Santi Trimarchi

Type B aortic dissection: a potential paradigm shift for uncomplicated patients

Type B aortic dissection (TBAD) is an acute aortic syndrome that often leads to the development of clinical complications that alter the treatment pathway. *Confluence* spoke with Professor Santi Trimarchi, Director of the Thoracic Aorta Research Centre, IRCCS Policlinico San Donato, University of Milan, Italy to discuss endovascular intervention for the treatment of both 'complicated' and 'uncomplicated' TBAD patients.

What is type B aortic dissection?

Santi Trimarchi (ST): Type B aortic dissection (TBAD) is a catastrophic complication of the aorta, characterised by an intimal tear, usually located below the region of the left subclavian artery. The disease is classified into four distinct time periods: the hyper-acute phase (onset – 24 hours), the acute phase (onset – 2 weeks), the sub-acute phase (2–8 weeks), and the chronic phase (>8 weeks).

TBAD patients are characterised by a complicated or uncomplicated clinical status, and make up almost one third of the entire cohort of dissected patients.[1–6] Uncomplicated patients are those who mostly present under stable conditions, whilst 'complicated' patients develop complications such as ruptures, visceral/renal/limb malperfusions, refractory/recurrent pain, refractory, potential paraplegia or spinal cord ischaemia, which usually indicates that additional treatment is needed.

What are the current treatment options for patients with TBAD?

ST: The best medical management today is through the use of beta-blockers, with the aim of reducing heart rate, cardiac output and blood pressure. Beta-blockers are usually used in combination with other important vasodilators such as nitroprusside, calcium channel blockers and intravenous management to address different types of hypertension. In addition to medical management, patients who present with complications are usually treated using an endovascular procedure, namely thoracic endovascular aortic repair (TEVAR).

What morphological factors can be used to predict the development of complications?

ST: There are several predictors of complications that have been reported over the last 5 years. The most well-known include partial thrombosis of the false lumen, the site and location of the proximal entry tear, and the presence of recurrent pain or hypertension towards the end of the acute or even sub-acute phase. Other predictors are related to the shape of the true and false lumen, where a circular false lumen and elliptical true lumen leads to high false lumen pressurisation. The literature has also suggested that a diameter of the descending aorta over 40 mm may also indicate the development of complications, as well as the number of vessels that take off from the false lumen.[7]

Additionally, there are also predictors with no aortic growth. These include the presence of intramural haematoma, complete thrombosis of the false lumen, the increasing age of the patient cohort, the use of calcium channel blockers in combination with other drugs and a higher number of intimal tears,[2,6,8] which is often related to an adequate redistribution of blood pressure within both the true and false lumen.

How has the treatment landscape changed in recent years?

ST: The management of uncomplicated patients using TEVAR is increasing, with intervention especially targeted at patients who present with morphological factors that indicate complications. There is also an indication to use TEVAR for treatment of the younger patient population,

who are more likely to yield the benefits that have been reported at 5-year follow-ups.[8]

There is a key question regarding which phase of dissection is most effective for intervention. There is evidence from the VIRTUE trial that shows that the best time for treatment is during the sub-acute phase,[10] which means no intervention within the first 2 weeks. This is because the aorta is more fragile during the acute setting, where the risk of complications such as aortic rupture or the retrograde dissection are much higher.

With regard to devices used in endovascular intervention, I wouldn't say that one graft is significantly better than another. The most important variable is the patient's anatomy; if there is suitable anatomy for treatment, we can expect good results. If we observe features that may cause difficulty, such as an intimal tear below the region of the left subclavian artery, or a 'gothic' arch, meaning an angulated left hemi-arch, then the management of the disease will likely be less straightforward.

What factors do you use in your centre to decide whether an uncomplicated patient should be treated with TEVAR?

ST: Factors that we look for include the recurrence of pain or hypertension after 7–10 days, as well as morphological factors that indicate the development of complications, such as a total aortic diameter higher than 40 mm and a circular shape of the false lumen associated with a very elliptic shape of the true lumen. In addition, another factor that we consider as important for treating uncomplicated TBAD is whether the aortic anatomy is suitable for a safe standard TEVAR.

Are there any differences in the treatment approach for patients in the sub-acute versus chronic phase of dissection?

ST: TEVAR using a standard graft can be applied to patients in both the sub-acute and chronic phase (Figure 1 and 2). In the chronic setting, additional tools may be used on top of the standard procedure. Patients in the chronic phase usually present with thicker aortic lamellae, so we cannot expect remodelling of the aorta to be as successful as in the sub-acute phase, where complete remodelling can be achieved in the absence of additional complications.

Recent literature has highlighted that patients will benefit from TEVAR in the sub-acute phase of dissection – is this evidence enough to shift clinical practice?

ST: I think that recent literature has raised an important point, but additional data from different experiences would be beneficial. Furthermore, a larger adoption of dynamic imaging in the future could help practitioners to better define the right interval time for treating these patients, as this might help to visualise the elastic status of the intimal flap and the capability of the aorta to remodel entirely.

What are the main barriers preventing widespread adoption of TEVAR?

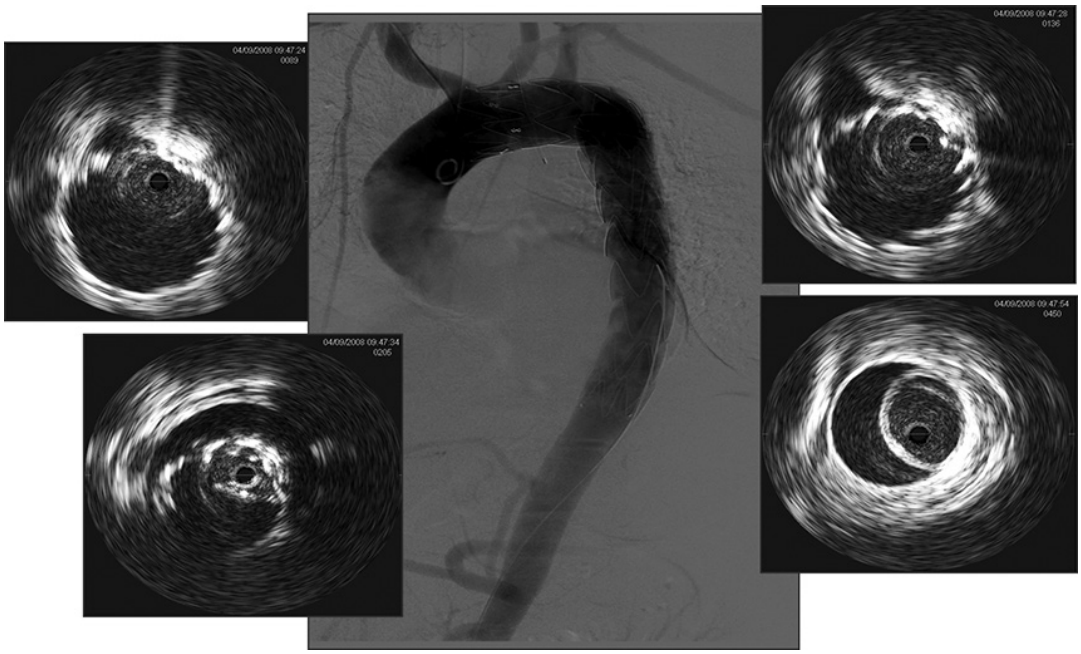
ST: Within the cardiovascular community, there are some physicians who are in favour of management with TEVAR and have a higher interest in optimising treatment through intervention in the sub-acute phase. There is also another group of physicians who continue to treat their patients medically because they think that greater benefits have been reported at 5-year follow-up. TEVAR is considered by some physicians to be less favourable due to associated

fig. 1

The Valiant® Captivia Thoracic Stent-Graft System is indicated and approved for the treatment of all thoracic pathologies, including thoracic aortic dissections.

fig. 2

Valiant® Captivia deployed for type B aortic dissection with total exclusion of the false lumen. Accompanying intravascular ultrasound images demonstrate circumferential apposition of the stent graft at multiple levels, with pressurisation of the distal true lumen.



complications such as retrograde type A dissection. Additionally, there is a risk that management with TEVAR could modify the clinical status of the patient from stable to unstable; this can easily occur when we are faced with unsuitable anatomy, so anatomy should be strongly considered before TEVAR, as it has the potential to predict a successful long-term endovascular intervention.

Another barrier to the adoption of TEVAR is the ageing patient population. The most solid data that we have for TEVAR in relation to good outcomes is at 5-year follow-up. As many TBAD patients are affected in the 6th and 7th decade of their life, physicians have a stronger interest in using a treatment pathway that will produce better immediate outcomes. All evidence regarding the best phase to intervene with TEVAR must be placed within a larger discussion regarding whether we should intervene with TEVAR or not.

What is the main complication of TBAD and how can this be improved?

ST: The literature says that retrograde type A dissection (RTAD) in acute TBAD occurs in around 16% of patients and is regarded as a major complication.[10] The risk of RTAD could potentially be reduced through the use of softer endografts. It is also important that we assess the impact of TEVAR in relation to the curvature of the arch; a higher curvature likely increases the risk of RTAD, which may be even higher in patients affected by connective tissue disorders.

To lower the risk of complications such as RTAD, we need to have more knowledge of anatomy and the interaction between the stent graft and fragile aorta. In light of this, we are creating a programme for the development of additional tools that will help to evaluate parameters, such as computational fluid dynamics, fluid structure interaction between the endograft and the aortic wall and the drug forces at the level of the arch. All of these tools today are in the lab; tomorrow, we hope that they will be in a clinical setting to help improve overall treatment.

How can available stent grafts be enhanced to improve TEVAR?

RV: One method of improving TEVAR is to enhance the technology that we use to perform this procedure. It is important that stent grafts become softer to ensure that they are conformable within the arch. I would also like to see the development of a graft with a stent branch that gives the opportunity to use endovascular treatment alone and avoid treatment options such as open surgery or surgical debranching. Availability of branched arch TEVAR could allow us to operate in an aortic area where there is neither dissection nor arch

angulation. In addition to this, better results could also be achieved as deployment of the stent graft would be more controlled.

How can imaging of aortic dissections be improved?

ST: Imaging of the aortic dissection is based on magnetic resonance imaging (MRI) or computer tomography (CT). In the future, these could include four-dimensional visualisation, which means dynamic imaging that would allow us to understand the motion of the lamellae and the direction of the blood flow in the acute setting. Hopefully, such conditions will also be useful to predict the evolution of the disease in the sub-acute/chronic setting. MRI will definitely play a larger role in the near future, especially for follow-up examinations where imaging details are not of high importance with regards to treatment. Nevertheless, CT scans may remain more appropriate in the hyper-acute setting, when any imaging detail can be an important guide to intervention.

How do you expect the treatment pathway of TBAD patients to change?

ST: The future of the treatment landscape is moving towards a tailored approach in terms of medical management, or medical management plus TEVAR. People are different, and different treatment pathways are needed to reflect the variation observed from one patient to another. With this in mind, TEVAR may not be the most appropriate course of action for all TBAD patients. As we are faced with an ageing population, there will be an increasing need for alternatives to endovascular intervention to address an older cohort who are clinically stable.

We need to know more about the medication we are using. A large number of the drugs being used in medical management have been tested in the setting of the ascending rather than descending aorta. In the future, I would like to see a trial focused specifically on the descending aorta, with assessment of the effects of each medication, such as a plus/minus evaluation of the efficacy of beta-blockers and calcium channel blockers. However, for younger patients, or when TBAD presents with known predictors of aortic growth, TEVAR will be more largely adopted in the uncomplicated cohort. Nevertheless, more solid evidence, perhaps in the form or a large, randomised control study assessing both efficacy and safety of the procedure, would allow for greater adoption of TEVAR in the uncomplicated patient cohort.

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