EJVES Vascular Forum (2020) 48, 1–4

CASE REPORT

Placement of a Zenith® Dissection Endovascular System in the Descending Thoracic Aorta Can Hamper Further Surgical Aortic Operations

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Introduction: The efficacy of endovascular treatment for complicated Stanford type B acute aortic dissection is being established. However, aortic events sometimes occur, and some cases require surgical intervention.
Report: A 52 year old man underwent ascending aorta replacement for Stanford type A acute aortic dissection in August 2016. Post-operative computed tomography (CT) showed residual dissection from the aortic arch to the right common iliac artery and a large re-entry in the right common iliac artery (RCIA). Two months after the operation, CT revealed enlargement of the false lumen of the thoracic aorta and the thoracic aortic diameter. Aiming to reduce the false lumen and remodel the aorta, a three stage operation was performed, as described below. Four months after the dissection, total aortic arch replacement and a frozen elephant trunk insertion were performed as the first stage. Subsequently, as a second stage operation, thoracic endovascular repair (TEVAR) was performed using a Zenith® Dissection Endovascular System (Cook Japan Co., Ltd, Tokyo, Japan), with the aim of expanding the true aortic lumen. The implanted devices were a stent graft for the proximal part and two bare stents for the middle and distal part. As a third stage operation, abdominal aortic endovascular treatment was performed with the purpose of closing the re-entry from the RCIA. However, two years after the three stage operation, CT showed that the thoracic aorta was over 60 mm in diameter. Graft replacement of the thoraco-abdominal aorta was performed. The bare stents were expected to be easily removable from the aorta, but unexpectedly, they were strongly attached to the intima, which made it extremely difficult to perform surgical and aortic operations.
Discussion: Surgical operations for the aorta can become more difficult after bare stent placement in the aorta.

Article history: Received 20 December 2019, Revised 20 April 2020, Accepted 18 May 2020,
Keywords: Aneurysm, Bare stent, Dissecting, Open surgical repair, TEVAR, Thoracoabdominal aortic aneurysm

INTRODUCTION

Interventions with stent grafts for Stanford type B aortic dissection are common and have been recognised as a reasonable treatment option.[1,2] It has also been reported that, within six months, the aortic remodelling effect of TEVAR for type B aortic dissection with a patent false lumen, prevents aortic events.[3] However, cases that require late phase aortic intervention are encountered. Herein is reported surgical graft replacement as treatment for a thoraco-abdominal aortic aneurysm after placement of a Zenith® Dissection Endovascular System in the descending thoracic aorta.

CASE REPORT

The patient was a 52 year old man (height, 178 cm; body weight, 126 kg) who underwent ascending aorta replacement for Stanford type A acute aortic dissection in August 2016. He had no family history of connective tissue disease, including sudden death, or family history of cardiovascular events. No physical or laboratory findings suggestive of connective tissue disease were found. Post-operative contrast enhanced computed tomography (CT) showed residual dissection from the aortic arch to the right common iliac artery and a large re-entry in the distal right common iliac artery. CT revealed a 32 mm right internal iliac aneurysm, a 41 mm left common iliac aneurysm, and a 40 mm left internal iliac aneurysm. CT showed that the coeliac artery, superior mesenteric artery, and left renal artery were branched from the true lumen, and the right renal artery arose from the false lumen. At two months after the initial operation, CT revealed that the thoracic aorta false lumen had enlarged by 5 mm or more, and the total diameter of the thoracic aorta had enlarged by 5 mm to approximately 52 mm. With the aim of remodelling the aorta, a three stage

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https://doi.org/10.1016/j.ejvsvf.2020.05.006

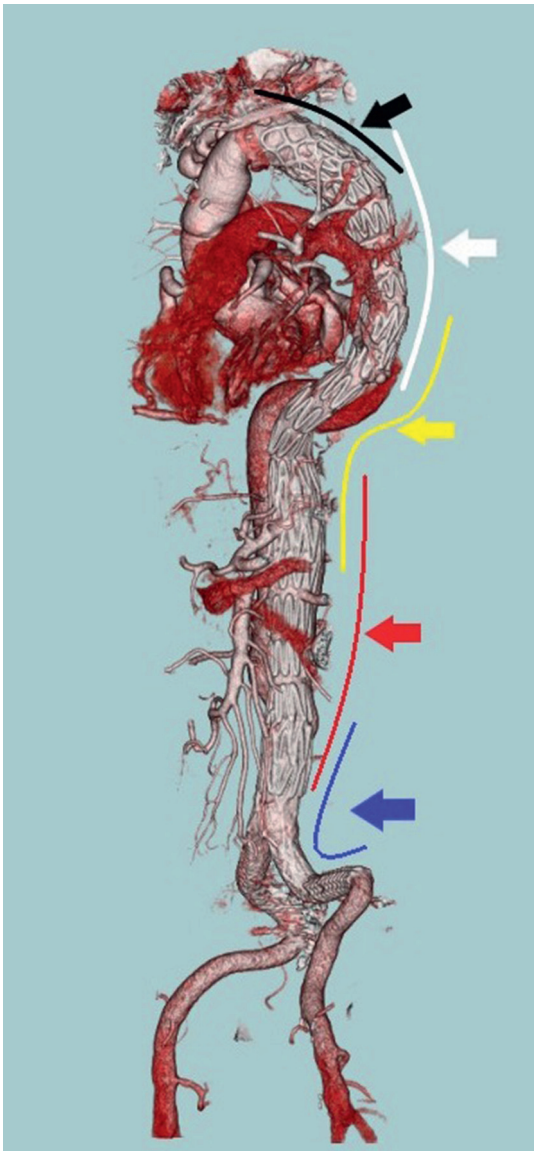

Figure 1. A three dimensional image reconstructed from computed tomography before open surgery. The black line and arrow indicate the frozen elephant trunk inserted during the first stage. The white arrow and white line indicate the Zenith TX-2 Dissection Endovascular Graft placed during the second stage. The yellow/red arrows and yellow/red lines indicate the Zenith Dissection Endovascular Stent (TX-D) placed during the second stage. The blue arrow and blue line indicate the abdominal aortic stent graft device placed during the third stage.

operation was planned, as described below. Four months after the onset of dissection, total aortic arch replacement and frozen elephant trunk insertion were performed as the first stage operation. Subsequently, as a second stage operation, thoracic endovascular repair (TEVAR) using a Zenith® Dissection Endovascular System (Cook Japan Co., Ltd, Tokyo, Japan) was performed with the aim of expanding the true lumen of the thoraco-abdominal aorta. The implanted devices were a stent graft (TX-2 36 mm—26 mm, 159 mm) for the proximal part and two bare stents (TX-D 36 mm, 164 mm) for middle and distal part. Five months after the onset of dissection, the third stage abdominal aortic endovascular treatment (EVAR) was performed with the purpose of not only closing the re-entry from the right common iliac artery but also treating iliac aneurysms. The EVAR procedure involved placing the iliac stent graft (PXC 141000J; W.L. Gore & Associate, Flagstaff, AZ, USA) from both common iliac arteries to the external iliac arteries. The main body was a BA22-80/I16-40 (Endologix, Inc., Irvine, CA, USA). The diameter of the thoracic aorta after the third stage operation was reduced by approximately 5 mm compared with that before the first stage operation, indicating that the series of surgical treatments had been effective. However, two years after the three stage operation (Fig. 1), CT showed that the thoracic aorta was over 60 mm in diameter and that the abdominal aortic false lumen had expanded from 16 mm to 27 mm. It was determined that therapeutic intervention for the dissecting thoraco-abdominal aortic aneurysm was necessary. Although treatment with a branched stent graft was also considered, open surgical repair was performed because the maximum endovascular treatment available at the hospital had already been carried out.

Surgery

The patient was placed in the right hemilateral position and thoracotomy was performed with rib cross thoracotomy[4] to expose the aorta. Extracorporeal circulation was established using the femoral artery for arterial drainage and the femoral vein for venous drainage. The aorta was replaced from the descending aorta to the infrarenal abdominal aorta. The Adamkiewicz artery was found to be connected to the seventh and eighth right intercostal arteries starting from the false lumen and the plan was to use it for revascularisation. By segmental aortic clamping, the proximal stump was made at the site of the TX-2 stent graft and anastomosed with a 28 mm J graft (Japan Lifeline Japan Co., Ltd, Tokyo, Japan). The clamp was moved, and the two intercostal arteries were reconstructed. The aortic clamp was moved to the abdominal aorta and an attempt was made to remove the previously implanted bare stent (TX-D), but it was stuck in the intima and impossible to remove while preserving the intima. Thus, anastomosis of the visceral arteries using the button technique was impossible. The visceral arteries were sufficiently dissected distally and anastomosed end to end to the branch of the artificial graft.

The abdominal aorta where the TX-D had been inserted was stumped together with a bare stent and the abdominal aortic wall was anastomosed to the branched artificial graft; then the operation was completed. The operation time was 953 minutes and the extracorporeal circulation time was 355 minutes. The patient spent 23 days in the post-operative intensive care unit and was transferred to a rehabilitation hospital on the 82nd day. The hospitalisation was prolonged because respiratory failure and left empyema necessitated tracheal intubation for 11 days and tracheostomy for 42 days. Post-operative CT revealed no

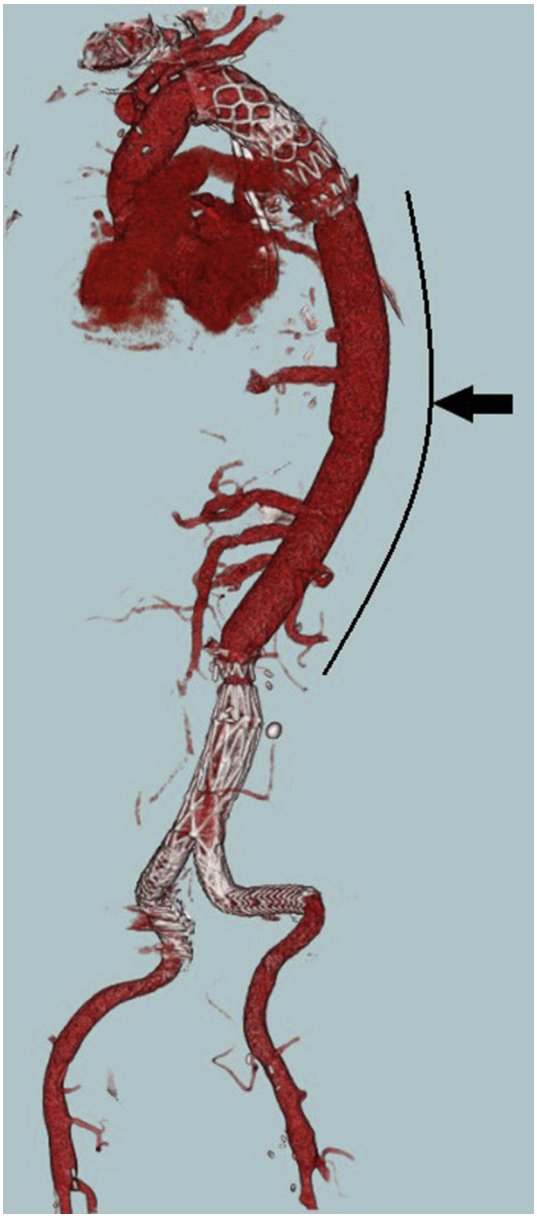

Figure 2. A three dimensional reconstructed image based on computed tomography after open surgery. The black line and arrow indicate the area in which the artificial blood vessel was replaced in this operation. The proximal portion was anastomosed to a Zenith TX-2 Dissection Endovascular Graft and the distal side was anastomosed to the level of the distal Zenith Dissection Endovascular Stent.

significant residual aneurysm (Fig. 2). Before transfer, the patient was able to walk on his own using a walker. Renal function before transfer was 1.56 mg/dL, indicating mild renal dysfunction. Two admissions were needed because of a fever that was suspected to be due to thoracic graft infection. The first was relieved by conservative treatment, and the second was relieved by drainage. Four months after transfer, CT showed no pseudoaneurysm or new aneurysm formation. The patient consented to the publication of this report.

DISCUSSION

According to studies of the treatment of complicated and non-complicated thoracic aortic type B dissection using endovascular repair, good results have been reported in acute and non-acute phase interventions,[5,6] and endovascular treatment for complicated type B dissection may continue to increase. Lombardi et al.[5] reported that many interventions for aortic events after TEVAR for type B aortic dissection appear to be treated by endovascular approaches; however, at least two cases underwent surgery that required bare stent removal. Based on such reports, this three stage operation was performed on the assumption that the onset of type B aortic dissection had occurred in the aorta of this patient after ascending aortic replacement. After the third stage operation, the false lumen was initially reduced; however, two years after the third stage operation, the false lumen had expanded and intervention was required. Because further endovascular intervention at the hospital was impossible and there were no facilities in the neighbourhood providing further endovascular treatment, open surgical repair was chosen.

Performing EVAR to close distal re-entry carries a risk of causing false lumen dilatation. However, the patient had large bilateral iliac aneurysms, so EVAR was considered necessary to repair these aneurysms endovascularly. As a result, the bilateral iliac aneurysm repair was completed, but the dissecting aortic aneurysm was enlarged.

Endovascular solutions for the treatment of complex post-dissection aneurysms may increase in the future.[7,8] These endovascular procedures are highly complex and require specialised techniques. Endovascular techniques and their durability in young patients with previously implanted endografts and bare metal stents remain to be evaluated. However, given that open thoraco-abdominal repair involves a massive operation, the further development of endovascular options may be of value. Surgical procedures are more difficult than in cases without an endovascular prosthesis.[9] A stent graft placed in the aorta not only makes the aorta and branch dissection difficult, it also worsens the surgical field of the false lumen because the stent is very rigid and difficult to mobilise. Regarding the arterial dissection at the site at which the bare stent is attached, as shown in the supplementary video, an electric cautery device, Cooper, Mayo, wire cutter, and other instruments were used, but there were no effective tools. Operability seemed to be relatively smooth when the electric cautery device was operated at a high output. When removing the bare stent, it may be effective to cut the thread connecting the stent together with the aortic wall using an electric cautery device.

Supplementary video related to this article can be found at https://doi.org/10.1016/j.ejvsvf.2020.05.006.

The following are the supplementary data related to this article:Video 1

Based on previous surgical experience, stent grafts did not integrate with the intima and bare stents were believed

to be similar; they were expected to be relatively easy to remove due to their weak radial force. As shown in the video, contrary to expectation, the bare stents and the intima of the true lumen were integrated. Thus, based on this experience, bare stent placement should be considered carefully for young people who may require surgical intervention in the late phase and in cases in which aortic treatment is unlikely to be completed by anatomical endovascular treatment.

CONCLUSION

A bare stent (TX-D) placed in the thoraco-abdominal aorta was explanted. Surgical operations for the aorta can be hampered after bare stent placement in the aorta.

CONFLICTS OF INTEREST

None.

FUNDING

None.

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