrombosis, and the closure of an entry tear. Color-Doppler imaging can aid in locating any residual flow within the FL, or endovascular leaks that call for further intervention. Persistent perfusion in the FL typically reveals an unsuccessful sealing of an entry tear, trouble with the alignment of the stent graft, damage to



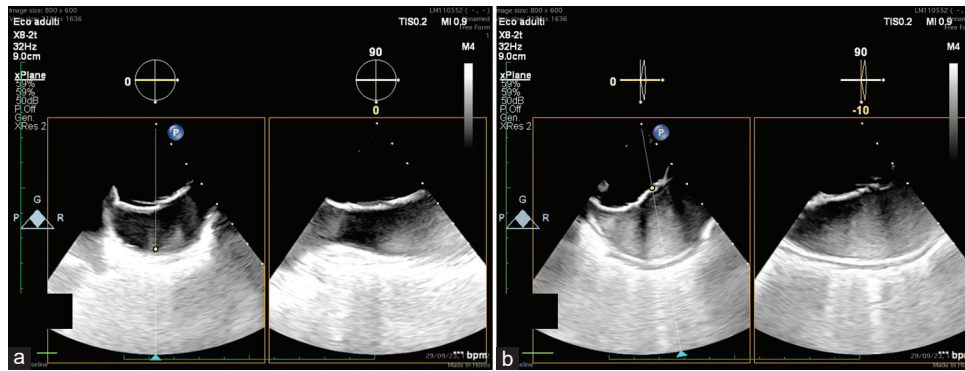
**Figure 4:** Transesophageal two-dimensional X-Plane view showing the positioning of the guide into true lumen. TEE: Transesophageal echocardiogram



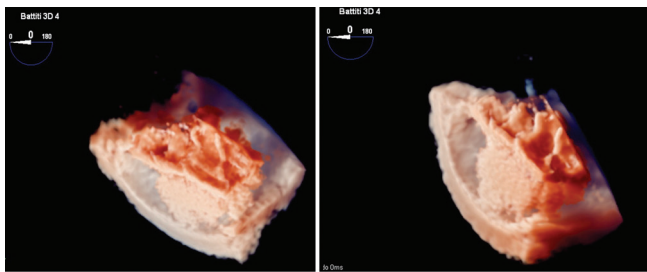
**Figure 5:** Three-dimensional transesophageal echocardiography showing the positioning of the catheter into true lumen. 3D: Three-dimensional, TEE: Transesophageal echocardiogram



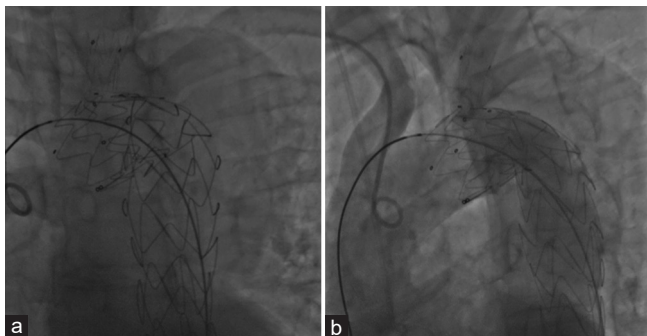
**Figure 6:** Transesophageal two-dimensional X-Plane view showing the positioning of the side branch of the endoprosthesis for the left subclavian artery (a) and spectral PW Doppler demonstrating typical subclavian artery spectral flow (b)



**Figure 7:** Transesophageal two-dimensional X-Plane view showing the endoprosthesis placed in the proximal descending aorta (a) and the early thrombotic formation (smoke effect) in the false lumen (b)



**Figure 8:** Transesophageal echocardiogram TrueVue transillumination volume rendering showing from two different points of view, showing the adhesion of the endoprosthesis to the thoracic aorta wall and early thrombotic formation in the false lumen. 3D: Three-dimensional



**Figure 9:** Angiography, at the end of the procedure, without (a) and with (b) contrast medium showing the correct endoprosthesis sealing at the level of the proximal portion of the descending aorta, the branch adhesion to the walls of the vessel and the absence of endo-leak

stent struts, or the presence of additional entry points distal to the stent graft.<sup>[8]</sup>

TEE is more sensitive than fluoroscopy or CT at detecting persistent leaks in the acute period (after stent-graft deployment) because of its superior spatial and temporal resolution and Doppler signal.<sup>[10]</sup> It is also helpful in excluding retrograde dissection into the aortic arch and proximal ascending aorta. In addition, TEE should be used to check if the supra-aortic branches have been incarcerated by the device. Before ending a case, it is important to rule out any additional potential issues, such as the development of pericardial effusion and abnormal left ventricular function.<sup>[11]</sup> In the case of using

single-side branch TEVAR devices, such as the Castor, the TEE is essential for verifying the correct adhesion of the main body of the prosthesis and the branch to the arterial wall, as well as the good sealing and stability of the same prosthesis at the proximal level. The use of TEE monitoring reduces fluoroscopy times and the amount of iodinated contrast medium used during the procedure, thus lowering the time of exposure to ionizing radiations and the possible adverse effects related to the use of contrast medium, in particular contrast-induced nephropathy.

## CONCLUSION

This clinical case shows how TEE can give fundamental information before, during, and after the surgery as an auxiliary intraoperative imaging tool, improving the intervention's success and safety. Even though learning the TEE abilities required to collect the information given here takes time and proper training, our experience suggests that TEE is advantageous, and its usefulness can be worth the effort.

## Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his consent for his images and other clinical information to be reported in the journal. The patient understands that his name and initials will not be published and due efforts will be made to conceal his identity, but anonymity cannot be guaranteed.

## Financial support and sponsorship

Nil.

## Conflicts of interest

There are no conflicts of interest.

## REFERENCES

1. Czerny M, Pacini D, Aboyans V, Al-Attar N, Eggebrecht H, Evangelista A, *et al.* Current options and recommendations for the use of thoracic endovascular aortic repair in acute and chronic thoracic aortic disease: An expert consensus document of the European Society for Cardiology (ESC) working group of cardiovascular surgery, the ESC working group on aorta and peripheral vascular diseases, the European Association of Percutaneous Cardiovascular Interventions (EAPCI) of the ESC and the European Association for Cardio-Thoracic Surgery (EACTS). *Eur J Cardiothorac Surg*

- 2021;59:65-73.
2. Isselbacher EM, Preventza O, Hamilton Black J 3<sup>rd</sup>, Augoustides JG, Beck AW, Bolen MA, *et al.* 2022 ACC/AHA guideline for the diagnosis and management of aortic disease: A report of the American Heart Association/American College of Cardiology Joint Committee on clinical practice guidelines. *Circulation* 2022;146:e334-482.
  3. Patel H, Raisinghani A, DeMaria A. Echocardiography in transcatheter structural heart disease interventions. *Prog Cardiovasc Dis* 2018;61:423-36.
  4. Castro-Verdes M, Yuan X, Mitsis A, Li W, Nienaber CA. Transesophageal ultrasound guidance for endovascular interventions on the aorta. *Aorta (Stamford)* 2022;10:3-12.
  5. Kong X, Ruan P, Yu J, Chu T, Gao L, Jiang H, *et al.* Single-center experience with a unibody single-branched stent graft for zone 2 thoracic endovascular aortic repair. *Front Cardiovasc Med* 2022;9:995173.
  6. Grabenwöger M, Alfonso F, Bachet J, Bonser R, Czerny M, Eggebrecht H, *et al.* Thoracic Endovascular Aortic Repair (TEVAR) for the treatment of aortic diseases: A position statement from the European Association for Cardio-Thoracic Surgery (EACTS) and the European Society of Cardiology (ESC), in collaboration with the European Association of Percutaneous Cardiovascular Interventions (EAPCI). *Eur Heart J* 2012;33:1558-63.
  7. Daye D, Walker TG. Complications of endovascular aneurysm repair of the thoracic and abdominal aorta: Evaluation and management. *Cardiovasc Diagn Ther* 2018;8:S138-56.
  8. Burke CR, Bavaria JE. The role of thoracic endovascular repair in chronic type B aortic dissection. *Semin Thorac Cardiovasc Surg* 2020;32:21-4.
  9. Bhave NM, Nienaber CA, Clough RE, Eagle KA. Multimodality imaging of thoracic aortic diseases in adults. *JACC Cardiovasc Imaging* 2018;11:902-19.
  10. Nana PN, Brotis AG, Tsolaki V, Spanos K, Mpatzalexis K, Zakyntinos E, *et al.* Transesophageal echocardiography during endovascular procedures for thoracic aorta diseases: Sensitivity and specificity analysis. *J Cardiovasc Surg (Torino)* 2021;62:79-86.
  11. Hirose N, Orihashi K, Miyashita K, Tashiro M, Kihara K, Yamamoto M. Advantages of transesophageal echocardiography during stent grafting for aortic dissection: A report of three cases. *Ann Vasc Dis* 2018;11:557-61.