STABILISE technique to promote aortic remodeling in acute/subacute type B dissection

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ABSTRACT

The goals of treating type B aortic dissections include maintaining or restoring blood supply in cases of organ malperfusion, preventing aortic rupture, promoting aortic remodeling, and preventing disease progression and aneurysmal degeneration. The European Society of Vascular and Endovascular Surgery guidelines recommend endovascular treatment for patients with complicated acute/subacute type B aortic dissections and those failing medical management. Several techniques have been used over the past few decades. Recently, the STABILISE (Stent-Assisted Balloon-Induced Intimal Disruption and Relamination in Aortic Dissection Repair) technique has been proposed to treat type B aortic dissections. This method involves proximal thoracic aortic stent grafting with the deployment of distal bare stents, followed by ballooning to intentionally rupture the intimal lamella, allowing the true lumen to fully expand and resulting in a "single-channeled aorta." Since its adoption, several authors have reported satisfactory results, demonstrating that the technique is safe and effective, and it could be considered a serious attempt to promote positive aortic remodeling over time. This paper provides an analysis of presurgical preparation and planning, detailed procedural description during surgery, necessary support equipment, and strategies for perioperative management. (J Vasc Surg Cases Innov Tech 2025;11:101687.)

Keywords: TEVAR; TBAD; Aortic dissection; STABILISE technique; Endovascular repair

The STABILISE (Stent-Assisted Balloon-Induced Intimal Disruption and Relamination in Aortic Dissection Repair) technique has been proposed as a potential long-term solution for aortic dissection.[1,2] This method integrates stent-assisted procedures, balloon-induced intimal disruption, and bare stent relamination to achieve optimal results in the complex treatment of aortic dissection. This paper delves into critical aspects of the procedure, exploring the rationale behind each maneuver, sharing critical decision points, and highlighting key considerations that contribute to the success of this approach. By covering stent-assisted strategies, balloon-induced intimal disruption, and relamination maneuvers, this paper provides surgeons with actionable insights and key considerations to master the STABILISE technique for optimal patient outcomes.

PREOPERATIVE STRATEGY: MANAGEMENT OF AORTIC IMAGING

Computed tomography.

1. Proximal landing zone measurement:
   - Careful preoperative measurements are essential for appropriate stent graft (SG) sizing in acute/subacute type B aortic dissection (TBAD) cases. The proximal landing zone, considered a nondissected aortic segment at least 2 cm long immediately proximal to the dissection, is measured for aortic diameter, accounting for 10% oversizing of the SG (Fig 1).[3]
2. Overall diameter assessment:
   - Measuring the aortic diameter of the true lumen (TL) and false lumen (FL) at various points (descending thoracic aorta, thoracoabdominal junction, celiac trunk, superior mesenteric artery, and renal arteries) is critical. For noncircular FL, the longer diameter in the shortest axis is considered.
   - Multiplanar reconstruction images aid in planning and sizing endovascular procedures for TBADs. However, the maximum intensity projection algorithm has limitations due to reduced intraluminal detail visualization, making it less useful for detecting important anatomical details like the intimal lamella or thrombus.[4]
3. Visceral vessel study:
   - Assessing the patency, origin from FL or TL, and the length before the first bifurcation of visceral vessels is crucial for planning cannulation and potential stenting (Fig 2).
4. Three-dimensional surface reconstructions:
   - Visualizing three-dimensional surface reconstructions of the entire aortoiliac system provides comprehensive insights into the condition of the affected vessels.

In this scenario, electrocardiogram (ECG)-gated computed tomography (CT) may be a useful replacement

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Fig 1. Nondissected proximal landing zone is to be preferred; **(A)** 3D volume rendering reconstruction of the preoperative CT, **(B, D)** 3D MIP reconstruction at the level of the PLZ, **(C)** measurement of the non dissected PLZ.

for conventional CT studies in patients undergoing aortic surgery. It has been well demonstrated that the use of ECG gating is necessary to obtain motion-free imaging of the thoracic aorta, reducing aortic artifacts related to the cardiac cycle. In addition, with ECG-gated CT, it is now possible to image not only the entire aorta but also the coronary tree in the same examination, without using additional contrast material or increasing radiation exposure for the patient.

INTRAOPERATIVE ADJUNCTS

Intraoperative monitoring adjuncts are useful for ensuring the safety and success of the endovascular treatment of TBAD.

Transesophageal echocardiography. Transesophageal echocardiography (TEE) is useful for guiding and monitoring endovascular treatment for TBAD, particularly to verify the proximal seal (Fig 3). It focuses on assessing the seal of entry tears beyond the left subclavian artery. TEE provides real-time insights by visualizing the thoracic aorta, evaluating the dissection extent, detecting thrombus formation, and assisting in the precise placement of wires, catheters, and SGs. It dynamically assesses positioning and expansion, identifies and manages endoleaks, assesses lamella mobility, evaluates cardiac valve function and FL thrombosis, detects aortic regurgitation, and evaluates branch vessel perfusion. However, its main limitations include the inability to visualize the aortic arch due to airway interference and coverage limited to the thoracic region.[5]

Intravascular ultrasound imaging. Intravascular ultrasound (IVUS) imaging provides high-resolution images of vessel walls and luminal structures, offering detailed cross-sectional views of the aorta. It allows comprehensive assessment of vessel morphology, including the TL and FL, intimal flaps, and thrombus presence. Intraoperative IVUS helps evaluate SG apposition to vessel walls, ensuring precise SG placement and reducing the risk of endoleaks or stent migration. It also aids in accurately measuring vessel diameter and length, selecting appropriately sized SGs, and identifying entry and exit tears in the aortic wall. This helps operators target these areas during the procedure, ensuring effective sealing with SGs. IVUS aids in the precise deployment of SGs by providing immediate feedback on their position and expansion. However, IVUS has limitations, including cost, the requirement for vascular access, and the need for a guidewire in place. The combination of TEE and IVUS provides a comprehensive and complementary approach to intraoperative monitoring during endovascular treatment for TBAD. While TEE images the aorta and heart from the esophagus, IVUS offers a detailed perspective from within the blood vessels, enhancing precision and effectiveness.[6]

STEP BY STEP ENDOVASCULAR PROCEDURE

All procedures are conducted under general anesthesia in a hybrid suite equipped with fusion imaging capabilities. Cerebrovascular fluid drainage using the LiquoGuard device (Möller Medical GmbH) is selectively used for patients at high risk, such as those with previous aortic surgery or a history of paraparesis/paraplegia with extensive thoracic coverage.[7] Heparin is initially administered at a dose of 70 units/kg and supplemented to maintain an activated clotting time of over 300 seconds. Percutaneous femoral access is performed under ultrasound guidance using the Perclose ProGlide (Abbott Vascular) suture-mediated system. Surgical access is reserved for cases where percutaneous access is contraindicated. If rapid cardiac pacing is required, the femoral vein may be catheterized, and an electrocatheter (St. Jude Medical) is advanced into the right ventricle.

The TL is catheterized with a 5F pigtail catheter, which is carefully advanced with angiographic or ultrasound checks along the entire aorta, ensuring that the wire does not navigate between the TL and the FL through

Fig 2. Visceral vessels' study and their patency and origin from true (*TL*) or false lumen (*FL*) are extremely important during preoperative evaluation of TBDs. Axial scans and three-dimensional reconstructions are carefully evaluated before surgery. In this case, all four visceral vessels arose from the TL more generally at least the LRA arises from the FL. *LRA*, Left renal artery; *TBD*, type B dissection.

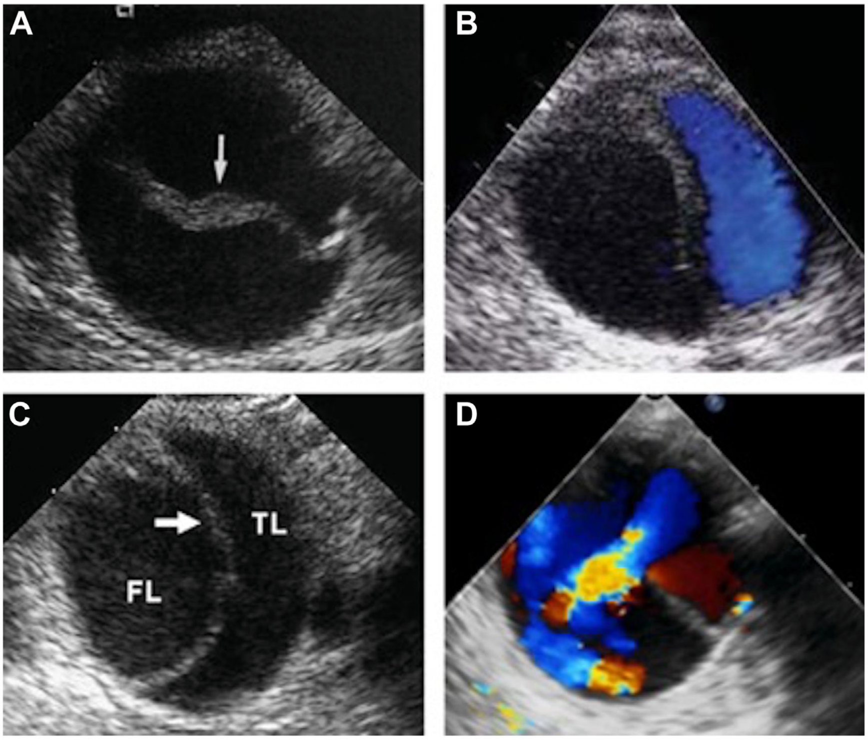

Fig 3. Transesophageal echocardiography in aortic type B dissection is an important adjunct that may help the operator's work. It may be used to identify the intimal lamella **(A)**, the patency of both lumina of the dissected aorta **(B)**, FL thrombosis **(C)**, and distal entry tears when present **(D)**. *FL*, False lumen; *TL*, true lumen.

tears in the lamella. A standard covered SG is deployed to cover the proximal entry tear.

The Zenith Dissection Endovascular System (ZDES; William Cook Europe) is a modular system specifically designed to treat aortic dissection. It consists of a proximal component, the Zenith TX2 Dissection Endovascular Graft with Pro-Form, and a distal component, the Zenith Dissection Endovascular Stent. The length of the SG is

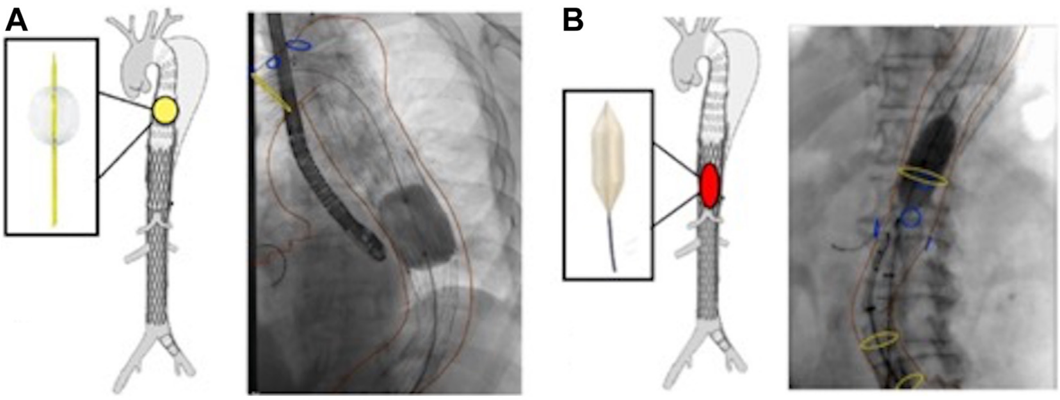

Fig 4. The dilatation of the stent graft (*SG*) inside the fabric is performed with a compliant balloon **(A)**. It is important not to balloon the proximal aorta to avoid serious complications such as retrograde dissection. Paravisceral and abdominal aortas are ballooned using noncompliant balloons **(B)** with a diameter not exceeding transaortic diameter at this level.

determined based on the risk of spinal cord ischemia, typically extending only up to the mid-thorax and usually less than 200 mm to reduce the risk of spinal cord ischemia.

After placing the covered SG, one or two aortic bare stents, specifically designed for aortic dissections, are deployed along the distal thoracic and abdominal aorta down to the bifurcation with an overlap of at least one stent. The diameter of the bare stents should be at least equal to the overall aortic diameter (including both the TL and FL) at the paravisceral level. Before ballooning, the aorta is checked angiographically. All aortic branches arising solely from the FL are catheterized with a wire coming from the TL, passing through the orifices in the lamella at the origin of the aortic branches. This improves the alignment of the orifice in the lamella with the origin of the target artery, and a stent is placed if necessary.

A compliant balloon is manually inflated to expand the covered SGs (Fig 4), rupturing the intimal lamella and achieving aortic relamination (creating a single-channel aorta) in the descending thoracic segment. The proximal landing zone is never ballooned. Distal to the covered SG, at the level of the bare stents, dilation is performed using only a noncompliant or semicompliant balloon (such as a valvuloplasty or venoplasty balloon), not exceeding the total aortic diameter (TL + FL) at this level. This ruptures the intimal lamella and achieves relamination at the distal thoracic and abdominal levels. Balloon dilations are constantly monitored with fluoroscopy and, where possible, with TEE or IVUS. If the bare stents do not fully expand to the outer aortic wall, ballooning is repeated no more than two times. After three inflations, no additional maneuvers are performed. Larger or compliant balloons are never used within the bare stents (Fig 5). This cautious approach significantly reduces the risk of aortic rupture.

Completion angiographies are performed at both the proximal and splanchnic levels. After the removal of all sheaths and closure of the access sites, patients are promptly awakened to assess neurological function.[8] All patients undergo follow-up thoracoabdominal CT scans at 1, 3, and 6 months after the procedure to evaluate SG positioning, vessel patency, and aortic remodeling (Fig 6).

DISCUSSION

The STABILISE technique was proposed to definitively cure TBAD by promoting aortic remodeling of the newly formed single-channel aorta.[9-13] Initially, this technique did not gain immediate consensus among vascular specialists, as many were reluctant to use ballooning on an acutely dissected aorta. However, several authors reported satisfactory early results, and the STABILISE concept has gradually gained acceptance as a viable approach to curing TBAD and achieving aortic remodeling.[1,2,7,14] When deciding between STABILISE, medical management, open surgical repair, or non-STABILISE thoracic endovascular aortic repair, several key findings from imaging modalities such as CT angiography, magnetic resonance imaging, and IVUS can help guide treatment.

Intimal flap extension. Patients with an intimal flap that extends into the distal abdominal aorta with TL collapse are more likely to benefit from STABILISE.

Aortic diameter. Patients with a maximum aortic diameter of >40 mm are, in our opinion, poor candidates for STABILISE, as we explain extensively in the paper.

Distal malperfusion. STABILISE is particularly beneficial in cases of malperfusion syndrome, where the dissection compromises perfusion to visceral organs or the lower limbs.

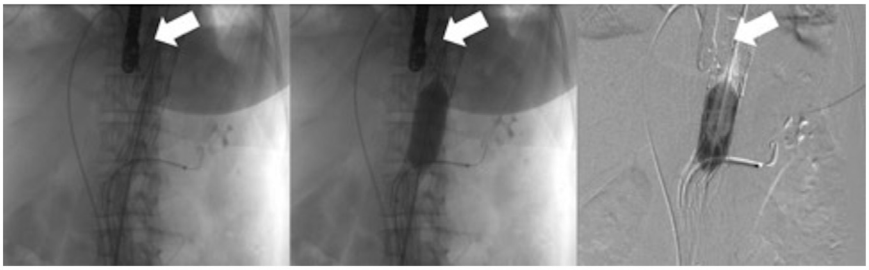

Fig 5. All vessels arising from the false lumen (*FL*) are catheterized from the true lumen (*TL*) before ballooning in order to protect them and to facilitate stenting if necessary. The ballooning procedure is performed, when possible, under transesophageal echocardiography (*TEE*) monitoring and guidance (*white arrow*).

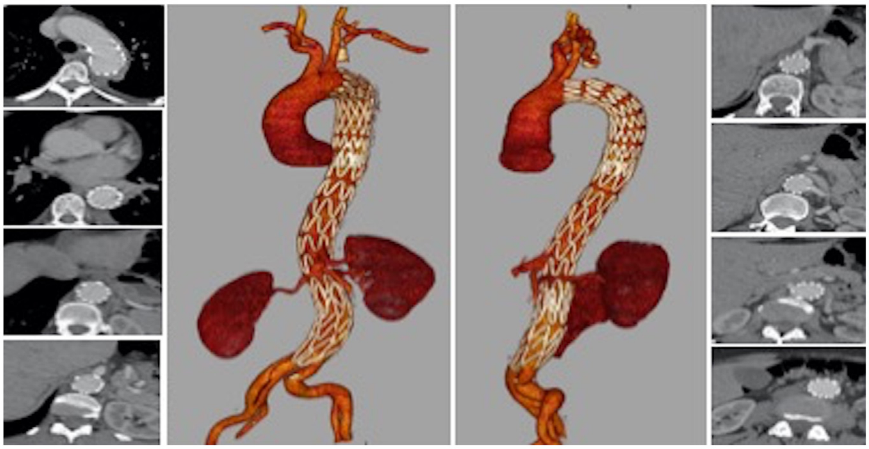

Fig 6. Axial scans and three-dimensional reconstruction of a postoperative computed tomography (*CT*) scan showed all vessels arose from the true lumen (*TL*); there was no need for additional stenting with complete expansion of the TL and maintained patency of visceral and renal arteries.

We have proposed some modifications to the original protocol to enhance outcomes and mitigate procedural risks. First, we reserve this approach exclusively for patients with acute or subacute TBAD within a timeframe of up to 90 days after the index event, deferring hyperacute cases up to 2 weeks unless clinical complications necessitate immediate intervention. Moreover, establishing a proximal landing zone in the nondissected aorta is crucial to avoid complications, and we recommend performing liberal supra-aortic trunk debranching when indicated.

In addition, we prefer using dissection-specific devices, such as the COOK Medical ZDES device, which are designed and approved to treat such pathologies. In these cases, a proximal covered SG is deployed to cover the proximal dissection entry tear and depressurize the TL. A second (distal) covered SG may be positioned in a subsequent procedure if FL perfusion persists from additional re-entry tears. Because this adjunctive maneuver results in additional aortic coverage, we perform it in a multistage procedure to reduce the risk of spinal cord ischemia.

We routinely use large latex compliant balloons only inside the fabric-covered SG. In this context, the balloon dilation is constrained within the SG's nominal diameter, with its fabric protecting the aorta from overdistension.[14]

Several series of patients treated with the STABILISE technique have been recently published in the literature.[14,15] The prevalent opinion among the vascular community is that the technique may cure dissection and prevent late aneurysmal degeneration. However, the cohorts in these studies are heterogeneous, including hyperacute and chronic patients, type A and B dissections, and those with genetically triggered aortic diseases. Furthermore, there is technical variability among the studies regarding the type of balloon used, the number of inflations, and additional maneuvers performed. These technical details are often unspecified, though they are crucial for understanding the technique's results.

To address the issues associated with such a heterogeneous case mix and to prove the efficacy of the technique, we believe that more robust data from large series with a homogeneous patient mix treated with standardized techniques are needed. For these reasons, we initiated the STABILISE registry (NCT03707743) in 2018. The enrollment phase is now complete, and we aim to gather—for the first time—data from high-volume international aortic centers performing the STABILISE technique to establish a solid scientific basis for evaluating its outcomes.

CONCLUSIONS

The STABILISE technique, when rigorously performed, may be a safe and effective strategy in acute/subacute complicated TBAD patients. Patient selection is crucial, and several technical aspects need to be considered to succeed, reducing the risk of complications, with the aim to promote aortic remodeling over time. Longer follow-up and more robust patient data are needed.

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DISCLOSURES

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