

Simple endovascular thoracic aortic stenting rescues a wrongly deployed frozen elephant trunk during a modified procedure

Journal of International Medical Research
49(2) 1–5

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DOI: 10.1177/0300060520986710

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Abstract

We report a bail out approach of endovascular thoracic aorta repair following incorrect deployment of a modified frozen elephant trunk stent graft into the false lumen. A 76-year-old patient was admitted to our Emergency Department. A computed tomography angiography scan showed type I DeBakey aortic dissection. An emergency modified frozen elephant trunk procedure was performed. Immediate postoperative computed tomography angiography showed that the distal segment of the stent was deployed in the false lumen, probably through a re-entry tear at the descending thoracic aorta. Emergency endovascular repair of the thoracic aorta, as well as angioplasty of the superior mesenteric artery and left iliac artery, were performed.

Keywords

Modified frozen elephant trunk, endovascular repair, ascending aortic dissection, stent, thoracic aorta, false lumen

Date received: 25 September 2020; accepted: 14 December 2020

Introduction

The modified frozen elephant trunk (mFET) procedure is a hybrid approach whereby conventional ascending aorta and hemiarch replacement is combined with stent graft implantation into the distal aortic arch. This procedure provides

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excellent in-hospital and mid-term outcomes,¹ and stent expansion in the distal aortic arch provides favorable remodeling of the downstream aorta.² A rare complication can arise when the introduced stent graft is deployed into the false lumen. This report highlights a case of a unique bail out approach in this situation.

Case report

A 76-year-old patient was admitted to our Emergency Department for severe chest pain. A computed tomography angiography (CT-A) scan showed a DeBakey type I aortic dissection with an entry tear at the ascending aorta, which originated from the aortic root. This tear extended distally into both femoral arteries and occluded the left communal femoral artery (Figure 1a)

and the right superficial femoral artery (Figure 1b).

An emergency mFET was performed. The ascending aorta and hemiarch were replaced and an antegrade endovascular aortic stent was inserted at the distal aortic arch. Central cannulation of the ascending aorta was conducted using the Seldinger technique guided by intraoperative epi-aortic echocardiography. After a nasopharyngeal temperature of 28°C was reached, the aortic arch was transected using conventional hemiarch repair. Antegrade brain perfusion was initiated into the left carotid artery and brachiocephalic trunk. No distal guidewire could be inserted because of occlusion of both femoral arteries. A short 100-mm stent graft (37 × 37 × 100 mm; GORE®TAG®, WL Gore & Associates, Flagstaff, AZ, USA)

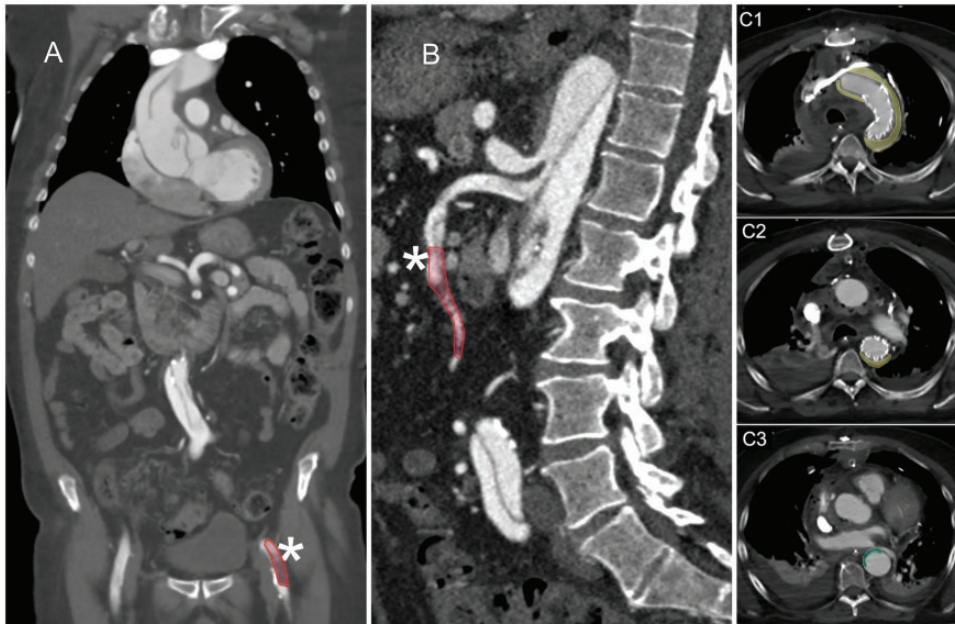


Figure 1. Preoperative computed tomography angiography scan showing acute DeBakey type I dissection at the ascending aorta with occlusion of the left femoral artery (red outlined area, *) (a) and occlusion of the SMA (red outlined area, *) (b). Immediate postoperative computed tomography angiography scan showing proximal stent deployment in the true lumen (c1, c2) (yellow outlined area indicates the false lumen) and the intimal flap occluding the true lumen distally (blue outlined area) (c3).

was delivered antegradely into the true lumen, under direct visualization, distally to the left subclavian artery. Subsequently, a surgical graft (30 × 8-mm Gelweave™; Terumo Aortic, Inchinnan, Scotland) was implanted in a standard manner as described previously.^{3,4}

Immediate postoperative CT-A was performed under suspicion of preoperative occlusion of the superior mesenteric artery (SMA). The distal segment of the stent was found to be deployed into the false lumen, leading to complete collapse of the true lumen. The previously described occlusion of the SMA persisted (Figure 1c).

The patient returned to the operating theater. An arterial access was placed at the level of the right superficial femoral artery, and a guidewire (Amplatz wire; Cook Medical, Bloomington, IN, USA) was inserted and advanced under C-arm X-ray control to the thoracic aorta

re-entry point. The distal opening of the thoracic stent was reached through the intimal tear just underneath of the implanted stent. A stent graft (34 × 34 × 150-mm GORE®TAG®) was implanted over an extra stiff guidewire (Lunderquist, Cook Medical). The SMA was subsequently dilated with a 6-mm percutaneous transluminal angioplasty balloon (Figure 2a). Stenting of the SMA was not performed because of re-establishment of perfusion pressure. After swift rehabilitation, the patient was discharged after 14 days. CT-A at discharge showed no further progression of the aortic dissection membrane and appropriate contrasting of the SMA, with no signs of intestinal ischemia (Figure 2b).

Discussion

The mFET procedure has excellent in-hospital and mid-term outcomes.¹

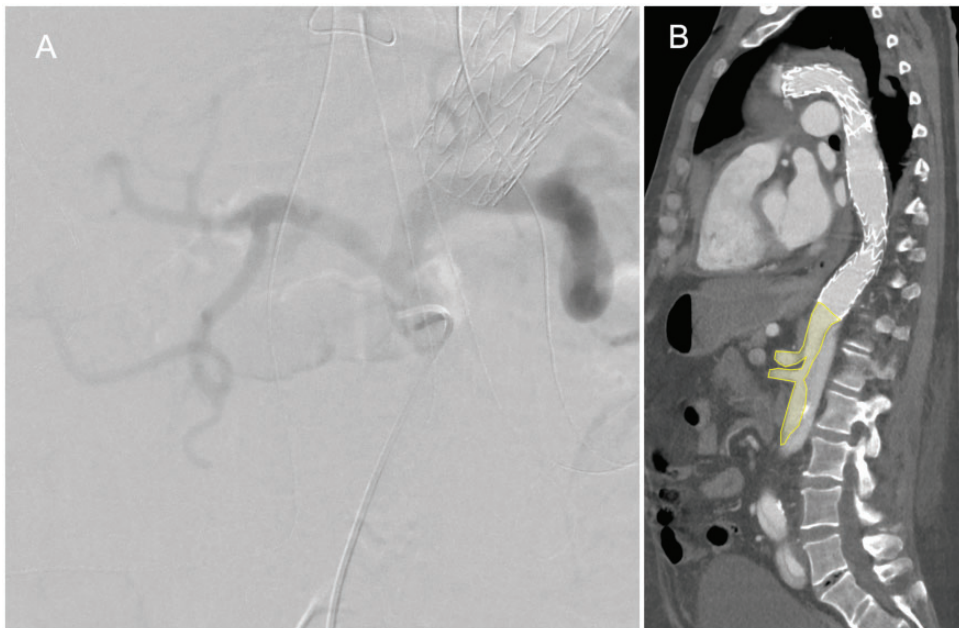


Figure 2. Intraoperative probing of the superior mesenteric artery and celiac artery (a). Computed tomography angiography before discharge showing an open celiac artery and superior mesenteric artery originating from the true lumen (yellow outlined area) (b).

The mFET is used in our institution on a regular basis for DeBakey type I acute aortic dissection. A potential complication of this technique is deployment of the stent graft into the false lumen of the descending aorta.

The stent length needs to be considered when preoperative images are analyzed. In our patient, the 37 × 37 × 100-mm stent graft that was used might have been too large. For sizing the stent, the aortic diameter, which is measured perpendicular to the vessel centerline at the level of the origin of the left subclavian artery, dictates the width of the stent. In our patient, the stent was oversized by 0% and appeared to be optically coherent. We rarely use a stent longer than 150 mm to avoid spinal cord injury. The implanted stent was 100 mm, and the distance from the subclavian artery to the re-entry tear was 180 mm. Nevertheless, the distal end of the stent reached the intimal tear. This finding might have been due to the rigid nature of the GORE®TAG® stent graft used, and it could have created a new entry on the fragile endothelium, into the false lumen. Furthermore, in cases with a long and curved descending aorta, a more supple stent graft is advantageous. We believe that use of *in situ* endovascular endoscopy for identifying an entry tear, as well as stent deployment, would enable avoidance of this complication. Performing standard ascending aorta and hemiarch replacement, with secondary stent implantation, may have avoided our patient's complication. We also believe that use of the over-the-wire insertion approach may minimize the risk for this complication. However, even when the guidewire technique is applied, migration of the distal end of the stent into the false lumen may occur.² When a guidewire cannot be advanced owing to occlusion of a vessel, a device, such as the CRONUS stented graft (Microport Medical, Shanghai, China), could be a viable alternative.

Implementation of CT-A as a routine tool post-intervention in mFET enabled us to immediately identify the devastating complication of a stent graft deployed into the false lumen in our patient. Although rare, this complication should be always kept in mind, especially if the stent graft cannot be introduced over a guidewire.

Ethics statement

Ethical approval for reporting individual cases is not required by our institution. Written consent for use of data and tissue for research purposes and subsequent publication was obtained from the patient.

Declaration of conflicting interest


The authors declare that there is no conflict of interest.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

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