

# Endovascular occlusion of an aortic coarctation after thoracic endovascular aortic repair of an anastomotic aneurysm

Tea Covic 

Nicola Leone 

Stefano Gennai 

Roberto Silingardi 

## ABSTRACT

A 58-year-old man with a history of aortic and mitral mechanical valve replacement was referred to our hospital for symptomatic chronic heart failure. In 1988, he had undergone open surgical correction of an isthmic aortic coarctation (CoA), with the creation of an extra-anatomic bypass from the left subclavian artery to the descending thoracic aorta. The following findings were found: severe mitral valve failure with perivalvular leakage, severe aortic valve stenosis, pulmonary hypertension, distal anastomotic aneurysm with the apparent occlusion of the CoA. A thoracic endovascular aneurysm repair was performed. A postoperative high-pressure leak with no evident signs of ineffective sealing was observed. Computed tomography angiography (CTA) 3D reconstruction demonstrated the recanalization of the CoA. A second procedure was planned. The CoA was anterogradely cannulated. Three coils were deployed into the aneurysmal sac, followed by a vascular plug, positioned on the coarctation conduit, but it failed to anchor and dislocated into the sac. A second plug was deployed, but it also partially dislocated. Finally, a patent foramen ovale occluder device was deployed to occlude the communication. The final angiogram showed the complete occlusion of the coarctation and correction of the leak, which was confirmed by a 6-month post-operative CTA.

For patients who undergo surgical repair of aortic coarctation (CoA), lifelong follow-up should be mandatory, due to the risk of long-term complications. Up-to-date guidelines suggest surgical correction of the CoA in infants, in order to maintain the aortic flow, while an endovascular approach is preferred in adults (1, 2). We describe a case of CoA catheter-based occlusion with a patent foramen ovale (PFO) closure device.

A 58-year-old man with a history of aortic and mitral mechanical valve replacement was referred to our hospital for symptomatic chronic heart failure. In 1988, he had undergone open surgical correction of an isthmic aortic coarctation, with the creation of an extra-anatomic bypass from the left subclavian artery to the descending thoracic aorta.

Transesophageal and transthoracic ultrasound evaluations showed severe mitral valve failure with perivalvular leakage, severe aortic valve stenosis, and pulmonary hypertension. Computed tomography angiography (CTA) confirmed the aforementioned findings and showed enlargement of the anastomotic aneurysm (from 47 mm to 58 mm) with the apparent occlusion of the CoA (Fig. 1a). Progressive worsening of the symptoms required prompt surgical substitution of the mechanic valves. However, after consultation with the cardiac surgery team, it was decided to postpone the procedure to perform thoracic endovascular aneurysm repair (TEVAR) first, in order to reduce the risk of aneurysm rupture during open heart surgery.

## Technique

A standard TEVAR was performed with a Conformable C-TAG (31/150 mm; W. L. Gore and Associates) (Fig. 1b). The stentgraft was introduced through the femoral access. It was advanced over a 400 mm hydrophilic guidewire (Radifocus, Terumo) via through-and-through technique following the surgical exposure of the right femoral and the left axillary. A 6 F Flexor sheath (Cook Medical) was introduced from the axillary access. The endograft was advanced into the ostium of the subclavian artery and the axillary sheath was used to capture the tip of the delivery system to avoid injury to the vessel. Final angiography confirmed

From the Department of Vascular Surgery (N.L. [✉ nicola.leone.md@gmail.com](mailto:nicola.leone.md@gmail.com)), Civil Hospital of Baggiovara, University of Modena and Reggio Emilia, Modena, Italy.

Received 26 May 2020; revision requested 8 June 2020; last revision received 22 June 2020; accepted 6 July 2020.

Published online 20 May 2021.

DOI 10.5152/dir.2021.20385

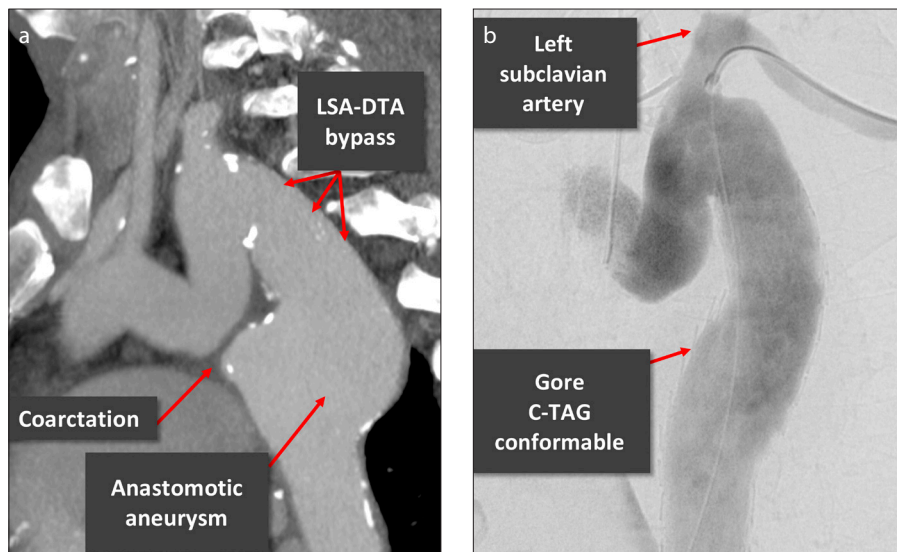
You may cite this article as: Covic T, Leone N, Gennai S, Silingardi R. Endovascular occlusion of an aortic coarctation after thoracic endovascular aortic repair of an anastomotic aneurysm. *Diagn Interv Radiol* 2021; 27:567-569

correct deployment without any obvious sign of proximal and distal endoleak. The postoperative CTA showed a high pressure leak with no evident signs of ineffective sealing (Fig. 2a). The 3D reconstruction demonstrated recanalization of the 3 mm CoA. A second endovascular correction was planned to occlude the CoA. Percutaneous access of the right brachial artery was performed. The CoA was anterogradely cannulated with a 6 F Flexor sheath (Cook Medical) and a Supracore wire (Abbott). Three Azur Detachable (Terumo) coils were deployed into the aneurysmal sac, followed by an Amplatzer II 6 mm vascular plug (St. Jude Medical), positioned on the coarctation conduit, but it failed to anchor and dislocated into the aneurysmal sac. A second Amplatzer II Plug was deployed, but it also partially dislocated into the sac. Finally, in collaboration with the cardiology team, an Amplatzer PFO Occluder 18 mm (St. Jude Medical) was deployed through an Amplatzer TorqVue 8 F sheath occluding the communication, as shown in Fig. 2b.

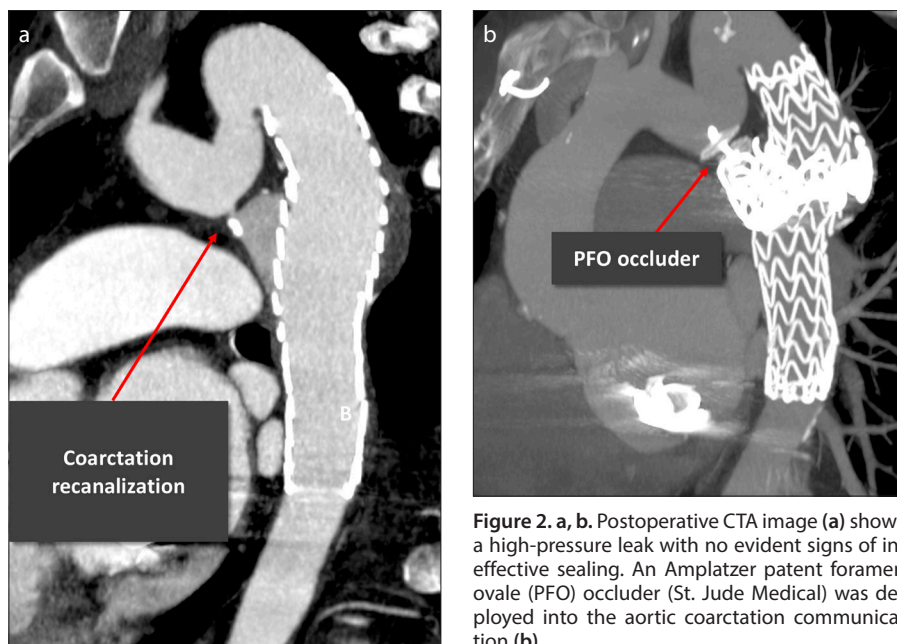
The final angiogram showed complete occlusion of the coarctation and correction of the leak, which was confirmed by postoperative CTA and 6-month follow-up CTA (Fig. 3).

## Discussion

According to up-to-date guidelines for the management of adult congenital heart diseases, an endovascular option for treating CoA should be considered, because it reduces the risks of open surgery and still preserves high-pressure blood flow in the aorta, thus avoiding upper extremity hypertension and consequent cardiac hypertrophy and cardiac failure (1, 3). The patient had underwent extra-anatomic subclavian-aortic bypass in the late 80s, when the



**Figure 1. a, b.** Computed tomography angiography (CTA) image (a) confirms enlargement of the anastomotic aneurysm with apparent occlusion of the aortic coarctation. Standard thoracic endovascular aortic repair was performed with a Conformable C-TAG (b, 31/150 mm, W. L. Gore and Associates). LSA, left subclavian artery; DTA, descending thoracic aorta.



**Figure 2. a, b.** Postoperative CTA image (a) shows a high-pressure leak with no evident signs of ineffective sealing. An Amplatzer patent foramen ovale (PFO) occluder (St. Jude Medical) was deployed into the aortic coarctation communication (b).

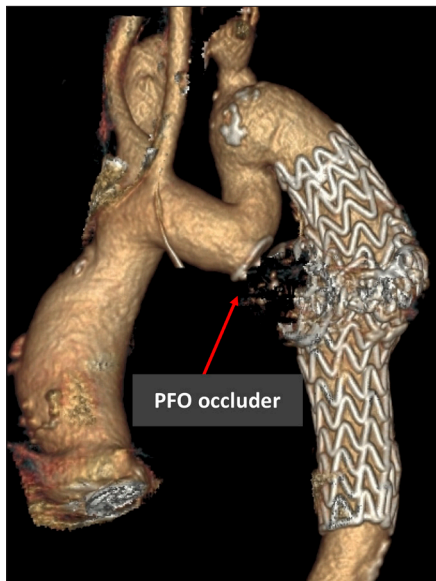
### Main points

- The present case showed an aortic coarctation acting as the source of high pressure endoleak.
- The endoleak was corrected using an occluding device, which was originally designed for cardiac use but showed excellent results in a different location, such as the aortic coarctation.
- The present experience underlines the importance of a multidisciplinary approach in the treatment of aortic pathologies, especially in anatomically complex regions.

endovascular field was not as advanced as it is today.

The TEVAR was completed via through-and-through technique. This technique is usually performed in case of severe aorto-iliac angulation. The application in this specific case was different. The bypass from the left subclavian artery to the descending thoracic aorta was short and presented an acute angulation with respect to the subclavian vessel. Thus, the delivery system (22 F) would be advanced into the subcla-

vian artery. The subclavian artery is weaker than major vessels and the sheath diameter was not negligible. All that said, we preferred this approach to capture the tip of the delivery system with a sheath advanced from the brachial artery. Once the brachial sheath captured the tip of the delivery system into the aorta, the devices were united over the through-and-through wire. Thanks to this trick the tip followed the wire and reduced the possibility of vessel injury even in acute angulation.



**Figure 3.** Six-month follow-up CTA shows complete occlusion of the coarctation and correction of the leak.

Due to the radiological presentation, in which the coarctation appeared closed, the endograft was deployed over the distal anastomosis of the bypass (Fig. 1b). We

suppose that the recanalization was already present at admission CTA, but not visible. Still, angioplasty and/or stenting was not feasible anymore and the CoA, acting as the source of leakage, had to be occluded (Fig. 2a). However, the morphology of the CoA conduit was not suitable to be plugged with the Amplatzer II (St. Jude Medical). Specifically, it was short, resembling a “hole” more than a conduit. With this presentation, a device designed to occlude such morphology was required.

To the authors’ knowledge, this is the first case in the literature to report the use of a cardiac device (PFO occluder) for this purpose, through an entirely endovascular procedure. A similar approach has been described to seal the entry tear in aortic dissections or in hybrid interventions for CoA (4, 5).

In conclusion, the case showed that advanced endovascular skills may expand the field of catheter-based interventions even to correct late open complications. The present experience underlines the importance of a multidisciplinary approach in the treatment of aortic pathologies, especially in anatomically complex regions.

### Conflict of interest disclosure

The authors declared no conflicts of interest.

### References

1. Stout KK, Daniels CJ, Aboulhosn JA, et al. 2018 AHA/ACC guideline for the management of adults with congenital heart disease. *J Am Coll Cardiol* 2019; 73:e81–e192. [\[Crossref\]](#)
2. Erbel R, Gørges G, Gerber T, et al. Dissection following balloon angioplasty of aortic coarctation: review of the literature. *J Intervent Cardiol* 1992; 5:99–109. [\[Crossref\]](#)
3. Dijkema EJ, Leiner T, Grotenhuis HB. Diagnosis, imaging and clinical management of aortic coarctation. *Heart Br Card Soc* 2017; 103:1148–1155. [\[Crossref\]](#)
4. Yuan X, Mitsis A, Mozalbat D, et al. Novel endovascular management of proximal type A (DeBakey II) aortic dissection with a patent foramen ovale occluder. *J Endovasc Ther Off J Int Soc Endovasc Spec* 2017; 24: 809–813. [\[Crossref\]](#)
5. Pu X-B, Chen S-J, Chen M, et al. Two-stage hybrid treatment strategy for an adult patient with aortic arch coarctation, poststenotic aneurysm, and hypoplastic left subclavian artery: A case report. *Medicine (Baltimore)* 2017; 96:e8618. [\[Crossref\]](#)