Type B Aortic Dissection: Management Updates

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Abstract

Acute aortic dissection (AAD) is the most frequent catastrophic event of the aorta; it occurs nearly three times as frequently as the rupture of abdominal aortic aneurysm. Sixty percent of dissection cases are classified as proximal or type A and 40% as distal or type B, according to the Stanford Classification. The most frequent causes of death in acute type B dissection are aortic rupture and malperfusion syndrome.

We herein review recent data suggesting different management modalities of type B aortic dissection, including medical, surgical, and endovascular treatments. Although medical therapy is still the standard approach in uncomplicated cases, there are subgroups of patients who may benefit from endovascular management. Endovascular techniques or surgery are valuable options for complicated cases. Hybrid suites, multidisciplinary approaches, and good imaging techniques can be considered as the key to success in this regard.

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"The tragedies of life are largely arterial."

"Sir William Osler"

Introduction

The term "acute aortic syndrome" refers to a variety of pathological-clinical entities affecting the aorta; they include rupture of aortic aneurysm, acute aortic dissection (AAD), intramural hematoma, penetrating atherosclerotic ulcer, and traumatic aortic transection.

AAD is the most frequent catastrophic event of the aorta; it occurs nearly three times as frequently as the rupture of abdominal aortic aneurysm. In one autopsy series, the antemortem diagnosis, made in only 15% of patients, revealed that many immediately fatal events remain undiagnosed.

Men are twice as often found to suffer AAD as are women, with 60% of dissection cases classified as proximal or type A and 40% as distal or type B according to the Stanford classification.

The historical data of untreated aortic dissection of the ascending aorta show a mortality rate of 1% per hour in the first 2 days, resulting in a mortality rate of 50% in the first 48 hours and 75% in the first two weeks.

Uncomplicated acute type B dissection is less frequently fatal with survival rates of 89% in medically treated patients at 1 month, 84% within 1 year, and up to 80% within 5 years. However, other variable long-term prognoses have also been reported with 5-year survival rates as low as 48%.

The most frequent causes of death in acute type B dissection are aortic rupture and malperfusion syndrome.

The indications for surgical or interventional repair include contained or free aortic rupture, acute aortic expansion, intractable pain, uncontrollable hypertension, and progression of dissection despite maximal medical management.

Medical treatment

Currently, the primary treatment of uncomplicated acute
Type B dissection is medical.

Most of the guiding tenets for the management of AAD, derived from the early experience of Wheat and Austen, suggest a better outcome with medical management.9, 10

Patients with an impression or diagnosis of AAD should be admitted to the intensive care unit for hemodynamic monitoring and diagnostic evaluation and be provided with good IV-line, invasive arterial pressure monitoring, urine output monitoring, supplemental oxygen, and Electrocardiography (ECG). In addition, blood samples should be obtained for routine laboratory tests cardiac enzymes and type- cross match for 10 units of packed cells. It is recommended that any painful or stressful procedure such as central venous line placement or transesophageal echocardiography (TEE) be avoided in waking patients and that pain be treated with appropriate analgesics like morphine.

Kodama and his colleagues demonstrated that tight heart rate control with β-blockers reduced secondary adverse events in patients with type B AAD.11 Target systolic blood pressure should be between 90-110 mmHg. β-blockers are the first choice drugs because they control the maximal force of left ventricular contraction (dp/dt max) in addition to heart rate and blood pressure, which can avert the extension of dissection, rupture, or malperfusion. Common β-blockers include Labetalol, Esmolol, Metoprolol, and Atenolol. Calcium channel blockers like Diltiazem or Nicardipine may be alternative in patients with potential intolerance to β-blockers as is the case with asthmatics.

Vasodilators such as Nitroglycerine, Sodium Nitroprusside, or Hydralazine can be added to β-blockers to control blood pressure, but some of these vasodilators may give rise to reflex tachycardia and so should be used cautiously.

**Surgical treatment**

The modern surgical treatment for AAD, including those for acute type B aortic dissection, began after the landmark aortic operation by Drs Cooley and DeBakey in 1950s.12 Complications such as contained or free rupture, acute aortic expansion, malperfusion (visceral or limb), intractable pain, and uncontrolled hypertension may necessitate interventional management; the goal of surgery is the prevention of malperfusion or rupture of the aorta, which are the most frequent causes of death in complicated type B dissection.

The results of surgery are currently suboptimal, with reported in-hospital mortality rates of 25-50%.13 Improved imaging modalities have made faster recognition of the disease possible, and streamlined techniques of cardiopulmonary bypass, spinal cord protection, hemostatic vascular graft, and intensive care of these critically ill patients should all be credited for the recent decrease (down to 10%) in operative mortality rates in most experienced centers. There are reports of no operative mortality in 34 consecutive patients at a single center14 or in specific series, not including patients with pre-operative thoracoabdominal malperfusion syndromes. For all these promising improvements, however, the overall surgical mortality in the International Registry of Aortic Dissection (IRAD) stands at 29.3%.

The ideal operation is the replacement of as little of the descending aorta as is necessary when resecting the segment that contains the primary tear site, which is most often located in the proximal 1/3 of the descending aorta. This strategy is based on the fact that an increase in the size of the resected segment adds to the risk of paraplegia (as high as 19%).15

In recent years, adjunct measures such as CSF drainage and cardiopulmonary bypass have decreased the risk of early neurological deficit16 Dr. Safi and his co-workers demonstrated the safety and efficacy of these adjuncts in a large series.17, 18

Whereas most centers advocate surgical treatment for complications of type B dissection, some centers consider the large diameter of the false lumen as a predictor of late complication and, therefore, recommend surgery in the acute phase for patients with a large aortic diameter (≥ 40 mm) and a patent primary entry site in the thorax.19 In one study, branch vessel involvement and a large maximal false lumen area were shown to be powerful predictors of in-hospital complications.20

Hemodynamic instability in type B dissection is due to hemorrhagic shock (rupture) or visceral or limb malperfusion. Intubation and fluid resuscitation should be commenced prior to the patient’s transfer to the operating room or hybrid suite, depending on the hospital’s facilities. As was mentioned before, renal or mesenteric ischemia correlates with a high surgical mortality rate.21-23

**Endovascular treatment**

The latest additions to the armamentarium to treat dissection have been based on percutaneous interventional techniques. The minimally invasive nature of these techniques makes them an attractive alternative to open surgical intervention; be that as it may, the exact role and long-term durability of these procedures remain to be determined. The earliest endovascular therapies were directed toward the complications of aortic dissections and included angioplasty of an obstructed aorta, angioplasty and stenting of branch vessels, and fenestration of the intimal flap to treat the malperfusion.24-26

More recently with newer generations of endografts, surgeons, interventional cardiologists, and radiologists have extended the application of thoracic endovascular aortic repair (TEVAR). The concept is that covering the primary intimal tear in the thoracic aorta depressurizes the false lumen, accelerates the thrombosis of the false lumen, and prevents the aortic expansion or progression of the dissection.
There are two other endovascular applications in complicated cases: flap fenestration and branch vessel stenting.

In some cases endovascular techniques may obviate the need for surgical management, whereas in other cases, endovascular techniques are complementary to surgical repair. As in endovascular treatment of abdominal aorta, TEVAR needs a proximal and distal landing zone of enough length to seal the blood flow to the false lumen and prevent the transmission of systemic blood pressure to the false lumen; this means redirection of blood to the true lumen to relieve the dynamic obstruction of the branches supplied by a diminutive true lumen.

A very important point in these cases of TEVAR is the sizing of the stent graft; the segment between the left common carotid and left subclavian artery (normal aorta at proximal) is used to estimate the original size of the involved aorta before dissection. This measurement is oversized up to 10% to select the stent graft diameter (In usual cases of thoracic aneurysm or chronic dissection, a 20% oversizing is recommended).

The other endovascular treatment, fenestration seeks to create a distal reentry to the true lumen so as to effect equalization of pressure between the true and false lumens and thus relieve the dynamic obstruction of the branch vessels.27, 28

Because the stent graft treatment is a more definite treatment directed at correcting the pathology, fenestration is reserved for those in whom anatomical constraints preclude stent grafting or for those who still bear the stigmata of organ or limb malperfusion after surgical repair or endovascular treatment.

Percutaneous fenestration can be performed under fluoroscopic guidance or with intravascular ultrasound or both, and, needless to say, it requires a high level of interventional skill.

Sometimes, the mechanism of the obstruction of the aorta or side branches is static (compression). In such cases, attempts are made to restore normal blood flow to the involved branches by placing uncovered stents via the lumen of the aorta into the true lumen of the side branches. It also can be employed to reopen the collapsed aorta and support the true lumen.29

**Outcomes of endovascular management**

A meta-analysis by Eggebrecht et al.30 reviewed all data published between January 1999 and May 2004 involving stent-graft placement for aortic dissection. A total of 609 patients were reviewed (Table 1).30 Procedural success rate was 98.2%, neurological complications including stroke or paraplegia occurred in 2.9%, total in-hospital conversion rate reached 2.3%, overall in-hospital mortality rate amounted to 5.2%, and the 30-day mortality rate stood at 5.3%. In the IRAD data, the 30-day mortality rates are 10.7% and 31.4% for the medically treated group and surgical group, respectively.31

A composite Kaplan- Meier table, encompassing all the three interventions, shows worse survival outcomes in surgical groups and similar outcomes in medical and endovascular groups. A mean follow-up time of 19.5 months was available for 561 patients. During the follow-up, false lumen thrombosis was observed in 75.5%, late surgical conversion in 2.5%, and supplemental endovascular stent-graft procedure in 4.6% of the patients. The total reintervention rate was 11.9%. It is deserving of note that there are more contemporary studies the results of which are comparable to those of this meta-analysis.25-34

These collected observational data demonstrate that the endovascular treatment of type B dissection is feasible with high initial success and acceptable short-term outcomes. In contrast to the general consensus about endovascular treatment for complications of type B dissection, however, the role of this type of treatment in uncomplicated cases is uncertain. Some experts believe that there are subgroups of patients like those with large diameters of the false lumen who may benefit from endovascular intervention in the acute phase. The results of future trials will help shed further light on this dilemma.

**Conclusion**

Enhanced imaging techniques have ushered in the feasibility of faster diagnosis of this disease entity. In

<table>
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<th>Study</th>
<th>Year</th>
<th>609 (Type B: 96%; retrograde type A: 4%)</th>
<th>131 (Type B: 10; chronic type B: 28)</th>
<th>43 (Acute type B: 24; chronic type 19)</th>
<th>28 (All type B)</th>
<th>63 (All type B)</th>
<th>62 (All type B)</th>
<th>28 (All type B)</th>
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N/A, Not applicable
uncomplicated cases, medical therapy is still the standard but there are subgroups of patients who may benefit from endovascular management.

For complications or endovascular techniques to be valuable options. Hybrid suites, multidisciplinary approaches, and good imaging techniques are the key to success.

References