Case Report
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Innovative Modified Right Brachiofemoral Technique (Amber Technique) in Delivering Stent Graft in Difficult Aortic Arch Anatomy

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Abstract
Thoracic endovascular aortic repair (TEVAR) is a less invasive alternative to open surgery for aortic arch pathologies, but extreme arch tortuosity or sharply angulated "gothic" arches can impede successful stent-graft delivery. Conventional adjunct techniques (such as brachiofemoral through-and-through guidewires or externalized transseptal wires) often provide inadequate support or carry substantial procedural risks. To address these challenges, we developed the **Amber technique** – a modified right brachiofemoral approach that forms a stable M-shaped guidewire loop (from femoral to right brachial access) in the ascending aorta, providing enhanced support and alignment for the endograft. We applied this technique in three patients with complex aortic arch anatomy (two with arch dissections and one with a saccular arch aneurysm). All three cases achieved successful stent-graft deployment in the intended position with acceptable procedure durations (approximately 85–97 minutes) and fluoroscopy times (~50 minutes). No major intraoperative complications occurred; one patient experienced a delayed hemorrhagic stroke attributed to postoperative antithrombotic therapy rather than the procedure. These initial results demonstrate the feasibility of the Amber technique and suggest that its superior guidewire support and proximal stent-graft stabilization can facilitate TEVAR in severely tortuous, angulated arches. This novel approach appears to overcome limitations of conventional methods and may reduce the need for riskier adjuncts (such as transseptal wires), positioning the Amber technique as a promising innovation for safely extending TEVAR to patients with challenging aortic arch anatomy.
Keywords: Aorta, thoracic, endovascular aneurysm repair, vascular surgical procedures, amber technique

Introduction

Thoracic endovascular aortic repair (TEVAR) has been widely adopted for managing various aortic arch pathologies due to its minimally invasive nature, offering a valuable therapeutic option for critically ill patients.[1] TEVAR procedures require meticulous preoperative planning with computed tomography angiography (CTA) for accurate stent-graft sizing, establishment of reliable endovascular access to the thoracic aorta, and careful deployment of the stent graft.[2] Despite expanding indications for TEVAR, several technical and anatomical challenges persist. One major challenge is extreme tortuosity of the thoracic aorta and arch, which complicates advancement and deployment of the endograft. Additionally, factors such as significant aortic arch angulation, inadequate conformability of the proximal stent graft to the inner curve of the arch, and the so-called "windsock effect" — an unstable proximal stent-graft position in the high systolic jet of the proximal aorta — can further impede accurate device positioning and alignment.

In cases of pronounced aortic tortuosity, various strategies have been proposed to overcome these difficulties. These include the use of extra-stiff "buddy" guidewires and catheters, direct videoscopic or open surgical access to the aorta, and, as a last resort, a transbrachiofemoral through-and-through guidewire to stabilize the stent graft and facilitate passage through tortuous vessels.[3,4] However, even the transbrachiofemoral wire approach may have limited success when significant proximal arch angulation or other arch abnormalities are present.[3,4] Another described approach for challenging arch anatomy is the externalized transseptal guidewire technique. This method does provide enhanced wire support, but it carries substantial risk from the transseptal puncture itself, including complications such as cardiac tamponade and mechanical valve injury.[5]

In this report, we present a novel modified right brachiofemoral approach—termed the **Amber Technique** after its developer, Dr. Khalid Amber—designed to facilitate stent-graft delivery in unfavorable aortic arch anatomy. We applied this technique in a 52-year-old male patient who presented with an acute dissecting descending thoracic aneurysm. Notably, the patient had a bovine aortic arch (a common origin of the innominate and left carotid arteries) with the dissection originating at the innominate artery (a "non-A, non-B" dissection pattern), as well as severe aortic tortuosity and a sharply angulated ("gothic") arch (Figure 1). An initial attempt using the conventional brachiofemoral technique failed to advance the stent graft beyond the acute arch angulation. We subsequently employed the Amber Technique, which resulted in successful stent-graft delivery. The entire procedure—from initial arterial access (Seldinger technique) to device deployment—was completed in 90 minutes, with a fluoroscopy time of 51 minutes, Figure 2 illustrates the angiographic sequence of the procedural steps that was implemented in the reported case. Informed consent was obtained from all patients for publication of their case details and images.

This modified brachiofemoral technique was successfully implemented in three patients with complex aortic arch anatomy. In all cases, the stent graft was delivered and deployed at the desired position without intraoperative complications. Procedure duration ranged from 85 to 97 minutes, with fluoroscopy times of 50–52 minutes. One patient (Case 2) experienced a postprocedural complication: a cerebral hemorrhage on postoperative day 3, which was attributed to dual antiplatelet therapy and deemed unrelated to the procedure. No other short-term complications were observed.

Table 1 provides a summary of the patient cases, including their pathology, procedural details, and outcomes.

Technique Steps

The **Amber Technique** (modified right brachiofemoral approach) was utilized to perform TEVAR in patients with difficult aortic arch anatomy. The procedural steps of this technique are outlined below (Figure 3 provides a schematic representation of the described technique):

1. **Introduce a stiff guidewire:** Insert a super-stiff guidewire (e.g., Lunderquist) through the right femoral artery access.
2. **Establish through-and-through access:** Snare the guidewire from the aortic arch via the right brachial artery access, creating a continuous femoral–brachial wire pathway.
3. **Advance a brachial catheter:** Introduce a diagnostic or multipurpose catheter through the right brachial access, over the externalized guidewire (preferably ≤100 cm in length; if a longer catheter is used, modification may be necessary).
4. **Position the stent-graft device:** Advance the thoracic stent-graft device from the femoral access into the descending thoracic aorta, while ensuring the proximal end of the guidewire remains accessible at the femoral entry site.
5. **Form the "M-loop":** Advance the guidewire further from the femoral side while simultaneously pushing both the guidewire and catheter from the brachial side. This maneuver prolapses the wire toward the aortic valve, forming an "M"-shaped loop anchored in the aortic root.

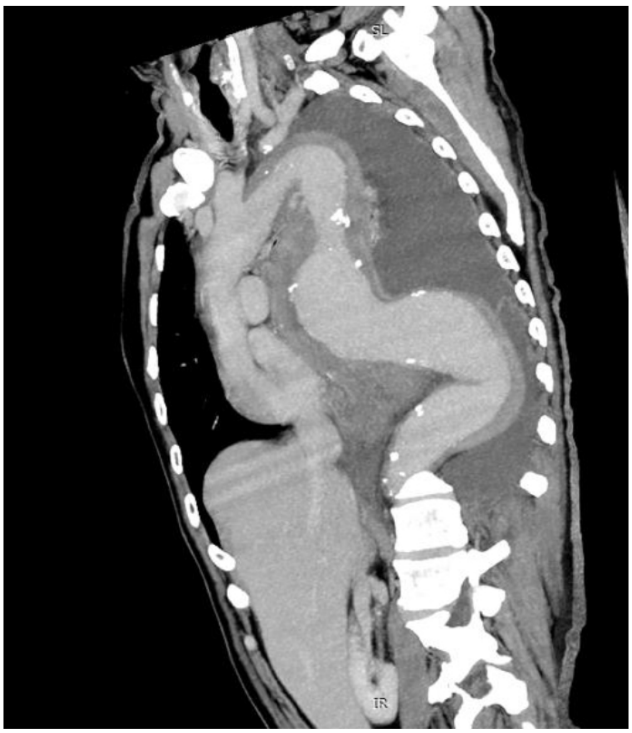

Fig. 1 **Computed tomography angiography (oblique view) showing the severe tortuosity and angulation of the patient's aorta.**

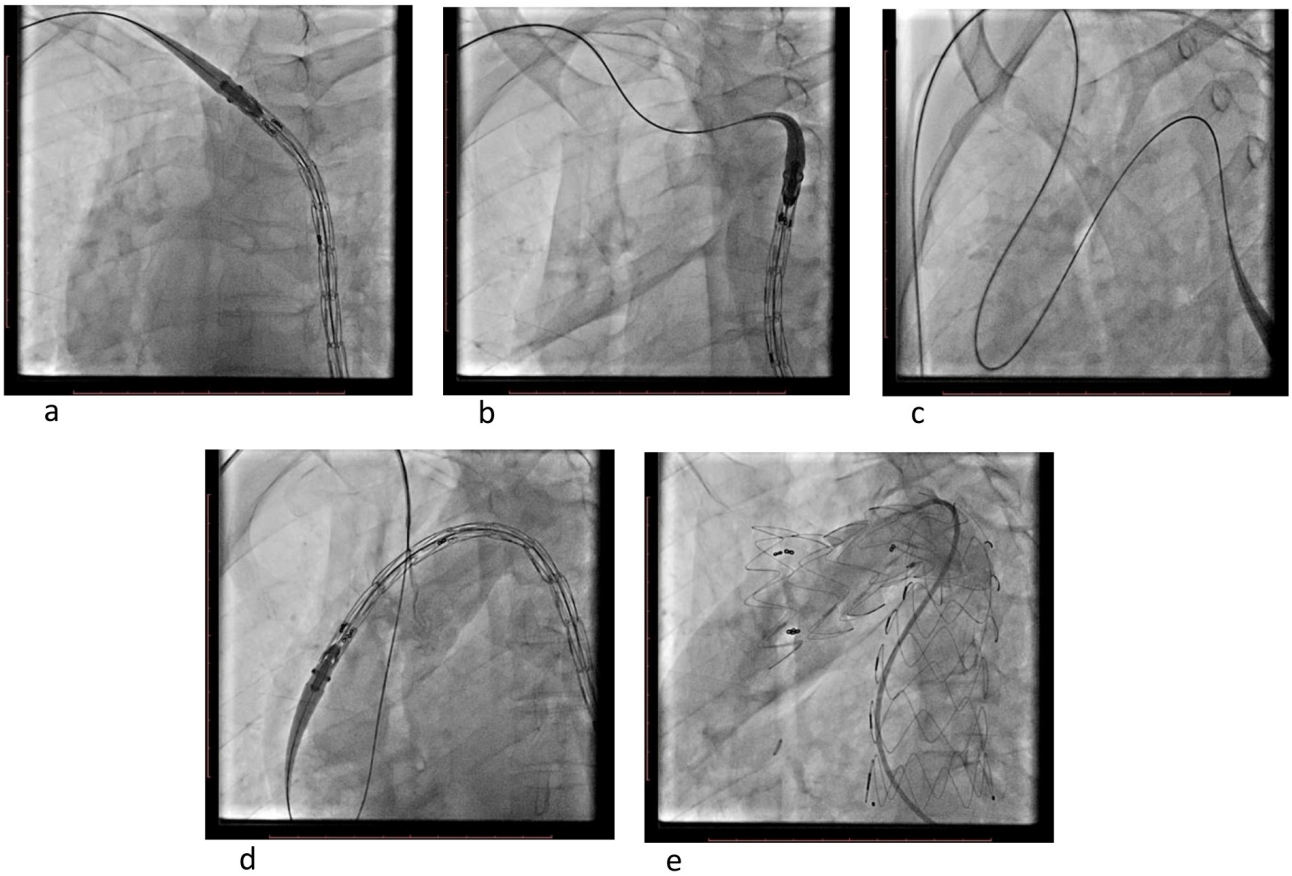

Fig. 2 **Sequential cine-angiographic images demonstrating the steps of the Amber Technique. In panel C, the guidewire forms an "M"-shaped loop. This configuration results from pushing the wire via the right brachial catheter while simultaneously advancing it from the femoral side, which anchors the wire in the proximal ascending aorta.**

Table 1. **Summary of the patient cases, including their pathology, procedural details, and outcomes**

Case	Age /sex	Pathology	Procedure/fluoroscopy time in minutes	Outcome	Complication
Case 1 (the reported case above)	52 yr/M	Non-A non B dissection combined with severe tortuous and angulated (gothic) aortic anatomy	90 min/51 min	Successful desired device delivery	No short-term complication
Case 2	80 yr/F	Sacular aneurysm between left carotid and left subcla-vian artery with tortuous descending aortic and gothic aortic arch	85/50 min	Successful desired device delivery	No acute complication, 3rd day after procedure patient developed cerebral hemorrhage probably due-to the routine use combined antiplatelet unrelated to procedure
Case 3	40 yr/M	Dissecting aneurysm start from left carotid till iliac vessels with sever angulated arch, in vivo fenestration of the graft to maintain blood to carotids was done	97 min/52 min	Successful desired device delivery	No short-term complication

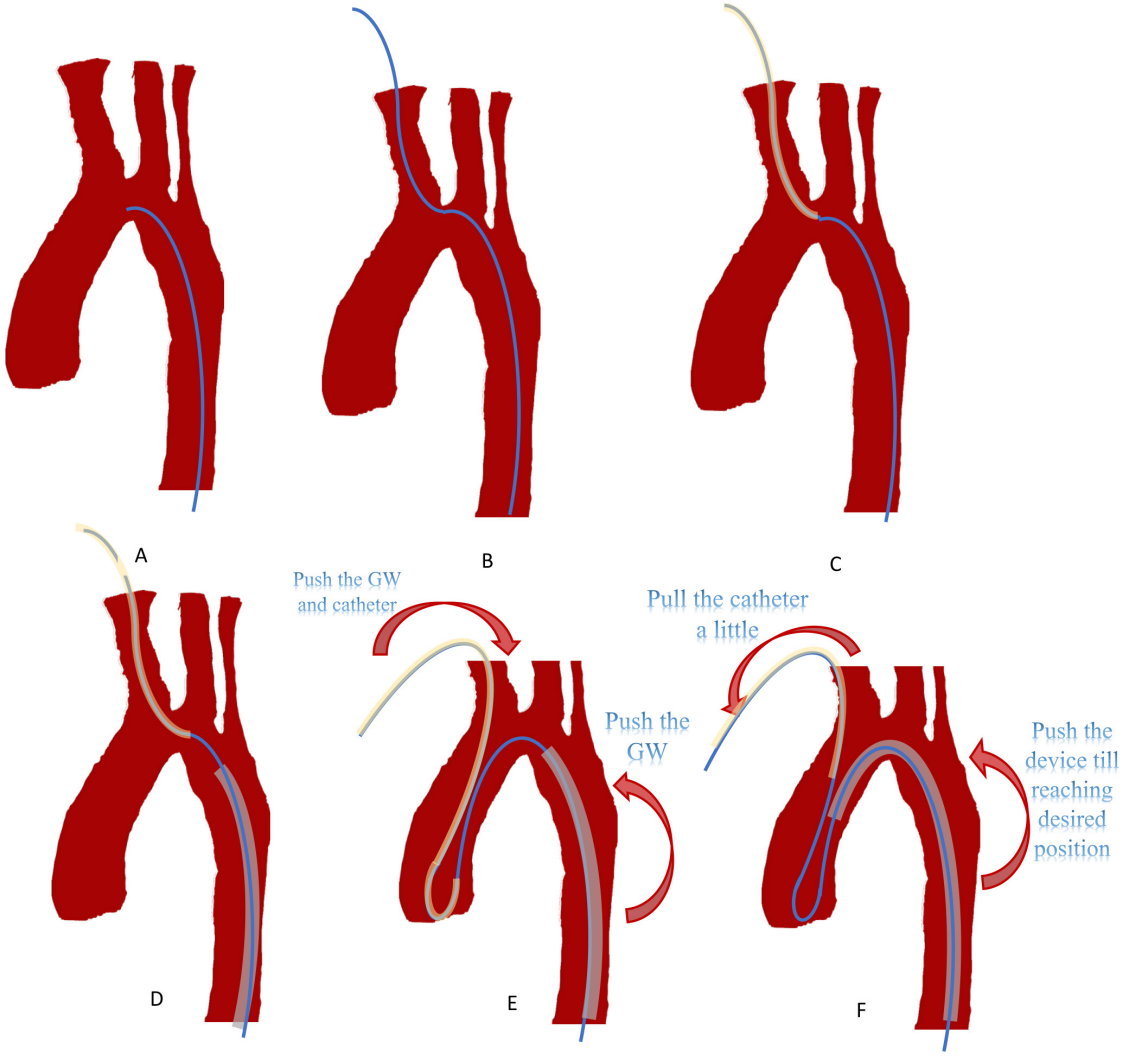

Fig. 3 **Schematic illustration of the modified brachiofemoral technique. (A) A guidewire (blue line) is introduced through the femoral access. (B) The guidewire is snared via the right brachial access. (C) A catheter (yellow line) is advanced over the externalized guidewire from the brachial access. (D) The stent-graft device (gray line) is introduced through the femoral access into the descending thoracic aorta. (E) Both the guidewire and catheter are advanced from the brachial side, while tension is maintained on the guidewire from the femoral side, anchoring the wire in the aortic root. (F) The stent-graft device is then advanced across the arch into the desired position while gently pulling back the brachial catheter, allowing precise deployment at the target location.**

6. **Retract the brachial catheter:** Partially withdraw the brachial catheter while maintaining tension on the guidewire from both the brachial and femoral ends to keep the wire securely anchored.
7. **Deliver the stent graft:** Advance the stent-graft device across the aortic arch to the predetermined deployment site. Once proper positioning is confirmed, deploy the stent graft in the target location.

Discussion

Severe aortic tortuosity and acute aortic arch angulation pose considerable challenges to stent-graft delivery during TEVAR.[6] Several specialized endovascular techniques have been developed to address these anatomical obstacles, including the right transbrachiofemoral (through-and-through) guidewire technique, the "skewer" technique, and the externalized transseptal technique.[5] The transbrachiofemoral approach can provide additional support to navigate tortuous arches, but it has limitations: there is a risk of trauma at the innominate artery origin, and it may not effectively address situations requiring extensive proximal arch coverage. Similarly, the skewer technique shares these shortcomings due to its analogous mechanism of through-wire stabilization. The externalized transseptal guidewire technique offers enhanced wire support; however, it carries significant risk from the transseptal puncture, including complications such as cardiac tamponade and mechanical valve damage.[5]

Our modified brachiofemoral (Amber) technique offers several key advantages over these existing methods. First, it provides superior guidewire support during stent-graft delivery. Second, it improves proximal stent-graft stabilization during deployment. Third, it facilitates access to the proximal aorta, which is particularly valuable in cases requiring complete aortic arch coverage. This last advantage, in turn, reduces dependence on the high-risk externalized transseptal technique.

Since its introduction in August 2024 by Dr. Khalid Amber at Najaf Cardiac Center, the Amber Technique has been applied in three TEVAR cases involving severe aortic tortuosity and arch angulation. All three cases were completed successfully without serious complications, as detailed above (and summarized in Table 1). These early outcomes demonstrate the feasibility and safety of the technique in extremely challenging anatomies.

Conclusion

The modified right brachiofemoral (Amber) technique appears to be a promising solution for performing TEVAR in patients with severe aortic tortuosity and markedly angulated aortic arches. By providing enhanced support for device delivery and improving stent-graft stabilization, this technique effectively addresses some limitations of conventional approaches. Early clinical experience demonstrates its feasibility, with successful outcomes in complex cases and a potential reduction in the need for riskier adjuncts such as the externalized transseptal guidewire technique. Further investigation with larger patient cohorts is warranted to validate the efficacy and safety of the Amber Technique.

Conflict of Interest

None.

References

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