Post-EVAR Surveillance Considerations

Evaluating and stratifying risks based on currently available data.

BY FREDERICO BASTOS GONÇALVES, MD, PHD

The problem of life-long surveillance after endovascular aneurysm repair (EVAR) is well recognized by physicians: it is troublesome for patients, requires significant resources, and may be associated with harm due to the risk of potentially unnecessary interventions, repeated exposure to radiation, and contrast nephrotoxicity. As EVAR becomes the preferred modality for abdominal aortic aneurysm (AAA) repair worldwide, health care providers can easily become overloaded by yearly routine examinations. For example, if a high-volume center performs 100 primary procedures every year, with the consideration that patients will survive a mean of 8 years after EVAR (probably an underestimation in most countries), the hospital will have to perform 800 CTA or duplex ultrasound (DUS) examinations per year—that's about 3.5 examinations every working day! Generally, this means a similar number of outpatient visits for the sole purpose of trying to identify and offer treatment for potential problems before they become clinically evident. The need to identify patients at low risk of complications and simplify their surveillance is obviously desirable.

CURRENT SURVEILLANCE PROTOCOLS AND PITFALLS

The need to identify and treat the potentially life-threatening situations that can develop after EVAR is not questionable; the devastating consequences of untreated type I or III endoleaks are evident. However, there is no consensus on how to best identify these before symptoms occur.

When using the recommendations of current guidelines,[1,2] a number of examinations are required to detect complications that prompt treatment. Even when more restrictive imaging protocols are adopted, a significant number of secondary interventions still result from the presence of symptoms and not as a consequence of findings on CTA or DUS. Dias et al suggested that only 9% of patients actually benefited from yearly CTAs, as that was the number of patients who underwent secondary interventions based on asymptomatic imaging findings.[3] Similarly, Nordon et al found that roughly 90% of patients who underwent EVAR do not benefit from their imaging follow-up at all.[4] The challenging part is to identify those 10% that do.

The difficulty or unwillingness to apply the recommended surveillance strategies is well expressed in a publication by Schanzer et al, revealing that half of 20,000 Medicare beneficiaries treated by EVAR were lost to imaging follow-up at 5 years.[5] Reducing the burden of imaging surveillance may help resolve this serious failure to comply with current guidelines. To further complicate things, Garg et al suggested that deviation from the Society for Vascular Surgery guidelines for post-EVAR imaging was not associated with worse outcomes.[6] Along the same lines, Leurs et al compared patients included in the EUROSTAR registry who underwent complete surveillance with patients who had incomplete surveillance and found that the first group had higher mortality despite undergoing

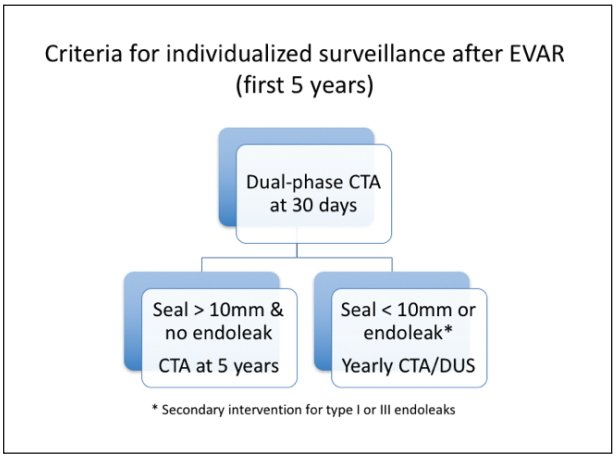

Figure 1. Possible strategy for surveillance after EVAR, based on individual risk of complications within the first 5 years.

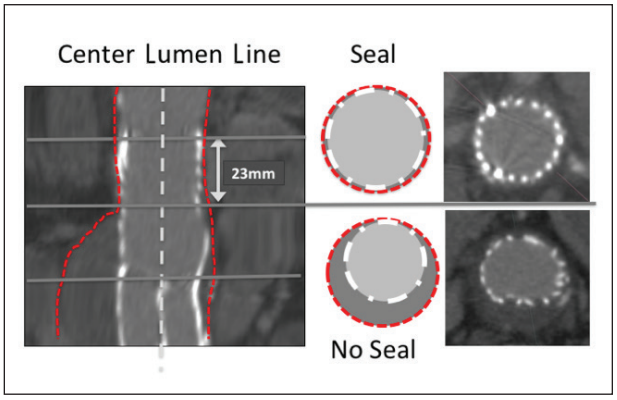

Figure 2. Method for measuring seal length on a CTA using center lumen line reconstruction.

more imaging.[7] The subject of potential harm and quality of life deterioration resulting from interventions performed as a result of postoperative surveillance is not well explored and deserves attention.

Uncertainty regarding the ideal follow-up strategy after EVAR has led to great discrepancy in protocols. The inefficacy of recommended surveillance regimens has legitimized physicians adapting various strategies, such as yearly noncontrast CTs only, DUS only, ultrasound diameter measurements only, and examinations every 2 or 3 years. Objectively, there is no consensus or quality evidence to support any given strategy.

CTA, DUS, OR BOTH?

Both CTA and DUS have been shown to be sufficiently accurate in the early detection of potentially threatening conditions that could ultimately lead to postimplantation rupture or graft occlusion. In many cases, the choice is made according to local logistics and experience. CTA-based regimens obviously include the need for contrast administration and high radiation dosages. The former is a serious limitation for patients with impaired renal function due to contrast agent nephrotoxicity. Repeated radiation exposure may have carcinogenic effects in the long term, which has again come into discussion following the late results of the Endovascular Aneurysm Repair Trial 1 (EVAR 1).[8]

DUS may be a good alternative, as it has shown reliable and reproducible results in expert hands, especially when microbubble contrast agents are used.[9] However, the technology is user-dependent and requires good-quality equipment. Therefore, it is unclear if results published by expert centers are generalizable. Also, DUS only allows for visualization of already existing endoleaks, and therefore, it is not useful in the assessment of progressively shorter sealing zones. Consequently, preemptive treatment before endoleaks develop is not possible, which means that the patient needs to be exposed to the risk of rupture before treatment is offered. Last, DUS may be more time consuming and costs may exceed those of CTA, depending on local settings. Frequently, a combination of both CTA and DUS is used. This may be a good alternative, but there is no evidence to support this strategy, and one must acknowledge that measurements are not comparable between the two techniques, making AAA sac dynamics harder to determine.

IS THERE ENOUGH EVIDENCE TO IMPLEMENT A TAILORED APPROACH TO SURVEILLANCE?

Gradually, our understanding of risk factors and predictors of late complications has improved. A key element to defining individual risk is the analysis of the postoperative CTA. This analysis allows physicians to determine how effective treatment actually was, as opposed to the potential effectiveness given by the preoperative anatomy. Sternbergh et al published a study based on data from the pivotal continued access US Zenith multicenter trial, which included 739 patients.[10] The authors found that absence of endoleak on the first postoperative CTA was a strong predictor of freedom from aneurysm-related morbidity at 5 years (83% vs 56%). Another study by Gill et al found a sixfold risk increase in patients with early endoleaks, based on the presence or absence of endoleak on the first CTA.[11]

We have published a study with similar findings, adding seal zone analysis using center lumen line reconstructions.[12] Of the 131 patients included, 62 were considered low risk based on the absence of endoleak and sufficient proximal and distal seal. In that group, only one aneurysm-related adverse event occurred (a rupture due to infection in a patient with normal CTA results a few months before) compared to 19% of patients in the high-risk group. We estimated that for each diagnosis, 82 imaging examinations were necessary in the low-risk group, and eight were needed in the high-risk group. Based on this, we proposed a stratified follow-up regimen (Figure 1). Although large-scale confirmation of this concept is required, we firmly believe that when sufficient effective proximal and distal seal is achieved in the primary procedure, direct (type I or III) endoleaks and migration are exceedingly rare. Effective seal can be measured using center lumen line axial reconstructions (Figure 2). However, the presence of effective seal may not prevent complications in the long term (> 5 years) due to late degeneration of the aortic wall.

Another study by Troutman et al reported on 410 patients followed with DUS alone.[13] In line with the previous observations using CTA as a discriminator, the authors suggest that a "negative" 30-day DUS examination (no endoleak or graft limb stenosis) is highly predictive of the need for secondary intervention. In that study, only 2% of patients at low risk eventually required treatment during the first 3 years after EVAR, compared to 25% of patients with abnormal findings.

We also investigated whether early AAA sac dynamics could be used as a predictor for subsequent complications and found that patients with significant shrinkage (≥ 5 mm) 1 year after EVAR had a much greater likelihood of uneventful follow-up out to 5 years.[14] This may add to a tailored approach in which patients with early shrinkage do not require routine imaging for a reasonable period of time.

These data suggest that early risk stratification may significantly reduce the need for routine imaging for patients at lower risk for at least the first few years after EVAR. However, to date, there is no good-quality evidence to support stratification of follow-up because no prospective comparison has been made. Efforts to produce such evidence should focus on freedom from secondary intervention, AAA-related mortality, and post-implantation rupture as endpoints. Due to the relative rarity of events, evolving technology, and long period of follow-up necessary before results become evident, such a task is challenging and may not be achievable.

SURVEILLANCE FOR LATE SURVIVORS

Recent data from EVAR 1 have emerged, casting new doubts over the long-term durability of this treatment modality.[8] Even for patients at very low risk of complications in the first few years after EVAR, it is possible that further degeneration of the aortic wall or material fatigue (or both) may result in repressurization of the aneurysm.[15] Anecdotal reports claim that this may be especially concerning in patients with effective AAA exclusion for many years, as the aortic aneurysm wall becomes more fragile and prone to rupture if exposed to arterial blood pressure again. Therefore, and in the absence of a solid understanding of late outcomes after EVAR, it is of utmost importance to continue (and possibly reinforce) imaging surveillance in the longer term (≥ 5 years).

CONCLUSION

There is no high-quality evidence to support simplification or stratification of surveillance after EVAR. However, there is sufficient evidence suggesting that the presence of endoleak and insufficient seal on the first postoperative examination and the absence of shrinkage at 1 year are strong predictors of risk. Patients with these findings require more intensive imaging, whereas the remaining patients may not benefit from routine examinations. However, in the long term, even low-risk patients may be susceptible to rupture. Consequently, late surveillance remains determinant for lasting success after EVAR. ■

1. Moll FL, Powell JT, Fraedrich G, et al. Management of abdominal aortic aneurysms clinical practice guidelines of the European Society for Vascular Surgery. Eur J Vasc Endovasc Surg. 2011;41(suppl 1):S1-S58.
2. Chaikof EL, Brewster DC, Dalman RL, et al. The care of patients with an abdominal aortic aneurysm: the Society for Vascular Surgery practice guidelines. J Vasc Surg. 2009;50(4 suppl):S2-49.
3. Dias NV, Riva L, Ivancev K, et al. Is there a benefit of frequent CT follow-up after EVAR? Eur J Vasc Endovasc Surg. 2009;37:425-430.
4. Nordon IM, Karthikesalingam A, Hinchliffe RJ, et al. Secondary interventions following endovascular aneurysm repair (EVAR) and the enduring value of graft surveillance. Eur J Vasc Endovasc Surg. 2010;39:547-554.
5. Schanzer A, Messina LM, Ghosh K, et al. Follow-up compliance after endovascular abdominal aortic aneurysm repair in Medicare beneficiaries. J Vasc Surg. 2015;61:16-22.
6. Garg T, Baker LC, Mell MW. Postoperative surveillance and long-term outcomes after endovascular aneurysm repair among Medicare beneficiaries. JAMA Surg. 2015;150:957-963.
7. Leurs LJ, Laheij RJ, Buth J; EUROSTAR Collaborators. What determines and are the consequences of surveillance intensity after endovascular abdominal aortic aneurysm repair? Ann Vasc Surg. 2005;19:868-875.
8. Patel R, Sweeting MJ, Powel JT, Greenhalgh RM; EVAR trial investigators. Endovascular versus open repair of abdominal aortic aneurysm in 15-years' follow-up of the UK endovascular aneurysm repair trial (EVAR trial 1): a randomized controlled trial. Lancet. 2016;388:2366-2374.
9. Bredehl KK, Taudorf M, Lonn L, et al. Contrast enhanced ultrasound can replace computed tomography angiography for surveillance after endovascular aortic aneurysm repair. Eur J Vasc Endovasc Surg. 2016;52(6):729-734.
10. Sternbergh WC 3rd, Greenberg RK, Chuter TA, Tonnessen BH; Zenith Investigators. Redefining postoperative surveillance after endovascular aneurysm repair: recommendations based on 5-year follow-up in the US Zenith multicenter trial. J Vasc Surg. 2008;48:278-284; discussion 284-285.
11. Gill HL, Ladowski S, Sudarshan M, et al. Predictive value of negative initial postoperative imaging after endovascular aortic aneurysm repair. J Vasc Surg. 2014;60:325-329.
12. Bastos Goncalves F, van de Luijtgaarden KM, Hoeks SE, et al. Adequate seal and no endoleak on the first postoperative computed tomography angiography as criteria for no additional imaging up to 5 years after endovascular aneurysm repair. J Vasc Surg. 2013;57:1503-1511.
13. Troutman DA, Chaudry M, Dougherty MJ, Calligaro KD. Endovascular aortic aneurysm repair surveillance may not be necessary for the first 3 years after an initially normal duplex postoperative study. J Vasc Surg. 2014;60:558-562.
14. Bastos Gonçalves F, Baderkhan H, Verhagen HJ, et al. Early sac shrinkage predicts a low risk of late complications after endovascular aortic aneurysm repair. Br J Surg. 2014;101:802-810.
15. Antoniou GA, Georgiadis GS, Antoniou SA, et al. Late rupture of abdominal aortic aneurysm after previous endovascular repair: a systematic review and meta-analysis. J Endovasc Ther. 2015;22:734-744.

Frederico Bastos Gonçalves, MD, PhD
Vascular Surgeon
Hospital de Santa Marta
CHLC/NOVA Medical School
Lisbon, Portugal
+351213594203; frederico.goncalves@chlc.min-saude.pt

Disclosures: None.