Editorial

Frozen elephant trunk in chronic dissection

Alessandro Leone[1], Roberto Di Bartolomeo[2], Luca Di Marco[1], Davide Pacini[1]

[1]Alma Mater Studiorum, University of Bologna and IRCCS Sant'Orsola University Hospital, Bologna, Italy; [2]Alma Mater Studiorum, University of Bologna, Bologna, Italy

Correspondence to: Alessandro Leone, MD. Cardiac Surgery Department, S.Orsola Hospital, University of Bologna, Via Massarenti n. 9, 40128 Bologna, Italy. Email: leone.alessandro@yahoo.it.

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The frozen elephant trunk (FET) has been introduced to simplify the treatment of complex aortic pathologies. In the last decade, this technique has become more and more popular, with more than 30,000 hybrid prostheses implanted worldwide (1) thanks also to the improvement of the techniques and devices. Starting from the first modification of the classical elephant trunk proposed by Kato (2) to the first custom-made prosthesis developed by the Hannover group (3), there was a progressive development of new devices that are less complicated and more versatile, and able to be used in different settings and for different indications. According to many aortic surgeons, this has almost replaced the classical elephant trunk.

Among all the improvements introduced, the proximalization of the FET with the possibility to make a more proximal distal anastomosis, significantly reduced the surgical complexity, in acute and chronic settings reducing also the incidence of postoperative paraplegia (4). Secondly, a much appreciated aspect of the FET technique is good longe term results and staging for possible future endovascular or open procedures, especially in cases of aortic dissections.

Chronic aortic dissection is likely one of the first and most frequent indication for total arch replacement with the FET.

The indication for operation occurs usually in two different settings, first, residual aortic dissection, in patients who have undergone primary limited repair for acute type A dissection, with chronic post-dissection aneurysm including a progression in diameter, residual arch dissection, impending aneurysmal rupture and malperfusion syndrome. Secondly, chronic type B aortic dissection, which is usually less frequent and presents less difficulties compared with the first indication, even though both indications have in common the management of the distal aorta with its chronic true/false lumen.

In case of chronic aortic dissection, especially in young patients, the FET offer a feasible solution in order to guarantee a definitive repair of the thoracic aorta, and in addition it can be a safe landing zone for further endovascular extension. However, different aspects of the dissected aorta have to be considered. Hemiarch replacement does not always resolve the issue of the arch intimal tear, or it can become a site for a new entry tear. Furthermore, a tear located near the left subclavian artery can be serious risk factor for false lumen enlargement.

Analysis of the preoperative CT scan is crucial to ensure correct indication for repair and a successful operation. The diameter of the proximal descending aorta is important especially in relation to the true/false lumen ratio. In the case of a large false lumen with consequent compression of the true lumen by a proximal entry tear, it can be easily occluded by the stent portion of the FET. On the other hand, if the entry tear is far from the left subclavian artery with compression of the true lumen by retrograde flow, a different strategy could be taken into consideration, such as a classical elephant trunk with large fenestration of the flap and prompt endovascular extension.

At Bologna University, in patients with extended chronic dissection, FET is used in first instance, especially when further endovascular extensions or open procedures are expected. In these patients, we usually slightly oversize 20% of the true lumen area, except for patients with connective tissue disease, in whom no oversizing is done. The length

of the stent and the type of prosthesis is chosen according to the distance from the distal anastomosis site and the distal end, in order to cover the entire tear in the proximal descending aorta (5). Secondly, the size of the endovascular portion should be chosen according to the anatomy of the proximal descending aorta, the proximal true lumen size that quite often is narrow in relation to the size of the landing zone, and this can be a challenge during the sizing process.

Another important point of discussion is that all residual dissections require re-operations. Redo for aortic arch replacement is technically challenging and the increased operative mortality and morbidity is a well-known issue. The extent of the initial aortic arch repair during the first operation for acute type A aortic dissection (AAAD) remains controversial and significantly influences the follow up and future re-intervention (6). Distal re-intervention rate after operation for AAAD remains high, between 7% and 33% (6,7).

We have already discussed the surgical decision-making process in such patients (8), highlighting the risk-benefit ratio between the lower reoperation rate given by a more complete primary operation, especially in young patients, versus the advantages of a reduced cross-clamp time associated with a more conservative, life-saving repair. However, the continued improvement in operative techniques, and devices used, the experience acquired in high-volume aortic centres, combined with advances in cerebral protection strategies, have all contributed to improve long term results and to lower the reoperation rate after AAAD (9).

Overall, improved long-term follow up of patients after the primary AAAD operation, improvements in advanced imaging and the ability of new devices to facilitate future distal aortic intervention have all led to the widespread adoption of FET in chronic aortic arch dissection.

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Footnote

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References

1. Ma WG, Zheng J, Sun LZ, et al. Open Stented Grafts for Frozen Elephant Trunk Technique: Technical Aspects and Current Outcomes. Aorta (Stamford) 2015;3:122-35.
2. Kato M, Ohnishi K, Kaneko M, et al. New graft-implanting method for thoracic aortic aneurysm or dissection with a stented graft. Circulation 1996;94:II188-93.
3. Karck M, Chavan A, Hagl C, et al. The frozen elephant trunk technique: a new treatment for thoracic aortic aneurysms. J Thorac Cardiovasc Surg 2003;125:1550-3.
4. Leone A, Di Marco L, Coppola G, et al. Open distal anastomosis in the frozen elephant trunk technique: initial experiences and preliminary results of arch zone 2 versus arch zone 3†. Eur J Cardiothorac Surg 2019;56:564-71.
5. Pantaleo A, Jafrancesco G, Buia F, et al. Distal Stent Graft-Induced New Entry: An Emerging Complication of Endovascular Treatment in Aortic Dissection. Ann Thorac Surg 2016;102:527-32.
6. Kreibich M, Berger T, Rylski B, et al. Aortic reinterventions after the frozen elephant trunk procedure. J Thorac Cardiovasc Surg 2020;159:392-399.e1.
7. Rylski B, Beyersdorf F, Kari FA, et al. Acute type A aortic dissection extending beyond ascending aorta: Limited or extensive distal repair. J Thorac Cardiovasc Surg 2014;148:949-54; discussion 954.
8. Leone A, Di Marco L, Murana G, et al. The Decision-Making Process in Acute Type A Aortic Dissection: When to Replace the Aortic Arch. Semin Thorac Cardiovasc Surg 2019;31:691-6.
9. Thomas M, Li Z, Cook DJ, et al. Contemporary results of open aortic arch surgery. J Thorac Cardiovasc Surg 2012;144:838-44.

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