

Treatment of Complex Thoracic Aorta Diseases in Europe

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Patients with complex and extensive lesions of the entire thoracic aorta, acute and chronic, usually are treated with different surgical procedures, in single or double-step approach. Until the early 2000s, the combined pathologies of the arch and of the descending thoracic aorta were mainly treated by a two timely-different surgical steps, the Elephant Trunk technique (ET) described in 1983 by Borst [1]. Despite the excellent results obtained with this technique, its main limitation is represented by the fact that more than half of the patients did not arrive at the second surgical step, both because they died between the first and the second step and because some patients refused the second surgical operation. With the advent of the stent-graft system and of endovascular procedure for the treatment of descending thoracic aorta aneurysms, it became possible to perform the second step of ET through endovascular approach avoiding, in this way, the second surgical step. In 1996, two Japanese surgeons, Suto and Kato, in order to treat combined lesions of the thoracic aorta during a single-stage procedure, introduced a new technique: they placed a stent-graft in the descending thoracic aorta in antegrade fashion directly from the arch. This new procedure was called "open stent-grafting technique" [2,3]. In 2003, this technique was modified by Haverich from Hannover using a custom made hybrid prosthesis and the procedure was re-named "Frozen Elephant Trunk" (FET). The hybrid prosthesis consisted in a distal endovascular stent graft and a proximal conventional surgical [4]. The current indications for FET include chronic aneurysm of the ascending, arch and descending aorta, acute and chronic dissection involving all the thoracic aorta and also the aneurysm involving the distal part of the aortic arch and the upper part of the descending aorta. The FET technique should be considered in all patients with acute type A aortic dissection when the primary entry tear is localized in the aortic arch or in the proximal part of the descending aorta, or in case of retrograde dissection. FET procedure should also be used in acute type B aortic dissection when thoracic endovascular aortic repair (TEVAR) is not anatomically feasible and when there is a coexisting ascending and/or arch aneurysm.

In Europe, at the moment, there are two available hybrid prosthesis for the FET procedure, the E-Vita prosthesis and the Thoraflex hybrid device.

The E-Vita Open and its evolution, the E-Vita Open Plus (Jotec GmbH, Hechingen, Germany) were the first commercially available hybrid prosthesis, composed of a proximal part consisting of a Dacron-vascular prosthesis and a distal part of self-expandable nitinol stent graft. In 2012 a new kind of hybrid prosthesis was introduced by Vascutek, the Thoraflex hybrid device (Vascutek, Terumo, Inchinnan, Scotland, UK). The proximal part consists in a quadruple branched vascular prosthesis and the distal part is a self-expandable nitinol stent graft with a different stent shape. The multi-branched portion allows to perform the individual arch vessel reimplantation. Both prostheses are available in different diameter and length.

In the last years, the use of FET technique is increasing and the early as well as the midterm results are encouraging [5-8].

Satisfactory results have been reported by the Vascular Domain of the European Association of Cardio-Thoracic Surgery [9].

Moreover, data from E-Vita registry demonstrated that early results are comparable, without significant differences, between aortic dissection and chronic degenerative aneurysm: in hospital mortality was 17.1% and 13.2%, respectively [10].

However, in addition to the good results of the FET technique, one of the most important complication associated with FET is spinal cord injury (SCI) that has a not negligible incidence [11]. SCI during FET surgery is multifactorial where spinal cord ischemia and occlusion of the thoracic intercostal arteries seem to be the most important risk factors. Probably, its incidence could be reduced shortening the length of the descending aorta coverage and reducing the spinal cord ischemia time. Cerebrospinal fluid (CSF) drainage, has been demonstrated to be an effective means of preventing SCI and its use is always recommended during FET surgery. In the consensus paper of the European Association of Cardio-Thoracic Surgery, it has been reported that SCI tends to occur more frequently in patients operated on for chronic dissection [9].

FET procedure has demonstrated to be a very useful technique in chronic as well as in acute dissection because restoring the flow in the true lumen and covering the proximal entry tears, the thrombosis of the false lumen is promoted. In a recent meta-analysis it has been showed that, in acute type 1 aortic dissection treated by FET, partial or complete thrombosis of the persistent false lumen occurred in more than 90% of cases [11]. Visceral ischemia after the complete covering of the false lumen could occur if the visceral arteries arise from the false lumen itself and no re-entries are present in the distal aorta. For this reason, careful angio CT-scan evaluation of the thoraco-abdominal aorta has to be carried out before surgery, and FET procedure should be contraindicated if re-entry sites are not visualized in the distal descending thoracic and/or abdominal aorta and the visceral arteries arise from the false lumen. A close surveillance with angio-CT scan is highly recommended and, in case of persistent perfused false lumen, a further repair could be necessary. In conclusion, the FET procedure represents a feasible and effective surgical option for the treatment of complex aortic disease of the thoracic aorta. The refinement of the technique, associated with the introduction of a new device have contributed to improve either early and late outcomes.

Relationship with Industry Policy

No relationship with industry exists.

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