TYPE B AORTIC DISSECTION: IT SHOULD BE TREATED

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Abstract

Aortic dissection has one of the highest mortality rates of cardiovascular diseases, and the complexities of management remain a challenge. In type B dissection, disappointing results of surgical therapy have encouraged intensive medical therapy in nearly stable and uncomplicated cases. However, acute complicated cases with evidence of blood loss or malperfusion syndrome and chronic aneurysm expansion with risk of rupture, may qualify for the option of endovascular treatment.

The interventional management of aortic dissection and the use of stent-grafts evolved rapidly. Early results and case series confirm the technical feasibility and low rate of complications with respect to open surgical repair, while results of randomized controlled trials expanded the concept of preventive treatment of uncomplicated dissection. Future refinements of stent-graft technology, growing technical skill and long-term outcome data will be relevant to demonstrate the potential long term benefit of endovascular repair.

Acute aortic dissection is one of the most dreadful cardiovascular events, with still high mortality in the acute phase. While general consensus exists regarding the need of immediate surgical repair for patients with acute ascending aortic dissection (Type A dissection), the optimal treatment of type B dissection has long been a matter of debate [1-5]. Historically, emergent open surgical repair of descending aortic dissection has been affected by high mortality (25% to 50%) and morbility rate, resulting in prolonged hospitalization and high costs. Therefore, for the majority of patients with acute type B dissection, medical therapy was the only option if uncomplicated. The advent of endovascular techniques for thoracic aorta repair modified the clinical approach

to type B aortic dissection, representing a low invasive alternative with encouraging results even in the first reports [6,7].

Rationale of endovascular treatment of aortic dissection

Aortic dissection is a laceration of the aortic intima and inner layer of the aortic media that allows blood to course through a false lumen in the outer third of the media. This event weakens the aortic wall and may lead to aortic rupture. Moreover, a growing blood pressure in the false lumen can compress the true channel affecting the blood supply of all the branch vessels (like abdominal, iliac and spinal arteries) with consequent ischemic complications. About 30% to 42% of acute type B aortic dissections at clinical presentation are complicated by peripheral vascular ischemia or hemodynamic instability, and have a highly unpredictable outcome. The rationale of endovascular treatment is to promote both depressurization and shrinkage of the false lumen by the simple closure of the entry tear. Subsequent thrombosis and fibrous transformation of the false lumen usually result in remodelling and stabilization of the aorta thus improving distal visceral perfusion.

Acute type B dissection

Endovascular treatment is advocated when a patient with acute type B aortic dissection presents with signs of aortic rupture at imaging and clinical evaluation, evidence of severely impaired visceral/peripheral perfusion or showing clinical instability like uncontrolled hypertension, severe hypotension and recurrent or pain refractory to therapy [8]. One or more covered stents are placed through femoral access over the intimal tear and additional stents are often used to hold open the true lumen, cover additional entry sites and promote thrombosis of the false lumen, thus protecting the aortic wall from rupture (fig. 1). In the majority of cases stent-graft occlusion of the entry site in the descending thoracic aorta also lead to re-expansion of the true lumen, when compressed, normalizing distal vessel perfusion and restoring branch vessel patency [7]. Endovascular approach is being increasingly used in patients with type B dissection. Two systematic reviews have assessed the results of stent grafts in the management of type B dissection [8,9]. Reported overall outcomes from both reviews were similar, with 5% in-hospital mortality, 2% stroke, 1% paraplegia and, overall, 11% of major complications.

20-fold increase in mortality with medical management (35.6% vs. 1.5%) has been reported in patients with refractory pain or hypertension. Other independent predictors of in-hospital mortality have been investigated by multiple logistic regression analysis, developing a bedside risk predictor tool for patients with type B aortic dissection based on different variables at hospital admission [10]. Increasing age (OR 1.03), hypotension/shock (OR 6.43), periaortic hematoma (OR 3.06), descending diameter ≥5.5 cm (OR 6.04), mesenteric ischemia (OR 9.03), acute renal failure (OR 3.61), and limb ischemia (OR 3.02) were independently associated with increased in-hospital mortality.

TEVAR has become the treatment of choice for acute complicated Type B dissection, as it confers a clear mortality advantage over open repair. Current

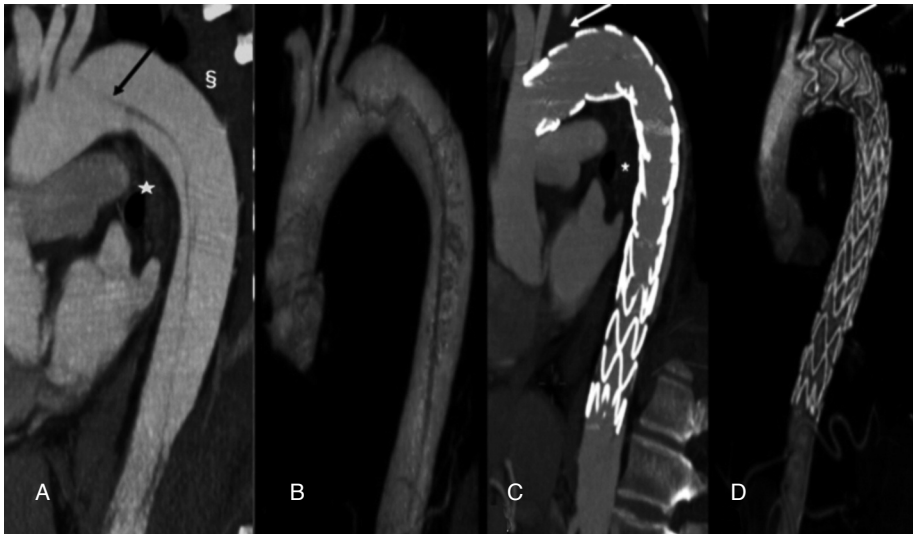

Fig. 1. A-B: MultiDetector Computed Tomography (MDCT) images of acute type B dissection: the entry tear is close to the origin of left sub-clavian artery (black arrow); active mediastinal hematoma (*) and pleural effusion (§) are also visible. C-D: MDTC MIP (C) and VR (D) images demonstrating complete obliteration of the false lumen with endovascular stent graft positioned immediately after the origin of left common carotid artery with occlusion of the proximal segment of the left sub-clavian artery (white arrow); mediastinal hematoma (*) and pleural effusion are resolved.

European and American guidelines [11,12] recommend TEVAR in complicated type B aortic dissection within class I indication. Nevertheless, some dreadful complications, which include retrograde type A dissection, aortic rupture and continued perfusion of the false lumen, suggest that management of type B aortic dissection might be performed in centers with particular experience in aortic diseases.

Comparison of survival in acute type B aortic dissection of Thoracic EndoVascular Aortic Repair (TEVAR) versus surgery has been analyzed in IRAD [13]: the widest existing Registry collecting data on acute aortic dissection from 1996 to date: 390 patients (68.3%) were treated medically, while among complicated cases, 59 (10.3%) underwent standard open surgery and 66 (11.6%) endovascular repair. TEVAR provided better outcome, with 9.3% of mortality in patients treated with stent-graft and 33.9% of mortality in patients submitted to open surgery.

Immediate relief of malperfusion syndrome is an important result of endovascular stent graft treatment of aortic dissection. A relief of visceral ischemia was observed in 16 of 17 patients of the IRAD population with malperfusion syndrome submitted to stent-graft placement, in 9 of 18 treated with percutaneous fenestration and in just 4 of 14 patients treated with open surgery.

Interdisciplinary consensus and case series [14,15] stressed the importance of early diagnosis of static or dynamic malperfusion with support of laboratory markers (bilirubin, amylases, enzymes, creatinine) and imaging data. General-

ly, TEVAR is sufficient to decompress the false lumen, facilitating its collapse. In case of residual distal malperfusion other endovascular techniques including visceral stenting or percutaneous fenestration may be required. Self-expandable bare stent positioned in the true lumen distal to the covered stent graft in order to obtain expansion of the true lumen have been tested in prospective multicenter STABLE trial and recently a systematic review in 108 patients treated with this technique has showed improved true-lumen perfusion and diameter although failing to suppress false-lumen patency completely [16-18]. Moreover, new type of uncovered multilayer stent technology (Cardiatis multilayer flow modulator) has been applied in residual type B dissection with aneurysmal degeneration in order to direct flow in the true lumen and surrounding branches while reducing flow velocity within the aneurism [18]. However, paucity of data and some negative reports [19] does not permit to draw conclusions on employment of such devices in the treatment of patent false channel.

Sub-acute and chronic type B dissection

Definition of acute, sub-acute and chronic phase of an aortic dissection has been recently focused in an European interdisciplinary consensus [15] according to spontaneous mortality rate, suggesting to term type B dissection as acute if <2 weeks, sub-acute between 2 and 6 weeks and chronic after 6 weeks from symptoms. A further classification have been proposed by IRAD investigators [20] in order to characterize survival based on four different time periods: hyper-acute (<24 h), acute (2-7 days), subacute (8-30 days) and chronic (>30 days). Cumulative survival continued to decline throughout all four of these temporal groups regardless of treatment modality: 94-99%, 82-93%, 77-92%, and 73-91% respectively. However surveillance imaging for any type B aortic dissection is essential to provide benefit regardless of temporal or risk stratification or even treatment applied.

TEVAR is considered life-saving for complicated acute type B dissection, but its role in stable type B dissection is still unknown. Results of TEVAR for "first generation" stent-grafts arise from many single-center series and multicenter controlled registries, such as Talent Thoracic Retrospective Registry (TTR) and EUROSTAR [21,22]. These reports encouraging initial results, with some concerns regarding long term efficacy and durability: late aneurismal degeneration of the thrombosed false lumen has been reported while several case reports have highlighted the risk of retrograde extension of the dissection into the ascending aorta, potentially caused by stent-graft induced intimal injury [23,24]. Nevertheless, recently released European Guidelines on diagnosis and treatment of aortic diseases consider now the employment of TEVAR uncomplicated type B aortic dissection in Class IIa (level of evidence B) while recommend medical therapy in class IC [11].

Recent published studies have found favourable long-term outcomes with endovascular intervention. In IRAD [25], a subgroup of acute type B dissection patients treated with endovascular repair showed higher 5-year survival compared with patients with medical therapy alone (fig. 2). The 5-year Kaplan-Meier estimates were significantly lower for patients managed with interventional techniques (15.5% vs. 29.0%; p = 0.018) despite the initially higher risk

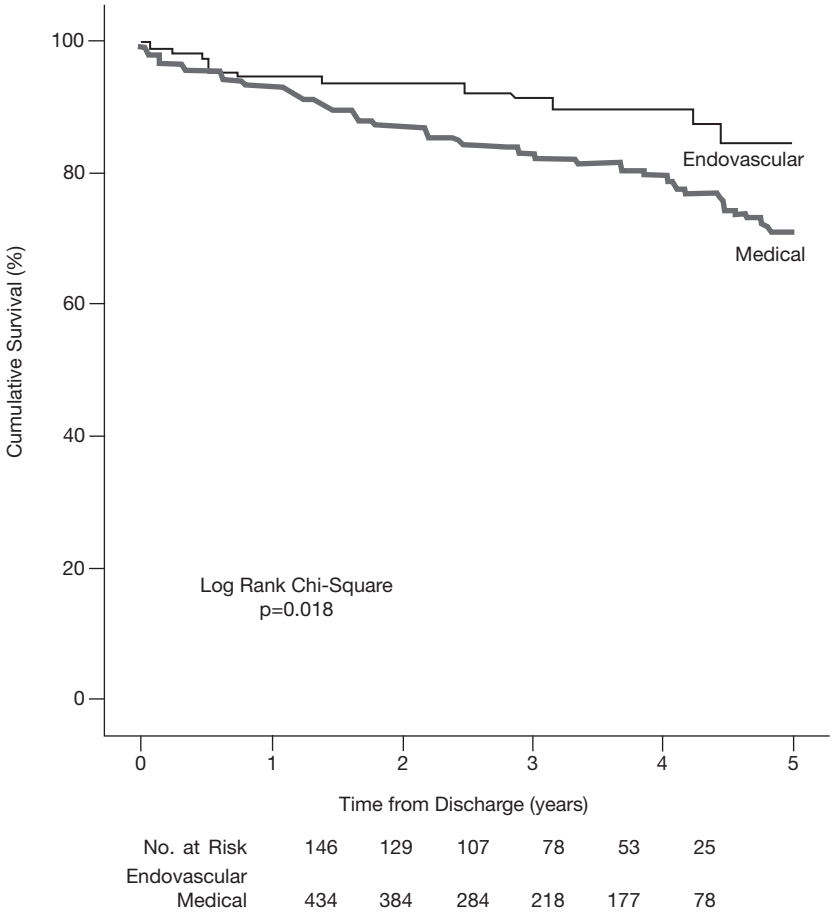

Fig. 2. Kaplan-Meier Survival Estimates Patients with type B dissection subjected to thoracic endovascular aortic repair are compared with those treated with medical therapy alone. Adapted with permission from [25].

profile due to the complicated nature of the dissection patients subjected to TEVAR.

Another series of nearly 300 medically managed type B aortic dissection patients [26] showed that 12% of patients failed medical therapy within 15 days and about 41% enjoyed intervention-free survival at 6 years with end-stage renal disease as predictive of failure of medical treatment (HR 2.6). Kaplan-Meier estimate demonstrated that survival after 6 years was higher in patients who underwent interventions (76% vs. 58%; P=0.018).

Results of randomized trials in acute and sub-acute dissection

Two randomized trials have been conducted to define the role of TEVAR on acute and sub-acute/chronic uncomplicated type B aortic dissection [27-29]. In

the INSTEAD (Investigation of Stent Grafts in Patients with type B Aortic Dissection) trial a total of 140 patients with uncomplicated type B aortic dissection between 2 and 52 weeks after onset of symptoms were randomized to elective TEVAR plus Optimal Medical Therapy (OMT) versus OMT alone (respectively 72 vs. 68 patients). Primary endpoint was all-cause mortality and secondary endpoints were aortic-specific mortality, progression of disease and evidence of aortic remodelling. During follow-up, late intervention (TEVAR and/or surgery) was required in a higher proportion of patients in OMT. No differences were seen between the groups in all-cause or aortic mortality at 1 or 2 years (93.1 vs. 97.1; P=0.283), but greater favourable aortic remodelling in the endovascular arm compared to medical therapy. At 5 years, aortic-specific mortality was significantly improved with TEVAR plus OMT when compared with OMT (6.9 vs. 19.3%; P=0.045) with continued increase divergence in survival between 2 and 5 years (100 vs. 83.1%; P<0.001).

In the ADSORB (Acute Dissection Stentgraft OR Best Medical Treatment) study, 61 patient with acute (<15 days) uncomplicated type B aortic dissection were randomized to OMT or OMT plus TEVAR using the Gore C-TAG endoprosthesis (W.L. Gore & Associates, Flagstaff, Arizona) (TAG group). Primary endpoints were freedom from all of the following variables at 1 year: 1) incomplete or no false lumen thrombosis; 2) aortic dilatation of 5 mm or the maximum diameter of the descending thoracic aorta 55 mm; 3) aortic rupture in descending thoracic or abdominal aorta. For the overall endpoint OMT + TAG group was significantly different from OMT only (P<0.001). Incomplete false lumen thrombosis was found in 43% of the OMT + TAG group and 97% of the OMT group. The false lumen reduced in size in the OMT + TAG group whereas in the OMT group it increased. The true lumen increased in the OMT + TAG group whereas in the OMT group it remained unchanged. The overall transverse diameter decreased in the OMT + TAG group, while it was the same at the beginning in the OMT group. However, given the small sample size and follow up duration, the trial was not correctly powered to detect any differences in aortic-related and all-cause mortality. Therefore, a larger prospective randomized trial with longer follow-up should be conducted to assess the treatment strategy in uncomplicated type B aortic dissection.

Conclusions

Further higher-level studies on type B aortic dissection stratified by type and timing, with long-term assessment of outcomes are required to provide optimal treatment strategy directives on the disease. Waiting for long-term follow-up of randomized trials, which could modify our daily clinical management, continuous progress in stent-graft technology, improving morphology and flexibility, may lead to more suitable stent-graft configuration for aortic dissection and thus improve clinical results.

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