Is Open Thoracoabdominal Aortic Aneurysm Repair Following Frozen Elephant Trunk Justifiable?

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Editorial

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In the current era, thoracic aortic disease management is tailored to patients' associated comorbidities, risk profile, surgeon's skills, and expectations. Consequently, focused surgical approaches are mandated to facilitate intervention which would impact outcomes and survivability. Although the conventional 2-stage elephant trunk technique alleviated distal thoracic aortic management, its applicability was limited by the failure to complete the repair (1). The advent of frozen elephant trunk (FET) ameliorated those shortcomings allowing a single-stage repair of extensive aortic arch disease or facilitating a staged thoracic endovascular aortic repair (TEVAR) of extensive aortic disease (1). Its advantage is that the stented graft, unlike a conventional elephant trunk prosthesis, can be securely anchored at the desired level distally in the descending thoracic aorta (1). Interventions on distal aortic pathologies via TEVAR or endovascular aneurysm repair (EVAR) also facilitate the manage thoracoabdominal aortic aneurysms. Such an approach for aortic repair is often taken, for example in cases of DeBakey type I aortic dissection (2).

Hybrid aortic surgery means that the entire thoracic and abdominal aorta can be repaired limiting often poor outcomes seen in open surgery. Conventional thoracic aortic surgery evolved, and FET established a platform for dealing with distal aortic pathology by providing an excellent landing zone. The growing evidence in the literature balanced on observational data around the use of FET meant that distal aortic disease shifted to a rather repairable segment through TEVAR, especially in acute settings. This is also applicable to patients with retrograde type A aortic dissection with a primary entry tear in the descending thoracic aorta. This strategy eliminated the necessity for second stage open aortic repair (3). Indeed, Berger et al. have demonstrated that the FET technique was associated with up to 95% positive remodeling around the perigraft space, which translated therefore to a lower risk of reintervention: bolstering the versatility of the FET technique (4).

Furthermore, in patients with multilevel thoracic aortic pathology, when the threshold for intervention has not yet been reached, this strategy enables endovascular completion to be performed. The therapeutic versatility offered by FET has undoubtedly been key to its widespread adoption in the management of aortic arch disease, and this strategic advantage is central to providing personalized aortic care. The adoption of evidence-based guidelines for prosthesis sizing (discrepancy in FET sizing practices is a well-known issue within the aortovascular community), together with the development of custom-made grafts for elective repair, would undoubtedly augment hybrid repair of complex, multisegmented aortic disease.

In cases necessitating multi-stage repair of the aortic arch and thoracoabdominal segments, it is vital to consider the downstream effects of proximal repair in contributing to the management of distal aortic pathologies. Berger et al. noted that in addition to extensive positive remodeling around the perigraft space, false lumen thrombosis was observed around the coeliac trunk in 37% of patients, 12 months post-implantation (4). As such, hybrid aortic interventions mitigate the trauma of a complete thoracoabdominal open approach, harness the downstream beneficial effects of proximal repair, and use innovative graft design (such as branched EVAR) to remove the need for open revascularisation. Post-FET thoracoabdominal stent-grafting therefore allows a safer alternative to extensive aortic repair in the high-risk patient population (2, 4).

Clamping of the stent-graft in the open thoracoabdominal approach following FET is not without concerning complications. Although due to its self-expanding capability and associated memory effect nitinol can retain its original anatomical configuration, fracture and hematoma following stent-graft clamping has been reported (5). Kreibich et al. report an incidence of stent leakage during second-stage thoracoabdominal aortic repair wherein clamping of the stent lead to leakage around the proximal graft. It is suggested that the authors' unfolding of the folded stent led to compromise of the newly formed neo-intima and neo-adventitia, disrupting tissue formation, and causing leakage (5). Additionally, an anastomosis between the distal end of the stent-graft and a conventional Dacron prosthesis in an open approach has its limitations (3). Proof-of-concept small studies highlighting a second-stage open replacement after previous FET implantation are biased with a low sample and colliding nature. The challenge of navigating the abdominal visceral arteries can be overcome with coverage of the false lumen origin with a covered endovascular stent-graft and subsequent use of the PETTICOAT technique (6). This involves deploying a bare-metal stent with low radial force distal to the covered stent-graft into the t abdominal true lumen (6). Such techniques amongst others have all been added

to the armamentarium of endovascular intervention for extensive aortic disease, providing an alternative to invasive open repair post-FET implantation, negating the need for clamping of the FET stent-graft. These interventional approaches are always advised to be undertaken in high-volume aortic centers with a team approach using protocols dedicated to spinal cord ischemia prevention.

Hybrid or staged approaches for thoracoabdominal aortic aneurysm after FET have far proven effectiveness in the mid and long-term, and are recommended in cases where TAAA are involved alongside aortic arch pathology (7).

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