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Covered frozen elephant trunk technique for prevention of distal stent graft-induced new entry

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Abstract

Distal stent graft-induced new entry is not rare after frozen elephant trunk implantation. We report a case of covered frozen elephant trunk placement for prevention of distal stent graft-induced new entry. Coverage of the rigid distal stent edge using a graft reduces mechanical stress on the intima and radial force of the distal stent; therefore, this technique can potentially prevent distal stent graft-induced new entry.

Keywords: Frozen elephant trunk • Distal stent graft-induced new entry

INTRODUCTION

The frozen elephant trunk (FET) technique is widely used to promote aortic remodelling in cases of acute type A aortic dissection. However, FET placement may postoperatively result in distal stent graft-induced new entry (SINE), a new intimal tear created at the distal edge of the FET. Reportedly, the incidence of distal SINE is as high as 25% [1]; however, preventive measures against this complication remain unclear. We report a case of covered FET implantation as a useful strategy to prevent distal SINE.

CASE REPORT

A 78-year-old woman who presented with syncope was transferred to our hospital. Contrast-enhanced computed tomography revealed acute type A aortic dissection with an entry tear in the transverse arch of the aorta, and the left vertebral artery originated from the aorta.

Emergency surgery was performed via median sternotomy. Cardiopulmonary bypass was established via cannulation of the ascending aorta, the right atrium and a left ventricular vent.

The distal edge of a commercially available FET (J Graft FROZENIX, Japan Lifeline, Tokyo, Japan) was modified during systemic cooling (Fig. 1; Video 1). The proximal FET graft segment (2 cm in length) was excised. The distal edge of the FET was partially unfolded within the excised graft. The FET and excised graft were sutured at 4 points using 4-0 polypropylene sutures to

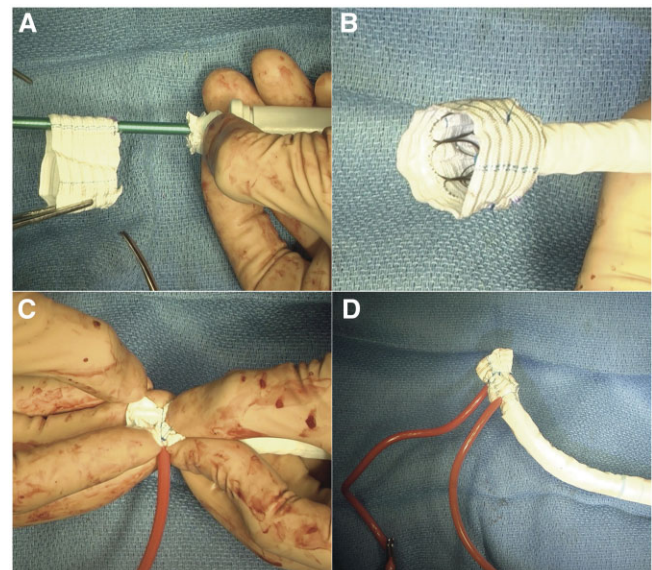
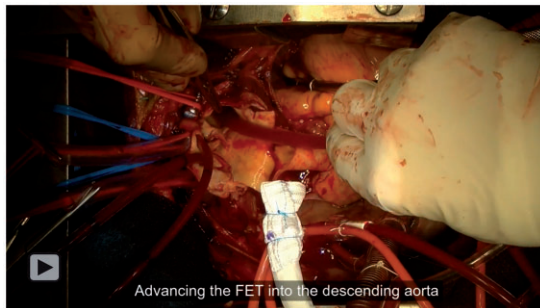


Figure 1: Image showing preparation of a covered frozen elephant trunk. (A) A proximal graft portion of the frozen elephant trunk (FET) is excised, (B) the slightly unfolded distal edge of the FET and the excised graft are sutured, (C) the FET is manually compressed using 4-0 polypropylene sutures and a tourniquet and (D) the compressed FET is curved in shape.

avoid graft detachment. Subsequently, the distal covered edge of the FET was manually compressed using 4-0 polypropylene sutures and tourniquets. For smooth insertion, it is important to completely compress the FET before deployment.



Video 1: Intraoperative video and computed tomography image.

Hypothermic circulatory arrest was accomplished at a rectal temperature of 28°C. Retrograde and antegrade cardioplegia were intermittently administered. Antegrade selective cerebral perfusion was initiated. The entry tear was excised, and the transverse aortic arch was transected proximal to the left subclavian artery. The modified FET (27 mm in diameter and 120 mm in length) was deployed into the descending aorta. We used the fenestrated FET technique for distal anastomosis with reconstruction of the left subclavian artery and left vertebral artery [2]. The lower body hypothermic circulatory arrest time was 42 min. Subsequently, using continuous sutures, we performed proximal anastomosis with reconstruction of the left common carotid and innominate arteries. Cardiopulmonary bypass and aortic cross-clamp times were 182 and 95 min, respectively.

The postoperative course was uneventful. Postoperative computed tomography revealed satisfactory graft coverage of the distal edge of the FET (Fig. 2). We observed no difference in blood pressures between the upper and lower extremities.

DISCUSSION

Distal SINE may occur secondary to the shear stress observed between the rigid distal end of the FET and the dissection membrane. Several factors including a fragile aortic wall may contribute to the development of distal SINE. The radial force of the FET induces mechanical stress on the aortic wall. A spring back force, which refers to the tendency of the FET to revert to its original straight form, can also increase mechanical stress on the aortic wall. Although several risk factors are implicated in the onset of distal SINE, this phenomenon remains unpredictable [1]. Distal SINE is frequently diagnosed incidentally during follow-up. Although untreated distal SINE is associated with a high mortality rate [1], a definitive preventive strategy against distal SINE remains unknown.

Considering the pathophysiological mechanism underlying distal SINE, we are of the view that a less rigid distal end of the FET may reduce the risk of dissection membrane injury. The covered FET technique involves coverage of the rigid stent edge using a soft graft, together with a tapered design of the FET, and reduction of radial force at the distal edge of the FET (Supplementary Material, Fig. S1). A tapered FET prosthesis

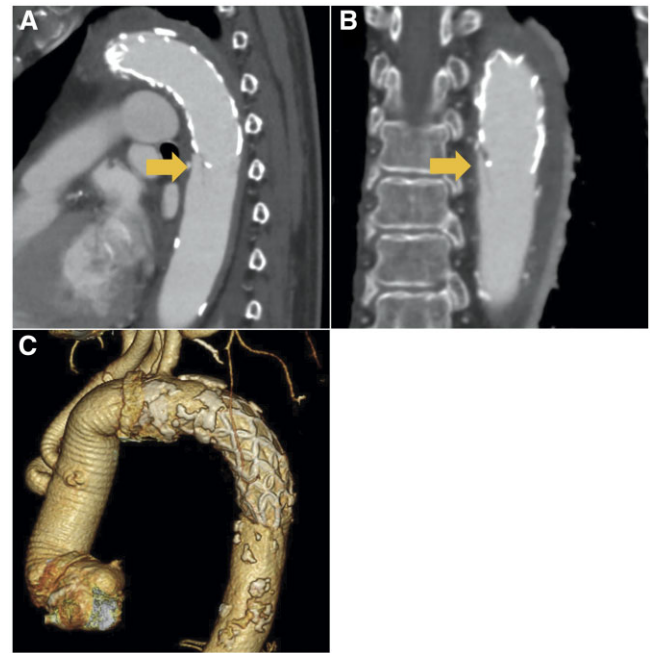


Figure 2: Postoperative contrast-enhanced computed tomography scan: (A) sagittal view, (B) coronal view and, (C) 3-dimensional computed tomography scan. Arrows indicate the covered distal edge of the frozen elephant trunk.

can easily be created by altering the diameter of the attached graft, based on the surgeon's choice. Notably, any kind of FET can be modified using this technique. Theoretically, our technique may be useful to prevent distal SINE; however, larger-scale studies are warranted to validate the prophylactic effect of this novel method.

SUPPLEMENTARY MATERIAL

Supplementary material is available at *ICVTS* online.

Conflict of interest: none declared.

Reviewer information

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