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EDITORIAL COMMENT

Thoracic Endovascular Aortic Repair in Acute and Chronic Type B Aortic Dissection*

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The temporal course of type B aortic dissection (TBAD) can be divided into several phases: hyperacute (<24 h), acute (within 2 weeks), subacute (2 weeks up to 3 months), and chronic (>3 months) (1-3). This distinction has become highly important, because it may help to identify the time interval during which these patients are at higher risk for complications and, for selected patients, the optimal moment for TEVAR (Thoracic Endovascular Aortic Repair). Identification of both the optimal cohort and most ideal time to perform TEVAR remains a matter of debate.

The VIRTUE trial suggested that ideal timing of TEVAR should be in the subacute phase, when the aorta still has aortic plasticity, which leads to similar remodeling and survival rates compared with treatment in the acute setting (3). In addition, it may also be that the incidence of TEVAR-related complications, like retrograde dissection, is reduced by waiting a period of weeks after acute type B dissection.

In chronic TBAD, anatomic findings, such as narrow lumens and thickening of the intimal flap, may inhibit optimal aortic remodeling after TEVAR (4). Although open repair has higher operative mortality and morbidity, the previously noted anatomic issues are not insurmountable. However, no definitive evidence currently exists to confirm which method is optimal in uncomplicated type B dissection.

Currently, the optimal management for acute complicated TBAD is felt to be TEVAR, whereas open surgery is reserved for younger patients, patients with connective tissue disease such as Marfan syndrome, and those unsuitable for endovascular repair. For uncomplicated type B dissection, there is an ongoing debate regarding the most suitable therapy: medical therapy alone or endovascular along with optimal medical treatment. Although the ADSORB (Acute Dissection treatment with Stent graft OR Best medical therapy) and INSTEAD (the INvestigation of STEnt grafts in Aortic Dissection) trials showed long-term benefits of TEVAR in terms of survival and remodeling (5,6), several critiques have been published about these trials, mainly regarding small sample size and the primary outcome measures. Because of this, a conservative approach for many patients with uncomplicated TBAD is still encouraged.

In chronic TBAD, the indication for treatment is usually aneurysmal degeneration of the dissected segments of the aorta after initial medical therapy, which extends into the abdominal of the aorta in almost two-thirds of these patients (7-9).

After standard TEVAR, which includes stent graft treatment limited to the descending aorta, complete false lumen thrombosis during follow-up is described between 39% and 100% of patients (10), and rates of favorable aortic remodeling range between 5% and 89% (11-13). In these patients, despite remodeling in the proximal stented sections, distal segments of the aorta may still be patent.

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In the paper by Fanelli et al. (14) in this issue of *JACC: Cardiovascular Interventions*, predictors and influencing factors of remodeling and outcome after TEVAR for both acute and chronic TBAD are

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addressed. They used the "old" definition of acute and chronic (≤14 or >14 days after onset). The results could have been different if they had used truly chronic patients, namely after 3 months from the onset of symptoms. The factors they assessed are interesting, because some of these have not been studied well before, such as oversizing, the stent, left subclavian artery embolization, and length and number of implanted devices. Interestingly, oversizing did not influence the occurrence of endoleaks, remodeling, or major adverse events, although 2 cases of retrograde dissection were reported in the acute cohort. Furthermore, the length of coverage did not have any influence on remodeling. In chronic dissections, it may be expected that the length of coverage would be of importance in type IIIb patients, because a patent abdominal aortic segment may lead to aortic growth and inhibition of favorable aortic remodeling. In the current results, however, endoleaks were not related to the degree of false lumen thrombosis in the chronic patients.

A significant enlargement of the aortic diameter above the stent graft was seen in the acute group, which is important because this may reflect increased strain on the aorta in the segments adjacent to the stent graft. This effect of the stent graft on the aorta and its hemodynamic surroundings should be studied in more detail.

The observation that left subclavian artery embolization was protective against endoleak development in acute cases is interesting, because it promoted false lumen thrombosis. This was not observed in the chronic TBAD cohort.

Of course, these results need to be interpreted carefully, because it is a retrospective case series with a limited number of patients, including 5 cases of post-traumatic dissection that per se are thought to have a different etiology, prognosis, and evolution than spontaneous dissection. It seems pretty clear that precise characterization of the temporal events, including the exact time between the onset and the intervention, is critical. It appears that TEVAR in a 2-day-old and 3-week-old dissection can give significantly different results compared with a 12-month-old dissection in terms of stent graft–related risks, aortic remodeling, and technical success. The focus of the current paper is on diameter only; however, a volumetric analysis of the true and false lumen and the size and precise location of the entry tear would have added even more value to the paper, because this gives a more clear indication of the changes in both lumens after TEVAR.

Nevertheless, given the paucity of studies looking at this cohort, this paper adds to the knowledge and understanding of the differences between TEVAR for acute and chronic type B aortic dissections in terms of management and remodeling.

Usefulness of an uncovered stent graft in the abdominal aorta following standard TEVAR has become a viable option for treating complicated acute TBAD with malperfusion (15). Mid-term outcomes in this group of patients have been associated with promising results in terms of aortic remodeling; however, no randomized and controlled studies have been reported on its routine use.

Branched and fenestrated TEVAR has also become an emerging technique to treat patients with chronic TBAD with less favorable anatomy with endovascular management (16). These devices, which are patient-specific with dedicated fenestrations and branches, provide an opportunity to treat a larger cohort of patients with less invasive tools. Early reports surrounding branched and fenestrated TEVAR seem promising, but long-term results in the thoracic aorta are limited. Studies of larger cohorts with longer follow-up are widely anticipated. Currently, these devices can only be used in an elective setting, because the patient-specific fabrication takes time. In the future, it is conceivable that off-the-shelf branched and fenestrated devices will become available to treat emergent cases as well.

In addition to off-the-shelf devices, development of branched and fenestrated stent grafts specifically for chronic TBADs are needed, because continued perfusion of the distal aortic segments is often described, and stenting a longer section of the descending aorta may be necessary. This represents a problem with the current stent grafts, because they are not designed to also cover the visceral segments.

The entire field of TEVAR for aortic dissection is rapidly evolving. We need better technology, more randomized trials, and more precise phenotyping as we strive to optimize patient outcomes.

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