Hostile Neck in Abdominal Aortic Aneurysms: Does it Still Exist?

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Since its introduction in 1991, the endovascular repair of abdominal aortic aneurysms (AAAs) has been widely accepted by physicians and patients due to its minimally invasive nature and its lower perioperative mortality and morbidity. However, certain anatomical limitations in the geometry of the proximal aortic neck and the iliac arteries preclude the safe and efficient use of endovascular aneurysm repair (EVAR), that is, short infrarenal length <15 mm, angulated >60°, neck diameter >28 mm, conical or tapered morphology as well as significant calcification and thrombus lining of >50% of the neck circumference. These factors are associated with higher rates of proximal type I endoleaks, reintervention, and aneurysm-related mortality.

The Human Aortic Anatomy Project comprises a thorough, detailed analysis of the EVAR-suitability based on a study of computed tomography scans of 1063 patients with AAA. According to this report, only 32% of men and 12% of women fulfill all 3 instructions for use (IFU) for the infrarenal neck (length, angulation, diameter) for AAA of 5 to 5.5 cm, whereas these percentages decrease significantly for AAA greater than 6 to 6.5 cm. The neck length was identified as the most determinative criterion for EVAR eligibility. However, as Schanzer et al showed, a great percentage of physicians in real-world practice overcome those restrictions by performing EVAR outside the IFU. Interestingly, it has been estimated that a potential reduction in the IFU neck-length criterion to 7 mm would further enhance the EVAR eligibility to 70% and 45% from 46% and 25% for men and women, respectively, provided that other IFU criteria are kept constant. Therefore, the need to develop enhanced or new device designs that would downregulate the minimum anatomic requirements for EVAR was eminent.

Many endograft designs have been developed or improved to address efficiently the proximal fixation and sealing problems. The Aorfix (Lombard Medical, United Kingdom) can be used in infrarenal angulation up to 90° in neck lengths >20 mm. The Ovation Prime abdominal stent graft (Trivascular, Inc, Santa Rosa, California) is a trimodular device with suprarenal fixation achieved by a proximal stent and anchors. Its main characteristic is the dissociation between the fixation and the sealing mechanism which is accomplished by a pair of compliant, inflatable rings that are filled with a low-viscosity radiopaque polymer. The conformable paired O-rings guarantee a precise accommodation to neck surfaces with excessive calcification or significant amount and/or eccentric distribution of thrombus. Interestingly, the Ovation stent graft does not depend on the length of the neck (ie, a straight, cylindrical segment whose diameter discrepancies do not exceed 10% along its length) as long as the first ring seals 13 mm below the inferior renal artery in a diameter less than 30 mm. Furthermore, the endovascular aneurysm sealing (EVAS) philosophy introduced with the Nellix system (Endologix, Irvine, California) offers an alternative approach to endovascular treatment of AAA. This platform consists of dual balloon-expandable endoframes, each surrounded by a polymer-filled endobag, to achieve anatomical fixation in the aneurysm sac, dissociating the sealing efficiency from the shape and contour of the proximal aortic neck. The endobags fill the aneurysm sac obstructing the side branches, and, therefore, EVAS has the potential to reduce the incidence of type II endoleaks. The Nellix stent graft is particularly suitable for patients with conical necks as the endobags apply on the entire length of the conical neck elongating the sealing zone.

The use of nitinol-based conventional endografts in challenging neck anatomy is generally associated with inferior results of endoleak- and reintervention-free intervals. On the other hand, the off-label use of certain third-generation endografts with suprarenal fixation has been broadened to include challenging neck anatomies, such as the Endurant stent graft (Medtronic, Santa Rosa, CA, USA), yielding greater—but acceptable—endoleak type I results compared with the use according to IFU. An alternative, more advanced approach to treatment of challenging neck anatomies are the use of fenestrated EVAR.
(FEVAR) endografts and the chimney technique chimney-endo-
vascular aneurysm repair (chEVAR). Aim of the former is to
protect the side branches (renal and mesenteric vessels) enabling
their mating and direct stent grafting, whereas the chEVAR
technique focuses on elongating the central sealing zone to an
additional length proximal to the renal arteries, ensuring their
patency with parallel-running stent grafts.17,18 The use of the
chimney technique is feasible, and the potential advantages of
this technique over FEVAR include the reduced complexity, the
wider availability in smaller centers, and an immediate option in
the acute setting. On the other hand, the FEVAR conception
evolves to simpler “off-the-shelf” designs, with some authors
advocating a coverage of more than 70% of pararenal AAA
anatomies based on just 2 pivotal patterns (pivotal FEVAR),
including 2 fenestrations for the renal arteries, one for the super-
ior mesenteric artery and a scallop for the celiac artery.19

So, do the aforementioned solutions point to the end of the
perception of “hostile neck”? Admittedly, the newer endograft
platforms seem to strongly support such allegation. Moreover,
their use underscores another significant advantage that is
rather underappreciated in the literature: that of the nondilata-
tion of the infrarenal neck in the mid- and long term. Indeed,
the use of nitinol-free endografts has been associated with negli-
gible proximal dilatation compared to the conventional self-
expandable sealing mechanism which exerts continuous radial
force onto the aortic neck.20-22 However, their long-term results
are not well documented yet nor the kind, applicability, effi-
ciency, and cost of the rescuing (“bail-out”) maneuvers needed
in cases of technical failures or late-onset complications of the
newer endografts. There seems that for the time being the issue
of whether we should consider a hostile neck as a contraindica-
tion for EVAR has been practically replaced by the quest of the
most suitable, durable, applicable, and cost-effective solution
among the aforementioned ones.

To conclude, newly developed endograft designs overcome
the nitinol-based “cornerstone” function which is restricted by
the anatomical burdens of the “hostile” AAA neck; rather, they
focus on patient-specific individualized sealing mechanisms
that promise to improve the long-term durability of EVAR and
eliminate current anatomical restrictions. However, robust clin-
ical data and long-term follow-up are mandatory.

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