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Editorial

HOW TO DEAL WITH THE ACHILLES HEEL OF THE CHIMNEY ENDOVASCULAR TECHNIQUE FOR COMPLEX AORTIC PATHOLOGIES

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"The aortic stent-graft oversizing is the key parameter for successful ChEVAR planning. A 30% of main stent-graft oversizing has a significant association with freedom from persistent type IA endoleaks after ChEVAR."

In the last decade, the chimney EVAR (CHEVAR) has rapidly evolved. It started as a bailout option to save aortic branches in case of inadvertent coverage during EVAR and developed within 10 years of published evidence to a valid endovascular treatment option of complex abdominal aortic pathologies. [1-3] Recently, the technique was included in the ESVS 2019 guidelines for treatment of abdominal aortic aneurysms (AAA).[4] Despite this tremendous evolution from a bailout approach to a therapeutic modality a gutter-related endoleaks remain the Achilles heel of the technique.

Gutter-related endoleaks

The biological environment at the level of the gutters should induce a spontaneous resolution of flow, which is proportional to the length and inversely proportional to the gutters area. Therefore, the degree of the aortic stent-graft oversizing and the length of the sealing zone are commonly considered as the key factors to plan a ChEVAR successfully. The presence of an infrarenal neck increases the seal and minimizes the risk of persistent gutters to the aneurysm sac.

A wide neck diameter (>29 mm) is significantly associated with persistent type Ia endoleaks reducing the degree of oversizing of the maximum 36 mm in diameter aortic stent graft[5]. Moreover, presence of 2 chimneys require more fabric material to wrap up around the chimney grafts. Consequently, if 30% is the recommended degree of oversizing in case of single chimneys, 35% would be the recommendation in case of double chimneys. This is a major limitation for the technique in case of planning and sizing having as maximum accepted seal neck diameter the 29mm in case of single chimneys and 27mm in case of double chimneys, however, most abdominal endografts have a maximal proximal diameter of 36 mm[5].

On the other hand, a narrow seal neck diameter (<20 mm) has a significative risk for a compression of the chimney graft[6]. Moreover, in narrow pararenal aortic segments, pushing the sheath from the upper extremity results very challenging with high friction which increases the complexity of the procedure.

Considering the general clinical EVAR practice, there is a lost of seal of a few millimeters to expect after the placement of the aortic device per se. Therefore, long seal zones are necessary and can reduce the flow of the gutters also in case of suboptimal oversizing.

Ullery et al. described a spontaneous resolution of type Ia endoleaks with a rate of 35%, 20% and 7% after the procedure, 1 month and 12 months, respectively[7]. A recent French multicenter registry, including more than 200 ChEVAR cases, reported a rate of late IaEL of 10% by using a mean oversizing of 22%[8]. In both series, the majority of the used type of endoskeleton was from stainless-steel which is rigid and shows poor conformability around a rigid chimney graft such as a balloon expandable covered stent. Two subanalyses from the PERICLES registry and the PROTAGORAS Study reported superior results when a nitinol-polyester stent-graft was used. The nitinol endoskeletton is flexible and provides a high conformability leading to thrombosis of the gutters areas. It seems that the combination of the Advanta V12/iCast (Getinge, US) with a nitinol endoskeleton seems to have excellent performance regarding the incidence of persistent type IA endoleaks[9,10].

Furthermore, some authors reported a significant gutter volume variation during cardiac circle in silicon models, and CTAs were not ECG-gated in our series[11].

Conclusions

The aortic stent-graft oversizing is the key parameter for succesful ChEVAR planning. A 30% of main stent-graft oversizing has a significant association with freedom from persistent type IA endoleaks after ChEVAR. In case of double chimney grafts and/or additional hostile neck features, with exception of the short neck additional, a 20 to 25 mm total seal zone should be achievied defining the overall number of the chimney grafts. Wide necks or absence of an infrarenal neck are significant risk factors for persistent type IA endoleaks. The combination of the flexible nitinol endoskeleton as for example from the Medtronic Endurant device in combination with the stainless steel Advanta-iCast

V12 chimney graft have the most robust analysis and research evaluation in the published chEVAR evidence. Future research should include larger series and/or multicentric clinical experiences to validate further this and other combinations.

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