



Normothermic frozen elephant trunk without circulatory arrest

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Abstract

We describe our technique for total aortic arch replacement with stenting of the descending thoracic aorta allowing normothermic cardiopulmonary bypass and avoiding hypothermic circulatory arrest.

Keywords Aorta · Aortic surgery · Aortic arch

In the last years, aortic arch surgery with frozen elephant trunk (FET) technique has been progressively showing improved clinical outcomes, due to refined surgical techniques and organ protection methods. Nonetheless, long cardiopulmonary bypass (CPB) and hypothermic circulatory arrest (HCA) times still impact negatively on patients' outcome. Hereby, we present a FET technique that allows normothermic CPB and avoids HCA [1]. The main features are (1) uninterrupted total body perfusion by femoral artery and brachiocephalic trunk (BCT) cannulation; (2) complete antegrade selective cerebral perfusion (ASCP); (3) retrograde endograft delivery through femoral access; and (4) aortic endoclamping [2].

After full sternotomy, the aorta and the arch vessels are carefully prepared. Both the BCT and the femoral artery are cannulated. The retrograde deployment of an endograft is completed through contralateral femoral access. Normothermic CPB is started; the left subclavian artery is transected and cannulated for ASCP through interposition of an 8-mm graft. After cardioplegic arrest, ASCP is completed by cannulation of the left carotid artery. The BCT is occluded proximally and a balloon

catheter is used to occlude the endograft; this allows continuous lower body perfusion from the femoral artery inflow line, while ASCP keeps the brain fully perfused. Distal anastomosis between a Terumo Siena 4-branched vascular graft and the endograft is performed. The Siena graft is clamped, the balloon deflated, and the proximal anastomosis completed. Arch vessels are then reimplanted in the standard fashion.

We do believe that by the complete avoidance of HCA, our normothermic FET technique may improve clinical results after FET. Currently, we successfully performed 19 procedures in selected patients presenting with degenerative aneurysm ($n=17$) and aortic dissection ($n=2$). It has to be noted however that patients with aortic dissection are not the most suitable cases to be treated with this technique due to the risk of aortic injury following endoclamping or inadequate endograft sealing.

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Data availability The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Declarations

Ethical approval and informed consent statement The use of data for scientific and research purposes is included in the informed consent agreements used and signed by the patient. Furthermore, IRB approval and clinical trial registration are not applicable for this study. We also guarantee the respect of anonymity and professional secrecy and use the collected data and the statistical analysis solely for the scientific purposes granted in accordance with the law in force (GDPR).

Conflict of interest All authors have no conflicts of interest or financial conflicts to disclose.

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