Rescue of Compromised Cerebral Circulation in Hybrid TEVAR for Type B Aortic Dissection

Karthikeyan Muthugounder Athiyappan[1] Mathew Cherian[1] Santhosh Poyyamoli[1]

[1] Department of Interventional Radiology, Kovai Medical Centre, Coimbatore, Tamil Nadu, India

J Clin Interv Radiol ISVIR 2023;7:133–135.

Address for correspondence Karthikeyan Muthugounder Athiyappan, MBBS, MD, Department of Interventional Radiology, Kovai Medical Centre, Coimbatore, Tamil Nadu, India (e-mail: drkarthi001@gmail.com).

Clinical Details

A 60-year-old female presented with complicated type B aortic dissection (end organ ischemia), with location of entry tear just distal to origin of left subclavian artery (►**Fig. 1A**). She had a hypoplastic right vertebral artery ending as posterior inferior cerebellar artery, with dominant left vertebral artery solely constituting the vertebrobasilar circulation (►**Fig. 1B**). Hence, she was planned for emergency left subclavian artery to common carotid artery (CCA) bypass, followed by hybrid thoracic endovascular aortic repair (TEVAR).

Procedure Details

Patient underwent left carotid-subclavian bypass as the first stage under general anesthesia. Aortogram following the carotid-subclavian bypass showed a patent bypass, with nonvisualization of left vertebral artery suggesting an inadvertent involvement of the vertebral artery origin during the subclavian ligation (►**Fig. 1C**). Since the left vertebral artery was the predominant supply to the posterior circulation, and the patient was under general anesthesia, there was an uncertainty regarding perfusion of the posterior circulation. Selective common carotid angiograms were performed to assess the circle of Willis, which showed retrograde filling of the entire basilar artery through right posterior communicating artery (Pcom) with no venous delay (►**Fig. 1E, F**). In view of adequate cross-circulation, we proceeded for TEVAR through right femoral artery cutdown. Under fluoroscopy guidance, the proximal part of the aortic stent graft (34mm×200mm Reliant Aortic stent graft, Medtronic, Minneapolis, United States) was positioned distal to the left CCA (►**Fig. 2A**), and the stent graft was deployed. Postdeployment aortogram showed inadvertent partial coverage of the left CCA ostium by the aortic stent graft, with significant systolic arterial pressure gradient (50mm Hg) between the upper limbs (►**Fig. 2B**). Hence, the left CCA was cannulated from the left femoral access, and bail out stenting (►**Fig. 2C, D**) was performed using a 7×37mm balloon expandable stent (Express LD, Boston Scientific, Massachusetts, United States). Postprocedure aortogram showed patent left CCA stent and carotid-subclavian bypass with no significant residual pressure gradient (►**Fig. 2E**). She was extubated in the intensive care unit with no neurological deficits. Her postprocedure hospital stay was uneventful. Follow-up CT aortogram after 2 months showed obliteration of false lumen of thoracic aorta with patent left CCA stent (►**Fig. 2F**).

Discussion

TEVAR/hybrid TEVAR has become the standard of care in complicated type B aortic dissection.[1] Despite decreased morbidity and mortality in comparison with surgery, it has its own complications, which should be promptly recognized and managed to optimize the outcome. Arch debranching in acute aortic syndromes can rarely be associated with compromise of the cerebral blood vessels due to operative

article published online
September 12, 2022

DOI https://doi.org/10.1055/s-0042-1755610.
ISSN 2457-0214.

Thieme Medical and Scientific Publishers Pvt. Ltd., A-12, 2nd Floor, Sector 2, Noida-201301 UP, India

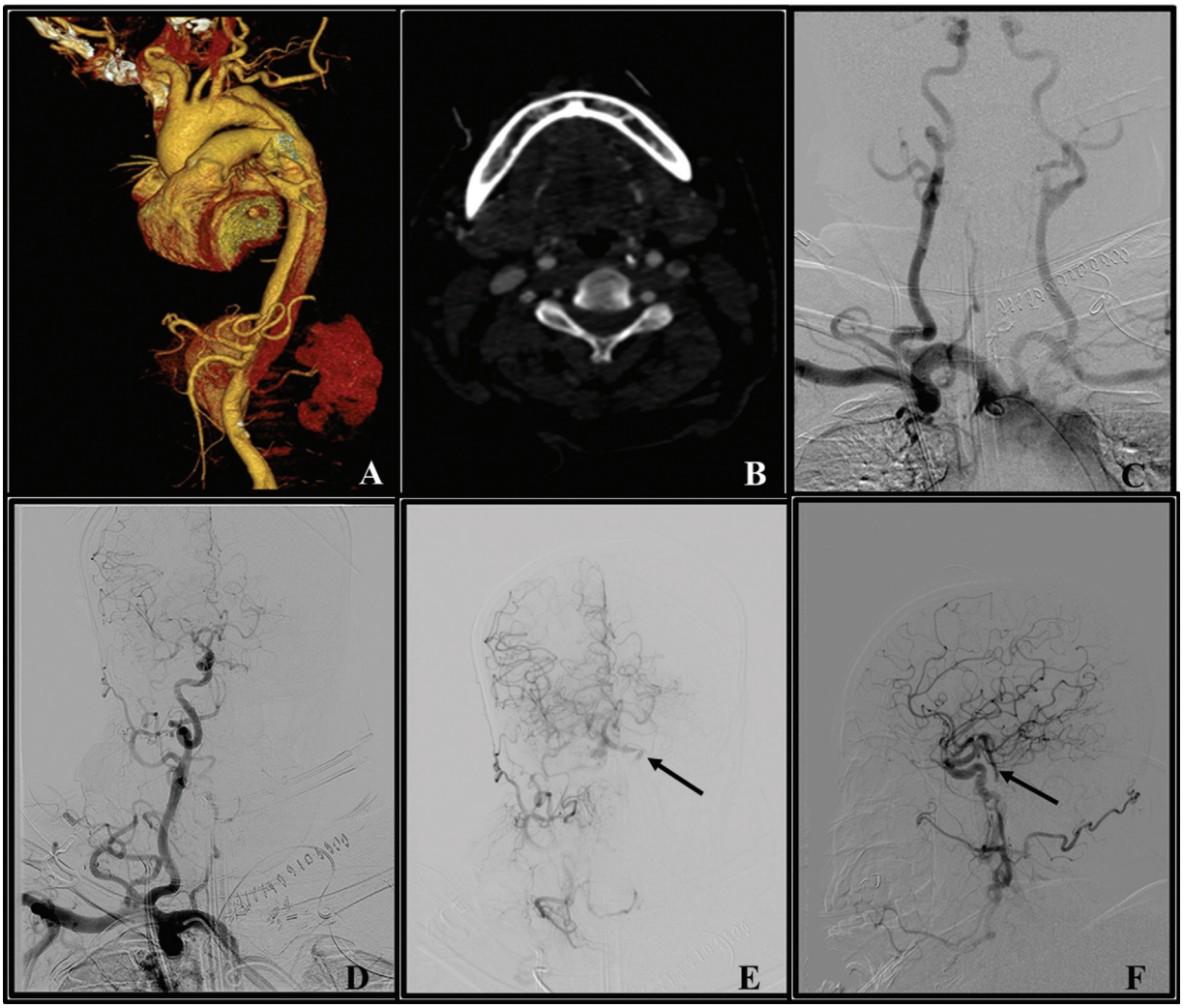

Fig. 1 (**A**) Complicated type B aortic dissection with location of entry tear just distal to origin of left subclavian artery. (**B**) CT showing hypoplastic right vertebral artery which terminates as posterior inferior cerebellar artery (PICA) and dominant left vertebral artery. (**C**) Pigtail aortogram following carotid-subclavian bypass showing patent carotid-subclavian bypass and nonvisualization of left vertebral artery. (**D**) Right subclavian angiogram confirming the right vertebral artery terminating as PICA, with no contribution to the vertebrobasilar system. (**E, F**) Right common carotid angiogram showing complete retrograde filling of basilar artery (arrow) through dominant posterior communicating artery (Pcom).

difficulties in mobilizing arch vessels closer to the diseased aorta, as in our case. Hence, prior knowledge of circle of Willis is of vital importance to decrease the incidence of perioperative stroke in patients who require aortic arch debranching procedures.[2] Inadvertent/unintentional coverage of arch vessels can become catastrophic. Various factors like breathing movements, cardiac pulsations, and forward migration during deployment, play a role in the unintentional coverage of the left common carotid artery (LCCA).[3] The chimney technique is often used as a planned procedure to extend the proximal landing zone and improve fixation and sealing.[4] In our scenario, a bailout stenting was performed similar to the chimney technique, using a balloon expandable stent, which was readily available to restore blood flow to the LCCA. Alternately, in situ laser fenestration of the aortic graft, followed by placement of stent graft, can be used for bail out of inadvertent coverage of arch vessel.[5]

Teaching Point

While planning the management of Type B Aortic Dissection by Hybrid TEVAR technique, the possibility of inadvertent coverage of aortic arch branches should be kept in mind. The Circle of Willis should be included in the pre-procedure aortic imaging. Bail-out stenting can be performed similar to the chimney technique, which is an easy, quick, and effective method to rescue the left common carotid artery.

Conflict of Interest
None declared.

References

1 Thakkar D, Dake MD. Management of type B aortic dissections: treatment of acute dissections and acute complications from chronic dissections. Tech Vasc Interv Radiol 2018;21(03): 124–130

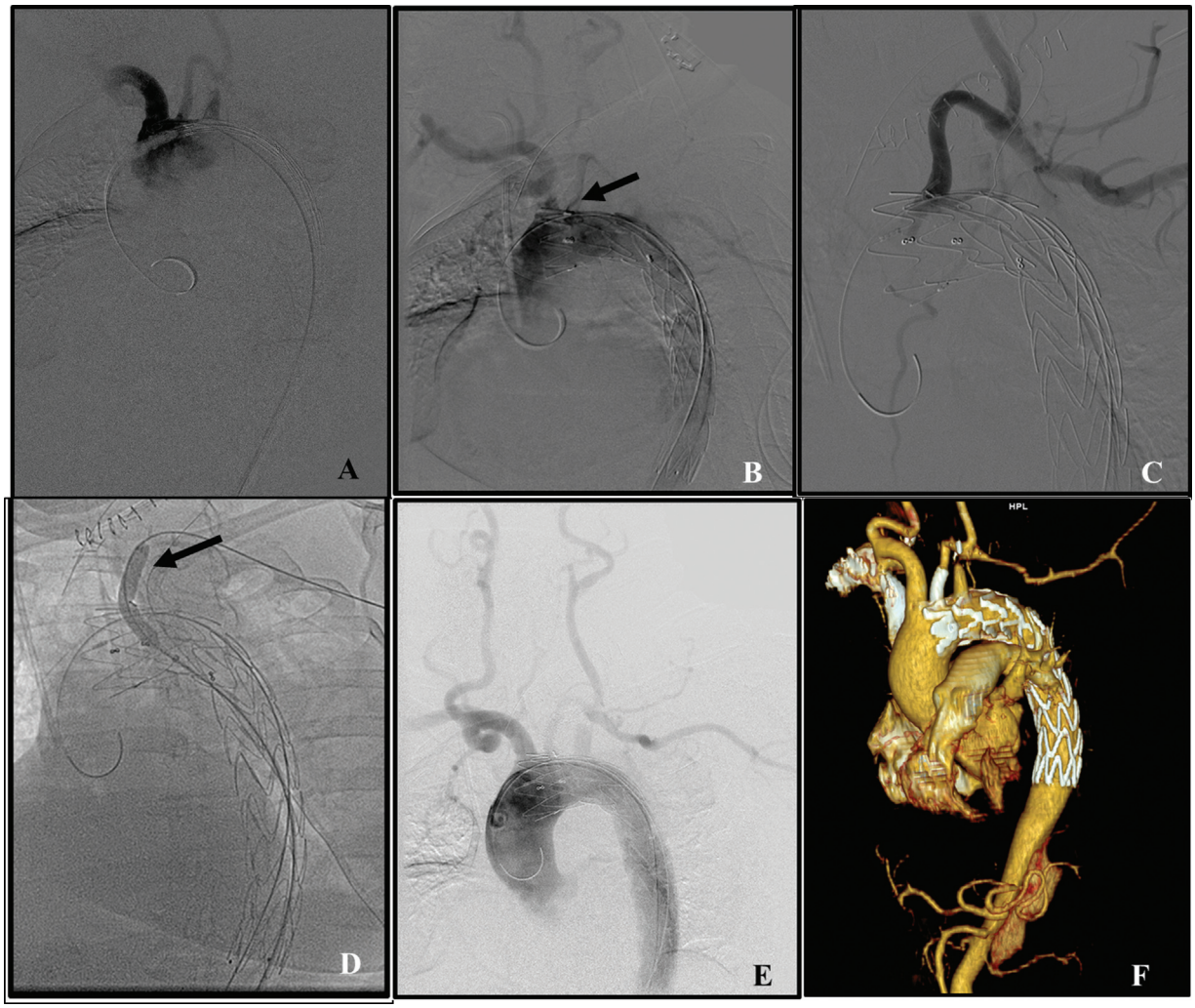

Fig. 2 (**A**) Angiogram prior to deployment of aortic stent graft shows optimal placement of graft distal to left common carotid artery (LCCA) origin. (**B**) Aortogram after the deployment of the aortic graft showing the partial coverage of the LCCA ostium (arrow) with poor forward flow. (**C**) The LCCA was cannulated using Bernstein catheter and exchanged for extra stiff wire. (**D**) Bailout stenting was performed using balloon expandable stent (arrow). (**E**) Postprocedure aortogram showed good forward flow within the LCCA, carotid-subclavian bypass and no evidence of endoleak. (**F**) Follow-up CT aortogram after 2 months showed obliteration of false lumen of thoracic aorta, with normal filling of left common carotid stent and artery.

2 Feezor RJ, Martin TD, Hess PJ, et al. Risk factors for perioperative stroke during thoracic endovascular aortic repairs (TEVAR). J Endovasc Ther 2007;14(04):568–573
3 Wang L, Guo D, Jiang J, Shi Z, Fu W, Wang Y. Severe compression of a bailout self-expanding chimney stent for rescuing the miscoverage of left common carotid artery during TEVAR of a type B aortic dissection. Ann Vasc Surg 2014;28(03):742.e9–742.e12
4 Baldwin ZK, Chuter TA, Hiramoto JS, Reilly LM, Schneider DB. Double-barrel technique for endovascular exclusion of an aortic arch aneurysm without sternotomy. J Endovasc Ther 2008;15(02):161–165
5 Li HL, Chan YC, Jia HY, Cheng SW. Methods and clinical outcomes of in situ fenestration for aortic arch revascularization during thoracic endovascular aortic repair. Vascular 2020;28(04):333–341

