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## Commentary: Should we freeze the elephant trunk with or without stents?

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### CENTRAL MESSAGE

The Siena multibranch collared elephant trunk graft should be part of the surgeon's armamentarium to treat extensive pathologies of the thoracic aorta.

In this issue of the *Journal*, Neri and colleagues<sup>1</sup> report their experience of arch replacement using their institutionally developed multibranch collared elephant trunk (ET) graft, known as the Siena graft. Between 2002 and 2020, arch replacement with the Siena graft was performed in 146 patients, including 37.6% with either an acute or a chronic dissection and 62.3% with diffuse aneurysmal disease. The 30-day mortality was 10.9%, the stroke rate was 5.4%, and paraplegia was seen in 1 patient (0.6%). Eleven patients died before the second-stage procedure. The second-stage operation was performed using an open surgery approach in 16 patients (14.2%) and an endovascular approach in 97 patients (85.8%). Among the patients undergoing endovascular second-stage completion, 72 (74.2%) were treated with standard straight stent grafts, using a single unit in 30 patients, with a total mean aortic coverage length of 182 mm (range, 154–214 mm). The rate of paraplegia in the patients with second-stage thoracic endovascular aortic repair (TEVAR) completion with branch grafts was comparable to that in patients operated on with an open approach but significantly higher than that in patients treated with a straight TEVAR.

The ET concept as proposed by Borst and colleagues<sup>2</sup> in 1983 was designed to facilitate a second-stage procedure by avoiding circulatory arrest and minimizing nerve injury during the second-stage descending aortic replacement.

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However, early ET series reported 10% interval rupture before the second stage and only 45% of patients undergoing the planned second stage.<sup>3</sup> The addition of the collar, as in the Siena graft, may decrease early interval rupture by reducing the tension on the anastomosis, especially in the presence of a large discrepancy between the ET graft size and the arch diameter. The advent of TEVAR greatly facilitated second-stage completion either through an antegrade approach during the index procedure as proposed by the Siena group or through a retrograde access during the same hospital stay. Although morbidity and mortality are significantly decreased with a second-stage TEVAR approach compared with an open procedure, paraplegia rates remain similar and of concern, especially with extensive coverage of the thoracoabdominal aorta using endovascular branch grafts. Furthermore, technical issues such as cannulation of a free-floating ET, need for a body floss technique, or kinking of the ET graft may complicate the second-stage endovascular procedure.

The development of frozen ET (FET) grafts has allowed for a single-stage repair of pathologies extending to the mid-descending aorta. Moreover, FET procedures have been shown to secure hemostasis of the distal anastomosis and offer optimal remodeling of the distal aorta after type A dissection repair. However, compared with the 2% rate of paraplegia with a standard ET procedure, paraplegia in FET repairs is reported in up to 8% to 10% of cases, especially when the stent graft extends distal to T8.<sup>4</sup> Thus, in patients with disease extending distal to the mid-descending aorta, an ET strategy as proposed by the Siena

group followed by a second-stage endovascular completion is usually recommended. In addition, current commercially available FET grafts offer a limited range of diameters to treat complex pathologies, such as degenerative chronic dissection after type A repair. In such circumstances, the stent-graft diameter is often oversized for a small true lumen. By snaring and pulling a standard nonstented ET more distal in the true lumen, as illustrated in a few cases in the current report, may efficiently remodel the distal aorta and obviate the problem of an oversized stented graft in a small true lumen. New emerging custom-designed FET devices may adjust to variable anatomies and extend the FET concept to small true lumens or larger-diameter aortas.<sup>5</sup>

In conclusion, Neri and colleagues must be congratulated for their excellent clinical outcomes. As for FET grafts, the Siena graft should be part of the expanding toolbox for surgeons dealing with extensive pathologies of the thoracic

aorta. Future graft development and operative strategies will strive to decrease the mortality and morbidity linked to these complex procedures.

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