

Staged Hybrid Repair for Acute Type B Aortic Dissection of Right-Sided Aortic Arch

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Abstract

Right-sided aortic arch is rare and the reported type B aortic dissection with this pathology has been limited. We report a case of staged hybrid surgical repair using short frozen elephant trunk for this pathology. The computed tomography after 3 month confirmed the shrinkage of aneurysm diameter and thrombosis of false lumen.

Keywords: Type B dissection; Right aortic arch; Frozen elephant trunk; Endovascular repair

Introduction

Right-sided aortic arch (RAA) is an anatomic variant occurring in approximately 0.05-0.1% of the population. Only around 10 surgical cases of acute aortic type B dissection of RAA have been reported [1-3] (Table 1). We report one case of hybrid repair using short frozen elephant trunk (FET) for acute type B aortic dissection involving RAA.

Case Report

A 73-year-old male presented with severe back pain. A computed tomography (CT) scan demonstrated an RAA with a Kommerell's diverticulum (KD). The ordering of the aortic branches was as follows; left common carotid artery (LCCA), right common carotid artery (RCCA), right subclavian artery (RSCA) and aberrant left subclavian artery (ALSCA) arising from KD (Figure 1). A dissection extended from the origin of RCCA to left common iliac artery. The proximal tear was observed just distal of KD. The maximum diameter of the distal arch was 40 mm at the onset. The patient was managed medically, however, a CT-scan after one week revealed rapid enlargement of the distal aortic arch from 40 to 51 mm. Therefore, we planned surgical intervention. Our planned surgical strategy was to cover the proximal tear by thoracic stent graft, which is considered to have less possibility of paraplegia and respiratory dysfunction. The optimal proximal landing zone was proximal to RCCA. In order to provide secure and sufficient proximal landing, total debranching or replacement of the ascending aorta and arch with ET was necessary. We employed graft replacement with ET. We considered the FET better than non-FET because FET has less possibility to kink in steep aortic arch, which was the characteristic of right-sided aortic arch and makes it easy to perform following thoracic endovascular repair (TEVAR). The aortic diameter of proximal landing was 27 mm and that of distal was 21 mm. Therefore, tapered stent graft seemed desirable to close the proximal tear. Then, the staged surgical treatment was decided to perform with replacement of the ascending aorta and arch with short FET via a median sternotomy in order to provide secure and sufficient proximal landing for following TEVAR with tapered stent graft to cover the proximal tear.

The bilateral axillary arteries (AxA) were exposed and anastomosed to 9 mm J graft (Tokyo, Japan Lifeline). After the circulatory arrest was introduced, the RSCA was ligated at the origin, and a selective antegrade cerebral perfusion was established. Open distal arch anastomosis was performed just distal to the origin of LCCA using four-branched J graft 26 × 11 × 9 × 9 mm graft (Japan Lifeline, Tokyo,

Japan). Before anastomosis, 27-60 mm J graft open stent graft (Japan Lifeline, Tokyo, Japan lifeline) was inserted into the true lumen of aortic arch. The LCCA, RCCA and two graft anastomosed to right AxA were anastomosed to the branches of the graft.

Scheduled TEVAR was performed 7 days after the first surgery. A conformable GORE TAG thoracic endoprosthesis (WL Gore and Associates) (31 × 26 × 100 mm and 34 × 34 × 150 mm) was inserted via femoral artery to cover the proximal tear with proximal end at distal anastomosis site of four-branched graft. The true lumen of KD was coiled with Interlock (Boston scientific Japan, Tokyo, Japan) and MRye (Cook Japan, Tokyo, Japan). We locked the AMPLATZER vascular plug (St. Jude Medical) to occlude the ALSCA.

The postoperative course was uneventful. Neither neurological problems nor hoarseness was detected. Postoperative CT demonstrated that false lumen was almost thrombosed and the KD was completely excluded by the endograft and vascular plug (Figure 2). The diameter of distal arch shrunken from 51 mm to 32 mm after 3 months of the procedure (Figure 3).

Discussion

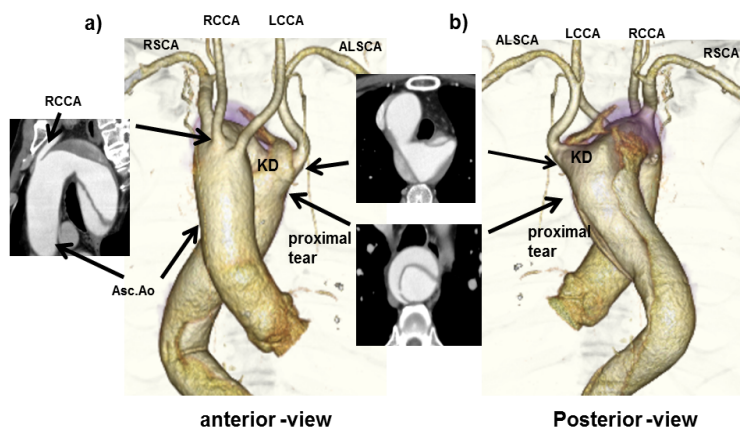
In the surgical treatment of type B aortic dissection involving RAA, single GR through right thoracotomy, usually employed, is considered to be radical therapy. However, neurological deficit such as paraplegia or recurrent nerve palsy and respiratory distress are not negligible. On the other hand, TEVAR is doubtless less invasive. Nevertheless, long term result remains unknown. Moreover "steep aortic arch", which is one of the characteristic of RAA, might result in increasing risk of kinking of stent graft or retrograde type A dissection [4]. Hybrid procedure, firstly total arch replacement with elephant trunk (ET) followed by TEVAR and single stage repair using FET, have also been reported [5]. However, single stage repair using long FET or ET might be accompanied with the risk of spinal cord injury.

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a) anterior view, b) posterior view.

KD: Kommerell's Diverticulum; LCCA: Left Common Carotid Artery; RCCA: Right Common Carotid Artery; RSCA: Right Subclavian Artery; ALSA: Aberrant Left Subclavian Artery Arising

Figure 1: Preoperative CT. Acute type B aortic dissection of right-sided aortic arch

		Year	Age	Gender	Classification/ of Raa (Stewart Edwards)	Location of Entry	Op Indication	Surgical Procedure	Resection of KD	Approach	Prognosis	Follow Up
1	Floten	1984	64	Male	IIIB	Distal to ALSA distal of KD	Persistent Dyspnea	extraanatomical bypass	Non-resected	Bilateral thoracotomy	Alive	16m
2	Sugita	1990	64	Male	IIIB	Proximal of ALSA	Rupture	entry closure and reinforcement of anastomosis site	Non-resected	Left thoracotomy	Alive	N.D
3	Masiello	1996	48	Male	IIIB	N.D	Enlargement of aneurysm	GR of distal arch and desaorta	Resected	Right thoracotomy	Alive	N.D
4	Kim	2010	47	Male	IIIB	Lower thoracic aorta	Enlargement of aneurysm, impending rupture	GR of des aorta	Non-resected	Right thoracotomy	Alive	6m
5	Kim	2012	32	Male	IIIB	Arch	Left arm malperfusion	total arch replacement	Resected	Median	Temporary paraparesis	N.D
6	Croccia	2012	62	Male	IIIA	N.D	Enlargement of aneurysm	TEVAR			Alive	2 year
7	Zhou	2013	65	Male	IIIB	N.D	Enlargement of aneurysm (52mm) t	TEVAR	Non-excluded		Alive	18M
8	Ma	2013	42	Male	IIIA	Arch	Malperfusion of lower extremity	TEVAR with chimney technique			Alive	1M
9	Hsu	2015	47	Male	IIIB	Just below of KD	Malperfusion	TEVAR with chimney technique	Excluded		Alive	ND
10	Present case	2016	73	Male	IIIB	Just below of KD	Enlargement of aneurysm	1. Total arch replacement with frozen elephant trunk, 2. TEVAR	Excluded by endograft and plug	Median	Alive	10M

ALSA: Aberrant Left Subclavian Artery; KD: Kommerell's Diverticulum; GR: Graft Replacement; TEVAR: Thoracic Endovascular Aortic Repair

Table 1: The reported cases of surgical treatment for acute type B dissection [2,3].

Short FET from the origin of aortic arch, as in the present case, has not been reported to be employed, followed by TEVAR in this pathology. We believe that the merit of short FET for this pathology is considered as followings; firstly, the risk of kinking of graft is considered to be low compared with prosthetic graft, especially in cases of RAA whose curve of aortic arch is generally steep. Secondly, the following TEVAR is technically easy to be performed providing the secure proximal landing zone. The short FET is less frequently accompanied with spinal cord injury. In addition, the distal anastomosis can be performed more proximal in first operation, resulting in prevention from bleeding and recurrent nerve paralysis.

Conclusion

We report a rare surgical case of acute type B DAA in RAA using short FET followed by TEVAR. This hybrid procedure might be associated with less likely spinal cord injury and recurrent nerve palsy and provide the sufficient proximal landing zone for following TEVAR. Long-term follow up should be necessary for validation of this procedure.

Disclosure Statement

All authors have no conflict of interest.

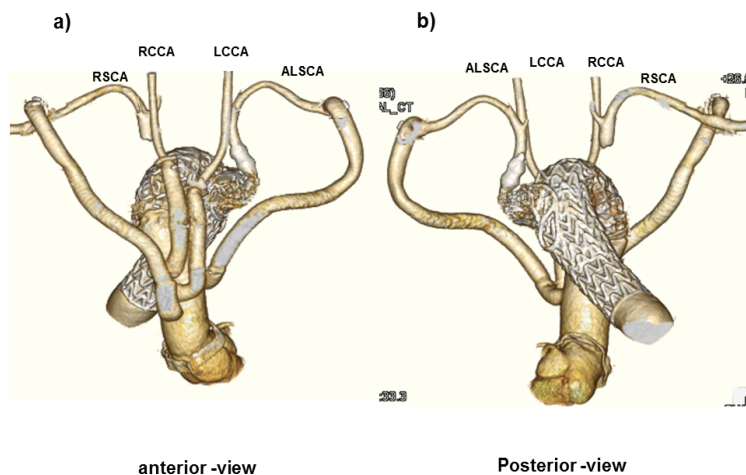


Figure 2: Postoperative CT a) anterior view b) posterior view.

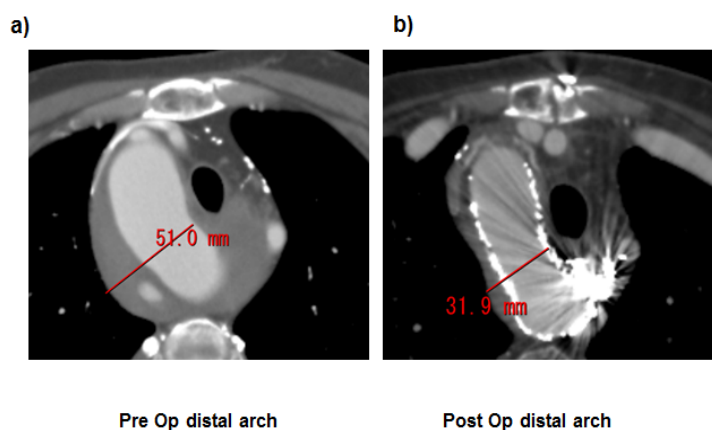


Figure 3: The diameter of distal arch shrunken from 51 mm (a) to 32 mm (b) after 3 months of the procedure.

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