One-stage total thoracic aortic repair for mega-aorta using frozen elephant trunk technique

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Abstract

We report the case of a 71-year-old female with mega-aorta extending from the ascending aorta to the descending aorta, who was successfully treated with a one-stage total thoracic aortic repair by the frozen elephant trunk technique using a stent-graft. We used a home-made frozen elephant trunk with four giant-turco Z-stents on the distal side that was inserted into the downstream descending aorta via an aortic arch guiding pull-through wire. The stent-graft was distally positioned at the level of the 12th thoracic vertebra after total arch replacement had been performed using a four-branch graft. The postoperative course was good, and there was no paraplegia or other complications. A postoperative computed tomography scan demonstrated complete thrombosis of the descending thoracic aneurysm without endoleak. In conclusion, the frozen elephant trunk was effective as a one-stage operation for mega-aorta.

Keywords: Frozen elephant trunk; Mega-aorta; One-stage operation

1. Introduction

The strategy to treat an aortic aneurysm extending from the ascending aorta to the descending aorta (mega-aorta) is controversial. We report here our experience of a case of one-stage replacement of the total thoracic aorta using the frozen elephant trunk technique for mega-aorta.

2. Case report

A 71-year-old female was admitted for surgery on a mega-aorta extending from the ascending aorta to the descending aorta, with a pericardial effusion and a left lower lobe atelectasis. Ninety per cent stenosis of the right coronary artery and moderate aortic regurgitation were identified. According to a preoperative computed tomography (CT)-scan, the maximum diameters of the thoracic aortic aneurysm were 34 mm at the sinus of Valsalva, 62 mm for the ascending aorta, 62 mm for the aortic arch, and 61 mm for the descending aorta (Fig. 1). The diameter was 48 mm at the level of the 10th thoracic vertebra, 35 mm at the level of the 11th, and 32 mm at the level of the 12th. The ostium of the left subclavian artery was occluded. We selected a one-stage operation using the frozen elephant trunk technique for this patient with mega-aorta, and performed cerebrospinal fluid drainage.

Fig. 1. Preoperative computed tomography scan. The maximum diameters of the thoracic aortic aneurysm were 34 mm at the sinus of Valsalva, 62 mm for the ascending aorta, 62 mm for the aortic arch, and 61 mm for the descending aorta. The diameter was 48 mm at the level of the 10th thoracic vertebra, 35 mm at the 11th, and 32 mm at the 12th.

After median sternotomy, cardiopulmonary bypass was started via the axillary arteries bilaterally. During cooling, coronary artery bypass to the right coronary artery was performed using a saphenous vein graft. Under moderate hypothermia of 28° minimum rectal temperature, a home-made stent-graft with four Giant-turco Z-stents (Cook, Bloomington, USA) that were fixed at the distal side on a straight graft of 37.5 mm diameter was inserted into the downstream descending aorta via an aortic arch guiding pull-through.
wire. We verified the position of the stent-graft by transesophageal echocardiography. Finally, the stent-graft was positioned at the level of the 12th thoracic vertebra (Fig. 2). An occlusion balloon was positioned at the distal stent-graft, and distal perfusion from the right femoral artery was started. Total arch replacement was performed using a four-branch graft of 28 mm in diameter. The plication to the sinotubular junction was performed using a 28-mm graft.

The patient’s postoperative course was good, and there was no paraplegia or other complications. A postoperative CT-scan demonstrated complete thrombosis of the descending thoracic aneurysm without endoleak.

3. Discussion

Patients with ‘mega-aorta’ who have an extended aneurysm of the ascending, transverse aortic arch and distal aortic involvement including the descending thoracic aorta are still considered to be a challenge for many cardiovascular surgeons [1–5]. Since the introduction of endovascular stent-graft technology for thoracic aortic aneurysms, it has been considered as an alternative treatment modality for thoracic aortic aneurysms that may be associated with reduced mortality and morbidity [1, 4]. Endovascular stenting of the total aortic arch with bypass of the supra-aortic vessels has recently become a popular and less invasive technique for arch aneurysm. However, this technique is not suitable for a mega-aorta that does not have proximal landing zone on the ascending aorta.

The frozen elephant trunk technique is performed via a median sternotomy, and an endovascular stent-graft is placed into the descending aorta in an antegrade fashion through the opened aortic arch [5]. The ascending aorta and arch aorta are then replaced conventionally. This technique has a combination of advantages of surgical and interventional approaches, and therefore, appears to be promising. The frozen elephant trunk technique has fewer anatomical limitations in terms of the proximal and distal aorta compared with an endovascular stent-graft.

The incidence of paraplegia after implantation of the frozen elephant trunk is 3.3% according to a review report by Karck and Kamiya [6]. Spinal cord injury after the frozen elephant trunk procedure was associated with a range of factors, such as the thoracic vertebral level, where the distal end of the frozen elephant trunk was deployed, the history of downstream aortic operation and intraoperative hypotension [7]. Cerebrospinal fluid drainage was performed before the operation in elective cases with a history of aortic repair to the thoracoabdominal or abdominal aorta or when the pathological condition required stent-graft delivery lower than the ninth thoracic vertebra.

This patient had mega-aorta of 62 mm for the ascending aorta, 62 mm for the aortic arch and 61 mm for the descending aorta. Because we thought that carrying out a two-stage operation would carry a risk of aortic rupture occurring between the procedures, we performed one-stage total thoracic aortic repair of the mega-aorta using the frozen elephant trunk technique. A technique using a pull-through wire from the aortic arch to the femoral artery was useful for deep deployment of the stent-graft.

4. Conclusion

In conclusion, the frozen elephant trunk technique was effective as a one-stage operation for mega-aorta.

References