Satisfactory short-term outcomes of the STABILISE technique for type B aortic dissection

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ABSTRACT

Objective: The aim of this study was to evaluate the perioperative and short-term results in a cohort of patients treated during the last year at our institution with the stent-assisted balloon-induced intimal disruption and relamination in aortic dissection repair (STABILISE) technique for acute complicated aortic dissection.

Methods: Between June 2016 and June 2017, 10 patients (all male; mean age, 62.6 ± 7.4 years) received treatment for acute complicated aortic dissection with the STABILISE technique. After a standard provisional extension to induce complete attachment procedure using the commercially available endovascular dissection system (Cook Medical, Bloomington, Ind), the distal stent graft area and the bare stent area were ballooned to completely exclude the thoracic false lumen (FL) and to obtain a single-channeled abdominal aorta. Computed tomography was routinely performed within the first postoperative week before discharge and then at 3 months, at 6 months, and yearly thereafter. The technical and clinical success rates were analyzed.

Results: The 30-day technical and clinical success rates were 100%, with complete thrombosis of the thoracic FL and no type I endoleak. Malperfusion was resolved in all cases. No aortic ruptures were recorded, and no open conversion was required. One case of delayed spinal cord ischemia fully resolved within the discharge period. Predischarge computed tomography showed complete thrombosis of the thoracic FL in all cases. In two cases, some degree of patency of the abdominal FL was observed. At short-term follow-up, the overall aortic diameters remained stable with no further dilation.

Conclusions: The STABILISE technique was safe and feasible in this cohort of patients, with complete thrombosis of the thoracic FL and creation of a single-channeled aorta in most cases. Further studies are needed to ascertain the long-term behavior of the treated aorta. (J Vasc Surg 2018;68:966-75.)

Keywords: Aortic dissection; Type B; STABILISE; Bare stent; Ballooning

Acute type B aortic dissection (TBD) is a serious condition that requires treatment in the presence of complications such as impending rupture, rapid dilation, intractable pain, hypertension, and especially malperfusion of organs or limbs.

Endovascular treatment of acute TBD is now the first choice, when it is anatomically feasible, because of its reduced invasiveness and the better results compared with open repair. The key goals of endovascular treatment are to close the proximal entry tear by means of a stent graft, to redirect the flow in the true lumen (TL), and to promote thrombosis of the false lumen (FL). A positive remodeling of the aorta and, occasionally, its healing may be obtained; however, more often, some degree of perfusion of the FL is maintained through additional tears in the thoracoabdominal aorta and iliac arteries, and therefore the potential for aneurysmal degeneration remains significant over the years.

Bare stents may be deployed in the thoracoabdominal aorta distal to the stent graft to enhance the TL, thus treating dynamic malperfusion and stabilizing the intimal lamella. This technique, also known as the provisional extension to induce complete attachment (PETTICOAT) technique, offers good short-term and midterm results[1-8]; however, some degree of perfusion of the FL is still maintained, and the aorta still has a tendency to grow distally to the stent graft.[5,6,9]

Hofferberth et al[10] in 2012 proposed an evolution of this technique, consisting of ballooning of the TL inside the stent graft and the distally deployed bare stents to rupture the lamella and to allow full expansion of the stent in a single-channeled aorta; it is known as the stent-assisted balloon-induced intimal disruption and relamination in aortic dissection repair (STABILISE) technique. It produced excellent results, especially in the relief of malperfusion and removal of the need for late reinterventions. Despite the good results, the STABILISE technique did not gain immediate acceptance in the community, mainly because of concerns about the potential risk of rupture of the aorta during ballooning.

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The aim of this study was to evaluate the perioperative and short-term results in a cohort of patients treated during the last year at our institution with the STABILISE technique for acute complicated TBD.

METHODS

Data of patients evaluated at our institution for acute TBD were recorded and prospectively collected in a database between June 2016 and June 2017. According to our standard practice, patients with uncomplicated TBD were treated medically, and patients with complicated TBD were treated with an endovascular approach and were evaluated in this study.

Patients considered in this study were either admitted from the emergency department of our hospital or transferred from a different hospital in the acute phase (within 2 weeks from the event). When the clinical conditions were stable, it was our target to delay the procedure for at least a week, with careful monitoring; however, in cases that could not be delayed, the procedure was performed immediately.

All the procedures were performed under general anesthesia in an operating room equipped with a portable C-arm (Ziehm Vision RFD Hybrid edition; Ziehm, Nürnberg, Germany). Cerebrospinal fluid drainage was inserted preoperatively, and the LiquoGuard (Möller Medical GmbH, Fulda, Germany) device (which allows monitoring of both the intrathecal pressure and the quantity of the fluid drained) was employed with a target intrathecal pressure of 8 mm Hg or less.[11] Patients who required supra-aortic trunk rerouting to achieve a proximal landing zone (PLZ) in the nondissected aorta received the surgical revascularization during the same procedure.

The left radial or brachial artery was catheterized with a 6F introducer sheath if a plug needed to be deployed at the origin of the left subclavian artery in PLZ 2. In most cases, the left common femoral artery was catheterized percutaneously with a 6F 90-cm-long introducer sheath for angiography, and the right common femoral artery was surgically exposed for deployment of the devices. The right femoral vein was also exposed through the groin, and an electrocatheter (Pacer; St. Jude Medical, Minnetonka, Minn) was advanced into the right ventricle for rapid cardiac pacing when needed. This routine might have varied in some specific cases according to anatomopathologic features of the case.

Transesophageal echocardiography (TEE) was performed in all cases to monitor the cardiac function as well as the positions of the wires at the thoracic level, the deployment of the devices, the ballooning, and the final outcomes. Heparin was administered at an initial dose of 70 units/kg and was supplemented as needed to maintain an activated clotting time >300 seconds.

The TL of the dissected aorta was catheterized with a 5F pigtail catheter that was carefully advanced, with angiographic checks performed during its advancement in the abdomen and with TEE in the thorax. In addition to TEE and angiographic images, in the last two cases, intravascular ultrasound was also used during the procedure. Once the tip of the pigtail catheter reached the ascending aorta, a Lunderquist extrastiff guidewire (Cook Medical, Bloomington, Ind) was inserted and parked adjacent to the aortic valve plane.

ARTICLE HIGHLIGHTS

- **Type of Research:** Single-center retrospective analysis of prospectively collected cohort data
- **Take Home Message:** The stent-assisted balloon-induced intimal disruption and relamination in aortic dissection repair (STABILISE) technique at the time of thoracic endovascular aortic repair in 10 patients with acute complicated type B dissection resulted in thrombosis of the thoracic false lumen in all patients with obliteration of the false lumen of the abdominal aorta in 8 patients and stable or decreasing aortic diameters in all patients at a mean follow-up of 7.2 months.
- **Recommendation:** This study suggests that the STABILISE technique in acute complicated type B dissections may enhance late remodeling of the thoracoabdominal aorta.

The STABILISE technique used to treat these patients is an evolution of the PETTICOAT technique that was previously reported in detail[5] (Fig 1, *A* and *B*) and is based on the following strategy:

1. Only patients presenting with an acute complicated TBD with a proximal suitable nondissected landing zone in the aortic arch or descending thoracic aorta are included (supra-aortic trunk debranching may be employed to obtain an adequate PLZ).
2. The total aortic diameter (TL + FL) of the abdominal aorta (from supraceliac to infrarenal level) must not exceed 42 mm.
3. A proximal covered stent graft is deployed covering the proximal dissection entry tear, using a 10% graft oversizing compared with the nondissected PLZ (outer-to-outer diameter).
4. A second (distal) covered stent graft is deployed in the descending thoracic aorta landing distally just above the origin of the celiac artery and allowing a generous overlap (at least 5 cm) with the proximal component. Distal bare stent configurations are avoided. The distal covered stent graft diameter is chosen using a 10% graft oversizing compared with the total aortic diameter (TL + FL) at this level.
5. Distal to the covered stent grafts, one or two aortic bare stents (Zenith Dissection Endovascular Stent; Cook Medical) are deployed to cover the entire dissected abdominal aortic segment, with a proximal overlap of at least one stent. Bare stent diameter is

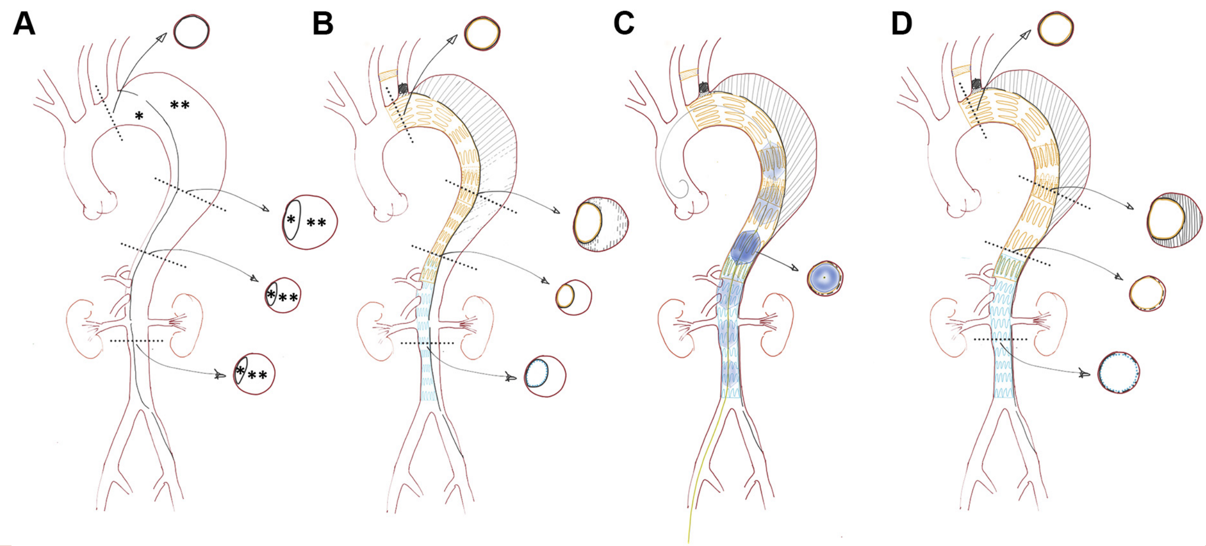

Fig 1. Schematic drawing depicting how the authors plan the stent-assisted balloon-induced intimal disruption and relamination in aortic dissection repair (STABILISE) procedure. **A,** In cases of acute type B aortic dissection (TBD), the false lumen (FL**) compresses the true lumen (TL*), creating the conditions for dynamic malperfusion. **B,** The provisional extension to induce complete attachment (PETTICOAT) procedure can be performed to solve the dynamic malperfusion. One or more standard stent grafts are deployed to cover the entry tears in the thoracic area combined with distal bare stents in the abdominal aorta to enhance the TL re-expansion and to solve the malperfusion. However, the FL usually remains perfused. **C** and **D,** The STABILISE procedure is performed by ballooning the distal thoracic stent graft area and the whole abdominal bare stent area to obtain a single channel, to block the distal FL reperfusion, and eventually to reattach the two lumens in the distal thoracoabdominal region. A noncompliant balloon not exceeding the total aortic diameter is used in the aortic segment supported by bare stents.

chosen to be at least equal to the total aortic diameter (TL + FL) at this level.

6. A 46-mm latex compliant balloon is used to dilate the covered stent grafts (Fig 1, *C* and *D*) to rupture the intimal lamella and to obtain relamination (ie, complete FL obliteration) of the descending thoracic segment. In this area, the dilation of the balloon is constrained within the stent graft's nominal diameter, its fabric protecting the aorta from overdistention.
7. The abdominal aortic bare stents are then dilated using a noncompliant or semicompliant balloon, not exceeding the total aortic diameter (TL + FL) at this level, to rupture the intimal lamella and to obtain relamination at the abdominal level as well. Balloon dilations are constantly followed both radiologically and with TEE where possible (Fig 2). In case of incomplete expansion of the bare stents to the outer aortic wall, ballooning is repeated two more times. After three inflations, no additional maneuvers are performed.
8. In case one or more branches arise from the FL, these are catheterized with a 6F introducer sheath coming from the TL before ballooning; after completion of the STABILISE technique, a bare or covered stent is deployed to connect the aortic TL with the target vessel (Figs 3 and 4).
9. Additional bare or covered stents might be used in the common iliac arteries to obliterate distal tears (Fig 5).

Completion angiography was performed both at the proximal level and at the splanchnic level to confirm FL obliteration and to ascertain patency of all aortic branches. After all the sheaths were removed and the access was closed, patients were immediately awakened to evaluate neurologic integrity.

Protamine sulfate was not routinely administered. Patients were usually monitored in the intensive care unit (ICU) and transferred to the ward after 24 hours if they were hemodynamically stable and asymptomatic. A computed tomography (CT) scan was routinely performed within the first postoperative week before discharge. Control CT scans were then performed at 3 months, at 6 months, and yearly thereafter. All the data were collected in our prospective database for future evaluations. The total aortic diameter (TL + FL) was measured at different levels preoperatively and at each CT scan performed during follow-up. At the thoracic level, diameter was measured after the origin of the left subclavian artery, at the level of the bronchial bifurcation, and just above the celiac artery. Diameter of the abdominal aorta was measured at the origin of the superior mesenteric artery, at the origin of the left renal artery, and 5 cm below the left renal artery. A decrease in diameter >5 mm was considered a reduction, and an increase >5 mm was considered an expansion. Any variation <5 mm was considered a sign of stability. The study protocol complied

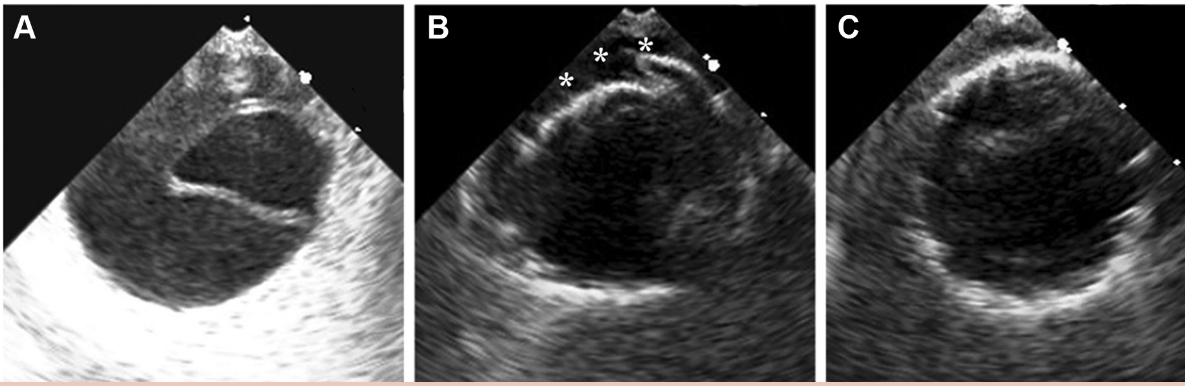

Fig 2. Intraoperative transesophageal echocardiography (TEE). After type B aortic dissection (TBD) onset **(A)**, the true lumen (TL) is collapsed. After stent graft deployment **(B)**, the TL partially re-expands; however, the stent graft is not fully expanded, and complete reattachment of the dissecting lamella to the outer wall is not obtained, with some degree of persistent false lumen (FL) perfusion (*asterisks*). After ballooning **(C)**, a single channel is obtained with complete obliteration of the FL.

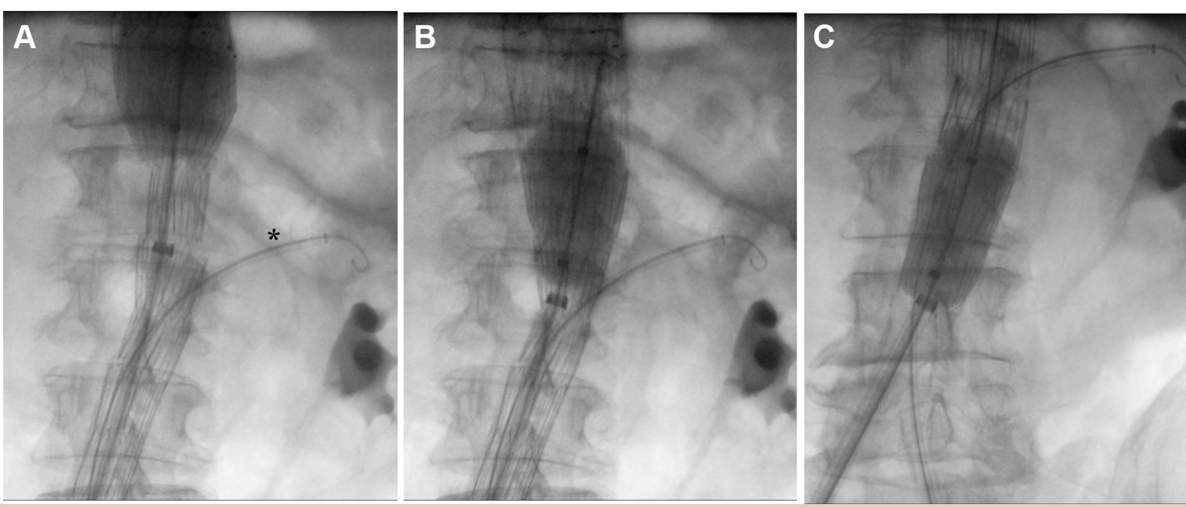

Fig 3. Sequence of intraoperative ballooning of the abdominal bare stent area with progressive expansion of the stent and reattachment of the lumen. The stent-assisted balloon-induced intimal disruption and relamination in aortic dissection repair (STABILISE) procedure is performed by ballooning the distal thoracic aorta **(A)**, the aorta at the level of the renal arteries **(B)**, and the infrarenal aorta **(C)**. Note that the left renal artery (*) arising from the false lumen (FL) has been precatheterized with a 6F sheath to avoid misalignment of the vessel ostium with the dissecting lamella and to allow selective stenting after aortic ballooning (Fig 4).

with the Declaration of Helsinki, and local ethical committee approval was not required for this retrospective study; however, all patients gave informed consent to both the procedure and data collection.

RESULTS

Between June 2016 and June 2017, we evaluated 27 patients at our institution for acute and subacute TBD. Ten consecutive patients (all male; mean age, 62.6 ± 7.4 years) with acute complicated TBD involving the thoracoabdominal aorta who met the anatomic criteria received treatment with the STABILISE technique (Table). Reasons for treatment included malperfusion (involving the visceral organs in six cases and the lower limbs in two cases), rapid dilation in one case, and intractable pain or hypertension in three cases (some patients had more than one presenting symptom). All the patients with complicated TBD received more than one CT scan and were strictly monitored before intervention.

Of the 10 patients analyzed in this cohort, six required supra-aortic trunk rerouting (4 left carotid to subclavian bypasses and 2 right-to-left carotid bypasses and left carotid-subclavian bypasses). A Zenith (Cook Medical) proximal stent graft (TX2 dissection endovascular graft in three cases or Alpha thoracic endovascular graft in seven cases) was deployed to land in an area of proximally nondissected aorta in all cases. A second proximal component (with no distal bare stent) Zenith stent graft (TX2 dissection endovascular graft in four cases or Alpha

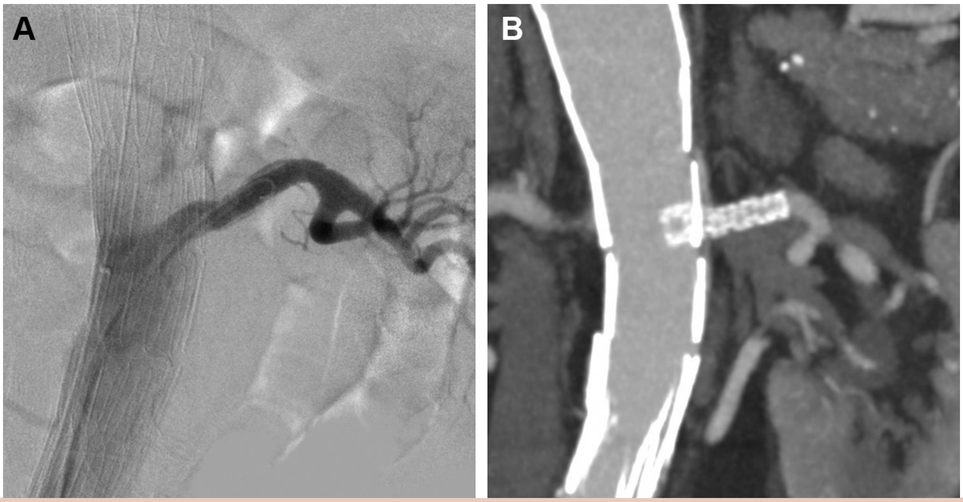

Fig 4. After the stent-assisted balloon-induced intimal disruption and relamination in aortic dissection repair (STABILISE) procedure, the left renal artery originating from the false lumen (FL) is stented to guarantee adequate perfusion **(A)**. On postoperative computed tomography (CT) scan **(B)**, the dissecting lamella is completely reattached to the outer aortic wall (no more FL is visible), and the left renal artery is reperfused.

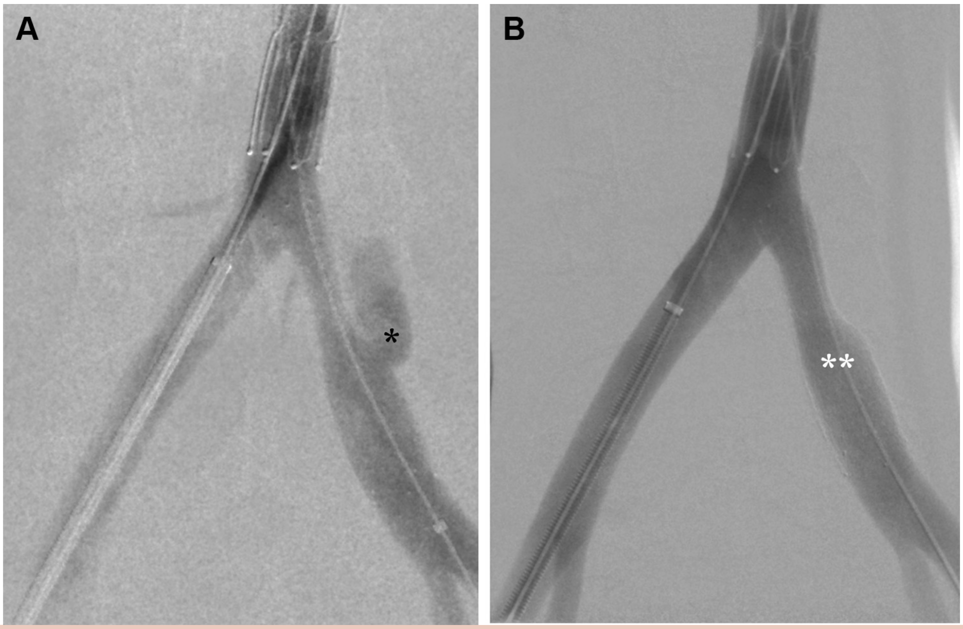

Fig 5. At the end of the stent-assisted balloon-induced intimal disruption and relamination in aortic dissection repair (STABILISE) procedure, a distal re-entry tear (**A**, *) from the common iliac artery is sealed with a covered stent deployment (**B**, **).

thoracic endovascular graft in six cases) was then deployed distally with a generous overlap of at least 5 cm, landing distally just above the celiac artery in all cases.

Ballooning of the stent grafts and bare stents immediately obtained complete disruption of the dissecting lamella in eight cases. In two patients, after three inflations at the same stent level, only a partial disruption of the abdominal lamella was achieved. Adjunctive endovascular procedures included seven cases of stenting of the left renal artery arising preoperatively from the FL, one case of stenting of the superior mesenteric artery arising from the TL with static malperfusion at the origin, and two cases of endovascular exclusion of distal secondary re-entry tears with covered stent deployment in the iliac arteries.

On awakening, all patients were neurologically intact and were extubated in the operating room before they were transferred to the ICU for monitoring. Malperfusion immediately resolved in all patients with this initial

Table. Demographics of the patients (N = 10)

Variables	
Male	10 (100)
Age, years, median ± SD	62.6 ± 7.4
ASA score 3-4	0 (0)
SVS score <10 points	10 (100)
Dissection onset	
Acute	2 (20)
Subacute	8 (80)
Malperfusion	
Visceral or renal	6 (60)
Lower limb	2 (20)
Hypertension	10 (100)
Smoking	4 (40)
Diabetes	0
Hyperlipemia	2 (20)
Cardiac SVS status >2	0
Pulmonary SVS status >2	0
Renal SVS status >2	1 (10)

ASA, American Society of Anesthesiologists; *SD,* standard deviation; *SVS,* Society for Vascular Surgery.
Values are reported as number (%) unless otherwise indicated.

indication. Posterior thoracic pain was a common complaint (six patients) in the first 24 to 48 hours; it responded well to medication and resolved spontaneously in all cases before discharge.

All patients were monitored for 24 hours in the ICU and then transferred to the vascular surgical ward, where they were observed for a week. One patient experienced paraparesis on postoperative day 5 after an episode of mild hypotension. He fully recovered after reinsertion of cerebrospinal fluid drainage and hemodynamic normalization.

Technical success was obtained in all patients. No deaths were recorded in the hospital or within 30 days postoperatively. No other complications besides the paraparesis were observed within 30 days postoperatively.

The follow-up period ranged from 1 month to 12 months (mean, 7.2 months). All patients were alive and clinically asymptomatic during the follow-up period. The thoracic FL was either completely excluded or had entirely disappeared in all cases (Figs 6 and 7), except in one case of mild reperfusion sustained by intercostal arteries. The total diameter of the thoracic aorta, including TL and FL, decreased in all the patients who preoperatively presented with dilation of the FL and remained stable in the case of a nondilated thoracic aorta. In the abdominal aorta, the TL was widely patent in all cases with no signs of malperfusion. Some degree of perfusion was observed between the bare stents and the external aortic wall in the two patients with only partial intraoperative lamella disruption. No further maneuvers were performed in these two cases. The diameter of the abdominal aorta remained stable in all the cases, and no abdominal aortic enlargement was documented at follow-up.

After 6 months of follow-up, one patient presented with asymptomatic right renal stenosis, successfully treated with a 7-mm balloon-expandable stent. No other patency issues were observed in splanchnic and renal vessels.

DISCUSSION

According to the therapeutic paradigm that is currently accepted and endorsed by most scientific societies in their guidelines for acute TBD, intensive monitoring and pharmacologic therapy are offered in uncomplicated cases, and an operative procedure is offered in complicated ones. The preferred operative procedure is endovascular (thoracic endovascular aortic repair [TEVAR]) when it is anatomically feasible and surgical in other instances. Complications that warrant treatment include, among others, signs of impending or frank rupture, malperfusion of any organ or limb, intractable pain or hypertension, and rapid expansion of the aorta.

Although the goal of the endovascular treatment of an aneurysm is clear-cut (exclusion of the aneurysmal sac from the systemic pressure, thus reducing the risk of rupture), the goals of the endovascular treatment of acute TBD are less obvious. Complete remodeling and healing of the diseased aorta are highly desirable but can be obtained only in a minority of cases. The primary goals are therefore to obliterate the proximal entry tear with a simple TEVAR and to exclude the FL from circulation, thus promoting its thrombosis. To do so, a commercially available stent graft is usually deployed in the TL landing proximally in the nondissected aorta and covering the primary entry tear.

There are, however, additional issues that are not addressed by the initial covering of the primary tear with a stent graft, including secondary tears, persistent dynamic malperfusion, intimal lamella flapping movements, fate of renal and visceral arteries, and fate of the FL.

Secondary tears are usually diagnosed intraoperatively by means of TEE or intravascular ultrasound and may be treated with additional stent grafts; however, this should be weighed against the increased risk of spinal cord ischemia (SCI), especially if flow is also limited in the subclavian and hypogastric arteries. For the other issues, the PETTICOAT technique may be particularly useful when the TL is still collapsed after the proximal stent graft placement with persisting dynamic malperfusion. Its main features are that it relieves dynamic malperfusion, maintains branch perfusion, stabilizes the intimal lamella, and promotes aortic remodeling.

Both single-center experiences and an international multicenter trial have shown significant increase in the TL diameters and volume and reduction in the FL; these features, however, are mostly limited to the thoracic

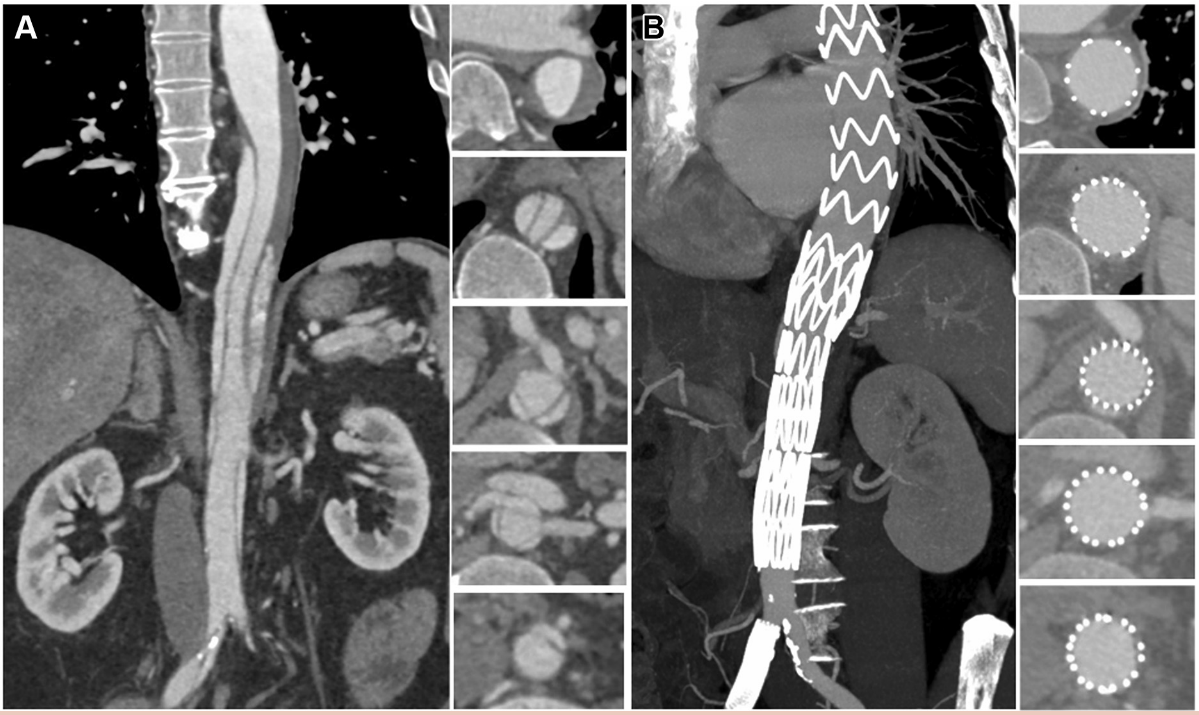

Fig 6. A, Preoperative computed tomography (CT) scan of acute type B aortic dissection (TBD) treated 6 days after the event for intractable pain and hypertension. **B,** CT scan 6 months after the stent-assisted balloon-induced intimal disruption and relamination in aortic dissection repair (STABILISE) procedure demonstrates complete remodeling of the thoracoabdominal aorta.

aorta.[5,6,9] The FL remains perfused in most cases, and the evolution to aneurysmatic degeneration is still possible.

A recent review analyzed 11 studies in which the PETTICOAT treatment was employed in 439 cases of type A (n = 40 [9.1%]) and type B (n = 399 [90.9%]) dissection. In terms of aortic remodeling, 9 of 11 articles reported the behavior of the lumens after the procedure. All studies observed an early significant expansion of the TL in the thoracic and abdominal aorta; but when the FL is taken into consideration, the data are more heterogeneous. Both the thoracic and abdominal FLs decreased in size significantly postoperatively because of the redistribution of the lumens, but at follow-up (six studies), the FL continued to decrease in size in the stent graft area, whereas in the abdominal aorta, the FL remained stable with no shrinkage (four studies) or increased (two studies at 2-year follow-up).[12]

The physiopathologic key to the evolution of the dissected aorta into an aneurysm is related to the presence of two channels with an increased tension burden on the wall of the FL that eventually leads to dilation; therefore, the possibility of reconnecting the two channels by endovascular means has been assessed with various techniques, including fenestrations with balloons inserted between the TL and FL or specifically designed cutting devices for the lamella.[13] Hofferberth et al[14] have proposed an ingenious system, blending the PETTICOAT technique with ballooning of the TL, aimed at rupturing the intimal lamella that is reconnected with the outer layers of the aorta by means of the self-expandable bare stents. This technique has been named STABILISE, and the initial report was very satisfactory, especially with regard to malperfusion and reinterventions.

The window of efficacy of both the PETTICOAT and the STABILISE techniques is probably limited to the first 8 to 12 weeks after the dissection, the so-called acute/subacute phase, in which the lamella is still pliable and the chance of positive aortic remodeling is greater. In the hyperacute phase (first hours and days after the dissection), on the other hand, the risk of rupture is probably higher, and interventions should be limited to emergency cases that cannot wait.

Ballooning of a dissected aorta bares a potential risk of rupture that cannot be ignored, and this is probably the main reason that the STABILISE technique has not gained more widespread acceptance despite the excellent results described by the original authors. To improve the initial description of the STABILISE concept, we described in this article a defined procedural protocol, including rules for stent graft and balloon sizing, that is intended to minimize the risk of intraprocedural aortic rupture and vessel occlusion. In addition, accurate intraoperative monitoring was employed in this series to

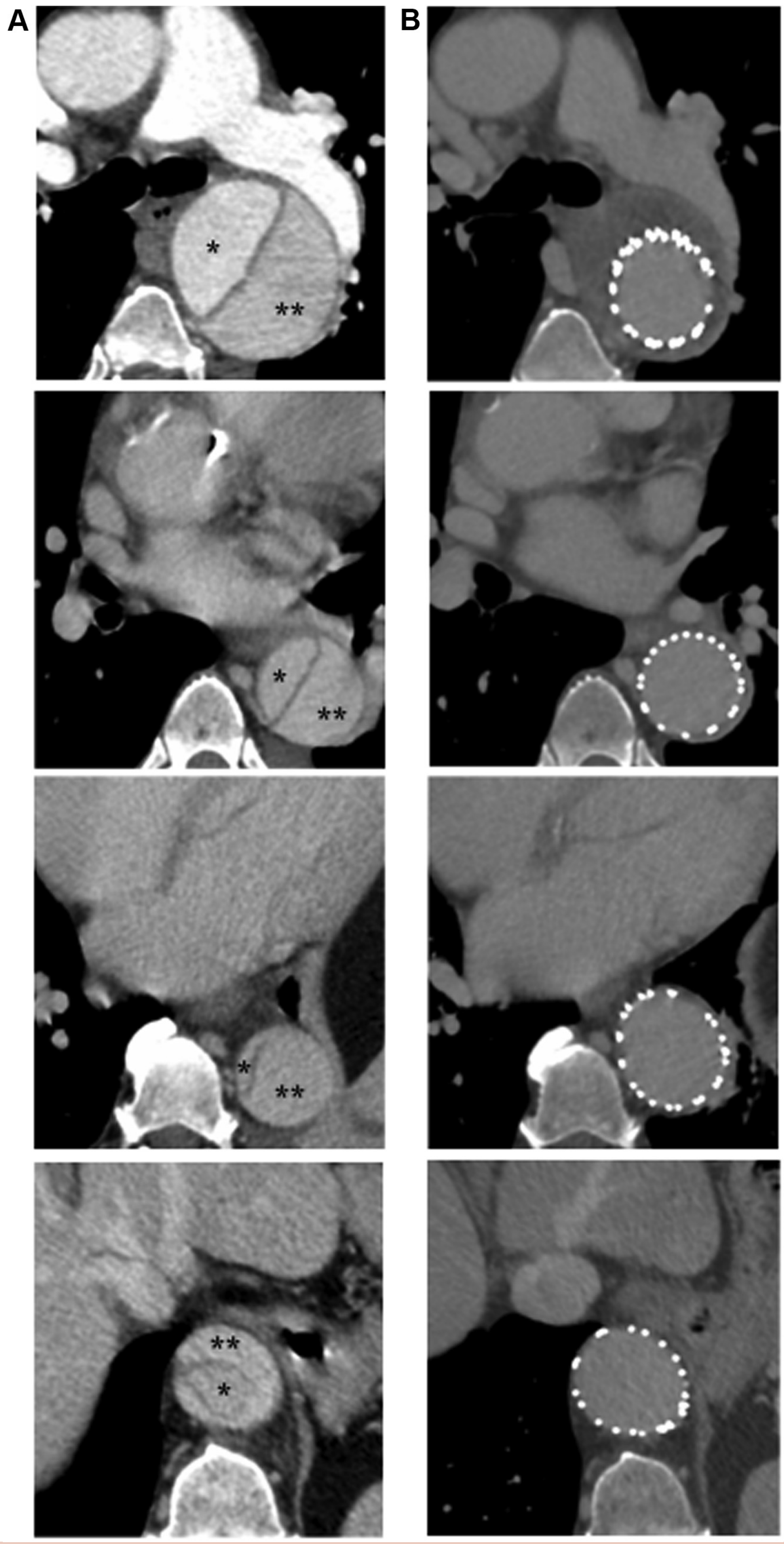

Fig 7. A, Preoperative computed tomography (CT) scan of acute type B aortic dissection (TBD). Axial scans show the true (*) and false (**) lumen of the dissected aorta at thoracic level. **B,** The 3-month follow-up CT scan after the stent-assisted balloon-induced intimal disruption and relamination in aortic dissection repair (STABILISE) procedure shows a single-channeled thoracic aorta with complete remodeling at the same levels.

immediately detect potential complications. Given this protocol, however, no intraoperative complication, such as aortic rupture or vessel occlusion, was observed in this small, initial experience.

SCI is a serious and potentially catastrophic complication with all aortic procedures that involve the thoracic and thoracoabdominal segments. The incidence, severity, and time at onset of SCI are variable, depending on many factors; however, as a general rule, the larger the amount of feeders to the anterior spinal artery (eg, subclavian, intercostal, lumbar, hypogastric arteries) that are occluded during the procedure, the higher the risk. Therefore, TEVAR limited to the thoracic aorta carries less risk than a complete thoracoabdominal procedure; moreover, with simple TEVAR limited to the proximal aorta in cases of aortic dissection, the thrombosis of the intercostal arteries is also limited to the proximal portion of the thoracic aorta, and therefore SCI is relatively less common with these procedures. With the proposed technique, however, the objective is to fully cover and obliterate the thoracic aorta; therefore, an increased risk of SCI may be anticipated in the periprocedural period. It is thus important to employ all possible means to prevent it. The key concern in SCI prevention is related to maintaining collateral flow, ensuring hemodynamic stability, optimizing intrathecal perfusion, and promptly diagnosing and treating the events. Our strategy includes revascularization of the supra-aortic trunks that need to be covered at the level of the PLZ and of the hypogastric arteries, cerebrospinal fluid drainage with the Liquo-Guard system, avoidance of prolonged hypotension (during proximal deployment, rapid pacing allows the cardiac output to be reduced only for the time strictly necessary to deployment, usually less than 30 seconds), avoidance of anemia (a hemoglobin level >10 mg/dL is maintained throughout and after the procedure), and avoidance of epidural or spinal analgesia that may be confounding in the early diagnosis of SCI. The authors have thoroughly discussed these issues in a recent article.[15]

Finally, a possible advantage of the STABILISE procedure compared with the simple PETTICOAT is that if any aortic enlargement occurs within time, by obtaining a single channel in the abdominal aorta, any possible future endovascular procedures with fenestrated or branched endografts might be facilitated by the wide lumen obtained. On the other hand, the presence of the bare stents might interfere with the bridging procedures.[16] For these reasons, careful selection of patients is necessary, and at this time, we offer the STABILISE procedure only to patients with acute and subacute complicated aortic TBD. A strict follow-up is mandatory to assess the long-term results of this approach.

The primary limitation of this study is the small number of patients, which may account for underestimation of technical concerns or possible complications associated with the disruption of the intimal lamella during the procedure. Also, a longer follow-up period is needed to validate these initial results and to draw any definitive conclusion about the safety and durability of the proposed technique.

CONCLUSIONS

The PETTICOAT concept has been proven to be a valuable adjunct in cases of persistent malperfusion after an initial TEVAR for TBD; however, it failed to be effective in promotion of remodeling of the distal thoracoabdominal aorta. The STABILISE concept has been proposed to create a single aortic channel to therefore effectively treat dynamic malperfusion, avoiding reinterventions and enhancing aortic remodeling and healing. Further studies are needed to ascertain the safety of this technique in a larger group of patients and to evaluate the behavior of the postdissected aorta with time.

AUTHOR CONTRIBUTIONS

Conception and design: GM, LB, RC
Analysis and interpretation: GM, LB, MD, FM, RC
Data collection: LB, ER, DM, AK, DL
Writing the article: GM, LB, ER, DM, AK, DL
Critical revision of the article: GM, MD, FM, RC
Final approval of the article: GM, LB, ER, DM, AK, DL, MD, FM, RC
Statistical analysis: GM, LB
Obtained funding: Not applicable
Overall responsibility: GM

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