

In vitro Stent Graft Fenestration to Preserve All Supra-aortic Branches in the Treatment of a Stanford Type A Aortic Arch Dissection

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For aged patients, the treatment of type A aortic dissection (TAAD) with the primary entry tear at the inner curve of the ascending aorta is a great challenge. Conventional surgical repair with cardiopulmonary bypass and deep hypothermic circulatory arrest is associated with high risk of mortality.^[1] Thoracic endovascular aortic repair (TEVAR) with associated techniques to reconstruct all supra-aortic branches is still controversial.^[2,3] Herein, we reported a new endovascular method.

An 80-year-old man complained of abrupt severe backache for 8 days. He had poorly treated hypertension and coronary heart disease for 10 years. Emergent computed tomography (CT) showed a TAAD with the primary entry tear at the inner curve of the ascending aorta and extending into the aortic arch. Because of the patient's advanced age, conventional open surgery was rejected and emergent TEVAR was performed. Angiography indicated that the primary entry tear was located at the inner curve of the ascending aorta opposite to the orifice of the innominate artery [Figure 1a]. After accurate measurement of the anatomic situation in CT and angiography images, a 40 mm × 36 mm × 145 mm stent graft (Relay, Bolton Medical, Barcelona, Spain) was adopted. The proximal part of the stent graft was unsheathed *in vitro*. Because the longest distance between the orifices of the innominate artery and left subclavian artery was 45.1 mm, a similarly rectangular fenestration nearby the spiral support strut was made on the fabric with a laser scalpel, 65.0 mm in length and 15.0 mm in width [Figure 1b]. The fenestration was 20 mm distal from the proximal margin of the fabric.

Then, the stent graft was carefully reassembled. Under the conduction of a stiff guide wire, the stent graft was inserted into the ascending aorta and aortic arch via the femoral artery. The heart rate was controlled at about 40 beats/min. After confirming the site of the fenestration, the proximal part of the stent graft was deployed. Then, a pigtail catheter inserted via the brachial artery, was advanced through the partially expanded fenestration into the stent graft to reconform the site of the fenestration. Angiography indicated patent blood flow in the innominate artery and left common carotid artery [Figure 1d]. The rest part of the stent graft was finally deployed. Angiography indicated that the aortic dissection was completely sealed and all supra-aortic branches were patent [Figure 1d].

At 2-year follow-up, the patient continued to have an unremarkable recovery without any complication; bilateral carotid and subclavian arteries were strongly palpable. CT angiography indicated that the aortic dissection was excluded completely without any stent graft-related complications [Figure 1e].

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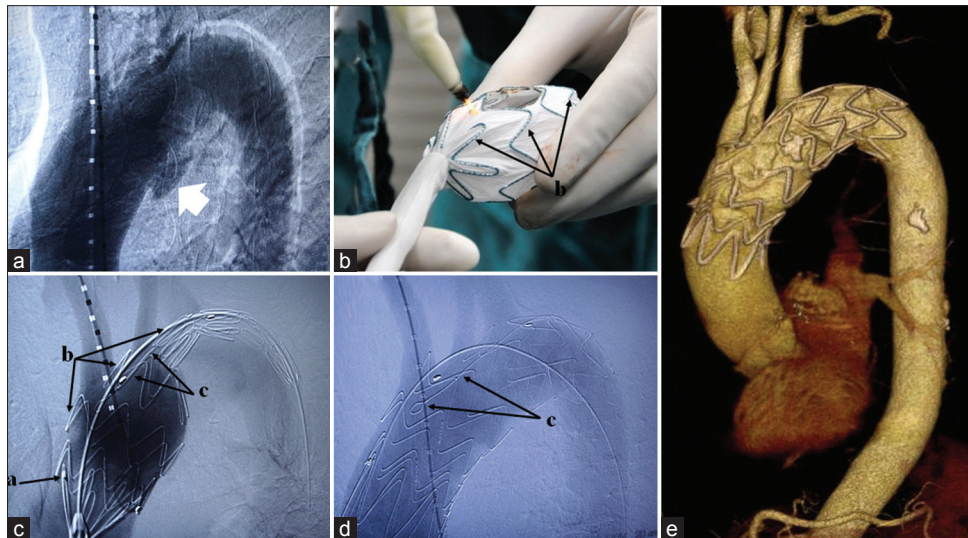


Figure 1: The primary entry tear (white arrow) located at the inner curve of ascending aorta, opposite to the innominate artery (a); Close-up photograph of the fenestration (b). Angiography after the proximal part of the stent graft was deployed. The pigtail catheter was inserted into the stent graft via the fenestration (c). All supra-aortic branches kept patent (d). Computed tomography angiography during the 2-year follow-up (e). “a”: The proximal marker; “b”: The circular “W” - shaped stents; “c”: The lateral spiral support strut.

This is our first case using this fenestration to treat a TAAD and preserve all supra-aortic branches. Positioning and rotation of the fenestration under fluoroscopy are the key maneuvers. Firstly, a thoracic stent graft with a lateral support strut should be used; the strut can be used as an important marker of the fenestration. The fenestration was 20 mm distal from proximal markers of the stent graft and was along with the lateral spiral support strut. With the guidance of the proximal marker, the lateral spiral support strut, and the circular “W” - shaped stents, the location of the fenestration can be recognized accurately under fluoroscopy [Figure 1b and 1c]. Secondly, aortic angiography via the right brachial artery, after the proximal stent graft was partially deployed, is also an important assistant procedure to reconfirm the position of the fenestration [Figure 1c]. The exact morphology of the aortic pathology is also important. In order, to prevent unexpected covering of aortic branches and subsequent severe complications, the distance between the aortic lesion and the orifices of crucial aortic branches, either circumferential or axial distance, must be at least 15 mm. Because the integrity of the stent graft might be compromised by the fenestration, a lateral spiral support strut that connects the circular “W” - shaped stents is a necessity. In addition, since the impact of the pulsatile blood pressure might cause slight migration of the stent graft, the fenestration must be appropriately larger than the region where all the supra-aortic branches originated to guarantee the long-term patency of all supra-aortic branches. At present, there are some endovascular techniques designed for the treatment of ascending aorta and aortic arch pathologies.^[2-4] However, creating patient-specific customized fenestrated, branched stent graft is time-consuming and expensive,^[2] which limits its application, especially in emergency situations. The chimney technique is a developing off-the-shelf choice.^[3] However, reconstruction of all supra-aortic branches is hard to achieved and unreliable for all of them.^[2,3] Besides, using fenestration

to cover the whole region of aortic dissection and aortic arch may increase stability, compared to pure zone 0 treatment of dissection.^[4]

In our case, because of the specific anatomic and pathological characteristics of the TAAD, exclusion of the primary entry tear is the critical point of interventions. Hence, the *in vitro* fenestration technique was performed; accurate positioning and sealing the entry tears, but not the whole aortic circumference, achieved an excellent result. When there is an appropriate circumferential distance between the primary entry tear of type A aortic dissection and the orifices of supra-aortic branches, fenestration of the stent graft *in vitro* can be considered.

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Conflicts of interest

There are no conflicts of interest.

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