Complete neck vessel preservation using a fenestrated stent graft for the treatment of proximal anastomotic leakage after open frozen elephant trunk graft aortic arch repair: A case report

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Short title

Fenestrated SG for anastomotic leakage after OSG

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ABSTRACT

We report a case of proximal anastomotic leakage excluded with the Najuta fenestrated stent graft after a surgeon-modified frozen elephant trunk (FET) aortic arch graft. The fenestrated stent graft was deployed at the zone 0 proximal site preserving the cervical branches. Complete neck vessel preservation during endovascular repair using a Najuta fenestrated stent graft appears to be safe and effective for anastomotic leakage after aortic arch aneurysm repair.

Keywords: Najuta; fenestrated stent graft; anastomotic leakage; open stent graft
Anastomotic leakage after open surgical repair of aortic arch aneurysm is often difficult to treat. Options include redo open surgical repair, stent graft, or trans-arterial embolization. We report a case of proximal anastomotic leakage 15 years after a surgeon-modified frozen elephant trunk (FET) graft for repair of an aortic arch aneurysm. Informed consent from the respective patients to publish their case details and images has been obtained.

CASE REPORT

A 76-year-old man presented with an unexplained abnormality on chest radiograph. He had undergone a surgeon-modified FET for aortic arch aneurysm and had developed paraplegia as a postoperative complication. The FET was a 120 mm length woven Dacron graft with a Gianturco Cook-Z Stent (Cook Medical, Bloomington, USA) attached only to the distal end. Computed tomography angiography showed an anastomotic leak at the level of left subclavian artery (LSA), and the diameter of the aneurysmal sac was 69 mm (Figure 1). The leakage point was located at the lessor curvature of the aortic arch opposite the LSA. Considering the leakage point, we decided to attempt a complete neck preservation fenestrated stent graft repair using the Najuta stent graft (Figure 2).

Under general anesthesia, trans-femoral access was obtained via surgical cutdown, and a 9 French gauge (9F) sheath was placed in the common femoral artery. A 7F twin sheath (double-lumen introducer sheath) was introduced from the right brachial artery, and a 4F pigtail catheter was advanced over a guidewire to the ascending aorta. A 6F sheath was placed in the left brachial
artery for brain protection balloon occlusion of the LSA. The FET was surgeon-modified and had no graft-lining stent in the middle of the graft. Therefore, it was severely kinked into a V-shape (Figure 1). First, we planned a CTAG stent graft (W. L. Gore & Associates) insertion to straighten the FET over a Lunderquist wire (Cook Medical, Bloomington, Ind). Since the CTAG’s trackability in tortuous aorta is excellent, we did not perform pre-dilatation with a balloon. The guidewire was exchanged for a 0.035-inch Radifocus wire (Terumo, Tokyo, Japan), which was then pulled through the right brachial artery to the femoral artery. The Najuta fenestrated stent graft (the outer diameter: 42 mm) was delivered with a 23F J-shaped sheath maintained under continuous strain by traction at both wire ends. It was delivered and deployed at the zone 0 proximal site, with delicate positional adjustments of the fenestrations of the Najuta stent graft to align with the origins of the three neck vessels. During stent graft delivery, we performed temporary LSA balloon occlusion and manual compression of both carotid arteries for brain protection. After endoprosthesis implantation, angiography revealed that all three neck vessels were patent and the aneurysm was successfully excluded (Figure 3). The patient's postoperative course was uneventful, and postoperative computed tomography revealed no endoleak (Figure 4). At a 1-year follow-up visit, aneurysm sac shrinkage of 10 mm was noted.

**DISCUSSION**

The Najuta stent graft is the only commercially available semi-custom made fenestrated device for TEVAR obtaining Japanese regulatory approval in 2013 and CE mark in 2017.
A customized full-scale stent graft model was deployed to the patient-specific plaster model before TEVAR. The use of an anatomic plaster model produced by the 3D printer is effective for obtaining a geometric analysis for the fenestrations.

The frequency of anastomotic leakage after open surgical repair of aortic arch aneurysm has been reported as 0.5%. Treatment options include redo open surgical repair, stent graft, or trans-arterial embolization. Standard repair for these cases is a thoracic endovascular aortic repair (TEVAR) with intentional LSA occlusion to obtain adequate proximal sealing length. Our patient's postoperative paralytic symptoms had improved, so it was important that the blood flow of the LSA should be maintained. Considering the patient's comorbidities, minimally invasive fenestrated TEVAR appeared to be a safe and effective treatment option. According to the instructions for use of the Najuta stent graft, if the proximal neck length between the LSA and aneurysm is >20 mm, the LSA could also be fenestrated. In this case, the anastomotic leakage point and the LSA were almost at the same level, but as the leakage point was located on the lesser curvature of the aortic arch, the distance between the leakage point and the origin of the LSA was 20 mm (Figure 2a). We therefore determined that minimally invasive endovascular treatment with complete neck vessel preservation without branch vessel bypass was possible. The Najuta stent graft is delivered to the ascending aorta over a pulled through Radifocus wire, so it was important to be able to go through the stenosis in the surgeon-modified FET. As the kinking was corrected by initial placement of the CTAG stent graft, the delivery of the Najuta stent graft became possible.
CONCLUSIONS

Complete neck vessel preservation using the Najuta fenestrated stent graft after careful planning was an effective treatment for anastomotic leakage in this case.
REFERENCE


FIGURE LEGENDS

Figure 1: Pre-operative computed tomography angiography

Pre-operative computed tomography angiography showed an anastomotic leak at the level of the left subclavian artery (white arrow). The diameter of the aneurysmal sac was 69 mm. The frozen elephant trunk graft was surgeon modified and was severely kinked in the middle (red arrow). The diameters were 11.7 mm for the innominate artery, 8.2 mm for the left carotid artery, and 10.1 mm for the left subclavian artery.

Figure 2: Implantation planning

Figure 2a: The leakage point was located on the lesser curvature of the aortic arch. The distance between the leakage point and the origin of the left subclavian artery was 20 mm (white arrow). We planned endovascular treatment with complete neck vessel preservation.

Figure 2b: The Najuta stent graft with three fenestrations.

Figure 3: Preoperative and postoperative angiography

Figure 3a: Preoperative angiography (LAO view) revealed a proximal anastomotic leakage (black arrow).

Figure 3b: Preoperative angiography (RAO view) revealed a proximal anastomotic leakage (black arrow).

Figure 3c: Postoperative angiography (LAO view) revealed no endoleak and complete neck vessels preservation.

Figure 3d: Postoperative angiography (RAO view) revealed no endoleak.
Figure 4: Postoperative computed tomography angiography

Postoperative CT revealed no endoleak.