Infra-renal Abdominal Aortic Aneurysm Treated with Endovascular Insertion of Domestic Grafted Stent: 12 Cases

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Abdominal aortic aneurysm (AAA) is one of the most common diseases in the vascular surgery field, with 90% of all cases caused by arteriosclerosis and most cases found in ages of 40 and above. The final outcome is ruptures, anterior wall ruptures for example, with a mortality rate as high as 90%. The surgical resection of aortic aneurysm plus the reconstruction of abdominal aortic blood flow with artificial blood vessels is the effective traditional therapy. At present, the mortality of selective surgery is lower than 5%, but may be up to 60% for high-risk patients with complicated diseases of such important organs as heart, brain, lung and kidney. Since Parodi initially reported the successful treatment of infra-renal artery AAA with grafted Stent endovascular insertion in 1991 [1], more and more vascular surgeons have selected this method to treat infra-renal AAA. Imported stents are restricted in such applications due to their expensive costs. From December 2005 to December 2008, our department performed endovascular prosthesis on a total of 12 infra-renal AAA cases with domestic stents and achieved a good therapeutic effect. Now it was reported below.

Discussion

The treatment of AAA by endovascular isolation operation has the following advantages: short operation time, a small wound, few complications, little bleeding, reduced surgical risks and difficulties, rapid postoperative recovery, satisfactory efficacy, and providing a treatment chance for the aged patients and the high-risk patients with complicated other severe diseases and intolerable to the traditional open abdominal surgery. Currently not all AAA cases are suitable for endovascular therapy, but with the continuous development of the structural materials used in the grafted Stents and the persistent advancement of intervention technologies, the endovascular therapy will become the major therapy for AAA. The domestic stents used even have some advantage over imported stents in structural design, and they are more convenient and safer to operate, but the long-term efficacy is still to be observed further due to a short follow-up time.

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Article

Hybrid Endovascular Repair in Aortic Arch Pathologies A Retrospective Study

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[Abstract] The aortic arch presents specific challenges to endovascular repair. Hybrid repair is increasingly evolving as an alternative option for selected patients, and promising initial results have been reported. The aim of this study was to introduce our experiences and evaluate mid-term results of supra aortic transpositions for extended end endovascular repair of aortic arch pathologies. From December 2002 to January 2008, 25 patients with thoracic aortic aneurysms and dissections involving the aortic arch were treated with hybrid endovascular treatment in our center. Of the 25 cases .14 were atherosclerotic thoracic aortic aneurysms and 11 were thoracic aortic dissection. The hybrid repair method included total-arch transpositions (15 cases) or hemi-arch transpositions (10 cases), and endovascular procedures. All hybrid endovascular procedures were completed successfully. Three early residual type-I endoleaks and one type-II endoleak were observed. Stroke occurred in three patients (8%) during the in-hospital stage. The perioperative mortality rate was 4%; one patients died post-operatively from catheter related complications. The average follow-up period was 15±5.8 months(range,1-41 months). The overall crude survival rate 15 months was 92% (23/25). During follow-up, new late endoleaks and stent-raft related complications were not observed. One case (4%) developed a unilateral lower limb deficit at 17 days and was readmitted to hospital. In conclusion, the results are encouraging for endovascular aortic arch repair in combination with supra-aortic transposition in high risk cases. Aortic endografting offers good mid-term results. Mid-term results of the hybrid approach in elderly patients with aortic arch pathologies are satisfying

[Keywords] aortic arch; endovascular repair; aneurysm; dissection

1. Introduction

The conventional surgical repair of thoracic aortic aneurysms and dissections remains a high risk procedure[1,2]. Based on the eight largest recent researches published (with over 40 patients) [3-10], the 30 day stroke/death rate aortic arch surgical repair is up to 25.6% (mean17.5%). The introduction of endovascular stent graft technology has reached an evolutionary threshold for the treatment of complex aortic diseases. The aortic arch presents specific challenges to endovascular repair, which mainly arise from the involvement of the supra-aortic branches and the tight inner curve. Inoue et al. reported one case of triple-branched stengraft[11] and Chuter and colleagues reported a branched stentgraft to the innominate artery[12,13]. However, these new designs are still at an experimental stage. Hybrid repair , which constitutes a combination of open supra-aortic branch revascularization and endovascular aortic repair, has increasingly evolved as an alternative option for selected patients, and promising initial results have been reported[14-18]. The aim of this study was to introduce our experiences and evaluate mid-term results of supra aortic transpositions for extended endovascular repair of aortic arch pathologies.

2. Methods

From December 2002 to January 2008, 25 patients with thoracic aortic aneurysms and dissections involving the aortic arch were treated with hybrid endovascular treatment in our center. Preoperative planning was at the discretion of the operating surgeon and was based upon contrast enhanced CT scanning with 1.5 mm cuts and three-dimensional reconstruction that allowed accurate, centerline measurements of the aorta, As a prerequisite for successful stent-graft placement, a proximal landing zone of at least 1.5 cm along the curvature of the aortic arch was necessary . All patients underwent risk evaluation according to EuroSCORE guidelines[19]. Patients who were not suitable for endografting and those at low risk for surgery were treated by open surgery (three patients during the same period).

The average age of the patients was 71.5±9.9years (range, from 50 to 83 years), and the ratio (male: female)was 5.5:1. Risk factors of the patients are shown in Table 1. Among 25 cases ,14 (56%) were atherosclerotic thoracic aortic aneurysms, the average length of aneurysms was242.33±82.34mm; 11(44%) were aortic dissection, three (12%) were type A thoracic aortic dissection, 8(32%) were type B thoracic aortic dissection, of which seven were chronic phase and one was acute phase. The acute phase was defined as within two weeks after symptom onset; the subacute phase as the following two-month period; and the chroic phase as anything thereafter. The interval

From onset of type B thoracic aortic dissection to treatment was 2-7 months. The average maximum aortic diameter was 64±11.3mm. None of the pathologies were a result of trauma.

Table 1. Risk factors in patients.

Risk factors	Number of patients	percentage (%)
Age over 70	17	68
Severe cardiac impairment: cardiac valvulopathy, Previous coronary bypass and/or MI	12	48
Chronic pulmonary disease: ($FEV_1 \leq 11$)	10	40
Neurological dysfunction	3	12
Surgery on thoracic aorta	7	28

In order to distinguish from Ishimaru's anatomical aortic classification[20] using antegrade numbering, we propose a retrograde landing zone clsssification[21]. This classification is based on pathophysiology and reflects the extension of the disease and case complexity, with respect to the need for transposition. We define four proximal landing zones as seen in Figure 1. An endografting procedure at Zone 3 is an ideal situation and requires no surgical complementary step for both aneurysms and dissections. Starting at Zone 2 requires either coverage or transposition of the left subclavian artery (LSA). If the origin of the left common carotid artery (CCA) (Zone 1)is involved, transposition to the right CCA via a carotid-carotid bypass must be performed. We call this adjunctive procedure a hemiarch transposition. If the disease extends the length of the aortic arch, requiring coverage of the innominate artery (IA), a bypass to the IA and left CCA is performed through a median sternotomy from the ascending aorta. We refer to this as total-arch transposition (Figure 2). The terminology of hemi-arch and total-arch transposition used in order to simplify the discussion, thus avoiding repetition of the different bypasses performed.

Figure 1. The proximal landing zone classification

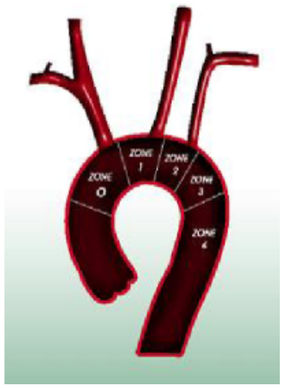
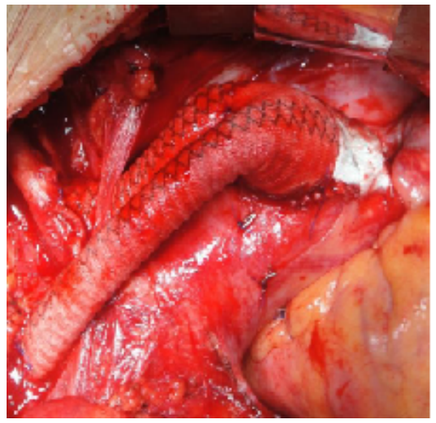
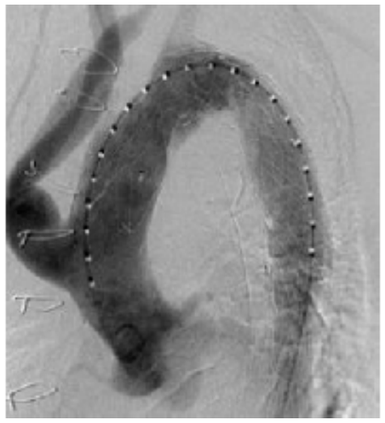


Figure 2. The intra-operative view of the implanted endograft (left) and the Angiogram (right) demonstrating the reconstruction of the total-arch transposition.





We performed 15 total-arch transpositions and 10 hemi-arch transpositions. For the total-arch transpositions, the endografts were deployed at a second step: 1 week following the creation of the proximal landing zone. We always used a femoral percutaneous access and an additional percutaneous humeral approach was used in some instances to mark the origin of the native LA and LSA. Carotid and vertebral artery circulation were assessed before operation. During the transposition procedure, the stump pressure was checked before clamping the arch vessels.

Hemi-arch transposition was performed via a vertical 4 cm cervical approach to both CCAs. Then an 8 mm Dacron graft (Braun Unigraft, Melsungen) was implanted between two CCAs in U shape anterior to the trachea. The strategy of this procedure was to perform an end-to-side anastomosis between the left CCA and the brachiocephalic trunk. Afterwards, an end-to-side anastomosis was performed between the LSA and the already transposed LCCA. Total arch transposition is performed through a median sternotomy. A 12 mm Dacron bifurcated graft (Braun Unigraft, Melsungen)was implanted on the ascending aorta as proximal as possible, using lateral clamping. An 8mm branch anastomosed end-to-end to the LA, with another 8mm branch was anastomosed the same way to the right CCA. The proximal stumps of these vessels were clamped during the anastomosis and sutured with a 5/0 prolene (Ethicon, Inc, Somerville, NJ, USA) suture after the bypass was finished in order to reduce the clamping time. Depending on the patient's anatomy, the graft was passed in front or behind the innominate vein, with can be divided or reconstructed if necessary. The LSA was not bypassed unless the vertebral artery was dominating, since if is often hard to teach through a standard sternotomy. Moreover, a paternt LSA may serve as access to the aneurysm, when coiling was necessary to treat a residual type I endoleak. A retrograde type II endoleak will appear only if there was an outflow from the sac, such as created by patent intercostal arteries, which are normally thrombosed. In only one case we observed a type II endoleak that was easily treated by percutaneous occlusion of the LSA (Figure 3). Endoleaks are defined as follows: type I include leaks from the proximal and distal Seal zones, type II are secondary to patency of aortic branches (intercostals arteries, Iumbars, etc.)[22].

Following total-arch transposition, markers (metal clips) were placed at the proximal anastomosis to the arch, to define the proximal extent of the proximal landing zone.

Figure 3. Coiling of the left subclavian artery after total arch repair [23].

Three different commercially available stent-graft systems were used, as shown in table 2. Endovascular procedures were performed under general anesthesia. In the majority of patients, a transfemoral approach was chosen. If the diameter of the external iliac was not large enough, the common iliac artery was used for arterial access. Stent-graft deployment was routinely performed under hypotonic conditions (systolic pressure<90mmHg). We did not use adenosine induced transient cardiac asystole. Endografts were oversized by 20% for aneurysms and 10% for dissections. The distal diameter of the endograft was initially slightly reduced with non-tapered devices. Since this series, we have been treating dissections with a tapered endograft whose 24 mm distal diameter better fits the distal landing zone, Stent-graft related data are shown in Table 3. We avoided using dilatation balloons unless it was necessary due to a residual endoleak. This was especially true for dissections.

Table 2. The relevant characteristics of the three proximal device implants used.

Device	Patients treated, %(n)	Proximal bate spring	Deployment strategy
Talent (Medtronic, Minneapolis, Minn)	32(8)	With	pullback
Ankura (Lifetech, Shenzhen, China)	24(6)	With	pullback
Zenith TX2 (Cook, Bjaeverskov, Denmark)	44(11)	without	Pullback and then release of trigger wire

Table 3. Stent-graft relate data

	Covered length	Proximal diameters	Distal diameters	Graft number
aneurysm	280.00±82.34 (184-388)	43.33±2.07	38.00±2.19	2.5-1.05
dissection	223.33±111.01 (113-335)	43.33±2.31	42.00±2.00	2±1

Following hospital discharge, patients were regularly contacted either by mail or telephone and they were asked to undergo both CT-scan and plain X-ray examinations at 3(in case of post-operative residual minor type 1 endoleak),6,12, 18 and 24 months post-operatively, and yearly there after. Data such as pre-operative size, patients' condition, risk factor,and post-operative control information, etc., were collected during regular working meetings, and were put together in a single Excel file. We calculated crude rates of survival, neurological complication and endoleaks because the study was not large enough to carry out a life-table analysis.

3.Results

3.1.Duration of Hospital Stay

3.1.1. Surgical Procedure

All patients recovered uneventfully without any serious neurologic injury after aortic debranching. One patient in the hemi-arch transposition group suffered a minor stroke, but was eventually discharged successfully. In the total arch transposition group, one proximal dissection occurred at the site of lateral clamping, which sealed spontaneously.

3.1.2. Stent-Graft Placement

All endovascular procedures were completed successfully. One worsening minor stroke was Observed in the hemi-arch transposition group, while no neurological complication occurred in the group of total arch exclusion. During the deployment, the stent graft had not misplacement. We observed three early residual type-I endoleaks (12%), which were left untreated since they may thrombose spontaneously in the post-operative course. The first residual endoleak thrombose spontaneously and the second was successfully treated by graft extension. The third was due to an uncovered entry teat in the ascending aorta and would have required total arch transposition, which was rejected by the patient. We also had one type-II endoleak in an aneurysm from LSA, which was successfully coiled after one week. We had no case of early paraplegia.

Stroke occurred in three patients (8%) during the in-hospital stage; one patient had a minor stroke within 48 h due to the occlusion of the left CCA bypass, which was resolved by a cervical carotidcarotid bypass. The perioperative mortality rate was 4%; one patient died post-operatively from catheter related complication: The patient died at three days from multiorgan failure after rupture of the descending of the aorta.

3.2. Fllow-up period

The average follow-up period was 15±5.8 months(range from 1-41 months), and all patients adopted follow-up regularly. Three-dimensional CT-scan and X-ray examinations were obtained for all the patients before their discharge to act as control images. The overall crude survival rate at 15 months was 92% (23/25). Another patient with chronic obstructive pulmonary disease(COPD) three months after the procedure because of acute respiratory failure.

During follow-up. new late endoleaks were not observed. The aneurusmal sac exclusion rate was 100%. The rate of occlusion in thoracic false lumen was 91%,while we observed seven cases (28%) patent abdominal false lumens. of which the maximum aortic diameter was <50mm. Endograft migration fracrure, and stent-raft related complications such as aorto-esophageal fistula were also not observed.None of the patients had new cerebral neurological adverse events. One case (4%) developed a unilateral lower limb deficit at 17 days and was readmitted to hospital. According to independent neurological assessment. this deficit could be due to medullar ischemia, based on cerebral and medullar MRI findings.

4.Discussion

Since the first description of revascularization of the left carotid and sbuclavian artery from the ascending aorta prior to stent grafting, only case reports and small case series have been published [24-30]. No comparative randomized or non-randomized studies of combined open debranching and endovascular procedures with other conventional treatment strategies for aortic arch repair have been identified. Furthermore. mid-term and long-term results are still awaited. Our mid-term results of alternative treatment approaches for aortic arch pathologies are satisfying. This hybrid approach

provides safe and effective treatment for patients at high risk for conventional repair. We recommend additional transposition of LSA when it supplies coronary circulation through the left internal mammary artery ,when the contralateral vertebral artery (VA) is stenosed or in a diseased vertabro-basilar system. We also recommend transposing the LSA in association with the left CCA when they are included in the aneurysm. except during total transpositions since the LSA is difficult to reach by median sternotomy. In all other cases, LSA transposition is only required later if the coverage becomes symptomatic. Great vessel transposition appears to be safe. There were no major strokes or deaths related to transposition, There was one early death (4%) after the endovascular step. which was either access or guide-w ire related.

In the total arch exclusion group. no immediate neurological complications occurred during either surgical or endovascular steps. On the other hand. in the hemi-arch exclusion group, we observed one major stroke. This may be due to catheter manipulation in front of a patent innominate artery ostium, in a patient with an atherosclerotic aorta. A possible way to reduce embolic complications may be to perform pre-operative trans-esophageal echography to better select the patients. We should also pay attention to reduce cross-clamping times of the brain supplying vessels by as much as possible. and furthermore. the absence of substantial atherosclerotic disease in the wall of the asending aorta in total arch rerouting procedures, Without doubt. the risk of embolism is present in all these procedures and careful manipulation of central vessels as well as minimizing the cross-clamp times, in order to not exceed the ischemic frame of cerebral tissue. is mandatory for success [31].

Total arch transposition allows availability of a longer proximal landing zone. easily reaching 3 cm in length for a better anchoring of the endograft. It also avoids stentgraft deployment within the arch curvature, which may cause endoleaks and migration. In selected cases 0f conical or larger aortas exceeding 40 mm in diameter. the banding technique may be useful in association with total arch transposition to allow a better proximal landing zone.

We prefer a staged procedure for the following reasons: the operating time is decreased: bleeding volume is lowered: the risk of graft infection may be lowered. since endovascular and imaging manoeuvers are not performed in front of an open chest. Considering our encouraging results. we have decided in our department to extend the use of total arch transposition with acute type A aortic dissection. We are combining the replacement of the ascending aorta with the transposition of the IA to the ascending aortic graft. This allows secondary arch coverage for recalcitrant dissection.

The future of this challenging approach is dependent on whether the endografting technology will be reliable or not [32]. Improvement of stent-grafting is needed in terms of flexibility to improve aortic arch navigation and reduce the embolic risk.

In summary, this study analyzed the mid-term results of endovascular repair of aortic arch aneurysm and dissection. The results are encouraojng for endova9cular aorric arch repair in combinarion with supra-aortic transposition in high risk cases. Combined treatment for high risk cases offers as good results as seen for conventional surgery for low risk patients. Aortic endografting offers good mid-term results. The mid-term results of the treatment approach in elderly patients with aortic arch pathologies at high risk are satisfying. Nevertheless, meticulous technique is mandatory in order to avoid diverse complications. Thus. the long-term utility of this technology awaits further investigation.

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Endovascular stent grail placement in patients with type B aortic dissection: A meta-analysis in China

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Objective: We summarized all published studies for endovascular stent graft placement among patients with type B aortic dissection in China with respect to clinical success, complications, and outcomes.

Methods: A meta-analysis was performed on all punished studies of retrograde endovascular stent graft placement encompassing 3 or more patients with type B aortic dissection Thirty nine studies, involving a total or 1304 Patients from January 2001 to December 2007, were included

Results: The average patient age was 52 years Procedural success was reported in 99.2%±0. 1% of patients Major complications were reported in 3.4%±0.1% patients, with the most severe neurologic complications in 0.6% Periprocedural Stroke was encountered more frequently than paraplegia (0.2% vs 0%). The overall 30-day) mortality was 2.6%±0.1%, In addition,1.5%±0.1 % of patients died over a mean follow-up period of 27.1±17.5 months Life-table analysis yielded overall survival rates of 96.9 % at 30 days, 96.7% at6 months, 96.4% at 1 year, 95.6% at 2 years, and 95.2% at 5 years

Conclusion: Although therapy with traditional medicines still remains the first line of treatment of type B aortic dissection, endovascular stent graft placement has shown its advantages, with a success rate of 99% or greater in a select cohort. The technical Survival rate, major complications, and acute and midterm survival rates in the Chinese-language literature appeared to favorably compare with that seen in punished literature This analysis is the first to provide an overview of the currently available literature on endovascular stent grail placement in type B aortic

Supplemental material is available online

A growing body of evidence has demonstrated the efficacy of endovascular repair for aortic dissection (AD) However, long-term studies on whether endovascular stent graft placement is the optimal initial treatment for elective cases of type B AD remain inconclusive.[1] Eggebrecht and colleagues[2] and Resch and associates,[3] respectively, reported multicenter retrospective studies of endovascular stent grail placement in patients with type B AD. However, the data were extracted exclusively from the English-language medical literature and mostly represented Western countries, such as those in Europe and North America, In 1998, endovascular stent graft Placement was introduced as a novel and less invasive option for patients with type B AD in China, and Since then, more than 1300 patients with type B ,AD have opted for the treatment. To date, nearly all single-center studies of endovascular stent graft placement in patients with type B AD were published in the Chinese- language literature, with no multicenter analysis in China being reported.

The aim of this meta-analysis was to summarize all available published data with respect to clinical Success, complications, and outcomes of endovascular stent graft placement among Chinese patients with type B, AD .This Chinese multicenter report of endovascular Stent graft placement in patients with type B AD will provide a direct comparison with existing studies Most importantly, this study will provide an insight into the pattern of

regional practice and patient distribution and demographic uniqueness.

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MATERIALS AND METHODS

Data Sources and Study Selection

"Aorta," "dissection." and "stent " were used as the key words for a comprehensive search of both the English- and Chinese-language literature in the PubMed, MEDLINE, CBMdisc (Chinese Biomedical Database), and CNK1 (Chinese National Knowledge lnfrastructure) database s. All Chinese studies on endovascular stent graft treatment published between January 2001 and December 2007 were identified for further analysis. Several criteria were applied Io determine whether articles would qualify for the analysis: (I) articles including patients with type B AD undergoing retro-grade endovascular stent graft placement into the descending thoracic aorta were selected for date extraction; (2) articles reporting on antegrade, surgical ("open") stent graft placement through the aortic arch were not included; (3) a minimum series of 3 patients with type B AD treated with stent grafts was required for inclusion; and (4) case reports were not included. The selected articles were carefully reviewed, and data were extracted.

Abbreviation and Acronym
AD = aortic dissection

included; (3) a minimum series of 3 patients with type B AD treated with stent grafts was required for inclusion; and (4) case reports were not included. The selected articles were carefully reviewed, and data were extracted.

Data Extraction and Statistical Analysis

Each article was analyzed by using a standardized protocol according to the 53 predelined variables regarding clinical characteristics, procedural data, and in-hospital and long-term outcomes (see Table El). Articles conraining insufficient data (<25% of predefined variables) were excluded from the data extraction. Only articles including patients with type B AD subjected to endovascular stent graft placement were included, and articles with patients with other thoracic aortic pathologies (eg, thoracic aortic aneurysms) were discarded. Unspecified information was classified as not available. As a result, the number of patients (denominator) varies, with the specific variables reported in the analysis.

Rates of events were calculated as the number of events divided by the number of treated patients with available data. The approach to calculating individual rates for different studies and to combining these rates into a weighted average produces identical results if the weights are defined as the proportion of available patients provided in a specific study. Results are presented as mean ± standard error or median and rinse, where approph0le. No adjustment for multiple testing was applied because the statistical analysis was performed in an exploratory manner. Comparisons between patients in relation to publication date or in relation to operator's experience were made by using the 2sided Student's t test for continuous variables. The life-table nonparametric method was used to generate estimates of survival at 30 days, 6 months, 1year, 2 years, and 5 years. The Kaplan-Meier nonparametric method was used to generate estimates of 30-day mortality and l-yea' survival in relation to publication date or in relation to operator's experience, and these values were compared by using the log-rank test. The 30-day procedure-related mortality of patients undergoing stent graft placement was compared with that of non-procedure-related mortality by using the log-rank test.

Definitions

AD was classified according to the Stanford classification. Dissection was considered an acute event if it occurred within the first 14 days from onset of symptoms, whereas it was considered chronic when occurring beyond 14days. Complications were classified as major when life-threatening or prompting major therapeutic consequences (eg, access complications requiting surgical revision), whereas complications that did not require futher treatment (eg, transient renal failure not requiring dialysis) were defined as minor. For the stent indication, Chinese vascular centers initially followed the indications for stent placement for type B dissection described by Nienaber and coworkers.4 However, with accumulating experience, some experienced centers extended indications l, 3, and 7.[4] Specifically, (1) when the distance from the entry site to the left subclavian artery is shorter than 1.5cm, endovascular repair was still made after a left carotid-subclavian arterybypass[5-7]; (2) endovascular repair was also performed, even when the maximal aortic diameter was less than 5.5 cm[5-7]; and (3) when the bilateral lilac arteries were tortuous and stenosed, endovascular repair could be performed through the abdominal aorta. [5-7] The technical details of endovascular repairs were described by Nienaber and colleagues,[8] Procedural success was defined by the technically successful deployment of the endoprosthesis at the intended target location. Any death that occurred suddenly or could not be related to other causes was classified as being caused by aortic rupture. Reintervention was defined ms the need for any surgical conversion or additional endovascular stent graft procedures. Procedure-related complications refer to complications that are related to endovascular stent placement (eg, retrograde dissection, organ or peripheral artery malperfusion, dissection rapture, type I endoleak, and stroke for subclavian artery occlusion). Non-procedure-related complications in dicate complications that are not related to endovascular stent placement (eg, myocardial infarction, cancer, and multiple organ failure or stroke with no relation to stent graft treatment). Studies were analyzed according to the reported total number of patients treated with endovascular stent graft placement, including dissections and other diseases of the thoracic aorta (eg, thoracic aortic ancurysms), to evaluate the potential influence of the operator' s experience on outcomes. Centers with a published total number of patients beyond the median (>16patients) were considered more experienced than those with total numbers below the median. In addition, the results of stent graft placement were analyzed in relation to the study publication dale. Specifically, studies published between 2001 and 2004 represent the earlier experience, and those published between 2005 and 2007 are considered the latest experience.

RESULTS

Study Selection

A total ofT0 Chinese-language publications published between January 2001 and December 2007 met the inclusion criteria. Twenty-three of these articles were excluded because of potential duplicate publications, and 7 publications were excluded for insufficient data. One study that incorporated complementary data from another study wax also excluded for data extraction. Thirty-nine studies were eventually selected for data extraction and analysis. A total of 1359 patients who underwent endovascular stent graft repair of the thoracic aorta were included in this analysis. Of these patients, 1304 (96.0%) had B-type AD (Table 1).5-7.9-45

Patient Characteristics

Seven hundred thirty-eight of 922 patients with available data had hypertension, and 130 of 696 patients with available data had cardiovascular risk factors, including 91 with coronary heart disease. 2 with aortic incompetence, and 37 with cardiac insufficiency (Table 2). Of note, 23 of 1139 patients had evidence of aortic rupture, as shown with computed tomographic angiography, magnetic resonance angiography, or digital subtraction angiography. For the grafts used in these studies, 726 grafts from 656 available cases were indicated, including Talent (Medtronic, Inc, Minneapolis, Minn; n = 341), Aegis (Microport, Inc, Shanghai, China; n = 189), Vasoflow (Weike Medical Apparatus and Instrument, Inc, Suzhou, China; n = 18), Endofit (Endomed, Inc, Phoenix, Ariz;n = 15), Zenith (Cook, Inc, Bloomington, Ind; n =6), Powerlink (Endologix, Inc, Irvine, Calif; n= 2), Aortec (YTH Biological Material Scitech, Inc, Beijing, China; n =55), Griking (Grikin Advanced Materials, Inc, Beijing, China; n = 36), Ankura (Lifetech Scientific, Inc, Shenzhen, China; n: 15), and homemade grafts (n = 49).

TABLE1. Detailed overview over the analysis reports

Anther	year	Patients with type B AD (n)	Pro success (n)	Emergency conversion (n)	Overall complications (n)	Major complications (n)	Overall neurologie compliactions (n)	Paraplegia (n)	30-d Mortailty (n)	Late surgical conversion (n)	Aortic rupture during follow-up (n)	Late mortaility during follow-up (n)
shi[5]	2005	150	150/150	0	3	3	1	0	2	0	0	0
Guo[6]	2005	159	159/159	0	6	6	1	0	6	1	0	2
Li[9]	2001	5	3/4	1	3	3	0	0	1	0	0	0
li[10]	2002	20	19/20	1	2	2	0	0	1	NA	NA	NA
Huang[11]	2002	6	6/6	0	0	0	0	0	0	0	0	1
Wang[12]	2003	18	16/18	2	6	2	0	0	1	NA	NA	NA
Zhang[13]	2003	10	8/10	0	1	1	0	0	1	0	0	0
zhang[14]	2003	6	6/6	0	0	0	0	0	0	0	0	0
shu[15]	2004	19	19/19	0	0	0	0	0	0	0	0	0
Li[16]	2004	11	11/11	0	0	0	0	0	0	NA	NA	NA
Wu[17]	2004	15	15/15	0	0	0	0	0	0	0	0	0
Wang[18]	2004	5	5/5	0	1	1	0	0	0	0	0	0
Yang[19]	2005	16	16/16	0	1	0	0	0	0	NA	NA	NA
Jiang[20]	2005	10	10/10	0	1	1	0	0	1	0	0	0
Su[21]	2005	22	22/22	0	1	1	0	0	1	0	0	0
Lin[22]	2005	26	26/26	0	0	0	0	0	0	0	0	0
Shan[23]	2005	22	22/22	0	1	1	0	0	1	1	0	0
Bao[24]	2005	7	7/7	0	0	0	0	0	0	0	0	0
Yu[24]	2006	12	12/12	0	0	0	0	0	0	0	0	NA
Yu[25]	2006	180	179/180	1	2	2	0	0	2	0	1	1
Xu[27]	2006	76	76/76	0	7	6	0	0	4	0	1	3
Wang[28]	2006	12	12/12	0	0	0	0	0	0	0	0	0
Luo[29]	2006	22	21/22	1	1	1	0	0	0	0	0	0
Li[30]	2006	17	17/17	0	NA	NA	NA	NA	0	0	0	0
Adeliai[31]	2006	23	22/22	0	2	1	1	0	1	0	0	0
Zhang[32]	2006	4	4/4	0	0	0	0	0	0	0	0	0
Wang[33]	2006	8	8/8	0	0	0	0	0	0	NA	NA	NA
Luo[34]	2006	55	55/55	0	1	1	0	0	1	0	0	0
Zhao[35]	2006	15	15/15	0	0	0	0	0	0	0	0	0
Wang[36]	2006	34	34/34	0	2	2	0	0	2	0	0	0
Tan[37]	2006	15	15/15	0	3	3	0	0	3	0	0	0
Yu[38]	2006	8	8/8	0	0	0	0	0	0	0	0	1
Li[39]	2006	42	42/42	0	0	0	0	0	0	0	0	0
Mci,[40]Jing[7]	2007 2003	146	143/145	2	7	6	1	0	6	6	1	4
Liu[41]	2007	38	37/38	1	1	1	0	0	0	NA	NA	NA
Cao[42]	2007	5	5/5	0	0	0	0	0	0	NA	NA	NA
Hu[43]	2007	9	9/9	0	1	0	0	0	0	0	1	1
Dong[44]	2007	10	10/10	0	0	0	0	0	0	0	0	0
Jing[45]	2007	46	46/46	0	4	0	2	0	0	0	1	3
All		1304	1290/1301 (99.2%)	9/1304 (0.7%)	57/1284 (4.4%)	44/1284 (3.4%)	8/1284 (0%)	0/1284 (0%)	34/1304 (26%)	8/1045 (0.8%)	5/1045 (0.5%)	15/1033 (1.5%)

AD,Aortic dissection NA,not applincable

TABLE 2. Patient characteristics

	Data available (n)	NO. of events or cases
Total no. of studies included	39	-
Total no. of patients reported	1359	-
No. of patients with type B AD	1304	96%
No. of patients with type B AD per study	39	16(4-180)*
Patient age (y)	1296	52.1
Male sex	1277	1118(86.8%±0.2%)
Acute dissection	744	273(36.7%±1.0%)
Presenting with rupture	1139	23(2.0%±0.2%)

*AD Aortic dissection *Median*

Procedural Data and In-Hospital Course

The stent graft placement procedure was successful in 99.2% + 0.1% of patients (Table 3). Emergency surgical conversion was required in 0.7% + 0.1% of patients (Table3), accounting for the total in-hospital conversion rate, Inhospital complications were reported in 4.4% ± 0.2% of patients (Table 3). Complications were predominantly of major clinical significance (3.4% ±0.1%), whereas minor complications were reported less frequently (1.0%±0.1%). The most critical in-hospital complications were related to retrograde extension of the dissection into the ascending aorta (0.4% ± 0.0%) and neurologic complications (0.6% ±0.0%). Concerning neurologic complications, periprocedural stroke occurred in 0.2% ±0.0% of patients, whereas no paraplegia was reported in 1284 patients. Thirty-four of 1304 patients, with available data died during the in-hospital period (Table 3), yielding an overall in-hospital mortality rate of 2.6% ±0.1%. Within the. 30-day period, there were no additional deaths, yielding a 30-day (operative) mortality rate of 2.6%±0.1 %.

Follow-up Data

Patients were examined 1, 3, 6, 12, 24, and 60 months after discharge with computed tomographic scanning, The major parameters for the follow-up period have included false luminal thrombosis, morphous of stent, type I endoleak, and organ or peripheral arterial blood supply. Follow-up information was available for all 1304 patients (Table 4). Thetime to follow-up (27.1 ±17.5 months) was available for only 1151 patients, False lumen thrombosis was reported in 92.9% ± 0.5% of the patients(Table 4), Late surgical conversion was performed in 0.8% ± 0. 1% of the patients, and adjunctive endovascular sent graft procedures were performed in 1.6%±0.1 % of the patients, Therefore the total reintervention rate was 2.4% ± 0.1% over the follow-up period of 27.1±17.5 months.

Aortic rapture occurred in 0.5% ±0.0% of the patients during the follow-up period. total of 1.5% ±0.1% of the patients died during the follow-up period, Figure E1 shows survival rates for all patients in whom the exact time to death was available in life-table format, Specifically, the survival rates were 96.9% at 30days. 96.7% at 6 months, 96.4% at 1 year. 95.6% at 2years, and 95.2% at 5 years.

TABLE 3. In-hospital data

	Data available (n)	NO. of events
Procedure	1301	1290(99.2%±0.1%)
No. of stent grafts per patient	656	1.1
Surgical conversion	1304	9(0.7%±0.1%)
Adjunctive endovascular procedures	1304	16(1.2%±0.2%)
Over complications	1284	57(4.4%±0.2%)
Major complications	1284	44(3.4%±0.1%)
Minor complications	1284	13(1.0%±0.1%)
Procedure-related compilations	1301	25(1.9%±0.1%)
Retrograde type A AD	1301	5(0.4%±0.0%)
Access complications	1301	5(0.4%±0.0%)
Neurologic compilations	1284	8(0.6%±0.0%)
Stroke	1284	3(0.2%±0.0%)
Paraplegia	1284	0%
In-hospital mortality	1304	34(2.6%±0.1%)
In-hospital mortality, procedure related	1304	10(0.8%±0.0%)
In-hospital mortality, non- procedure Related	1304	21(1.6%±0.1%)
30-d mortality	1304	34(2.6%±0.1%)

AD, Aortic dissection.

Results of Stent Graft Placement in Relation to Publication Date

Reported technical success rates were lower in the early studies published between 2001 and 2004 (94.7%±0.7%) when compared with the more recent studies published between 2005 and 2007 (99.6%±0.0%, P < .001, Table 5). The- overall rate of complications was consistently higher in the- earlier studies (11.4%±1.6% vs 3.8%±0.1 %. P <.001). However, the rate of neurologic complications, in particular, was lower in comparison with that see in the more recent studies (0% vs0.7±0.0%,P<.001). No significant difference was identified in operative or 1-year mortality between the 2 groups (Table 5).

Influence of Operator's Experience

As shown in Table 6. centers with a total number of patients beyond the median had a better procedural success rate and lower rates of complications and mortality than centers with low numbers of treated patients (98.4% ± 0.4% vs 99.3 % ±0.1% in procedural success rate, P < .001; 5.9%±0.9% vs 4.2% ±0.1% in overall complications, P = .01; and 3.2%±0.5% vs 2.5% ± 0.1% in 30-day mortality rate, P < .001). However, the rate of neurologic complications was higher in the centers with a total number of patients beyond the median (0.7% ±0.0% vs 0%. P <.001, Table 6).

TABLE 4, Follow-up data over 27.1± 17.5, months after stent graft Placement

	Data available (n)	No. of events (n)
Duration of follow-up (mo)	1151	27.1±17.5
False lumen thrombosis	1037	963(92.9%±0.5%)
Late surgical conversion	1045	8(0.8%±0.1%)
Adjunctive endovascular Procedures	1062	17(1.6%±0.1%)
Late complications	1062	38(3.6%±0.1%)
Late mortality	1033	15(1.5%±0.1%)

TABLE 5. Results of stent graft placement in relation to publication date

	Date available (n)				
	publication date,2001-2004(n=114)		publication date,2005-2007(n=1187)		P value
No. of publications		10		29	-
Patients/center (median)		10.5(5-20)		22(4-180)	-
Procedural success	114	94.7%±0.7%	1187	99.6%±0.0%	<.001
Overall complications	114	11.4%±1.6%	1170	3.8%±0.1%	<.001
Neurologic complications	114	0%	1170	0.7%±0.0%	<.001
30-d Mortality	114	3.5%±0.5%	1187	2.5%±0.1%	.516*
1-y Survival	63	96.8%±0.9%	970	96.3%±0.1%	.895*

**Log rank test*

Procedure-Related Versus Non-Procedure-Related Mortalities

Figure E2 depicts the procedure-related and non-procedure-related mortalities over the 30-day treatment period after the patient, were accepted. Non-procedure-related mortality was higher than procedure-related mortality (I.8% ±0.1% vs 0,8%± 0.0%, P = .016).

DISCUSSION

In this retrospective study we evaluated, by means of a large-scale meta-analysis, the efficacy of endovascular sent graft treatment for type B AD in China. Although the traditional antihypertensive therapy remains the first-line treatment for type B AD. endovascular stent graft placement is gaining more and more attention, especially with the high technical success rate and improved morbidity and mortality compared with those seen with its surgical counterpart 8,46 The concept of endovascular stent graft placement was propelled by the desire to induce aortic remodeling by means of exclusion of the false lumen and thrombosis of the false lumen and, at the same time, avoiding the risks associated with open surgical intervention. Clinical studies have suggested that patients with type B AD undergoing endovascular stent graft placement have a better midterm porgnosis than those receiving antihypertensive medicine or undergoing traditional open surgical intervcnlion.[47] For instance, Nienaber and colleagues4 showed that in comparison with the traditional surgical treatment, stent grafting had a lower perioperative mortality (0% vs 8% for surgical treatment), lower mortality after 30 days (0% vs 8%), and lower mortality after 1 year (0% vs 33%) in patients with subacute or chronic type B AD. Similarly, the Investigation of Stent Grafts in Patients with Type B Aortic Dissection trial in Europe showed that treatment of uncomplicated AD by means of stent grafting plus antihypertensive medications has a 1 -year survival rate of 95% in contrast to 77% for patients receiving antihypertensive treatment alone.8 In addition, the European Collaborators on Stent Graft Techniques for Thoracic Aortic Aneurysm and Dissection (EUROSTAR) study showed that for 131 patients with AD (57% with complicated AD and 43% with uncomplicated AD) treated by means of endovascular stent grafting, the primary technical success was 89%, and paraplegia occurred in just 0.8% of patients. The outcome at 1 year was more favorable for stent treatment with regard to aortic expansion (0%) and late survival (90%).[48]

Our study analyzed 1304 patients with type B dissection who underwent endovascular stent graft placement between 2001 and 2007 in China and demonstrated that endovascular stent graft treatment of AD was performed with a technical success rate of greater than 99%. Furthermore, our data showed an acute survival rate of 97.4% after stent graft placement, which is comparable with the reported survival rates after medical or surgical treatment of type B AD, For example, Dake and associates49 showed that stent grafting was associated with a 16% mortality within 30days in patients with acute-type AD who had life-threatening complications. This figure for the same category of patients treated conventionally with an emergency surgical procedure is approximately 40% and as high as 70% for patients treated with drugs, 49-51 ln addition. Hagan and colleagues52 showed 31.4% and 10.7 % of in-hospital mortalities for acute type B AD managed surgically and medically, respectively. Although our study and others support the idea that stent grafting is the optimal treatment for elective cases of type B AD in terms of acute

FABLE 6. Influence of endovascular experience

	Date available (n)				
	Endovascular experience,≤16 patients(n=188)		Endovascular experience,>16 patients(n=1113)		P value
No. of publications		20		19	-
Patients/center (median)		9.5(4-16)		34(17-180)	-
Procedural success	188	98.4%±0.4%	1113	99.6%±0.0%	<.001
Overall complications	188	5.9%±0.9%	1096	4.2%±0.1%	.01
Neurologic complications	188	0%	1096	0.7%±0.0%	<.001
30-d Mortality	188	3.2%±0.5%	1113	2.5%±0.1%	<.001
1-y Survival	130	93.9%±0.8%	903	96.7%±0.1%	.198*

**Log rank test*

and midterm survival rates, one should be extremely careful in drawing any conclusions without a randomized direct comparison with drug or surgical treatment strategies because patient selection might differ. Nevertheless, drug therapy is still the first-line treatment for type AD, and stent grafting might have the potential to replace or supplement drug therapy.

In comparison with the study by Eggebrecht and colleagues,2 our study of the Chinese-language literature suggests favorable rates of technical success, major complications, and improved acute and midterm survival, This might be because, first of all, the average age for patients with type B AD in our study is 10 years younger than that in the patients in the .study by Eggebrecht and colleagues. In addition, some risk factors are much lower in our study than those in the study by Eggebrecht and colleagues. For example, the rate of acute dissection is 36.7% ±1.0% in our study compared with 58.1% ±1.8% in the study by Eggebrecht and colleagues. The rate of rupture dissection is 2.0% ± 0.2% in our study compared with 16. I% ±1.2% in the study by Eggebrecht and colleagues. These risk factors have an effect on the patient's ability to tolerate the treatment and consequently have an effect on the outcome.

Second, the technique of stent grafting was applied in China 2 years after it was introduced to Europe and North America, This allowed the Chinese surgeons to have more time and chance to leam from their foreign counterparts, gaining both technical experience and the experience to assess the indications of the patients.

Third, our data reveal that this technique was being used in 4 major vascular surgery centers in China (Table 1), with more than 145 cases in each center, The patients from these 4 centers account for 48.6% of all cases (634/1304), and the technical success rate is 99.5% (631/634). Because theses 4 vascular surgery centers5-7,26 have a wealth of experience and that ensures that nearly half of the cases of type B dissection in our study have a high successful rate and a high early and midterm survival rate. In contrast, in the study by Eggebrecht and colleagues,2 only a single center has an experience of more than 100 cases (20.9% [127/6091]),and the other 79.1% of cases (582/609) were scattered over 38 vascular surgery centers, with the number of cases ranging from 3 to 38. Therefore we believe these contribute to the better success rate and the better rates of early and midterm survivial in our study.

Neurologic complications, especially paraplegia, remain the most severe potential complications of stent graft placement, as for surgical repair of type B dissection. Occlusion of numerous, critical intercostal arteries (Adamkiewicz artery with stent grafts is widely believed to be responsible for the increased risk of paraplegia.53 In particular, simultaneous abdominal and thoracic aortic repair with loss of lumbar and intercostal arteries appears to pose an increased risk of spinal cord damage because of insufficient, collateral circulation. 54 Our analysis has shown that the overall risk of neurologic complications in patients treated with stent grafting was 0.6%,with none having paraplegia. In addition, our data demonstrated that stroke occurred in 0.2%of patients after stent graft treatment, which, again, is significantly lower than reported in the study by Eggebrecht and colIceagues.2We believe that this is related to the age of the patients (52.1 years in our study vs 61.0 years in the report by Eggebrecht and colleagues) because younger Patients might have a lower incidence of atherosclerosis and a relatively better circulation in the medium and small arteries. When the traffic artery or the left subclavian artery is occluded by stent grafting, other arteries can compensate for the blood supply for the spinal cord or brain, thereby reducing the incidence of paraplegia and stroke.

Although a favorable survival rate and a lower incidence of neurologic complications appear to be somewhat encouraging in these initial experiences, it should be noted that inhospital complications were encountered in 4.4% of patients and 40% of these complications were related directly to the procedure itself. Figure E2 shows a statistically significant difference between the mortality rate caused by a procedure-related process and that

30-day postoperative period. However, it is interesting that we found this difference to be time related. As shown in Figure E2, this difference was not apparent within 5 days after the procedure. The tendency of procedure-related mortality curve suggests that procedure-related mortality most frequently occurs within 5 days of the operation, whereas the difference appeared 5 to 30 days after the operation. This could be useful information for the implication analysis after surgical intervention.

Our analysis suggests that centers with an experience of more than 16 stent graft procedures had a significantly higher success rate and a lower rate of complications than less experienced centers. Our data also suggested that the technical success rates have improved over time. which is accompanied by a decrease in 30-day mortality, However, neurologic complications have increased in the more recent studies compared with the earlier studies. This could be explained by the fact that the indications for stent graft placement have been expanded to include some high-risk patients who are more prone to complications while the experience in endovascular stent graft treatment grows. This was also evidenced by the fact that the spectrum of acute and midterm complications has broadened to include potentially disastrous events other than paraplegia or stroke.[55]

Our meta-analysis highlights some other technical limitations of endovascular stent graft placement in patients with type B AD. Stent grafting failed to abolish the false lumen in 7% of patients, suggesting that it might not be a definitive treatment for type B AD. Even in the presence of a thrombosed thoracic false lumen, the distal thoracic or abdominal aorta might enlarge during follow-up. Therefore there is a continued risk for aortic rupture (about 0.5% during follow-up) after stent graft placement and a need for adjunctive stent graft placement or a need for open operations in 4% of patients over time. However, the incidence of aortic rupture and the need for repeat endovascular of surgical intervention might also be related to the progression of the disease itself and might not necessarily reflect treatment failure. This is supported by the fact that 11% to 20% and 10% to 44% of patients with type B AD require repeated operations when treated with drugs or treated surgically, respectively. [56-57]

Our analysis is the first to provide an overview of the literature on endovascular stent graft placement in patients with type B AD in China. Although it is not a prospective and randomized comparison with other treatment strategies for patients with type B AD, it provides an important insight into technical success, potential advantages and complications, and survival rates. However, several unavoidable limitations exist in this study.

First, the retrospective nature of this study might lead to potential bias in data collection, which would handicap the clinical applicability of the findings. Second, in general, it is impractical to include all hospitals in all regions in China. Although we were trying to be inclusive and systematic in our approach, we could only study patients who were admitted to these tertiary care centers. Third, there might be referral bias based on the type B AD of these medical centers. Finally, there might be some cases of type B AD that might have been overlooked. Nevertheless, we believe that our data truly represented valuable and reliable information related to stent placement for type B AD in China.

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CASE REPORT

Use of a Vascular Occluder to Treat a Re-Entry Tear in a Patient With Stanford Type B Aortic Dissection:

Acute and 1-Year Results

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Purpose: To evaluate the feasibility and efficacy of a vascular occluder to treat a patent re-entry tear near a visceral artery after stent*graft repair of Stanford type B aortic dissection.

Case Report: A 34-year-old woman with a history of stent-graft repair for aortic dissection 6 months ago was admitted complaining of recurrent chest discomfort for 1 month. Computed tomographic angiography (CTA) revealed a proximal type I endoleak and a patent re-entry tear above the celiac artery orifice. A double-disk vascular occluder was used to treat the re-entry tear. The device was deployed successfully without perioperative complications; the re-entry tear was closed and perfusion of adjacent vessels was not compromised. CTA at 3 months and 1 year documented thrombus formation in the false lumen, proper position of the occluder, and no re-entry tear.

Conclusion: It is feasible to treat patent re*entry tears with a vascular occluder after primary proximal stent-graft repairs. Long-term clinical efficacy has yet to be confirmed.

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[Key words] thoracic aorta, vascular occluder, type B aortic dissection, re-entry tear

Aortic dissection is the most common catastrophe involving the aorta. The incidence of acute aortic dissection is estimated to be 5 to 10 per 100,000 person-years, and men are affected 5 times more frequently than women.[1-4] The efficacy and safety of thoracic endovascular aortic repair (TEVAR) for dissection have been confirmed in a number of studies.[5,6]As our experience widens, the importance of re-entry sites (secondary tears) has drawn attention. We applied a vascular occluder to treat a re-entry site near the celiac artery ostium in a patient who had undergone TEVAR for a Stanford type B aortic dissection.

CASE REPORT

A 34-year-old woman with a history of TEVAR for aortic dissection 6 months ago was admitted to our hospital complaining of recurrent chest discomfort for 1 month. Computed tomographic angiography (CTA) revealed a proximal type I endoleak (Fig. 1A) and a patent re-entry tear above the celiac artery orifice (Fig. 1B).

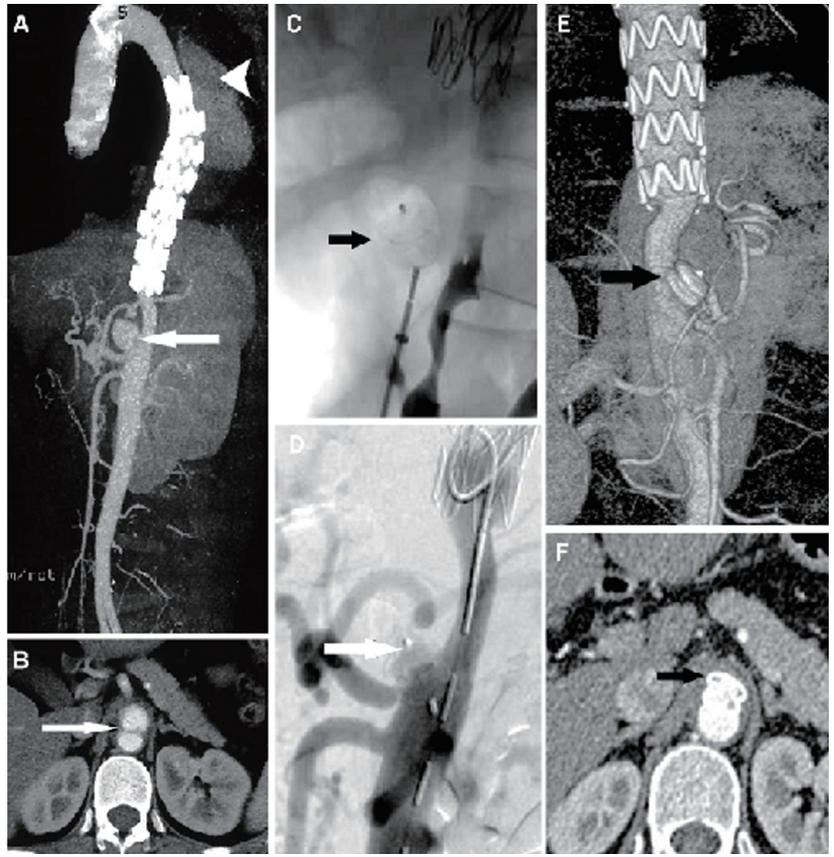

Figure 1. Preoperative CTAs (A, B) revealed a proximal type I endoleak (arrowhead in A) at the proximal stent-graft and a re-entry tear (closed arrows) above the celiac artery. (C) After the occluder (arrow) was deployed, the position of the device within the re-entry was checked by pushing and pulling the delivery cable. (D) The completion angiogram shows the occlude (arrow) in optimal position, without leakage into the false lumen, while the visceral arteries remained patent. (E, F) One year after the operation, CTA showed the vascular occlude (arrow) and no re-entry tear.

The authors have no commercial, proprietary, or financial interest in any products or companies described in this article.

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J ENDOVASC THER 2008; 15:566-569 Acquired Cardiovascular Disease

An endovascular repair was undertaken via a retroperitoneal approach to the left lilac artery because the femoral arteries were too small for access. Angiography revealed obvious leakage at the proximal stent-graft. A re-entry tear was found above the celiac artery with aneurysm formation. A tube-shaped stent-graft (32-×120-mm, Lifetech Scientific Co. Ltd, Shenzhen, China) was deployed distal to the left subclavian artery with >2 cm overlapping the previous stent-graft. Sealing was satisfactory at completion angiography. A 9-F long sheath with a Cobra-shaped tip (SFA9F occluder transmission system; Lifetech Scientific Co. Ltd) was then advanced over the wire to the false lumen through the re-entry tear. Sized to exceed the 11-mmdiameter re-entry tear by 2 to 3 mm, the 14-mm double-disk symmetrical occluder (Heartr; Lifetech Scientific Co. Ltd) was connected to the tip of the delivery cable by a microscrew fixed to the posterior disk and collapsed into a loader. The collapsed device was then advanced into the sheath by pushing the delivery cable. Under fluoroscopic guidance, the anterior disk and the waist of the occuluder were deployed in the false lumen and pulled gently against the dissection flap, which was both felt and observed by fluoroscopy. Then the posterior disk was deployed by further withdrawal of the sheath. A secure and stable position of the occluder within the re-entry was checked by gentle pushing and pulling of the delivery cable (Fig. 1C). the occlude was released by unscrewing it only when angiography had verified its position and ruled out interference with aortic branch vessels. On completion angiography, the device was in optimal position, and the re-entry tear was covered, with no leakage into the false lumen; the celiac and mesenteric arteries remained patent (Fig. 1D). The patient recovered uneventfully and was discharged 10 days later. The 1-year CTA documented no type I endoleak, with the vascular occlude in optimum position at the re-entry site in the abdominal aorta (Fig. 1E,F); the patency of the visceral arteries was maintained.

DISCUSSION

Adequate sealing of primary entry tears in the descending thoracic aorta after stent-graft placement can reduce the pressure in the false lumen to avoid further dilatation or rupture. The ideal results after TEVAR include aortic reconstruction and false lumen thrombosis or resolution, but remodeling failure in the abdominal aorta remains a problem. Kusagawa et al.7 reported that in acute-onset dissections, the false lumen is completely obliterated within 6 months after stent-graft placement if no endoleaks or intimal tears occur. The remaining intimal tears uncovered in the descending thoracic aorta were shown to be a critical factor that hampered shrinkage of thoracic false lumen.

The same situation exists in chronic cases7. Ouinn et al.8 reported a case of aortic dissection treated with a stent-graft, in which there was progressive enlargement of the infrarenal abdominal aorta at the re-entry tear site 7 months after stent-graft placement. The aneurysms were treated by surgical repair. Kato et al.9 studied 15 chronic type B dissection patients and found there was no significant difference in the size of the abdominal true and false lumens, even after successful remodeling of the thoracic dissection. Compared with acute aortic dissection, chronic dissection may have more re-entry tears in the abdominal aorta. An unthrombosed abdominal false lumen originates from persistent flow or pressure through multiple re-entry tears of abdominal aorta. Our case of progressive aneurismal dilatation in the infrarenal abdominal aortic false lumen was the result of a patent re-entry site in the abdominal aorta. Because the re-entry site diameter was large, it was unlikely to seal spontaneously, and the risk of rupture would persist.

As re-entry tears in the abdominal aorta tend to be located near the branch vessels, they are generally unfavorable for exclusion with a stent-graft unless the branch ostia are partially covered, which may lead to ischemia of the spinal cord, liver, intestine, gallbladder, or kidney. In the past, we have combined traditional surgery with endovascular intervention to expand the applicability of TEVAR. Bypass grafts between the visceral arteries and

abdominal aorta or autologous renal transplantation were done before the endovascular repair to avoid visceral ischemia, but this strategy significantly increased surgical trauma and difficulty.

Compared with other occluders, the Heart self-expanding nitinol double-disk device uses its short connecting waist to dock at the re-entry, forcing blood to flow through the access filled with thrombogenic polytetrafluoroethylene material. It is available in 2 configurations: symmetrical and asymmetrical. In the symmetrical design, the centers of the anterior and posterior disks are on the same axis, while they are not in the asymmetrical device (Fig. 2), which can be custom designed to seal the re-entry and avoid covering the adjacent branch vessels. The appropriate device size was chosen 2 to 3 mm large than the size of the re-entry. Sheath size depends on the size of the occluder chosen for closure. In this patient, the re-entry (~11mm in diameter) was 2 mm above the celiac artery, so a 14-mm symmetrical device and a 9-F long sheath were used.

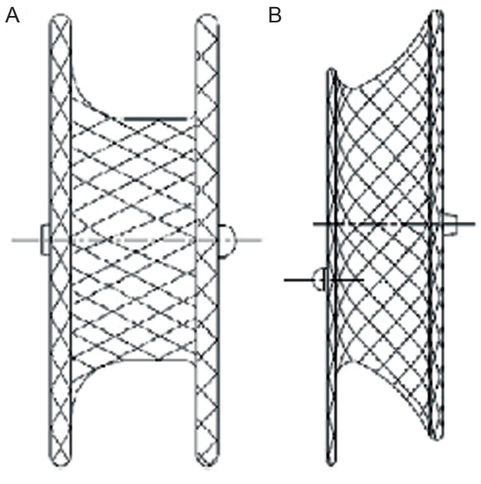

Figure 2. The occluder has 2 disks that are both 2 to 3 mm larger than the waist. (A) for the symmetrical occluder, the centers of the anterior and posterior disk are on the same axis, while for the asymmetrical device, (B) they are not.

Smaller occluders could be delivered through a 6- or 7-F sheath, which allows deployment via a percutaneous femoral or brachial artery approach.

Selecting the type and size (waist diameter) of the occlude should be planned based on the CTA prior to the procedure. Transesophageal echocardiography or multislice virtual intravascular endoscopy might be used when necessary. Intraoperative angiography can confirm the preoperative evaluation. An excessively large waist may tear up the intima, influence the final configuration of the occluder, and even interfere with the hemodynamics of adjacent visceral arteries.

In some instances, the re-entry may take an acute angle off the longitudinal aortic axis, causing great difficulties in guidewire engagement during the procedure. One solution is to approach from the brachial artery, but the extended working distance may pos other problems. Another possible solution, which we adopted in this case, is to pre-shape the guidewire and sheath with a long pre-shaped Cobra sheath to successfully engage the re-entry tear.

Conclusion

The treatment of re-entry tears that remain open after stent-graft repair of aortic dissection is of great significance in preventing distal aneurysm formation. The double-disk vascular occluer is a minimally invasive option compared with hybrid surgery. Our initial experience in this case suggests that the use of this occlude is feasible, efficacious, and safe, but further studies are required in a larger cohort before this technique can be routinely adopted in clinical practice.

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Outcome of endovascular stent graft placement in patients with acute thoracic aortic syndromes

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[Abstract] Objective To evaluate the outcome of endovascular stent graft placement in patients with acute thoracic aortic syndromes, **Methods** Emergency stent-graft implantations were performed in 57 patients with acute thoracic aortic syndromes from May 2001 to December 2005 (45 Stanford B aortic dissections, 9 acute penetrating aortic ulcers or pseudoaneurysms. 3 traumatic thoracic aneurysms). The clinical data, efficacy and follow-up results were analyzed. **Results** Procedures were successful in all patients. Type I endoleaks were evidenced in 5 patients and ascending aortic dissection occurred in 1 patient during operation, 5 patients with acute penetrating aortic ulcer complicating with coronary artery disease received successful PCI immediately post endovascular stent graft placement. Adynamia in extremities occurred in 1 patient and recovered two days later post anisodamine and manicol treatments. Left vertebroartery ischemia was found in 1 patient due to coated subclavian artery by slent-graft and the patient recovered spontaneously after two days lethargy without special treatment. The mean ICU time after surgery was 3.5 days (1-8 days) and the mean hospitalization time was 10 days. The mean follow-up time was 25.30 + 13.1 months (1-47 months). Two patients died within 30 days after operation, 1 patient died of rupture of the ascending aortic dissection (7 days post operation), 1 patient died of acute renal failure at the 2nd day post operation. One patient died of empsyxis 3 months after procedure, 1 patient died at the 4th month post procedure for unknown reason, 1 patient received second stent-graft implantation because of a newly formed endoleak at the proximal end of the stent-graft, 5 patients received second stent-graft implantation because of newly formed leaks at the remote end of the stent-graft. No paraplegia or stent migration or stenosis was observed during the follow up period. Total mortality during hospitalization and follow-up was 7.0%. **Conclusion** Patients with acute thoracic aortic syndrome could be effectively and safely treated by coated stent-graft endovascular placement.

[Key words] Aortic aneurysm, thoracic; Aneurysm, fasle; Acute Stanford B aortic dissection; Coated stent-graft

Endovascular repair of descending thoracic aortic aneurysm: preliminary experience

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[Abstract] Objective To report an initial experience with the endovascular repair of descending thoracic aortic aneurysm (DTAA). **Methods** Endoprostheses were placed into 41 patients with DTAA between January 2001 and July 2007 which were retrospectively analyzed. The preliminary right-left carotid and left carotid-subclavian bypass was performed in 4 cases in which the distances from the proximal aneurysm to the origin of the left common carotid artery were no longer than 15 mm. EVAR was conducted 1 week after the bypass or immediately. Results All stent grafts were deployed in proper position. There were two deaths (4.9%) during perioperative period, resulting from multiorgan failure and acute cardiac infarction, respectively. Eighteen endoleaks occurred immediately after EVAR (43.9%), four disappeared after balloon dilatation. There were two acute renal insufficiencies (4.9%), one requiring hemadialysis for more than 30 days. Follow-up, which ranged from 1 to 60 months [median, (18.6 + 4.2) months] was carried out in 26 patients (63.4%). Type- I endoleak and type- III endoleak were detected in two patients in 4 years and 2 years after EVAR, might because of migration, and were corrected using another stent-graft each. Two patients died of other diseases during follow-up. Complete thrombosis of the thoracic aneurysm sac with no late migration or endoleaks was reveled on CT at 3 months postoperatively in the remaining patients. The decrease in maximal aneurysm diameter was 0-22 mm [median, (8.3 + 4.5) mm] and the prosthetic vascular grafts in four patients with preliminary carotid subclavian bypass surgery were patent during the follow-up period. **Conclusions** The treatment of descending thoracic aortic aneurysm with an endovascular approach is feasible with less trauma, quick recovery and less complications. It may offer the best means of therapy for high risk patients.

[Key words] Aortic aneurysm, thoracic; Endoluminal repairing; Vascular surgical procedures

Endovascular graft exclusion for aortic discussion and aneurysm

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[Abstract] Objective To evaluate the safety and clinical efficacy of a stent-graft in the treatment of type B aortic discussion. **Methods** From January 200 to Decmber 2006, 48 patients with Stanford B aortic angiography was performed in all patients via the left brachial artery to determine the true and false lumen of the aorta, the orifice of the aortic discussion and the other branches of the aortic artery. After surgical exposure of the right femoral artery, the stent-graft delivery system was passed over the stiff guidewire and advanced until the middle of the stent-graft cover the orifice. The stent-graft was then deployed by pulling back the introducer sheath. Then an aortic angiography was performed immediately after the procedure to evaluated the correct placement of the stent-graft and the changes of blood flow supply the true lumen of the aorta, the viscus and thelower limbs. **Results** Stent-graft placement was technically successful in all patients, and the orifice of the aortic discussion was occluded in 46 patients with a successful rate of 95.8%. the blood pressure of false lumen was dropped immediately after the procedures with improvement of the blood flow in the lower limbs and the viscus greatly. **Conclusions** Transluminal endovascular stent-graft placement was a safe and effective procedure for the treatment of type B discussion and worthy of spreading extensively.

[Key words] Aortic dissection; endovascular graft exclusion; Treatment; stent-graft