Eur J Vasc Endovasc Surg (2009) **37**, 289–296

EDUCATIONAL SERIES ON THORACIC AORTA (EDITED BY R. FATTORI)

Indication, Timing and Results of Endovascular Treatment of Type B Dissection

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Submitted 9 December 2008; accepted 11 December 2008
Available online 25 January 2009

KEYWORDS
Aortic dissection;
Long-term follow-up;
Malperfusion;
Stent graft;
Timing

Abstract Aortic dissection is an uncommon but a highly lethal condition. Dissection of the ascending aorta is associated with a mortality rate of 1–2% per hour within the first 24 h and should be managed by an open surgery. An uncomplicated, acute, type B dissection, which should be treated medically, is less frequently lethal, with survival rates of 84% within 1 year. Unfortunately, long-term outcome of medical therapy alone is suboptimal, with a reported 30–50% mortality rate at 5 years and a delayed expansion of the false lumen in 20–50% of patients at 4 years. In this setting, endovascular treatment should be considered when the aortic diameter exceeds 55–60 mm, in case of uncontrolled pain, blood pressure and rapid growth of the dissecting aneurysm (>1 cm per year). About 30–42% of acute, type B aortic dissections are complicated, as evidenced by haemodynamic instability or peripheral vascular ischaemia with a mortality rate of 50–85% if not treated properly. In this scenario, stent-graft repair is an attractive alternative to surgical repair for correcting ischaemic complications. The long-term therapy of patients with aortic dissection includes aggressive medical therapy, follow-up visits and serial imaging.

Aortic dissection is an uncommon but a highly lethal condition, with an estimated incidence ranging from 3 to 8 cases per 100,000 persons.[1–3] Approximately, 0.5% of patients presenting to an emergency department with chest or back pain suffer from aortic dissection or its precursors.[4] Men are twice as often found to suffer from acute aortic dissection than women, with 60% of dissection cases classified as proximal or type A and 40% as distal or type B according to the Stanford classification.[1] The historical data of untreated aortic dissection of the ascending aorta show a mortality rate of 1–2% per hour within the first 24 h, resulting in a mortality rate of up to 50–74% within the first 2 weeks.[1,2] An uncomplicated, acute, type B dissection is less frequently lethal, with survival rates of 89% in medically treated patients at 1 month, 84% within 1 year and up to 80% within 5 years.[1,5]

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1078-5884/$34
doi:10.1016/j.ejvs.2008.12.004

However, patients with acute or late complications, including renal failure, visceral ischaemia or contained rupture, often require urgent repair, with a mortality rate mounting to 20% at day 2, and 25–50% within 1 month.[1] Similar to type A dissection, advanced age, rupture, shock and malperfusion are important independent predictors of early mortality in type B dissection.[6,7] While almost every patient with a type A dissection should be managed by open surgery, endovascular concepts have emerged as an alternative therapeutic option to manage acute and chronic aortic dissections, mainly distal thoracic aortic dissection. For proximal or type A dissection, any endovascular approach remains experimental and anecdotal for localised pathologies in patients unfit for surgical therapy. Although dissection of the aorta is an acute event, in most cases, an underlying chronic and generalised disease of the media vessel wall predisposes the aorta to chronic alterations, eventually leading to dissection.

In this article, we review current indication, timing and results of endovascular management of patients with type B aortic dissection in the context of the recent literature.

Table 1 Distribution of differential therapeutic strategies in aortic dissection

Surgery
Type A aortic dissection
Acute type B dissection complicated by
Retrograde extension into the ascending aorta
Dissection in fibrillinopathies (e.g., Marfan's syndrome, Ehlers–Danlos syndrome)
Medical
Uncomplicated, acute type B dissection
Stable, isolated aortic arch dissection
Chronic type B dissection
Interventional
Unstable, acute type B dissection
Malperfusion
Rapid expansion (>1 cm per year)
Critical diameter (≥5.5 cm)
Refractory pain
Stable type B dissection (under evaluation)
Type B dissection with retrograde extension into the ascending aorta
Hybrid procedure for extended type A aortic dissection

Indication for Stent-graft Repair in Type B Aortic Dissection

The natural course of aortic dissection is determined by two elements: early complications and chronic events. Early complications comprise any kind of malperfusion syndrome or rupture, while late events are usually a continued false lumen expansion with the risk for late rupture. Once a patient survives the first 2 weeks after the impact of dissection, the process is defined as chronic. Acute and chronic dissections differ considerably with respect to medical treatment, taking into consideration that even acute dissections can be complicated or uncomplicated.

The feasibility of stent grafting of the descending thoracic aorta has already been established as an alternative to surgical treatment of type B aortic dissection. However, due to the lack of both randomised controlled trials with long-term follow-up data and randomised comparisons with medical and surgical techniques, the indications for endovascular strategies remain to be fully defined for dissection (Table 1). There is clear observational evidence that depressurisation and shrinkage of the false lumen are beneficial in acute dissection, ideally followed by complete thrombosis of the false lumen and remodelling of the entire dissected aorta. Similar to previously accepted indications for surgical intervention, scenarios such as intractable pain, rapidly expanding false lumen, diameter >55 mm and signs of imminent rupture or distal malperfusion are increasingly being accepted as indications for stent-graft placement in type B dissection.[8,9] Even in some cases of retrogradely extended type A dissections, stent-graft treatment of the descending thoracic aorta can also be performed as a single step or as two steps after initial surgical repair of the proximal part of the aorta or the arch. Open surgery may include an elephant trunk or transposition of arch vessels to allow optimal landing zones for endovascular completion in a hybrid approach. In case of retrograde type A dissection, an isolated distal-entry tear can sometimes be sealed by a stent graft, hence enabling thrombosis and remodelling even of the proximal false lumen in type A dissection. With endografting, paraplegia generally appears to be a rare phenomenon (0.8%), but is known to be associated with extensive coverage of the aorta exceeding 20 cm and with the use of multiple stent grafts, or in case of previously operated aortas.[10]

Stable, Acute, Type B Aortic Dissection

Patients with suspected acute aortic dissection should be admitted to the intensive care unit for prompt diagnostical evaluation under clinical and haemodynamic monitoring. Reduction of systolic blood pressure to 100–120 mm Hg, with an eye on the renal function and pain relief, is the initial priority and is achieved by morphine sulphate and intravenous beta-blocking agents (e.g., metoprolol, esmolol or labetolol) or by a combination with vasodilating drugs such as sodium nitropusside, at a dose of 0.3 $\mu g\,kg^{-1}\,min^{-1}$, or angiotensin-converting enzyme inhibitors. Intravenous verapamil or diltiazem may also be used, if beta-blocking agents are contraindicated. A monotherapy with beta-blocking agents may be adequate to control mild hypertension (Table 2). In addition, heart rate should be kept low – a heart rate below 60 bpm significantly decreases secondary adverse events (aortic expansion, recurrent aortic dissection, aortic rupture and/or need for aortic surgery) in type B aortic dissection compared to a conventional rate of more than 60 bpm.[11] Once both stable blood pressure and symptom relief are achieved, the patient with an acute, uncomplicated, type B aortic dissection can be discharged (usually within 14 days), and clinical and imaging follow-up should be offered and advised at 3 and 6 months and annually thereafter. In a series of 384 patients with type B dissections from the International Registry of