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CASE REPORT

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RE-HYBRID THORACIC STENT GRAFT IMPLANTATION WITH TOTAL AORTIC ARCH DEBRANCHING IN URGENT PROCEDURE: CASE REPORT

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ABSTRACT

INTRODUCTION: Implementation of emergency endovascular aortic repair provides an opportunity to treat complicated acute aortic syndromes involving descending aorta.

CASE REPORT: A 40-year-old man with a history of aortic coarctation surgical repair as a child and an anastomosis aneurysm repair with a double endovascular stent graft implantation with hemi-arch transposition was urgently admitted with intensifying shortness of breath and hoarseness. A computed tomography study confirmed a blood leak into an aneurysm sac in proximal landing zones of implanted stent grafts (Type I endoleak). Therefore, he qualified for hybrid surgery. First, the ascending aorta brachiocephalic trunk was anastomosed with a 12 mm vascular prosthesis from an upper mini-sternotomy. In the next step, normothermic extracorporeal circulation was necessary to prevent cerebral circulation. Finally, a GORE stent graft (Gore Medical, Flagstaff, AZ, USA) was implanted with a proximal landing zone directly behind the anastomosis site of the vascular prosthesis and ascending aorta. The hospital course was uncomplicated, and the patient was discharged home 5 days after the procedure.

CONCLUSIONS: Complicated aortic pathologies requiring emergent interventions can be treated by a hybrid approach utilizing multistep surgical and endovascular techniques achieving optimal results.

KEY WORDS: hybrid treatment of aortic arch aneurysms; TEVAR; aortic arch debranching

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INTRODUCTION

Thoracic endovascular aortic repair (TEVAR), initially developed for elective descending aorta pathologies procedures, has become an attractive method of treating acute aortic syndromes (AAS) in emergency indications. The conventional surgical approach remains associated with high perioperative mortality and morbidity. TEVAR, since its introduction 20 years ago, has shown benefits in complex patients with comorbidities or a history of repeated surgical interventions.

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CASE REPORT

A patient aged 40 was admitted urgently to the Department of Cardiac Surgery due to shortness of breath accompanied by hoarseness. The symptoms were intensifying in the previous 2 days. In the past history (Tab. 1), the patient was treated at the age of 6 years because of aortic coarctation (CoA). At the age of 29, the first implantation of a stent graft with coverage of the left subclavian artery ostium was performed (Fig. 1). After another 10 years, due to a type Ia endoleak, another stent graft was implanted with a covering of the left carotid artery outlet (Fig. 2). In addition, a patient with a history of cerebral stroke and congenital mental retardation is to a mild degree. During the admission (12 months after the last procedure), a control angio CT, showed a type Ia endoleak with blood flow into the aneu-

Table 1. Patient past history including performed surgical interventions

Patient age	Diagnosis	Procedure
6 y.o.	Aortic coarctation	Surgical anastomosis with patch aortic enlargement through left thoracotomy
29 y.o.	Aortic anastomosis aneurysm	Stent graft implantation with coverage of the left subclavian artery ostium (LZ2)
39 y.o.	Stent graft Ia endoleak	Carotid-to-carotid anastomosis grafting and stent graft implantation with coverage of the left carotid artery ostium (LZ1)
40 y.o.	Stent graft Ia endoleak	Total arch debranching and stent graft implantation with coverage of the brachiocephalic trunk ostium (LZ0)

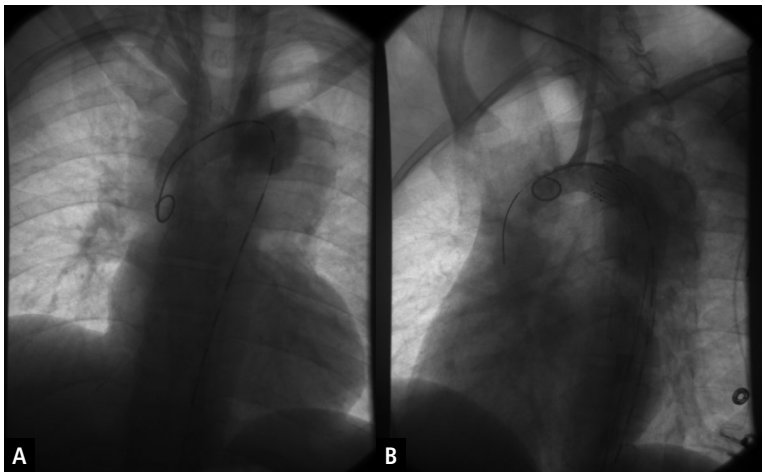

FIGURE 1. Fluoroscopy of LZ3 aortic arch aneurysm (**A**); fluoroscopy after LZ2 stent graft implantation (**B**). LZ, landing zone

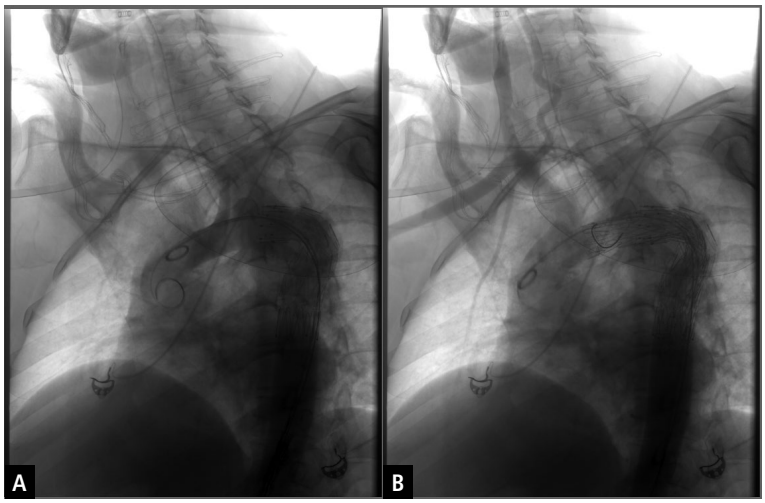

FIGURE 2. Fluoroscopy of LZ2 aortic arch aneurysm (**A**); fluoroscopy after carotid-to-carotid anastomosis grafting and LZ1 stent graft implantation (**B**). LZ, landing zone

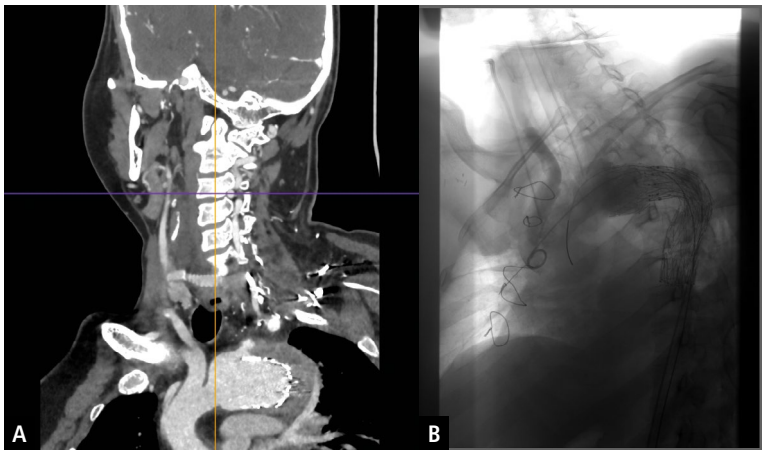

FIGURE 3. 2D reconstruction of LZ 1 aortic arch aneurysm (**A**); fluoroscopy after total arch debranching before LZ 0 stent graft implantation (**B**). LZ, landing zone

rysm sac most likely responsible for the reported symptoms (Fig. 3).

During this admission, one-year post-stent-graft implantation, a control angiography CT scan revealed a type Ia endoleak with blood flow into an aneurysm sac (Fig. 3); therefore, the patient qualified for a hybrid surgical repair. Standard antibiotic prophylaxis was used, and the patient received 10,000 IU of heparin. A mini-sternotomy through the upper right 2nd intercostal space exposed the ascending aorta above the sino-tubular junction, allowing the dissection of the brachiocephalic trunk (diameter 12 mm). Using a side clamp on a beating heart, a 12 mm vascular prosthesis was anastomosed with an ascending aorta about 2 cm above and laterally from the right coronary artery outlet. Subsequently, venoarterial extracorporeal circulatory support was initiated through the right axillary artery and femoral vein using a modified Sedinger technique to protect cerebral circulation. Extracorporeal circulation was continued with normothermia with a pump flow of 1000 mL/min. After placing two vascular clamps on the brachiocephalic trunk, the vessel was incised transversely. The proximal end was sewn with a Prolene 5–0 suture. The distal end was anastomosed to the vascular prosthesis previously connected with the aorta. Total extracorporeal circulation time was 17 min. Continuous blood pressures on the left and right radial and left femoral artery were monitored. Near-infrared spectroscopy (NIRS) was also used to monitor brain activity. The stent graft was implanted by surgical approach through the right common femoral artery in the next step. The left femoral artery was percutaneously punctured by Seldinger's technique for introducing a 6F straight catheter with side holes on a pigtail 5F one in the ascending aorta to position the landing zone target. The GORE (Gore Medical, Flagstaff, AZ, USA) stent graft was placed in the thoracic aorta over an Amplatz 0.35 guidewire. DSA (Digital Subtraction Angiography) was performed in five to ten series using an ionic contrast medium to confirm the final position and tightness of the prosthesis. The proximal end was located directly behind the anastomosis site of the vascular prosthesis with the ascending aorta, thus maintaining a large landing zone (Fig. 4). The course of hospitalization was uncomplicated. The patient reached primary clinical success — according to the Society of Vascular Surgery can only occur without any of the following: death as a result of treatment or as a result of the original pathology that was treated; type I or III endoleak, infection or aortic thrombosis; aneurysm expansion (diameter > 5 mm, volume > 10% or greater than two times interobserver variability) or rupture; conversion to open repair; or failure to arrest the original pathologic process (eg, embolization from penetrating ulcer) or causing a new thoracic aortic pathology as a result of the intervention (eg, pseudoaneurysm, dissection, intramural hematoma) [1]). The hospital course was uncomplicated, and the patient was discharged home 5 days after the procedure.

Currently, he is followed by the Cardiac Surgery Ambulatory team. Three months after the surgery, a control angiography CT of the chest was performed — confirming the good effect of the treatment and aortic aneurysm exclusion.

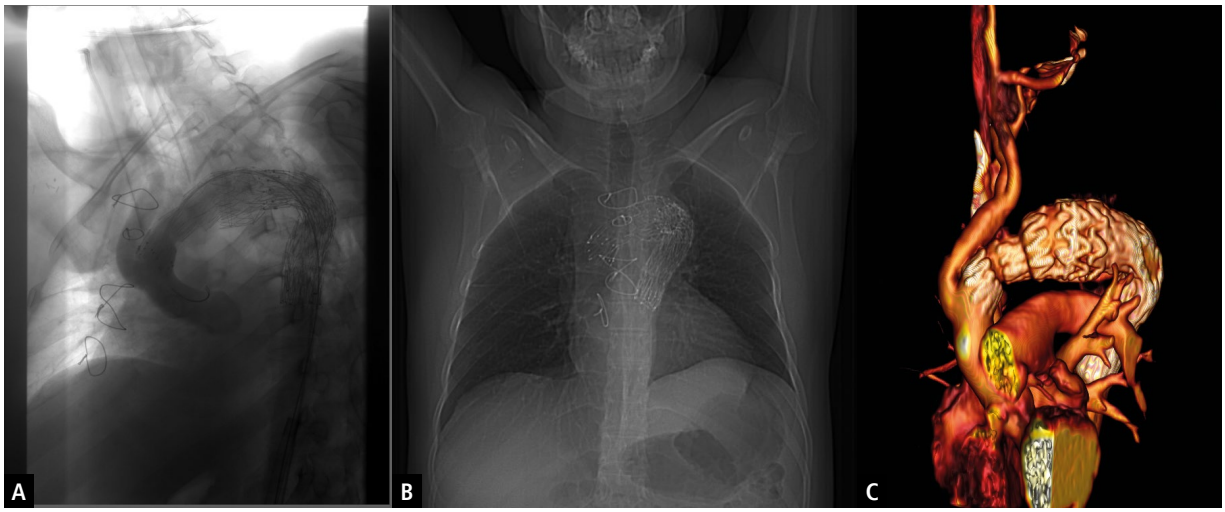

FIGURE 4. Fluoroscopy after total arch debranching an after LZ 0 graft implantation (**A**); X-ray after the final procedure (**B**); 3D reconstruction after the final procedure. (**C**) LZ, landing zone

DISCUSSION

In 2002, Mitchell et al. and Criado et al. proposed the division of the aorta into five landing zones (LZ) to properly plan the TEVAR strategy, including hybrid treatment [1–4]. During the 2004 Tokyo Consensus meeting, experts' opinion was presented in guidelines and recommended that the minimum length of the pathology-free aortic segment for safe fixation should be > 20 mm with an LZ aortic diameter of > 38/40 mm < is this 38 to 40 mm? > to minimalize the risk of leakage (Type 1 endoleak) [5–12]. The following expert consensus proposed the minimal proximal and/or distal landing zone length of more than 25 mm and a maximum diameter of the native aorta of less than 38 mm and no graft oversizing in type B dissection [6]. In rather rare cases when the aneurysm is located in the aortic arch and the proximal graft is in LZ 0-1, hemi-arch (LZ 1) or total-arch (LZ 0) transposition (debranching) precedes safe stent graft implantation [1–10]. An alternative procedure is a high-risk open surgical repair. However, even in high-volume cardiac surgical centers, TEVAR methods are preferable, especially in emergencies. One of the most severe complications following TEVAR procedures is an endoleak. Some publications suggest that it is provoked by incorrect procedure planning [1–4]. In this case, the 2nd and 3rd stent graft implantations were performed due to a Type Ia endoleak. The TEVAR procedure adopted in our center meets the Tokyo Consensus recommendations of a minimal proximal and distal Landing Zone of 25 mm (since 2019). As reported in this case, these recommendations have positively impacted our center's emergent TEVAR results [6].

CONCLUSIONS

A complex hybrid approach requiring multistep surgical and endovascular techniques can treat complicated aortic pathologies requiring emergent interventions. Optimal results can be achieved with an experienced and dedicated team. After analyzing the treatment methods and late complications in the form of Type 1 endoleaks, the recommended landing zone for proximal and distal stent graft implantation should be more than 25 mm.

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