Type B Dissections: What We Know and What We Don't

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Type B aortic dissection (TBAD) is a complex clinical condition requiring rigorous understanding of the pathology and the patient's unique individual characteristics. Aortic dissection is generally classified by anatomic criteria in addition to chronological information (acute, subacute, and chronic) and information about the clinical presentation status (complicated or uncomplicated). Anatomically, dissections can be classified as proximal, with involvement of the ascending aorta or the aortic arch (Stanford type A, DeBakey types I and II), or as a distal dissection without involvement of the ascending aorta (Stanford type B, DeBakey type III).

The Stanford and DeBakey classifications are well established and provide guidance for clinical decision making regarding open surgical repair versus medical treatment, but they require further clinical supplementation in the era of endovascular treatment of aortic dissections. A mnemonic-based approach proposed by Dake et al assessed six factors that influenced the decision making for invasive treatment of TBAD when considering thoracic endovascular aortic repair (TEVAR): (1) duration from the onset of symptoms, (2) location of the primary entry tear, (3) size of the aorta, (4) segmental extent of aortic involvement, (5) complications of the dissection, and (6) false lumen (FL) status.[1]

WHAT WE KNOW

Good Medical Therapy Is Essential for All Patients With TBAD

Medical therapy for patients with aortic dissection slows down progression of TBAD by reducing aortic wall stress caused by high blood pressure, high heart rate, and ventricular contraction. Therefore, medical therapy should be administered to address these factors as suggested by multisociety practice guidelines on the diagnosis and management of patients with thoracic aortic disease,[2] in which β-blockers represent the first-line option in aortic dissection treatment. For acute dissection, the guidelines recommend heart rate adjustment to < 60 bpm and establishing systolic blood pressure between 100 and 120 mm Hg to achieve a balance between low blood pressure and adequate organ perfusion.[3]

Acute Complicated TBAD Is Often Best Managed With TEVAR

Invasive management of acute complicated type B dissection has changed considerably over the past 2 decades, with endovascular repair becoming the

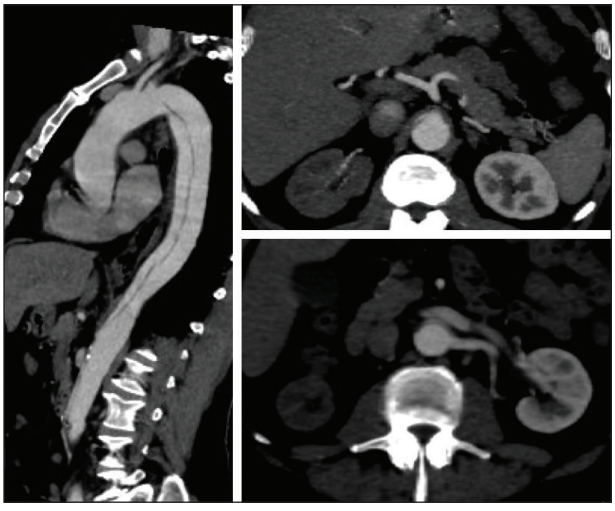

Figure 1. An acute TBAD with a large entry tear and true lumen collapse.

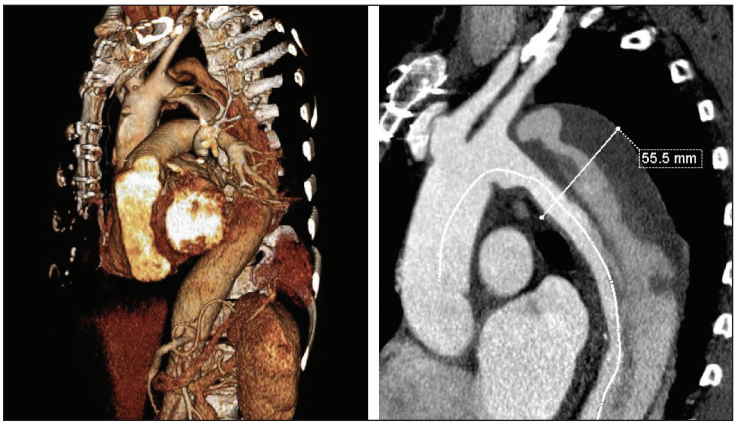

Figure 2. The formation of a FL aneurysm of the thoracic aorta.

treatment of choice in these patients, even though long-term evidence regarding durability is still lacking (Figure 1). Compared to open surgical repair, TEVAR offers clear benefits in terms of favorable outcomes such as operative morbidity and early mortality rates.[4] Additionally, TEVAR offers better quality of life and is associated with lower costs at 1 year compared to open repair.[5] Thus, TEVAR should be offered as the first-line therapy in cases of complicated TBAD. Open repair should be reserved for patients with connective tissue disorders in whom excellent results with open repair were previously reported.

The treatment goal of TEVAR for acute complicated TBAD is to seal the primary entry tear with a stent graft and depressurize the FL by redirecting flow into the true lumen. In cases of malperfusion or limb ischemia due to true lumen compression or collapse, redirection of blood flow to the true lumen is most effective in the reperfusion of the affected visceral and renal side branches, as well as the iliac arteries.

Long-Term Aortic Remodeling Is Better When TBAD Is Treated With Early TEVAR

In the INSTEAD-XL study, TEVAR was able to achieve a reduction of all-cause mortality (11% vs 19%; $P < .05$), aortic-related mortality (7% vs 19%; $P < .05$), and total diameter change (27% vs 46%; $P < .05$) at 5-year follow-up compared to optimal medical treatment alone.[6] Both INSTEAD-XL and IRAD suggested that favorable remodeling is achieved in TBAD compared with the best medical treatment alone.

WHAT WE DON'T KNOW

What Is Uncomplicated TBAD?

Over the past few years, several publications have suggested anatomic factors that indicate a complicated TBAD apart from the typical parameters, such as rupture, an aneurysm > 55 mm, or malperfusion that predicts aneurysmal dilatation and late adverse outcomes (Figure 2).[7-9] Predictive factors for late complications of TBAD are early dilatation of the thoracic aorta > 40 mm, presence of a FL diameter > 22 mm, proximal entry tear size ≥ 10 mm, and also its location at the inner aortic curvature or close to the left subclavian artery.[7-9] Furthermore, recurrent pain and refractory hypertension appeared as clinical signs associated with increased in-hospital mortality, particularly when managed medically (17.4% vs 4%, respectively; $P < .01$). Defining uncomplicated TBAD has become a challenging task, and more frequent aortic interventions, such as stent grafting, may be indicated.

What Is the Exact Definition of Malperfusion as It Pertains to Acute TBAD Treatment?

Although consensus papers and guidelines agree that renovisceral malperfusion after TBAD should be treated by urgent TEVAR, strict definitions for malperfusion have not been established. Perfusion occurs in the false lumen of approximately 20% to 30% of all renal arteries, often resulting in a delayed uptake of contrast during the CT scan. However, some patients with no apparent radiographic signs of renal malperfusion experience a deterioration of renal function after the index event (Figure 3). Although ultrasound of the renal arteries could provide useful information, it does not exclude a "silent" deterioration of renal function due to chronic malperfusion. More precisely determining which patients have chronic renovisceral malperfusion after TBAD will likely be an important factor in determining the optimal treatment strategy.

Is the PETTICOAT Technique Effective in Promoting Aortic Remodeling?

The combination of a proximal stent graft for coverage of the entry tear with an uncovered stent (PETTICOAT technique) remains a treatment option in patients with persistent malperfusion or true lumen collapse.[10] Although true lumen visceral perfusion is achieved after placing the main covered stent graft component in the majority of cases, some patients require additional measures to restore adequate flow to all renovisceral vessels.

The concept of implanting a large self-expandable bare stent distal to the covered stent graft over the visceral segment to reduce malperfusion has been postulated. However, this technique has not yet been confirmed

in a comparative study. The controversy regarding the possible and optimal clinical situations in which to use the uncovered stent is still disputed. It appears, however, that the PETTICOAT technique promotes faster expansion of the true lumen without significantly decreasing the volume of the FL in the thoracic and abdominal aorta, which is the most common reason for late reintervention.[11]

How Should We Treat an Acute Type B Dissection With Retrograde Involvement of the Arch?

In some cases, acute TBAD with entry in the proximal dissecting aorta affects the aortic arch (or even the ascending aorta) because of a retrograde intramural hematoma. These patients are in the gray zone between endovascular surgery and open aortic arch surgery, given that the landing zone for a standard TEVAR with overstenting of the left carotid artery does not represent a healthy aortic segment. A recent IRAD publication suggested that the presence of arch involvement did not significantly influence early or late outcomes in patients treated endovascularly, although fewer patients were treated with stent grafting in this cohort.[12]

Intramural hematoma of the ascending aorta is seen by cardiovascular surgeons as an indication for open surgery, which includes supracoronary or hemiarch replacement of the ascending aorta.[2,13] This recommendation does not differentiate in regard to the location of the primary entry tear, which may be sufficiently treated by TEVAR in the case of retrograde arch and ascending aortic involvement. We do not currently have enough evidence to answer the question of whether these patients should be treated with standard TEVAR or if open arch repair should be recommended to reduce the risk of retrograde type A dissection.

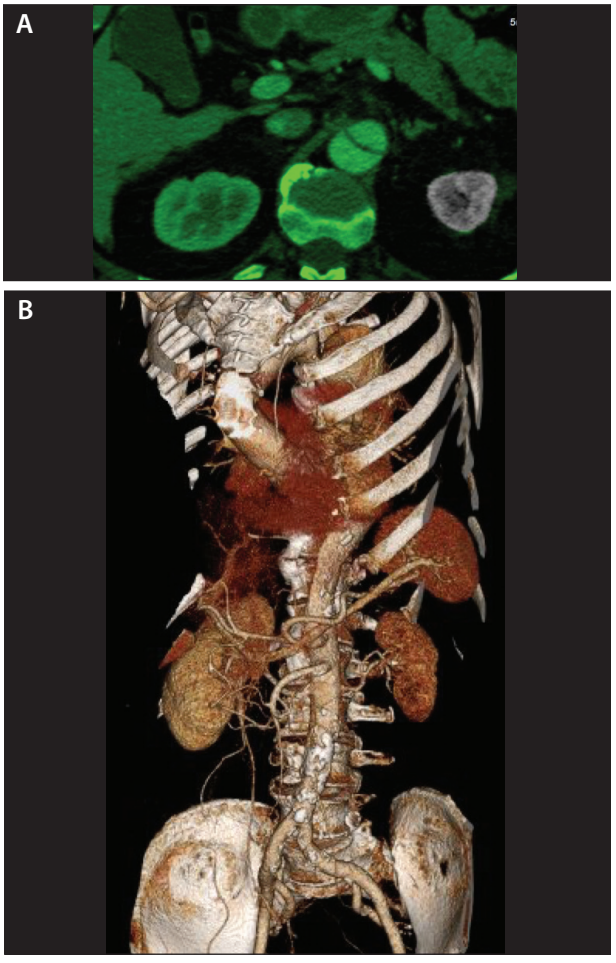

Figure 3. An axial (A) and three-dimensional reconstruction (B) CT scan of a patient with a shrunken right kidney 3 years after "uncomplicated" TBAD.

How Much Should We Oversize Distally to Avoid a Stent Graft–Induced New Entry Tear?

The proximal aortic diameter at the level of the left subclavian artery is usually larger than the aortic diameter at the level of the distal landing zone. The risk of assuming increased radial force in the true lumen when sizing the graft to the proximal diameter without taking into consideration the smaller aortic diameter of the true lumen more distally may lead to tears in the dissection flap at the distal end of the stent graft. Stent graft–induced new entry tears (SINEs) may repressurize the FL and lead to its expansion. The use of tapered components to address this issue may lead to decreased rates of SINEs distally and improve long-term outcomes.[14] Spear et al proposed using the long side of the croissant-shaped true

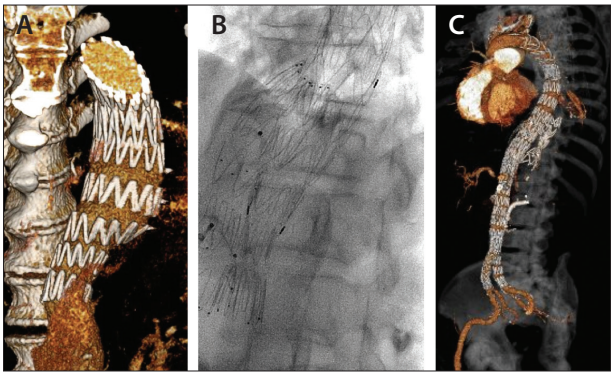

Figure 4. Thoracic FL embolization techniques with a Knickerbocker graft (A), a Candy-Plug graft for thoracic FL aneurysms (B), and a fenestrated/branched endograft for a postdissection thoracoabdominal aneurysm (C).

lumen to size the distal end of the stent graft without additional oversizing, which is a recommendation we follow to avoid SINEs.[15]

What Is the Best Timing for Intervention in TBAD?

Although resistance to stenting in uncomplicated TBAD has largely decreased with the results of the INSTEAD XL study, it is still unclear whether stenting in the acute phase (0–14 days) is associated with more negative outcomes in comparison to best medical therapy. A higher risk for retrograde type A dissections has been postulated, and the dissection membrane might be more vulnerable, thus increasing the complexity of the repair. Most operators prefer a time window between days 15 and 90 for TEVAR in TBAD.

What Will the Role of FL Occlusion Techniques and Fenestrated/Branched Endografts Be in Treating Chronic Dissections?

One-third of patients undergoing TEVAR will progress to aneurysmal dilatation of the dissected aorta[16]; the most commonly involved segment is the thoracic aorta and, secondary to that, the abdominal aorta. Although it is feasible to proceed directly with a thoracoabdominal fenestrated/branched stent graft to completely exclude FL perfusion of the thoracoabdominal aorta, this procedure requires practiced endovascular skills and is associated with a high endoleak rate and a high risk for spinal cord ischemia.[17] In the majority of cases in which only the thoracic aorta is aneurysmal with dilatation of the FL only in the abdominal component, it appears feasible to restrict the reconstruction in the thoracic aorta by isolating the thoracic component from the abdominal. This can be achieved using FL occlusion techniques such as the Candy-Plug or the Knickerbocker, but also standard embolization materials such as coils and plugs (Figure 4).[18,19]

CONCLUSION

The need for a better understanding of this complex disease, whether in the acute or in the chronic phase, is indisputable, and it remains a controversial topic that often confronts physicians with unanswered questions. ■

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