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INVITED COMMENTARY

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Is it time for an endovascular first approach for ruptured thoracoabdominal aortic aneurysms?

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In their article, Gallitto *et al.* [1] presented the results of their 10-year experience in the treatment of urgent thoraco-abdominal aortic aneurysms (TAAAs) with an off-the-shelf (OTS) multi-branched endograft (Zenith t-Branch, Cook Medical, Bloomington, IN, USA). The authors were able to treat 65 patients with satisfactory early and midterm results.

The available literature on the use of OTS devices to treat urgent TAAA is limited but shows promising results. A recent paper from Eleshra *et al.* [2] showed no differences in technical success between elective and urgent/emergent treatment of TAAA using a t-Branch device, although the latter group presented worse periprocedural morbidity and mortality.

In recent years, the treatment paradigm for ruptured abdominal aortic aneurysms (rAAA) has changed as more and more patients are now treated endovascularly (EVAR), which has now become the gold standard of treatment over the open repair (OR) with encouraging early and midterm results in anatomically feasible patients. According to the Guidelines of the European Society of Vascular Surgery, EVAR should be considered in case of rAAA when anatomically feasible [3]. Furthermore, a recent paper comparing 4257 patients receiving either EVAR or, EVAR presented a higher 5-year survival (55% vs 46%; $P < 0.001$) [4].

Should the same happen for TAAA? The paradigm shift in rAAA treatment took a long time to take place due to the novelty of the endovascular technology compared to the gold standard OR and to the somewhat similar 30-day results in high-volume centres. For rTAAA, the story is different. Morbidity and mortality rates are already high in elective settings and almost prohibitive for emergencies if not performed in few high-volume centre. Coselli *et al.* [5], in the largest TAAA series ever published, show a mortality rate for rupture open repair of 12.2% (88/723) in a referral aortic centre with extensive experience. In other reported series with a lower case load, mortality can reach up to 43.1% (23/51) [6]. For rTAAA endovascular treatment, recently published series present a technical success of 90–99% and a mortality rate of 10–19% in urgent/emergent settings [2, 7]. Considering this encouraging results, a shift to an 'endo first' approach to rTAAA seems feasible in the near future.

Unfortunately, the endovascular approach presents a few limitations as compared to the OR. First, anatomical feasibility must be carefully evaluated to understand whether a patient is treatable. Today, the portfolio of available OTS devices is increasing. Alongside the Cook t-Brach, the JOTEC® E-nside® Thoracoabdominal Branch Endoprosthesis off-the-shelf multibranched endograft (Jotec GmbH®, Hechingen, Germany) is now commercially available, and the GORE® EXCLUDER® Thoracoabdominal Branch Endoprosthesis off-the-shelf multibranched endograft (W. L. Gore and Associates, Flagstaff, AZ, USA) will soon follow. A recent paper [8] comparing the anatomical feasibility of these OTS grafts in a real-world population of TAAA showed that while each device alone could be used to treat 33–43% of the patients when they were all available, the feasibility went up to 58% due to different anatomical limitations of each device. This presents a significant number of patients that could be treated in emergent situations, considering that the instruction for use of the different devices may be bent a little to increase the anatomical feasibility further. It should be noted that in case of anatomical unfeasibility, the OR remains the only available approach.

Second, endoleaks in case of ruptured TAAA present a non-negligible problem as they can undermine the entire endovascular exclusion and lead to implant failure. This is especially important since they are reported in up to 3% of cases for endoleak type I, with high aortic-related mortality in this subgroup of patients. In case of complex endovascular procedures, target vessel endoleak (type III) can reach up to 9% of patients. This can be further complicated by secondary endoleaks, appearing during follow-up in up to 2% of patients, mainly in those with a larger inner aortic diameter at the level of the visceral vessels. The presence of endoleaks may often require secondary intervention as only about two-thirds of the primary endoleaks may resolve spontaneously, against none of the secondary ones [9].

Lastly, spinal cord ischaemia (SCI) should be considered. As opposed to OR, where reimplantation of intercostal arteries is feasible and could help reduce SCI, this is not possible during endovascular repairs. This is especially important during rTAAA, where no preconditioning or staging can be performed to

decrease the likelihood of SCI [10]. A short staging interval (3–5 days) can be selectively employed in case of intact but symptomatic TAAA as showed by Gallitto *et al.* [11] with acceptable permanent SCI rates (5%).

In conclusion, although the treatment of this dramatic pathology should be centred in high-volume institutions due to a steeper learning curve as opposed to a standard EVAR, especially in emergent cases, this reported series of OTS for rTAAA show promising results when compared to OR, even if endoleaks have to be added as possible complications. A comprehensive portfolio of devices (grafts, stents and ancillary armamentarium), as well as extensive operator experience, is needed to endorse and 'endo first' approach to ruptured TAAA.

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