Chronic Type B Dissection: Rules of Engagement for TEVAR

Endovascular solutions in the management of chronic type B dissections.

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Aortic dissection is a lifelong disease that goes to the grave with most patients. As E. Stanley Crawford mentioned in his seminal article, "No patient should be considered cured of the disease," which holds true to date.[1] Patients who present up to 2 weeks after the inciting event are considered to have an acute type B dissection. Those who present between 15 and 90 days are classified as subacute, and patients presenting after 3 months are considered to have a chronic type B aortic dissection (TBAD). Chronic TBAD dissections are a result of medically managed acute (uncomplicated or complicated) type B dissections or residual type B dissections after surgical repair of a type A dissection. Patients may present to an aortic specialist in either the acute or subacute phase of a TBAD or at a later date in the chronic setting with complications of the disease such as aneurysmal degeneration, low-grade malperfusion, or rupture.

Although TEVAR is increasingly utilized for acute TBAD, the use of thoracic endovascular aortic repair (TEVAR) has been slowly adopted in the setting of chronic TBAD because of the complex anatomy and pathology associated with the disease. Open surgical treatment of chronic TBAD continues to remain the standard of care, but it comes with significant morbidity including stroke, paraplegia, renal failure, and need for long-term ventilator support. However, the rate of such complications has significantly decreased over the past 2 decades. TEVAR has demonstrated decreased mortality and spinal cord ischemia compared to open surgical repair, albeit with a higher reintervention rate.[2] Chronic TBAD poses unique challenges, but surgeons and experienced centers familiar with the predictors of clinical success and aortic remodeling have reported excellent outcomes.[2,3] At the University of Pennsylvania, we have adopted a team-based approach consisting of vascular and cardiovascular surgeons along with cardiothoracic anesthesiologists and intensivists.

The consistent use of the criteria described in the following sections, which we refer to as our "rules of engagement," have allowed us to optimize short- and long-term outcomes in our patients with chronic TBAD.

RULES OF ENGAGEMENT: THE GOOD PATIENT

Initial Patient Assessment

Case planning is critical for any patient undergoing TEVAR, and this begins in the office or hospital when the patient is first seen. All patients are worked up appropriately with a CT angiography with three-dimensional reconstruction and, if needed, echocardiography, carotid duplex scanning, pulmonary function tests, and coronary catheterization. Any history of previous aortic repair should be taken into account, particularly in the abdominal aorta, as this puts the patient at a higher risk for spinal ischemia, and these patients would benefit from a spinal drain. After the initial patient evaluation, there are several other key factors that we consider in determining endovascular treatment success.

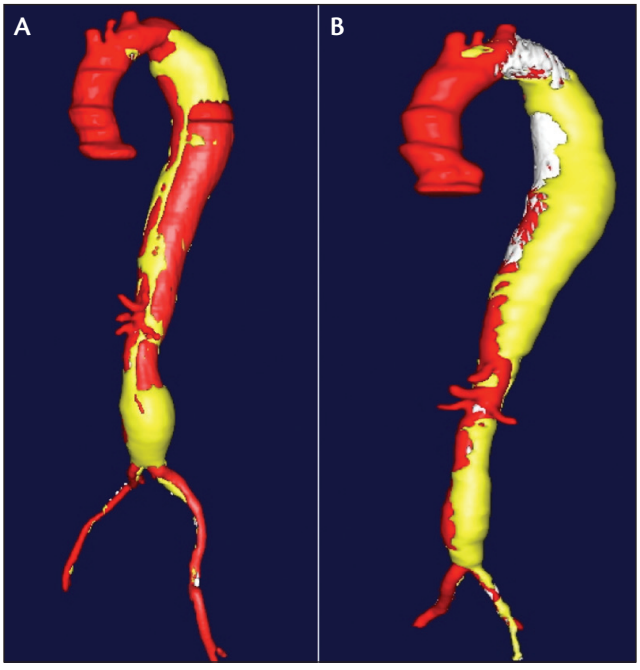

Figure 1. Predictors of good aortic remodeling. An ideal candidate with a good proximal landing zone and all four visceral vessels originating from the true lumen (A). Thrombosis of the false lumen at 1 year (B).

Importance of the True Lumen

With widespread use of imaging, more patients are seen with complex chronic TBAD where the true lumen can be quite small and can be compressed from the false lumen, thus causing a pseudocoarctation. These patients may present with progressive malperfusion. We believe

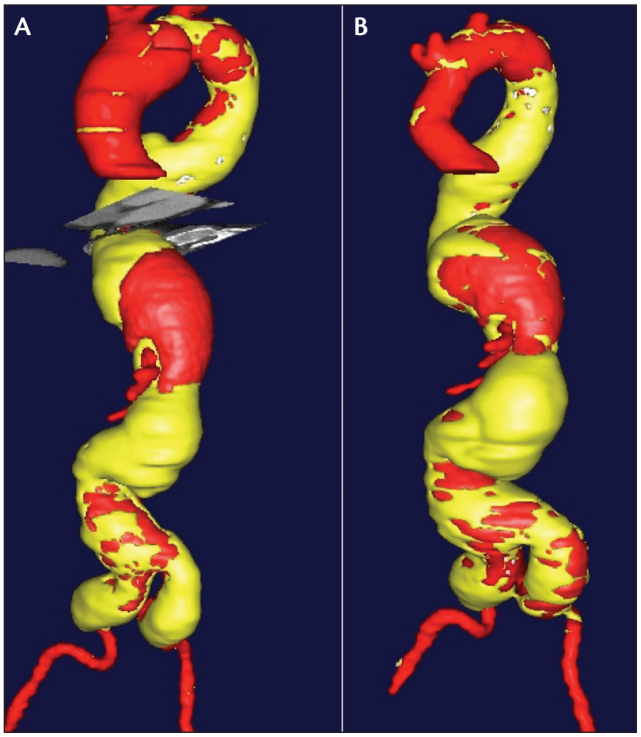

Figure 2. Predictors of poor aortic remodeling. Complex multiple fenestrations in the distal thoracic aorta and all four visceral branches not from the true lumen (A). One-year follow-up showed continued false lumen expansion and aneurysmal degeneration of the distal aorta (B).

that with a greater number of visceral vessels originating from the true lumen, better occlusion of the false lumen is likely, resulting in more effective overall treatment with TEVAR. The best-case scenario is when the celiac artery, superior mesenteric artery, and both renal arteries originate from the true lumen (Figure 1). The worst scenario occurs when all four visceral vessels originate from the false lumen. When most, if not all, abdominal vessels originate from the true lumen, this anatomy minimizes distal large re-entry sites and promotes remodeling, which is optimal for the long-term survival of such patients (Figure 2).

Solid Caliber Proximal Landing Zone

A good proximal landing zone is critical in achieving endovascular success, avoiding any endoleaks, and for future aortic remodeling. We recommend having approximately 1.5 to 2 cm of landing zone in the proximal aorta in which the most proximal part is nondissected. Frequently, this involves covering the left subclavian artery. Because most of these cases are performed electively, almost all of these patients can undergo a subclavian transposition or a carotid-subclavian bypass prior to TEVAR. It is imperative that the TEVAR procedure be performed within 5 to 7 days of the subclavian transposition/bypass in order to ensure that it does not clot off. The recent innovation of

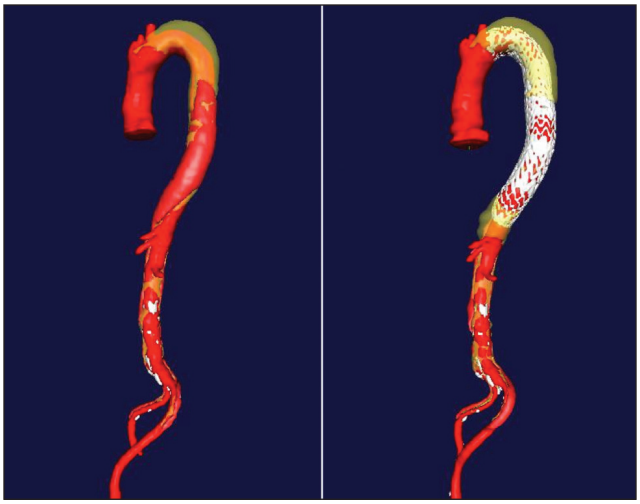

Figure 3. Use of Conformable GORE® TAG® Thoracic Endoprosthesis up to the celiac artery for better aortic remodeling. Of note, two grafts were used in this patient.

branched stent-graft devices, such as the investigational GORE® TAG® Thoracic Branch Endoprosthesis (TBE), allow landing into zone 2 while maintaining side branch patency.[4] This technology is being studied in aneurysms, and future applications may include additional pathologies such as chronic TBAD.

Primary Tear Site Coverage

One of the fundamental concepts in treating chronic TBAD is to cover the primary tear site. Inadequate coverage can lead to endoleak, persistent false lumen flow, or potentially cause a retrograde type A dissection in some patients. We also cover the descending aorta down to the celiac artery in all patients. This allows for better coverage of secondary tear sites, full expansion of the true lumen, and thrombosis of the false lumen over a larger portion of the aorta (Figure 3).

Pseudocoarctation of the Distal Landing Zone

It is not uncommon for patients with chronic TBAD to present with a distal pseudocoarctation. This occurs when a large false lumen severely compresses the true lumen. Many patients may experience low-grade visceral malperfusion or worsening renal function. We use IVUS in all patients undergoing TEVAR for chronic TBAD, but in patients with a small true lumen, IVUS is an invaluable tool in maintaining true lumen access and to assess compliance of the septum. Moreover, a very small true lumen may not allow the use of several standard stent-grafts that would otherwise be used in the treatment of chronic TBAD.

DO THE RULES OF ENGAGEMENT MATTER?

We firmly believe that if you keep these rules in mind when planning a TEVAR procedure for chronic TBAD,

the outcome is likely to be successful. In our series of 31 patients, we had four failures that presented with a persistent patent false lumen on surveillance imaging. Among these four patients, the rules of engagement were intact in only one patient. Eighty-seven percent of the patients underwent aortic remodeling in this series.[3]

Significant progress has been made during the past decades in decreasing mortality and stroke in patients who present with chronic TBAD and undergo open surgery or TEVAR. Paraplegia is significantly lower in patients undergoing TEVAR compared to open thoracoabdominal aortic surgery.[5] We use somatosensory-evoked potentials in all patients undergoing TEVAR. We do not use spinal drains in every patient; however, spinal drains are critical in patients who are at higher risk for spinal ischemia, such as those who have had abdominal aortic procedures or when the plan is to cover the left subclavian artery without revascularization.

CONCLUSION

The aorta in chronic TBAD has complex anatomy or abnormal histology that is quite different than what one encounters in an atherosclerotic aneurysm or even an acute TBAD. Although most experienced centers have been able to treat patients empirically, we have begun to understand the group of patients who would benefit from TEVAR for chronic TBAD. Our clinical experience demonstrates that good results can be achieved using TEVAR in the treatment of chronic TBAD by following our "rules of engagement." ■

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