The Heart Surgery Forum

Heart Surg. Forum **2026**; 29(8): 52963
https://doi.org/10.31083/HSF52963

Editorial

From "Endovascular First" to "Endovascular Right": Patient Selection, Durability, and the Next Frontiers in Aortic Care

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Academic Editor: Haiyang Li
Submitted: 16 April 2026 Revised: 8 May 2026 Accepted: 22 May 2026 Published: 7 August 2026

Patil et al. [1] should be commended for providing a broad and timely overview of the contemporary role of endovascular therapy across the spectrum of aortic disease. Their review captures an essential truth of current practice: endovascular treatment has moved well beyond proof of concept in abdominal aortic aneurysm, descending thoracic aneurysm, rupture, traumatic aortic injury, and complicated type B dissection. Indeed, in many settings, endovascular treatment has progressed beyond the status of being a mere alternative. The next stage of progress in aortic care is no longer defined simply by the expansion of endovascular capability, but rather by the transition from an "endovascular first" mindset to an "endovascular right" strategy. This strategy is grounded in patient selection, device-specific durability, anatomy, frailty, sex-related differences, and the anticipated burden of surveillance and reintervention [1,2].

Operationally, "endovascular right" may be understood as the point at which an endovascular strategy offers not only less immediate physiologic insult, but also an acceptable lifetime aortic plan. In practical terms, this means that four questions should be addressed before treatment: Is the anatomy suitable for a specific device rather than for endovascular repair in general? Is the expected durability proportionate to life expectancy and aortic risk? Can patients adhere to the necessary surveillance and tolerate possible secondary procedures? Would an open repair offer superior durability at an acceptable perioperative cost? This framework does not rule out open and endovascular surgery. Rather, it uses open repair as the durability benchmark and endovascular repair as the preferred strategy only when its early benefit is not offset by an excessive late burden.

This is particularly evident in the infrarenal abdominal aorta. Elective endovascular aortic repair (EVAR) is now well established, and an endovascular-first strategy is the contemporary standard for rupture whenever anatomy and logistics allow it [2]. However, the success of EVAR cannot be judged at the time of implantation alone, and long-term surveillance is not ancillary to treatment, but rather part of the treatment. Late sac behavior, occult endoleak, loss of seal, component failure, and the cumulative burden of secondary procedures remain central to the true assessment of benefit [2,3]. Long-term randomized data remain instructive in this regard: in EVAR trial 1, the early survival advantage of EVAR over open repair was lost during extended follow-up, and open repair showed lower total and aneurysm-related mortality after 8 years [4]. Moreover, late secondary sac rupture accounted for 13 aneurysm-related deaths after EVAR versus two after open repair. Although these data reflect earlier-generation devices and historical practice, the conceptual lesson remains contemporary: EVAR is not a single procedure, but a longitudinal treatment pathway. In this respect, the field has learned difficult but important lessons from device-specific failure patterns. The focused update by the European Society for Vascular Surgery (ESVS) on Nellix (Endologix, California, USA) stent-graft and recent explant analyses showed that some late failures were not isolated events but rather manifestations of intrinsic durability problems [5,6]. Similar concerns arise from reports of late AFX2 (Endologix, California, USA) endograft failure with fabric tear and stent fracture [7,8]. These experiences should not be used as arguments against endovascular repair, but as reminders that the biology of the aorta and the mechanics of the graft continue to interact long after the patient leaves the operating room.

The emergency setting offers the clearest example of the progression of endovascular therapy. In ruptured abdominal aneurysm, the debate has now largely shifted from whether EVAR is appropriate to how rapidly the anatomy can be assessed, the hemorrhage controlled, and the treatment delivered within structured pathways [2]. This also applies to large sectors of thoracic emergency care, where minimally invasive treatment has not only reduced physiologic insult but also widened the pool of treatable patients, including older and frailer individuals who historically might not have been considered for open repair [1]. Nevertheless, even in these life-saving scenarios, immediate technical success does not eliminate the need for durable planning. Emergency endovascular therapy should not be equated with definitive simplicity.

This principle is especially relevant for the thoracic aorta. Thoracic endovascular aortic repair (TEVAR) has transformed the treatment of descending thoracic disease, but long-term durability remains a major unresolved issue. Late endograft migration is a clinically relevant complica-

tion that can undermine the seal, alter branch relationships, and drive complex redo procedures years after an apparently successful index operation [9]. A recent systematic review and meta-analysis reported a pooled late endograft migration rate of 4%, with reintervention required in approximately one third of migration cases, and a migration-related mortality rate of about 5% [9]. This is not simply a historical problem of first-generation devices. It also remains pertinent whenever long, angulated, or degenerative thoracic segments are treated, and when initial landing-zone assumptions prove too optimistic over time [9]. The consequences are conceptual as much as technical: TEVAR should be judged not only by perioperative stroke, paraplegia, and mortality, but also by the capacity to remain mechanically stable within a changing aorta.

At the same time, any contemporary editorial on this subject should acknowledge that the frontier has already moved beyond standard EVAR and TEVAR. Complex abdominal aortic aneurysms and thoraco-abdominal aneurysms are increasingly at the center of endovascular innovation. Fenestrated, branched, and inner-branch devices, including off-the-shelf solutions, are expanding treatment possibilities in juxtarenal, pararenal, and thoraco-abdominal disease, even in urgent settings [10,11,12]. Here also, the field is moving from a focus on technical feasibility to a focus on long-term durability. Target-vessel instability, branch-related reinterventions, bridging stent performance, and long-term renovisceral patency now represent the new cost of success with minimally invasive procedures [10,11,13]. In other words, although complex EVAR has solved some access and exposure problems, it has created a new durability frontier at the level of the target vessels themselves. Hence, the relevant question is no longer whether fenestrations or branches can be catheterized, but whether target-vessel patency, bridging-stent geometry, and endograft stability remain reliable over the expected lifetime of the patient [10,11].

Management of the proximal thoracic aorta reflects a similar evolution. Patil et al. [1] correctly emphasize that the left subclavian artery and the aortic arch are current areas of intense innovation. However, in recent years, the discussion has moved past whether the left subclavian artery (LSA) should be revascularized, and increasingly to how it should be preserved with minimum physiologic penalty in often fragile patients. Dedicated single-branch platforms are pushing zone 2 TEVAR toward a genuinely total endovascular paradigm in cases with selected anatomy [14,15]. This trend is particularly attractive in frail patients, in whom avoiding cervical debranching may have real value [16]. However, with the aortic arch, technical elegance is still constrained by neurologic reality. Custom-made and off-the-shelf branched or fenestrated arch solutions are advancing rapidly, but stroke remains the true frontier in this field [17]. The arch does not merely represent another sealing challenge, but is also the site where hemodynamics, supra-aortic branch management, embolic risk, and cerebral protection converge unforgivingly.

Dissection represents another domain in which the field is maturing from simple coverage strategies and more towards remodeling. TEVAR is already established for complicated type B dissection and is increasingly considered for selected, uncomplicated patients at higher risk of adverse remodeling [1]. However, contemporary considerations are not limited to proximal entry tear closure. Adjunctive techniques such as provisional extension to induce complete attachment (PETTICOAT) and stent-assisted balloon-induced intimal disruption and relamination in aortic dissection (STABILISE) have become highly relevant because they aim to achieve whole-aorta remodeling rather than just proximal exclusion [18]. Their growing visibility reflects a broader conceptual shift: success in dissection is increasingly measured by downstream true-lumen expansion, false-lumen behavior, and a reduction in late aneurysmal degeneration. In contrast, appropriate caution is required for the ascending aorta. The 2025 ESVS consensus makes clear that ascending TEVAR is still a highly selected strategy for expert centers rather than a mature replacement for open surgery [19]. The Michigan experience with mesenteric malperfusion in acute type A dissection is important because it demonstrates how endovascular tools can be integrated into a staged rescue strategy [1]. However, it should also be considered as a lesson in selection rather than generalization.

Perhaps the most important evolution is that patient selection is no longer reducible to neck length, access diameter, or landing-zone measurements alone. Sex-related differences and frailty are now core considerations.

In pooled analyses, women undergoing EVAR have consistently shown worse perioperative outcomes, and such disparities may be even more pronounced with complex endovascular repair [20,21,22]. This may partially reflect sex-related differences in access and infrarenal neck morphology rather than simple differences in aneurysm diameter thresholds. Patient frailty is an equally important dimension. In both standard EVAR and thoraco-abdominal endovascular repair, frailty is a determinant of early and late outcome, rather than simply a background descriptor [16]. Thus, “endovascular right” means asking not only whether a graft can be implanted, but whether the patient will benefit from the entire subsequent pathway involving imaging, surveillance, adjunctive procedures, and the possibility of future reintervention.

The timely review by Patil et al. [1] is valuable because it addresses this very question. It encapsulates a field that has already demonstrated where endovascular therapy is unquestionably established, where it clearly shows promise, and where its limits are still visible [1].

The next decade in aortic care will not be defined simply by more devices or broader indications, but rather by the more precise matching of patients to procedures.

These include device-specific anatomy, biological fitness, frailty, sex-specific access and neck morphology, life expectancy, and willingness or ability to undergo lifelong surveillance. Innovation will remain essential, especially in the areas of lower-profile devices, improved conformability, branch stability, cerebral protection strategies, artificial intelligence-assisted planning, and more individualized surveillance algorithms, all of which may reduce the late cost of minimally invasive success. However, these advances should serve a defined clinical objective: to select the repair method for the individual patient that offers the best balance between early safety, long-term durability, surveillance burden, and reintervention risk.

If "endovascular first" is used to describe the momentum of the past era, "endovascular right" should define the discipline of the next era.

Abbreviations

EVAR, endovascular aortic repair; ESVS, European Society for Vascular Surgery; TEVAR, thoracic endovascular aortic repair; LSA, left subclavian artery; PETTICOAT, provisional extension to induce complete attachment; STABILISE, stent-assisted balloon-induced intimal disruption and relamination in aortic dissection.

Author Contributions

GGdC and WM designed the research study and performed the literature search and data extraction. GGdC provided expert input on vascular surgery methodology and contributed to the interpretation of results. WM and LdM assisted in data analysis, reference verification, and quality assessment. GGdC and WM drafted the manuscript. LdM critically revised it for important intellectual content. All authors contributed to editorial changes in the manuscript. All authors read and approved the final manuscript. All authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

Ethics Approval and Consent to Participate

Not applicable.

Acknowledgment

Not applicable.

Funding

This research received no external funding.

Conflicts of Interest

The authors declare no conflicts of interest.

Declaration of AI and AI-Assisted Technologies in the Writing Process

During the preparation of this work, the authors used ChatGPT-5.5 to check spelling, grammar, and language clarity. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

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