INVITED COMMENTARY

Regress with Progress: Look for Shrinkage after B/F-EVAR with the Eye of Artificial Intelligence

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In this issue, Rastogi *et al.* present the short and long term outcomes of fenestrated (F) and branched (B) endovascular aneurysm repair (EVAR) and their association with sac dynamics over time.[1] As they previously demonstrated for infrarenal EVAR,[2] sac regression appears to protect against all cause mortality and graft related complications in 165 patients undergoing complex aortic repair.

The study finding is sensible, and perhaps much more relevant for complex aortic pathology than for infrarenal repairs. A quantitative analysis of infrarenal aneurysms revealed that a diameter increase of 2 mm corresponds to a volume increase of more than 5%, which is amplified in cases of extensive aortic involvement.[3] In the present series, only 11% of patients had a diameter expansion greater than 5 mm, although 18% showed an increase in overall volume greater than 5%. Notably, the Society for Vascular Surgery recommends these two variables as alternatives for the follow up of complex EVAR.[4]

How can such relevant metrics be implemented in everyday clinical and research practice? Measuring the maximum diameter at a certain level of the aorta takes seconds, but volume sampling of the sole infrarenal segment takes up to 22 minutes per patient. Artificial intelligence (AI) algorithms in the *PRAEVAorta* fully automated software (Nurea, Bordeaux, France) proved to make the process nine times faster, with negligible discrepancy in measurements compared with trained human operators.[3] As reported by Caradu *et al.*,[3] this software was programmed to size aortic zones, foreseeing loss of sealing and identifying patients who would need re-intervention. Volume analysis on non-contrast enhanced computed tomography (CT) scans extends the benefit of CT surveillance to patients with kidney disease, possibly reducing the costs of unnecessary examinations. After patient specific endografts, it may be time for patient specific follow up protocols, rather than one for all schedules.

Besides initial software development, further research will focus on AI adaptation to the many sided aspects of thoraco-abdominal aortic pathology: target vessel instability, the interplay between aortic endograft and bridging components, and the relevance of type 2 endoleaks, to name a few. To feed the algorithm, software validation should include many patients and CT scans, but their interpretation remains a physician's prerogative. Rastogi *et al.*[1] identify two distinct sac dynamics in fenestrated *vs.* branched EVAR. The overall volume tends to regress in the first two years after F-EVAR and remains stable thereafter. Conversely, after B-EVAR the average trend is towards volume growth, but a critical limitation is the small number of patients treated in this cohort ($n = 43$), of whom it is undisclosed how many completed the several follow up steps. Furthermore, the B-EVAR cohort comprises patients with both branches and fenestrations in their endograft design. Hence, the most reliable findings may pertain to the F-EVAR cohort.

Finally, the article is inspirational in terms of direction for future research: volume changes and late events should be integrated by the role of anticoagulation and persistent type 2 endoleaks, the difference between ongoing failure after previous infrarenal EVAR and proper B/F-EVAR related endoleaks, the possible negative role of excessive shrinkage on bridging components dislodgement, fracture, and occlusion (not all that shrinks is gold!).[5]

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