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 months 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 type B aortic 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 endograft, 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 the branches of the graft. The true lumen of KD was excluded by the endograft and vascular plug (Figure 2). The diameter of false lumen was almost thrombosed and the KD was completely covered by thoracic stent graft, which is considered to be accompanied with the risk of spinal cord injury.

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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Received May 20, 2017; Accepted June 01, 2017; Published June 07, 2017

Citation: Shibukawa T, Yamauchi T, Masai T (2017) Staged Hybrid Repair for Acute Type B Aortic Dissection of Right-Sided Aortic Arch. J Vasc Med Surg 5: 315. doi: 10.4172/2329-6925.1000315

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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.

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

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

ALS A: 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].
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.

References


