EDITORIAL

Fenestrated and branched endovascular repair of complex aortic aneurysms - status quo and perspectives

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The use of fenestrated- branched stent-graft to treat aortic aneurysms was born in 1999 from the need to expand EVAR indications to patients with short necks and poor infrarenal sealing zones. Over the time surgeons have grown more confident in their ability to treat patients with extended aortic disease. Matsagkas et al in this retrospective single center study present the 30-day results of 74 patients with aneurysmal disease treated with fenestrated and/or branched endovascular repair (F/BEVAR) from 2018 to 2023. To date, this is by far the largest study from Greece on the topic, and the authors are to be congratulated for their results and this important effort to elucidate this complex aortic procedure.[1]

Almost 50% of the patients were treated with off-the-self devices confirming the anatomic suitability of the available off-the-self branched stent-grafts. Several studies have reported an anatomic suitability of the available off-the-self branched stent-grafts in percentages ranging from 50 to 63% with adjunct maneuvers.[2,3] The vast majority of patients (81%) were treated in an elective setting, while sixteen (21.6%) patients were treated for failed-EVAR (endovascular aneurysm repair). Technical challenges of F/BEVAR after failed EVAR include imaging difficulties, stiffness of the EVAR stent graft and the friction between the grafts, presence of bare metal stents and suprarenal fixation and the distance between the renal arteries and the flow divider of the EVAR stent-graft.[4] However, the authors reported an excellent primary technical success rate of 98.6%. A single fenestration for a renal artery could not be cannulated through a femoral approach and was successfully incorporated though an upper extremity approach in a second procedure.

Indeed, upper extremity access (UEA) can offer advantages when target vessels are caudally-oriented. For endografts with downward directional branches UEA has been judged unavoidable, and discussions have focused on the preferred side of UEA.[5,6] Whereas some operators prefer left-sided UEA with the argument of reduced manipulation in the aortic arch and assumed reduced risk of stroke, other operators prefer the right sided UEA because of the assumed better workflow and lower radiation dose. However, recent experience has demonstrated that with the use of steerable sheaths, even four-branched repairs in the challenging TAAA anatomy could be performed from the femoral access alone.[7] UEA was used in all B-EVAR cases without postoperative cerebrovascular events or access related complications.

In this mixed cohort study, including juxtarenal, pararenal AAAs, as well as, TAAAs of various extent, the 30-day mortality was 8.1%, underlining the impact of aortic pathology extent as risk factor for early mortality. A recent meta-analysis on FEVAR for juxtarenal AAAs reported a pooled early postoperative mortality rate of 3.3% (95 % c.i. 2.0 to 5.0).[8] In a recent clinical study, including 468 patients with predominantly TAAAs of various extent and pararenal AAAs, the 30-day mortality was 4.9%. In this last study the mortality was higher for Crawford types I to III TAAAs compared with infradiaphragmatic repairs and was associated with age, chronic kidney disease and initial TAAA preoperative diameter.[9]

A total of 272 target vessels (TV) were incorporated into the repairs using balloon expandable as well as self-expanding covered stents. The authors reported an excellent primary TV patency at 30-days of 99.2%. Postoperatively, thrombotic occlusion of 2 renal arteries was observed, which were successfully recanalized without clinical consequences.[1] Incorporation and patency of TV after F/B-EVAR is a critical issue. It has been observed that renal mating stents are performing worse compared to those of the coeliac trunk or superior mesenteric artery and fenestrations perform better compared to branches in the medium and long term.[10,11] Movement of the renal artery during the respiratory cycle, which usually occurs at a distance of 15 mm distally of the renal artery ostium may contribute to mating stent instability or even occlusion.[10] When a fenestration design is planned the mating stent rarely reaches this deep, whereas much deeper landing is usual with branches.

A final important point that merits further consideration is the rate of spinal cord ischemia (SCI) after F/B-EVAR. Van

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doi: 10.59037/38g8j528
ISSN 2732-7175 / 2023 Hellenic Society of Vascular and Endovascular Surgery Published by Rotonda Publications
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Calster K et al reported a SCI rate of 3.8% among 468 patients treated with predominantly TAAAs of various extents and pararenal AAAs.[9] In the study by Matsagkas et al a 4% SCI rate was observed.[1] In four patients the celiac artery was left unstented as the patients were deemed high-risk, and was subsequently stented in a second stage operation. In fact, among the suggested strategies for SCI prevention is the temporary sac perfusion branch, with plan of subsequent occlusion/incorporation in a second stage. Limitations of perfusion branches are the potential risks of increased sac pressure due to poor outflow through small segmental arteries and disseminated intra-vascular coagulopathy from large endoleak into a blind sac.[12] Three patients developed postoperatively SCI; 2 of them permanent grade 3. In addition, two patients developed ipsilateral lower limb reperfusion syndrome leading to amputation in one of them. Large transfemoral sheaths are associated with limb and pelvic ischemia, which may aggravate spinal cord ischemia because of compromised collateral networks. Increasing evidence indicates that minimizing lower limb and pelvic ischemia may improve outcomes of complex endovascular repair including lower risk of paraplegia.[13] This can be achieved by placing an antegrade sheath connected into the larger transfemoral sheath creating a shunt, especially when the procedure is planned to last more than 3h.

In summary, Matsagkas et al in this single-center study reported favourable 30-d outcomes of F/B-EVAR for complex aortic aneurysms.[1] Patient selection, meticulous technique, and optimal perioperative patient care are critical factors determining a favourable outcome. Each of these steps requires a steep learning curve to be mastered, and the excellent results of this study confirm the center's acquired experience. Moreover, a number of reports have shown the association between surgeon and hospital volume for almost every major operation. The impact of hospital and surgeon volume is even greater for repair of TAAAs. However, for major procedures, coordinated care involves multiple disciplines including the surgeon, operating room staff, anesthesia, critical care, and nursing. Each of these entities works cohesively to ensure optimal care.

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