

New Physio-Pathogenic concepts to Type B Aortic Dissection

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Uncomplicated Type B Aortic Dissection

- Medical therapy is still an effective means of management.
- Early TEVAR treatment may confer long term survival benefit.
- Two prospective randomized trials demonstrating the benefits of TEVAR.....

Stable “Chronic” Instead XL

- Landmark analysis
Years 2-5
- TEVAR more effective:
 - All cause mortality
 - Aorta related mortality
 - Progression of dissection

Peripheral Artery Disease

Endovascular Repair of Type B Aortic Dissection Long-term Results of the Randomized Investigation of Stent Grafts in Aortic Dissection Trial

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Background—Thoracic endovascular aortic repair (TEVAR) represents a therapeutic concept for type B aortic dissection. Long-term outcomes and morphology after TEVAR for uncomplicated dissection are unknown.

Methods and Results—A total of 140 patients with stable type B aortic dissection previously randomized to optimal medical treatment and TEVAR (n=72) versus optimal medical treatment alone (n=68) were analyzed retrospectively for aorta-specific, all-cause outcomes, and disease progression using landmark statistical analysis of years 2 to 5 after index procedure. Cox regression was used to compare outcomes between groups; all analyses are based on intention to treat. The risk of all-cause mortality (11.1% versus 19.3%; $P=0.13$), aorta-specific mortality (6.9% versus 19.3%; $P=0.04$), and progression (27.0% versus 46.1%; $P=0.04$) after 5 years was lower with TEVAR than with optimal medical treatment alone. Landmark analysis suggested a benefit of TEVAR for all end points between 2 and 5 years; for example, for all-cause mortality (0% versus 16.9%; $P=0.0003$), aorta-specific mortality (0% versus 16.9%; $P=0.0005$), and for progression (4.1% versus 28.1%; $P=0.004$); Landmarking at 1 year and 1 month revealed consistent findings. Both improved survival and less progression of disease at 5 years after elective TEVAR were associated with stent graft induced false lumen thrombosis in 90.6% of cases ($P<0.0001$).

Conclusions—In this study of survivors of type B aortic dissection, TEVAR in addition to optimal medical treatment is associated with improved 5-year aorta-specific survival and delayed disease progression. In stable type B dissection with suitable anatomy, preemptive TEVAR should be considered to improve late outcome.

Clinical Trial Registration—URL: <http://www.clinicaltrials.gov>. Unique identifier: NCT01415804. (*Circ Cardiovasc Interv.* 2013;6:407-416.)

Key Words: aortic dissection ■ aortic remodeling ■ prognosis ■ stent graft

Thoracic endovascular aortic repair (TEVAR) as an option for patients with type B aortic dissection is considered life-saving in the setting of complications such as contained rupture or malperfusion syndrome,¹⁻⁴ although its role in uncomplicated dissection is unknown. Traditionally, stable patients are managed with medical treatment (annual survival $\geq 80\%$).^{3,5-7} However, long-term outcomes are sobering because of aneurysmal expansion and a 30% cumulative mortality at 5 years.^{3,8-10} Consistently, false lumen perfusion is considered a harbinger

of adverse outcome, whereas complete thrombosis may invoke remodeling and improve outcomes.¹¹⁻¹⁴ Thus, we hypothesized that endovascular treatment of type B dissection may have long-term prognostic benefits.

Editorial see p 326

Although TEVAR is valuable for complicated aortic dissection both in the acute and chronic setting, controversy prevails in subacute uncomplicated type B aortic dissection with

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All members of the Investigation of Stent grafts in Aortic Dissection with extended length of follow-up (INSTEAD-XL) study group are listed in the Appendix in the online-only Data Supplement.

The online-only Data Supplement is available at <http://circinterventions.ahajournals.org/lookup/suppl/doi:10.1161/CIRCINTERVENTIONS.113.000463/-/DC1>.

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Stable “Acute” ADSORB

BMT (31) vs TEVAR & BMT (30)

– 30 days

- No complications
- No Deaths
- Favorable aortic remodeling

TEVAR/BMT

– Aortic dilatation:

- TAG+BMT 11/30 (37%)
- BMT 14/31 (45%)

Endovascular Repair of Acute Uncomplicated Aortic Type B Dissection Promotes Aortic Remodelling: 1 Year Results of the ADSORB Trial

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WHAT THIS PAPER ADDS

This is the only prospective randomised trial on acute type B dissection. The definition of the acute dissection is clearly defined as is the outcome. In the highly specialised centres participating, the outcome was good and the rate of thrombosis of the false channel can be estimated and be used as reference. Stent grafts induced thrombosis of the false channel and were safe to implant.

Objectives: Uncomplicated acute type B aortic dissection (AD) treated conservatively has a 10% 30-day mortality and up to 25% need intervention within 4 years. In complicated AD, stent grafts have been encouraging. The aim of the present prospective randomised trial was to compare best medical treatment (BMT) with BMT and Gore TAG stent graft in patients with uncomplicated AD. The primary endpoint was a combination of incomplete/no false lumen thrombosis, aortic dilatation, or aortic rupture at 1 year.

Methods: The AD history had to be less than 14 days, and exclusion criteria were rupture, impending rupture, malperfusion. Of the 61 patients randomised, 80% were DeBakey type IIIB.

Results: Thirty-one patients were randomised to the BMT group and 30 to the BMT+TAG group. Mean age was 63 years for both groups. The left subclavian artery was completely covered in 47% and in part in 17% of the cases. During the first 30 days, no deaths occurred in either group, but there were three crossovers from the BMT to the BMT+TAG group, all due to progression of disease within 1 week. There were two withdrawals from the BMT+TAG group. At the 1-year follow up there had been another two failures in the BMT group: one malperfusion and one aneurysm formation ($p = .056$ for all). One death occurred in the BMT+TAG group. For the overall endpoint BMT+TAG was significantly different from BMT only ($p < .001$). Incomplete false lumen thrombosis, was found in 13 (43%) of the TAG+BMT group and 30 (97%) of the BMT group ($p < .001$). The false lumen reduced in size in the BMT+TAG group ($p < .001$) whereas in the BMT group it increased. The true lumen increased in the BMT+TAG ($p < .001$) whereas in the BMT group it remained unchanged. The overall transverse diameter was the same at the beginning and after 1 year in the BMT group (42.1 mm), but in the BMT+TAG it decreased (38.8 mm; $p = .062$).

Conclusions: Uncomplicated AD can be safely treated with the Gore TAG device. Remodelling with thrombosis of the false lumen and reduction of its diameter is induced by the stent graft, but long term results are needed.

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Should We Treat All Type B Dissections ?

- Still a significant growth rate among treated dissections.
- Perivisceral aorta is the most prone to expansion and the most difficult area to treat.
- Secondary interventions among treated dissections can be as high as 30% for expansion.

The Challenges?

- Identify high risk groups
- Utilize early physiologic and anatomic markers may allow us to hone in to patients who truly are destined to fail medical therapy.

Heart Rate & BP Control

- SBP < 120 mmHg
- HR < 60 BPM

Improved Outcomes:

- Decreased Growth
- Decreased aortic events

Implications for Pt's difficult to control.

Tight Heart Rate Control Reduces Secondary Adverse Events in Patients With Type B Acute Aortic Dissection

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Background—Although type B aortic dissection has been treated with β blockers to lower the arterial blood pressure (BP), there has been little evidences about reduction in heart rate (HR). We assessed whether tight HR control improved the outcome of medical treatment in patients with aortic dissection.

Methods and Results—From 1997 to 2005, 171 patients with acute aortic dissection medically treated and controlled to lower BP under 120 mm Hg were enrolled. Based on the average HR at 3, 5, and 7 days after the onset, patients were divided into tight HR (<60 beat per minute) control group (32 patients; mean HR of 56.6 ± 3.1 beat per minute) and conventional HR (≥ 60 beat per minute) control group (139 patients; mean HR of 71.7 ± 8.2 beat per minute). We compared the frequency of aortic events including late organ or limb ischemia, aortic rupture, recurrent dissection, and aortic expansion of >5 mm, and surgical requirement between two groups. During a median follow-up of 27.0 months, late organ or limb ischemia, aortic rupture, recurrent dissection, pathological aortic expansion, and aortic surgery occurred in 0, 8, 14, 39, and 26 patients, respectively. Reduction in aortic events was observed in tight HR control group (12.5%) compared to conventional HR control group (36.0%), (Odds ratio: 0.25, C.I.: 0.08 to 0.77, $P < 0.01$).

Conclusions—The present study demonstrated that tight heart rate control improved the outcome of medical treatment in patients with aortic dissection. (*Circulation*. 2008;118[suppl 1]:S167–S170.)

Key Words: aortic dissection ■ heart rate ■ medical treatment ■ secondary adverse events

Aortic dissection is a catastrophic cardiovascular disease associated with high morbidity and mortality.¹ Blood pressure control using β -adrenergic receptor blocker is widely accepted for treating type B acute aortic dissection.² The goal is to lower systolic blood pressure to the lowest level commensurate with adequate vital organ perfusion, usually 100 to 120 mm Hg.³ Although lowering heart rate is also thought to be important, the target setting of heart rate has not been well established.

We conducted this study to assess whether tight heart rate control, <60 beat per minute (bpm), reduced subsequent adverse events in patients with type B acute aortic dissection.

Methods

Patients

From 1997 to 2005, 224 patients with type B acute aortic dissection were admitted to our institutions within 2 days from the onset. The diagnosis was confirmed by clinical and diagnostic evaluations consisting of combinations by imaging modalities such as contrast-enhanced computed tomography (CT), MRI, or transesophageal echocardiography. The onset was defined as the first instance of pain or discomfort. Patients with the aorta of more than 5 cm in maximum aortic diameter, aortic rupture, systolic left ventricular dysfunction

(less than 40% in ejection fraction), ischemic organs disturbance within 3 days after the onset, prior aortic dissection, prior cardiovascular surgery, malignancy, intractable hypertension (systolic blood pressure had not achieved less than 120 mm Hg within 3 days after the onset), or Marfan syndrome were excluded. The remaining 171 patients were enrolled in this study.

Treatment and Long-Term Follow-Up

Propranolol, diltiazem, verapamil, nicardipine, or nitroglycerine were administered intravenously to reduce systolic blood pressure to 100 to 120 mm Hg as initial therapy. Oral antihypertensive agents were also administered in the acute phase. Intravenous antihypertensive agents were tapered as systolic blood pressure achieved to 100 to 120 mm Hg by oral antihypertensive agents. Beta blocker was administered to all patients except those with the contraindication including chronic obstructive pulmonary disease and allergy for the drug. Patients with contraindication for β blocker took diltiazem or verapamil to reduce dP/dt. Plural antihypertensive agents were used to maintain to appropriate systolic blood pressure under 120 mm Hg unless any adverse effects attributable to the drugs were observed.

Heart rates and blood pressure were measured at 6 AM, noon, and 6 PM everyday during the admission. Based on the average heart rate at 3, 5, and 7 days after the onset, patients were divided into 2 groups, tight heart rate (<60 bpm) control and conventional heart rate (≥ 60 bpm) control groups.

After the discharge, the follow-up information was obtained with clinic visits to our hospital including CT examinations once a year

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Entry Tear Anatomy

- Examined
 - # of Entry tears
 - Location of entry tears
- Significant Aortic growth
 - 1 visible entry tear on presentation CTA
 - Location of Entry tear yielded no difference in growth

Number of Entry Tears Is Associated With Aortic Growth in Type B Dissections

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Background. Aortic growth rate in acute type B aortic dissection (ABAD) is a significant predictor for aortic complications and death. To improve the overall outcome, radiologic predictors might stratify patients who benefit from successful medical management vs those who require intervention. This study investigated whether the number of identifiable entry tears in ABAD patients is associated with aortic growth.

Methods. ABAD patients with uncomplicated clinical conditions and therefore treated with medical therapy were evaluated. Those with a computed tomography angiography (CTA) obtained at clinical presentation and a subsequent CTA obtained at least 90 days after medical treatment were included (2005 to 2010). The CTAs were investigated for the number of entry tears between the true and false lumen. Diameters of the dissected aortas were measured at five levels on the baseline and on the last available follow-up CTA, and annual aortic growth rates were calculated. The number of entry tears in these patients and the

location in the aorta were compared with the aortic growth rate.

Results. Included were 60 patients who presented with 243 dissected segments. Mean growth rates during follow-up (median, 23.2; range, 3 to 132 months) were significantly higher in patients with 1 entry tear (5.6 ± 8.9 mm) than in those with 2 (2.1 ± 1.7 mm; $p = 0.001$) and 3 entry tears (mean 2.2 ± 4.1 ; $p = 0.010$). The distance of the primary entry tear from the left subclavian artery did not have an effect on the aortic growth rate (median, 38; interquartile range, 24 to 137 mm; $p = 0.434$).

Conclusions. The number of entry tears in ABAD patients detected on the first CTA after clinical presentation is a significant predictor for aortic growth. Patients with 1 entry tear at presentation show a higher growth rate than other patients and might benefit from more strict surveillance or early prophylactic intervention.

(Ann Thorac Surg 2013;96:39–42)

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Acute type B aortic dissection (ABAD) is a relatively rare cardiovascular disease with high mortality and morbidity rates [1]. ABAD can be clinically classified as complicated or uncomplicated, and therapy given is based on this classification [2, 3]. Prompt intervention in patients with an ABAD is currently required in only complicated cases. For those uncomplicated ABAD patients managed conservatively by antihypertensive treatment, the in-hospital mortality rate ranges between 1% and 10% [2–4]. However, their medium-term and long-term outcome is less favorable due to aortic-related complications, such as aneurysm and rupture, with survival rates of 56% to 92% at 1 year and 48% to 82% at 5 years [5, 6]. Therefore, predictors for aortic complications in the long-term would be beneficial in patients with initial successful medical management.

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Previous clinical and bioengineering studies have demonstrated that increased inflow and impaired outflow of the false lumen can lead to a significant increase in the mean and diastolic pressure in the false lumen. In the acute setting, this may lead to true lumen collapse and even malperfusion [7–10]. On the basis of this mechanism, elevated pressure in the false lumen may also result in an increased aortic growth rate and risk for aneurysm and rupture. Therefore, the number of entry tears detected between the true and false lumen might be important in predicting which ABAD patients will develop aortic dilatation. The goal of this study is to investigate whether the number of identifiable entry tears is associated with aortic growth in the long-term of ABAD.

Patients and Methods

The independent medical ethics committees of the hospitals that participated in this study approved the study.

Patients

We retrospectively analyzed all computed tomographic angiography (CTA) data of ABAD patients who were

False Lumen Anatomy

Aortic Growth

- Patent False lumen
- Primary entry tear
– ≥ 10 mm

Patients may benefit
early TEVAR

Long-Term Outcome of Aortic Dissection With Patent False Lumen Predictive Role of Entry Tear Size and Location

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Background—Patent false lumen in aortic dissection has been associated with poor prognosis. We aimed to assess the natural evolution of this condition and predictive factors.

Methods and Results—One hundred eighty-four consecutive patients, 108 surgically treated type A and 76 medically treated type B, were discharged after an acute aortic dissection with patent false lumen. Transesophageal echocardiography was performed before discharge, and computed tomography was performed at 3 months and yearly thereafter. Median follow-up was 6.42 years (quartile 1 to quartile 3: 3.31–10.49). Forty-nine patients died during follow-up (22 type A, 27 type B), 31 suddenly. Surgical or endovascular treatment was indicated in 10 type A and 25 type B cases. Survival free from sudden death and surgical-endovascular treatment was 0.90, 0.81, and 0.46 (95% CI, 0.36–0.55) at 3, 5, and 10 years, respectively. Multivariate analysis identified baseline maximum descending aorta diameter (hazard ratio [HR]: 1.32 [1.10–1.59]; $P=0.003$), proximal location (HR: 1.84 [1.06–3.19]; $P=0.03$), and entry tear size (HR: 1.13 [1.08–1.2]; $P<0.001$) as predictors of dissection-related adverse events, whereas mortality was predicted by baseline maximum descending aorta diameter (HR: 1.36 [1.08–1.70]; $P=0.008$), entry tear size (HR: 1.1 [1.04–1.16]; $P=0.001$), and Marfan syndrome (HR: 3.66 [1.65–8.13]; $P=0.001$).

Conclusions—Aortic dissection with persistent patent false lumen carries a high risk of complications. In addition to Marfan syndrome and aorta diameter, a large entry tear located in the proximal part of the dissection identifies a high-risk subgroup of patients who may benefit from earlier and more aggressive therapy. (*Circulation*. 2012;125:3133-3141.)

Key Words: aorta ■ computed tomography ■ prognosis ■ transesophageal echocardiography

The long-term outcome of patients with successful initial treatment of acute aortic dissection and persistent patent false lumen in the descending aorta is not well established. Several studies have reported long-term overall survival of 50% to 80% at 5 years and 30% to 60% at 10 years,^{1–3} with no differences between Stanford type A and B dissections.³ Persistent patent false lumen in the descending aorta is common in both types and has been strongly associated with poor prognosis.^{3–7} However, the majority of series of type A and B dissections did not exclude cases with absence of residual dissection, total false lumen thrombosis, or intramural hematomas,^{3–8} which implies a different natural history.^{9,10}

Clinical Perspective on p 3141

Advances in imaging techniques may provide significant information^{11–13} for identifying patients at higher risk of adverse

events. The advent of thoracic endovascular aortic repair raised new expectations for the early management of complicated aortic dissection^{14–16} by occluding the intimal tear, restoring true lumen flow, and inducing false lumen thrombosis. However, to date, no study has shown that elective endovascular treatment in subacute phase of aortic dissection reduces mortality. Recent investigation of Stent Grafts in Aortic Dissection (INSTEAD) trial¹⁶ results failed to show an improvement in 2-year survival and adverse event rates. Therefore, identification of clinical and imaging predictors of poor prognosis seems mandatory to select patients for whom more aggressive management may be beneficial.

The aim of the present study was to assess the long-term outcome of aortic dissection with persistent patent false lumen in the descending aorta and define the clinical and imaging variables obtained in subacute phase that could predict adverse events during follow-up.

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BioMarkers

Serologic examination

- D-dimer, FDP, Platelets, Antithrombin III, C-Reactive protein.
- FDP \geq 20 $\mu\text{g/ml}$
 - Associated with Aortic Growth

Usefulness of Fibrinogen/Fibrin Degradation Product to Predict Poor One-Year Outcome of Medically Treated Patients With Acute Type B Aortic Dissection

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Previous studies have indicated that medical therapy provides excellent outcomes for patients with uncomplicated Stanford type B acute aortic dissection. However, affected aortas are often compromised by aneurysmal dilatation and rupture, resulting in poor outcomes. The purpose of this study was to determine predictors of aortic events in patients with Stanford type B acute aortic dissection receiving conservative medical therapy. The study group consisted of 78 consecutive patients with Stanford type B acute aortic dissection who were admitted to the hospital within 48 hours of onset. These patients were treated medically and followed up for 1 year. Aortic events were defined as rupture, recurrent dissection, aortic expansion with diameter \geq 60 mm, rapid aortic expansion at a rate of \geq 10 mm/yr, and the development of visceral or limb ischemia. Predictors of these events were determined using multivariate analyses. During 1-year follow-up, aortic events were observed in 13 (17%) patients, including aortic rupture in 3 (4%), aortic diameter \geq 60 mm in 4 (5%), rapid expansion of the aorta in 3 (4%), and the development of visceral or limb ischemia in 3 (4%). On multivariate analysis, fibrinogen-fibrin degradation product level \geq 20 $\mu\text{g/ml}$ (odds ratio 7.802, 95% confidence interval 1.405 to 43.335) on admission was the only independent predictor of aortic events at 1 year. In conclusion, careful monitoring is required for patients with medically treated Stanford type B acute aortic dissection associated with fibrinogen-fibrin degradation product level \geq 20 $\mu\text{g/ml}$ on admission. © 2008 Elsevier Inc. All rights reserved. (Am J Cardiol 2008;101:1341–1344)

In the present study, we performed a retrospective analysis of patients with Stanford type B acute aortic dissection who had initially received conservative medical therapy and sought to determine the predictive factors of adverse aortic outcomes.

Methods

From December 2000 to January 2006, a total of 383 patients with acute aortic dissection (138 with Stanford type A and 245 with Stanford type B) were admitted to the Cardiology Department of the National Cardiovascular Center (Suita, Japan). Of these 383 consecutive patients, 78 patients were admitted within 48 hours of the onset of type B aortic dissection and treated with conservative medical therapy. Patients who were judged at initial presentation as candidates for emergent aortic surgery or endovascular in-

tervention; those who had previous episodes of aortic dissection, aortic surgery, and/or endovascular intervention; those with Marfan's syndrome; and those with uncontrolled systemic diseases including malignancy were excluded.

The diagnosis of Stanford type B acute aortic dissection was confirmed by computed tomographic scanning or magnetic resonance imaging performed at the time of admission. Follow-up computed tomographic scanning or magnetic resonance imaging was routinely performed at the prescribed intervals (i.e., at 1 and 2 weeks and 1, 3, 6, and 12 months thereafter). During the acute phase, all patients were initially treated with anti-impulse therapy if there were no indications for surgical treatment, such as aortic rupture, diameter of the descending aorta \geq 60 mm, malperfusion of the thoracoabdominal aorta, and pseudocoarctation syndrome with uncontrollable hypertension. All patients who survived the acute phase with medical therapy were followed up at the outpatient clinic, and data on disease history, physical examination, and routine blood testing were collected. The patients were also followed up with computed tomographic scanning or magnetic resonance imaging as described previously.

To determine the predictors of aortic events, baseline clinical characteristics such as smoking habit; co-morbidities including hypertension, diabetes mellitus, and hyperlipidemia; the patency of the false lumen; the diameter of the dissected aorta; the presence of true aortic aneurysm; and routine admission laboratory tests including platelet count, C-reactive protein (CRP), fibrinogen-fibrin degradation

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Predictors of aortic growth in uncomplicated type B aortic dissection

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Background: Patients with uncomplicated acute type B aortic dissection (ABAD) generally can be treated with conservative medical management. However, these patients may develop aortic enlargement during follow-up, with the risk for rupture, which necessitates intervention. Several predictors have been studied in recent years to identify ABAD patients at high risk for aortic enlargement who may benefit from early surgical or endovascular intervention. This study systematically reviewed and summarized the current available literature on prognostic variables related to aortic enlargement during follow-up in uncomplicated ABAD patients.

Methods: Studies were included if they reported predictors of aortic growth in uncomplicated ABAD patients. Studies about type A aortic dissection, aortic aneurysm, intramural hematoma, or ABAD that required acute intervention were excluded.

Results: A total of 18 full-text articles were selected. The following predictors of aortic growth in ABAD patients were identified: age <60 years, white race, Marfan syndrome, high fibrinogen-fibrin degradation product level (≥ 20 $\mu\text{g}/\text{mL}$) at admission, aortic diameter ≥ 40 mm on initial imaging, proximal descending thoracic aorta false lumen (FL) diameter ≥ 22 mm, elliptic formation of the true lumen, patent FL, partially thrombosed FL, sacular formation of the FL, presence of one entry tear, large entry tear (≥ 10 mm) located in the proximal part of the dissection, FL located at the inner aortic curvature, fusiform dilated proximal descending aorta, and areas with ulcer-like projections. Tight heart rate control (<60 beats/min), use of calcium-channel blockers, thrombosed FL, two or more entry tears, FL located at the outer aortic curvature, and circular configuration of the true lumen were associated with negative or limited aortic growth.

Conclusions: Several predictors might be used to identify those ABAD patients at high risk for aortic growth. Although conservative management remains indicated in uncomplicated ABAD, these patients might benefit from closer follow-up or early endovascular intervention. (J Vasc Surg 2014;59:1134-43.)

Patients with an uncomplicated acute type B aortic dissection (ABAD) are currently treated conservatively in the absence of complications such as visceral malperfusion, renal failure, periaortic hematoma or rupture, or both, refractory pain, or hypertension.¹ Despite adequate antihypertensive treatment, delayed aortic dilatation will develop in 20% to 50% of patients with uncomplicated ABAD, which can lead to aortic rupture or late-term complications.²⁻⁴ In light of this, several randomized controlled trials studied the importance of prophylactic thoracic endovascular aortic repair (TEVAR) in uncomplicated ABAD. These studies failed to show TEVAR was beneficial in the

short-term, but very recently, a more positive long-term outcome after TEVAR has been shown.^{5,6}

Despite this potential benefit, TEVAR may nevertheless also be associated with complications, including aortic rupture, retrograde dissection, and stent graft-related complications such as endoleaks, and therefore, a conservative approach in many patients is still advocated.⁷⁻⁹ However, by identifying those patients prone for aortic growth at an early stage, a subset of patients might be identified that can benefit from stricter follow-up and even prophylactic intervention. Especially, a significant group of patients developing widespread aneurysmal degeneration along the dissected segments during follow-up may lose the chance for endovascular treatment if not identified at an early stage. In this report we systematically reviewed the current literature for the different predictors of aortic growth in conservatively treated uncomplicated ABAD patients.

METHODS

Literature search. An electronic literature search was performed in the MEDLINE and EMBASE databases for original manuscripts published until August 7, 2013. The language was restricted to English, and key search terms were "uncomplicated type B aortic dissection," "predictors," and "growth" and corresponding synonyms. The

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1134

Other Predictors of Growth

- Initial Transaortic Diameter $\geq 40\text{mm}$
- Initial false lumen diameter $\geq 22\text{mm}$
- Primary entry tear location - inner curvature
- Elliptical TL and round FL configuration

Summary Table

Table II. Summary of the predictors of aortic growth in uncomplicated type B aortic dissection

<i>Variable</i>	<i>Predictor</i>	<i>Negative predictor</i>
Patient characteristics	Age <60 years White race Heart rate ≥ 60 beats/min	Increasing age (≥ 60 years) Heart rate <60 beats/min
Medical history	Marfan syndrome	
Clinical information		Use of calcium-channel blockers
Blood test	FDP level ≥ 20 $\mu\text{g/mL}$ on admission	
Radiologic signs	Aortic diameter ≥ 40 mm during acute phase Patent FL Partially thrombosed FL (debated) Proximal descending thoracic aorta FL diameter (≥ 22 mm) on initial imaging Sac formation in partially thrombosed FL One entry tear FL/intimal tear located at the inner aortic curvature An elliptic configuration of the TL/round configuration FL Areas with localized dissection/ULP Degree of fusiform dilatation of the proximal descending aorta ($\text{FI} \geq 0.64$) Large entry tear (≥ 10 mm) located in the proximal part of the dissection	Diameter <40 mm (debated) Closed/thrombosed FL Intramural hematoma Increased number of entry tears FL/intimal tear located at the outer curvature A circular configuration of the TL/elliptic configuration FL FI <0.64

FDP, Fibrinogen-fibrin degradation product; *FI*, fusiform index; *FL*, false lumen; *TL*, true lumen; *ULP*, ulcer-like projection.

Complicated TBAD

- TEVAR is now the gold standard for patients with amenable anatomy.
 - Multiple options for repair:
 - Standard TEVAR
 - Proximal entry tear coverage
 - Petticoat Technique
 - Proximal entry tear coverage
 - Distal Bare stent support
- *Malperfusion*
 - *Rupture*
 - *Early Growth*
 - *Persistent HTN*
 - *Persistent Pain*

Acute Dissection: 30-Day Results

Literature Comparison

30-Day Event	STABLE I (Petticoat) Acute (N = 55)	White 2011 Pooled SVS dataset Acute, complicated (N = 85)	Fattori 2013 Pooled results on TEVAR Acute (N = 2,359)
Mortality	5.5% (3/55)	10.6% (9/85)	10.2% 30-day or in-hospital mortality
Stroke	10.9% (6/55)	9.4% (8/85)	4.9% 30-day or in-hospital stroke
Paraplegia	1.8% (1/55)	9.4% (8/85) Paralysis/paraparesis	4.2% 30-day or in-hospital spinal cord ischemia
Bowel ischemia	1.8% (1/55)	3.5% (3/85)	Not reported
Renal failure	10.9% (6/55)	9.4% (8/85)	Not reported

Lombardi et al. J Vasc Surg 2012 Mar;55(3):629-640

White et al. J Vasc Surg. 2011;53:1082-90.

Fattori et al. J Am Coll Cardiol. 2013;61:1661-78.

Acute Dissection: 30-Day Results

Literature Comparison

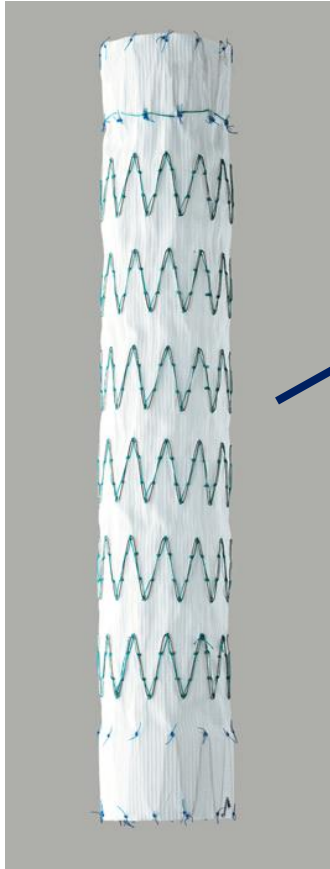
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Lombardi et al. J Vasc Surg 2012 Mar;55(3):629-640

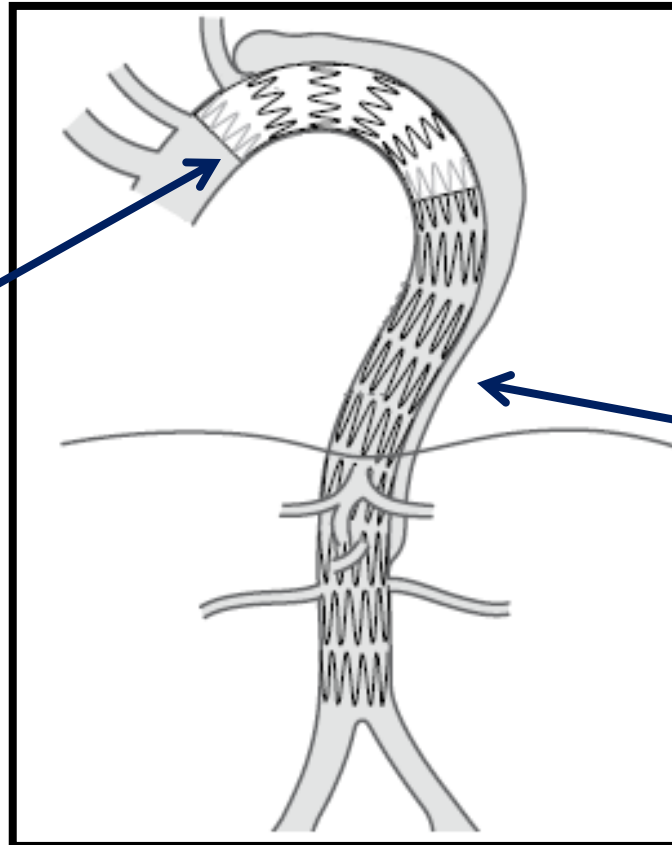
White et al. J Vasc Surg. 2011;53:1082-90.

Fattori et al. J Am Coll Cardiol. 2013;61:1661-78.

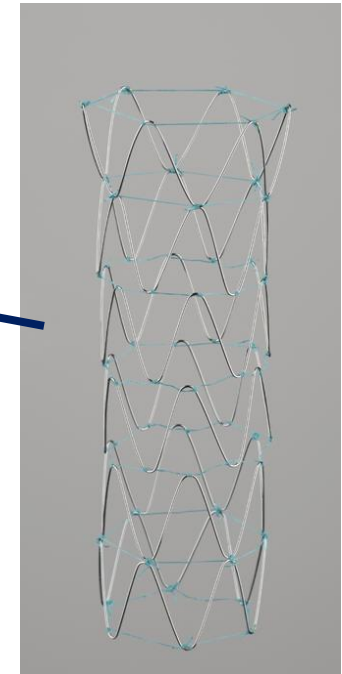
Dual Component System STABLE I & II



**Zenith® TX2®
Endovascular Graft**



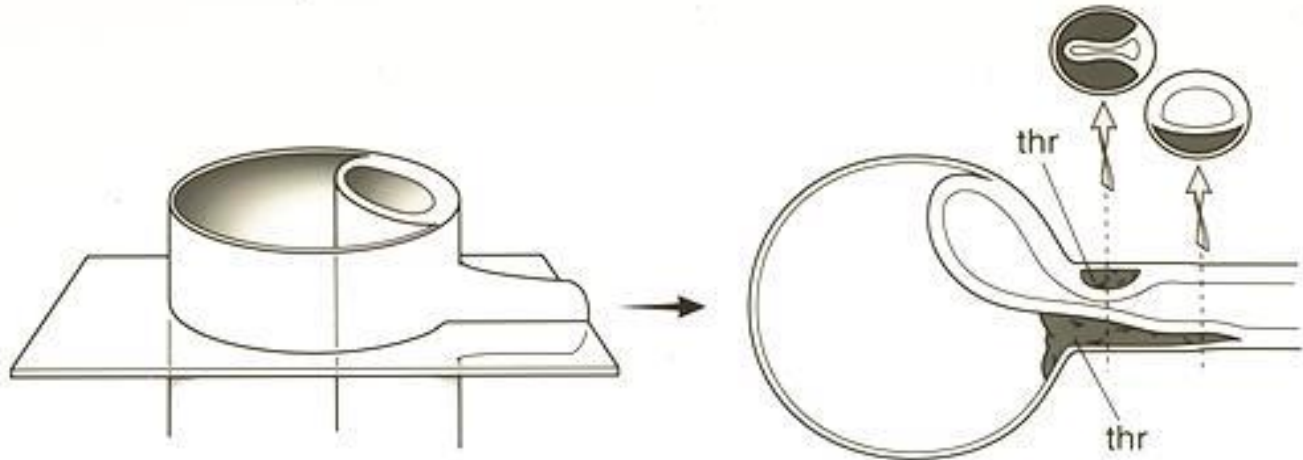
Caution - Investigational device. Limited by Federal
(or United States) law to investigational use.



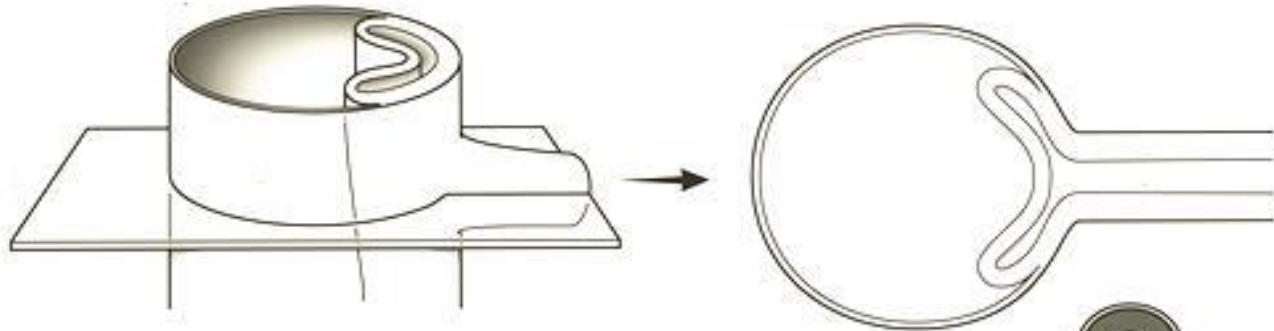
**Zenith® Dissection
Endovascular Stent**

Modes of Obstruction

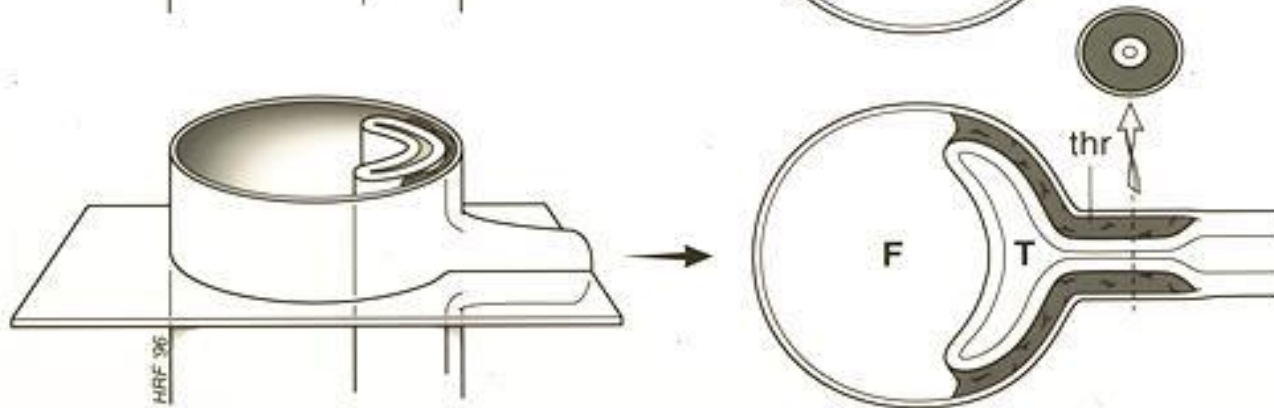
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Dynamic



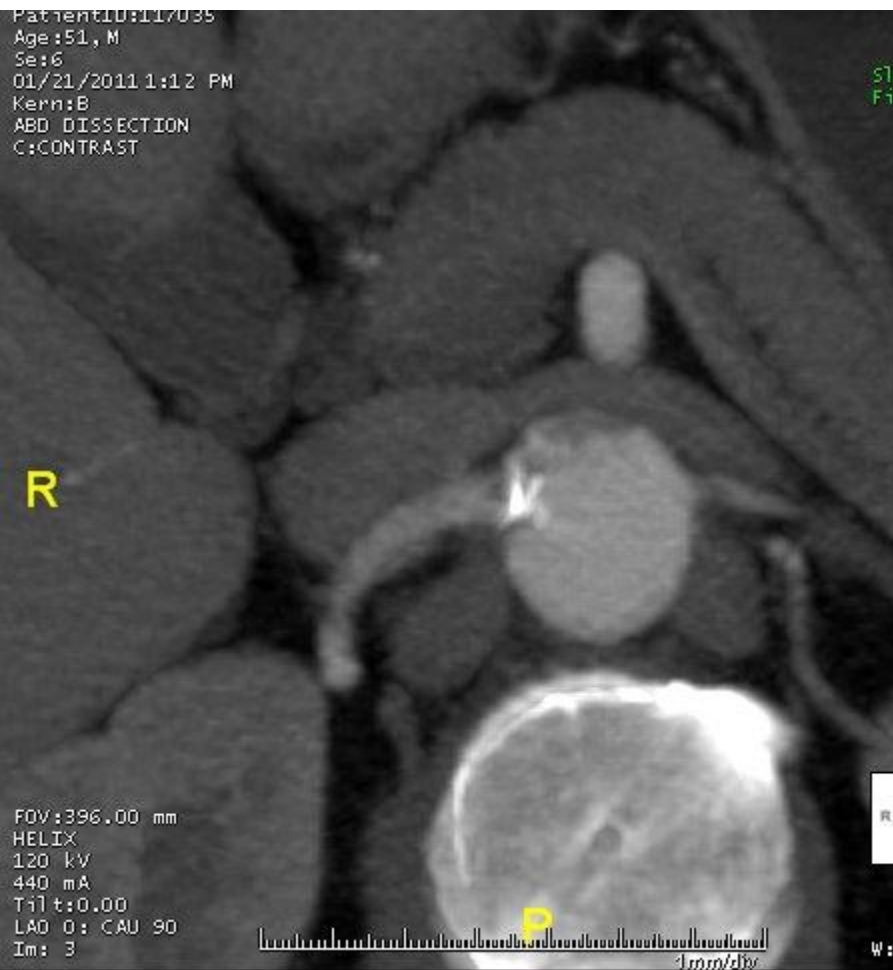
Both



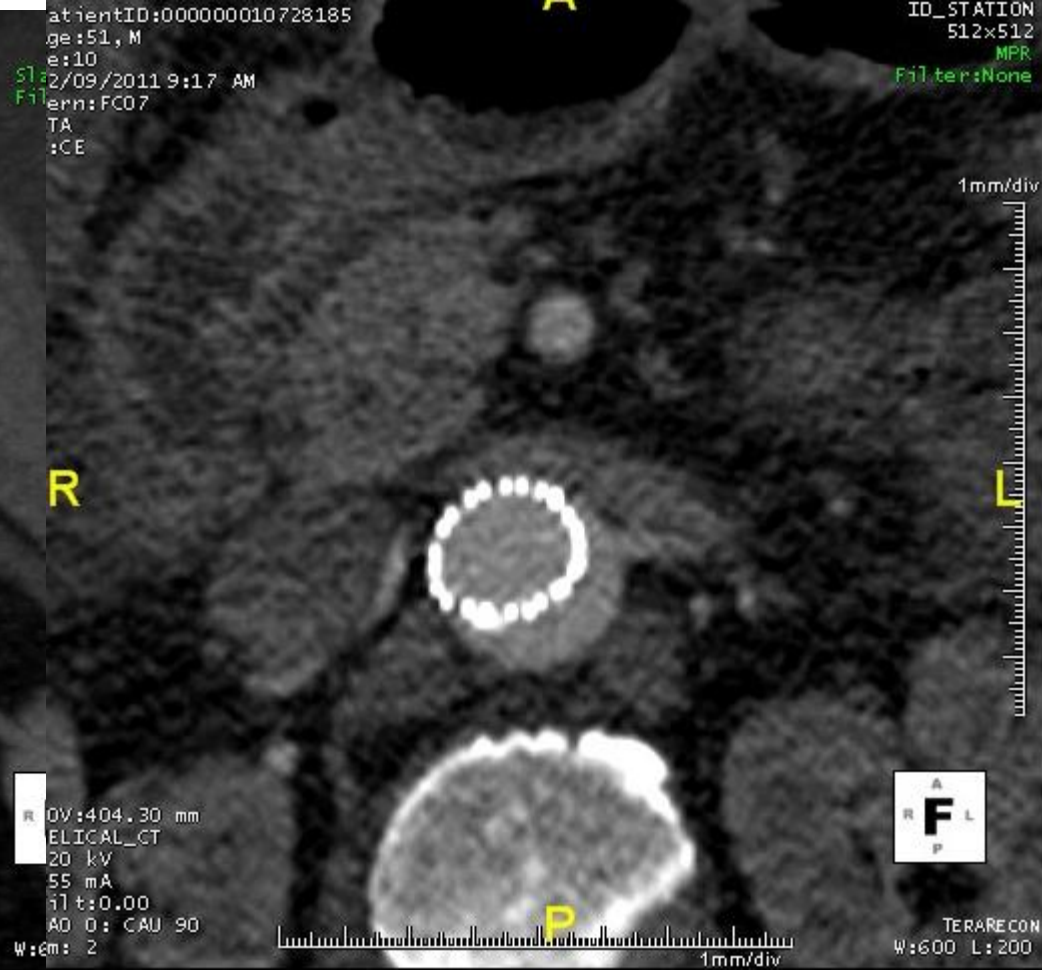
Petticoat

Pre and Post-op CTA

PatientID:117035
Age:51, M
Sex:6
01/21/2011 1:12 PM
Kern:B
ABD DISSECTION
C:CONTRAST



PatientID:000000010728185
Age:51, M
Sex:10
02/09/2011 9:17 AM
Filter:FC07
TA
:CE



Petticoat

Pre and Post-op CTA





Conclusions

Uncomplicated Dissection

- Enough data to “Guide” selective treatment with TEVAR.
- Current randomized trials do not support treatment of “All Comers”
- Substantial encouragement for patients without a reassuring response to medical therapy.

Conclusions

Complicated Dissection

- TEVAR remains gold standard.
- Long term growth can still be an issue.
- Petticoat technique has favorable early results and offers long term management options.