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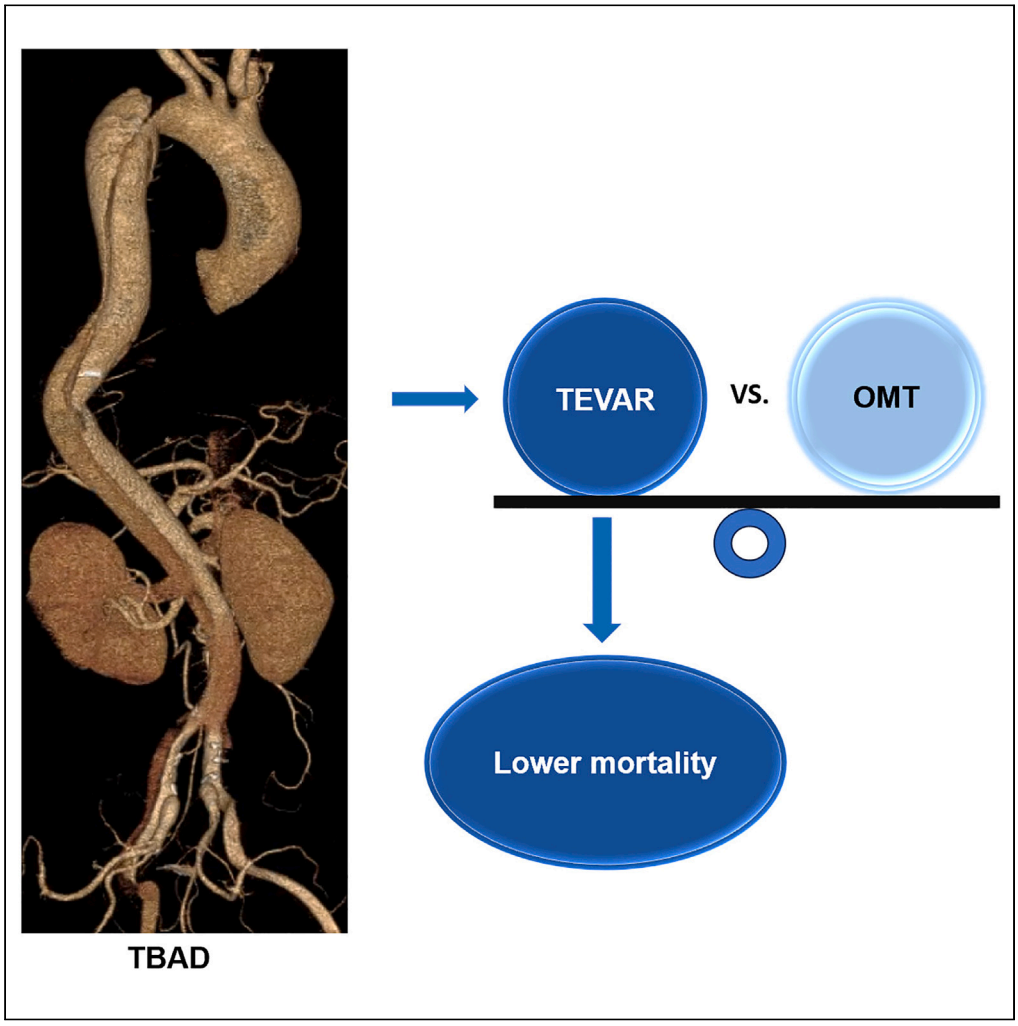

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Highlights

Mortality was lower in the TEVAR group than in the OMT group

A dissection length of over 150 mm was a risk factor for TBAD patient mortality

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Long-term survival and risk analysis of thoracic endovascular aortic repair for type B aortic dissection

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SUMMARY

To explore the safety and efficacy of thoracic endovascular aortic repair (TEVAR) in the treatment of patients with type B aortic dissection, and to evaluate the risk factors for long-term mortality. Our study retrospectively evaluated 729 patients with type B aortic dissection, who were divided into the thoracic endovascular aortic repair group and the optimal medical treatment group according to their treatment. In-hospital mortality, death within 30 days, and aortic-related mortality were lower in the thoracic endovascular aortic repair group than in the optimal medical treatment group ($p < 0.05$). The cumulative overall survival rates for the thoracic endovascular aortic repair group at 1 year, 5 years, and 10 years were 92.5%, 84.1%, and 73.5%, respectively. The Cox analysis found that TEVAR was beneficial in reducing mortality and that a vertical length of the dissection exceeding 150 mm was a risk factor for mortality.

INTRODUCTION

Type B aortic dissection (TBAD) is a type of aortic disease in which the primary tear is located in the descending aorta, distal to the left subclavian artery (LSA).[1] If the aortic dissection has rupture signs and is associated with malperfusion syndrome, TBAD can be subdivided into complicated TBAD and uncomplicated TBAD.[1] Thoracic endovascular aortic repair (TEVAR) is currently recommended as the first-line standard treatment for complicated TBAD.[2,3] However, for uncomplicated aortic type B dissection, treatment is still variable at present. Although the guideline recommends optimal medical treatment (OMT) for blood pressure and heart rate control as the first line of therapy.[2,3]

Previous studies have reported mixed outcomes for different treatment options. Clough et al.[4] reported that there was no difference in long-term survival in TBAD patients between the two groups receiving OMT or TEVAR. Another study found that although TEVAR did not improve the 2-year survival rate or reduce the incidence of adverse events, it was found to increase the 5-year survival rate.[5] TEVAR contributes to the positive remodeling of TBAD.[6] Nienaber et al.[7] reported that the positive remodeling rates of TBAD patients treated with TEVAR and OMT were 91.3% and 19.4%, respectively. Positive remodeling was shown to be advantageous for the long-term survival of TBAD patients.[5] However, data also suggest that TEVAR did not prevent aneurysmal degeneration of the thoracic or abdominal aorta in TBAD.[8]

To explore the safety and efficacy of TEVAR versus OMT in the treatment of TBAD patients and to evaluate the risk factors for long-term mortality, this study was conducted based on our 14-year experience with TBAD treatment.

RESULTS

Patient characteristics

The demographic data of 729 patients are presented in Table 1, with men (85.46%) being the majority of the cohort. The annual number of TBAD patients is shown in Figure S1. The average age of the TEVAR group (53.58 $\pm$ 11.70 years) was lower than that of the OMT group (58.25 $\pm$ 13.41 years) ($p = 0.000$). The percentage of complicated TBAD patients in the TEVAR and OMT groups was 9.70% and 11.73%, respectively ($p = 0.451$). The preoperative computed tomography angiography (CTA) imaging characteristics of TBAD are shown in Table 2, identifying that the number of tears was higher in the TEVAR group than in the OMT group (3.60 $\pm$ 2.04 vs. 3.08 $\pm$ 1.99, respectively).

Surgical details

In the OMT group, 28 (17.28%) patients underwent TEVAR for progression or complications of aortic dissection in the chronic phase. In the TEVAR group, the primary technical success rate of TEVAR was 99.65%. And 519 (91.53%) were completely endovascular, and 48 (8.47%) had TEVAR combined with bypass surgery. The LSA was covered in 139 (24.51%) patients, comprising partial coverage in 24 (4.23%) and complete coverage in 115 (20.28%). The LSA was reconstructed in 87 (15.34%) patients, comprising 44 (7.76%) using the hybrid procedures, 27 (4.76%)

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Table 1. Demographic data of 729 included patients

Variables	TEVAR group (n = 567)	OMT group (n = 162)	All (n = 729)	p *value*
Age (years)	53.58 ± 11.70	58.25 ± 13.41	54.62 ± 12.24	0.000
Male	489 (86.24)	134 (82.72)	623 (85.46)	0.261
BMI (kg/m^2)	25.20 ± 4.26	24.18 ± 3.88	24.99 ± 4.20	0.013
SBP (mmhg)	147.35 ± 27.22	149.50 ± 28.24	147.83 ± 27.44	0.380
DBP (mmhg)	86.33 ± 16.23	86.77 ± 19.07	86.43 ± 16.89	0.768
Smoking	272 (47.97)	81 (50.00)	353 (48.42)	0.649
Drinking	257 (45.33)	67 (41.36)	324 (44.44)	0.370
Symptoms				
Chest pain	301 (53.09)	69 (42.59)	370 (50.75)	0.018
Chest tightness	86 (15.17)	32 (19.75)	118 (16.19)	0.162
Abdominal pain	149 (26.28)	37 (22.84)	186 (25.51)	0.376
Backache	164 (28.92)	37 (22.84)	201 (27.57)	0.126
Comorbidities				
Coronary heart disease	45 (7.94)	25 (15.43)	70 (9.60)	0.004
History of myocardial infarction	4 (0.71)	8 (4.94)	12 (1.65)	0.000
Stroke	70 (12.35)	31 (19.14)	101 (13.85)	0.027
Chronic kidney disease	49 (8.64)	21 (12.96)	70 (9.60)	0.100
Hypertension	456 (80.42)	125 (77.16)	581 (79.70)	0.363
Diabetes mellitus	39 (6.88)	16 (9.88)	55 (7.54)	0.203
Marfan syndrome	2 (0.35)	2 (1.23)	4 (0.55)	0.215
Connective tissue disease	34 (6.00)	8 (4.94)	42 (5.76)	0.610
COPD	17 (3.00)	6 (3.70)	23 (3.16)	0.651
PAD	5 (0.88)	4 (2.47)	9 (1.23)	0.117
Complicated TBAD	55 (9.70)	19 (11.73)	74 (10.15)	0.451
History of operation	59 (10.41)	13 (8.02)	72 (9.88)	0.370
Loss to follow-up	101 (17.81)	36 (22.22)	137 (18.79)	0.205

Data are presented as n (%) or mean ± standard deviation. TEVAR, Thoracic endovascular aortic repair. OMT, Optimal medical treatment. COPD, Chronic obstructive pulmonary disease. BMI, Body mass index. PAD, Peripheral arterial disease. SBP, Systolic blood pressure. DBP, Diastolic blood pressure.

using the chimney technique, 13 (2.29%) using the fenestration techniques, and 3 (0.53%) using branched stent-graft. The incidence of complications in TEVAR was 35.19%. Complications of TEVAR for TBAD patients are presented in Table 3. Forty-six (9.87%) patients underwent re-intervention with the reasons for re-intervention being shown in Table 4.

Factors associated with mortality

There were 137 (18.79%) patients lost to follow-up in this study, with a mean follow-up time of 58.9 ± 45.17 months. A total of 150 (20.58%) patients died during the follow-up period, and the number of deaths was lower in the TEVAR group (20.60%) than in the OMT group (42.86%).

Table 2. CTA Imaging characteristics of type B aortic dissection

Variables	TEVAR group (n = 567)	OMT group (n = 162)	All (n = 729)	p *value*
Number of tears	3.60 ± 2.04	3.08 ± 1.99	3.49 ± 2.04	0.009
Primary tear size (mm)	11.54 ± 7.39	9.16 ± 6.77	11.12 ± 7.31	0.058
The distance from the primary tear to the LSA (mm)	20.14(10.00,37.61)	20.09(3.02,46.53)	20.14(9.76,39.16)	0.623
Vertical length of TBAD (mm)	332.77 ± 311.09	318.30 ± 118.35	330.12 ± 283.57	0.600

CTA, Computed tomography angiography. TEVAR, Thoracic endovascular aortic repair. OMT, Optimal medical treatment. TBAD, Type B aortic dissection. LSA, Left subclavian artery. Data are presented as mean ± standard deviation or median (first quartile, third quartile).

Table 3. Complications of TEVAR for TBAD patients

Complication	TEVAR (n = 466)
Ischemia	14 (3.00)
Left subclavian artery	8 (1.72)
lower limbs	2 (0.43)
viscus	3 (0.64)
Spinal cord ischemia	1 (0.21)
Hematoma	17 (3.65)
Sepsis	7 (1.50)
Stent-graft migration	2 (0.43)
Stroke	4 (0.86)
Pneumonia	27 (5.79)
Stress ulcer	3 (0.64)
Pulmonary embolism	1 (0.21)
Stent graft-induced new entry	27 (5.79)
Proximal stent graft-induced new entry	14 (3.00)
Distal stent graft-induced new entry	13 (2.79)
Endoleak	41 (8.80)
Abdominal aortic dissection dilatation	19 (4.08)
Stent occlusion	1 (0.21)
Retrograde type A aortic dissection	1 (0.21)

Data were presented as n (%). TEVAR, Thoracic endovascular aortic repair. TBAD, Type B aortic dissection.

The cumulative overall survival rates for the TEVAR group at 1 year, 5 years, and 10 years were 92.5%, 84.1%, and 73.5%, respectively. The cumulative overall survival rates for the OMT group at 1 year, 5 years, and 10 years were 77.8%, 69.9%, and 63.0%, respectively. The cumulative survival rates for the TEVAR and OMT groups are shown in Figure 1. Mortality and anatomical features during follow-up are presented in Table 5. In-hospital mortality, death within 30 days, and aortic-related mortality were lower in the TEVAR group than in the OMT group ($p < 0.05$). CTA results during follow-up suggested that complete and partial thrombosis of the false lumen was more common in the TEVAR group than in the OMT group. The multivariable Cox analysis suggested that TEVAR was beneficial in reducing mortality (HR 0.531, 95%CI 0.365–0.774; $p = 0.001$) and that the vertical length of the dissection exceeded 150 mm was a risk factor for mortality (HR 2.307, 95%CI 1.228–4.335; $p = 0.009$). The mortality rates in the TEVAR and OMT groups were 17.16% and 36.17%, respectively, when the length of aortic dissection was >150 mm ($p < 0.05$). Complicated TBAD was not shown to be a risk factor for patient death in this study. The results of the univariable analysis and multivariable Cox proportional hazard regression analysis are shown in Table 6.

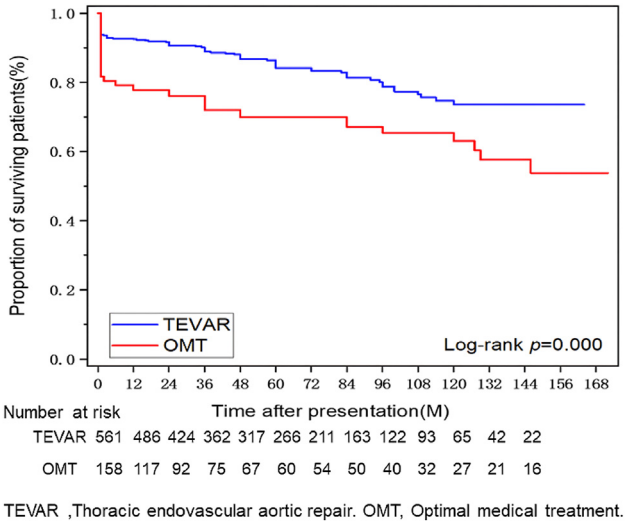
DISCUSSION

TBAD is a serious life-threatening aortic disease with an incidence of 1.6/100,000 per year.[9] OMT is effective in reducing aortic wall shear stress and preventing rupture of the aortic dissection[10] but cannot improve remodeling in TBAD. A report from the IRAD showed that more than

Table 4. Main causes for re-intervention in 46 TBAD patients

Causes	Patients (n = 46)
Endoleak	15 (32.61)
Stent occlusion	1 (2.17)
Abdominal aortic dissection dilatation	14 (30.43)
Proximal stent graft-induced new entry	4 (8.70)
Lliac Aneurysm	1 (2.17)
Distal stent graft-induced new entry	6 (13.04)
Ascending aortic aneurysm	1 (2.17)
Unclear	4 (8.70)

Data are presented as n (%).TBAD, Type B aortic dissection.



TEVAR ,Thoracic endovascular aortic repair. OMT, Optimal medical treatment.

Figure 1. Kaplan-Meier estimates of cumulative survival for TEVAR and OMT.

70% of TBAD patients treated with OMT developed aneurysmal degeneration during follow-up.[11] In contrast, the ADSORB study[6] found that endovascular repair promoted thrombosis within and reduced the diameter of the false lumen. A total of 729 patients with TBAD were included in this study. Our results showed that both all-cause mortality and aortic dissection-related mortality were significantly lower in the TEVAR group than in the OMT group, with 20.60% versus 42.86% and 5.58% versus 13.49%, respectively ($p < 0.05$). This result is consistent with the findings of Nienaber et al.[5] who revealed that all-cause mortality and aortic-specific mortality were lower in the TEVAR group than in the OMT group. Furthermore, Liu et al.[12] noted that the mortality rates over 5 years were lower in the TEVAR than those in the OMT group.

The length of aortic dissection was grouped based on the average length of the descending aorta in the Chinese population (approximately 150 mm). Our results suggest that an aortic dissection exceeding 150 mm in length was a risk factor for death in patients with TBAD. Morphologically, a dissection exceeding 150 mm in length suggested that the dissection crossed the diaphragm and involved the abdominal aorta, which indicated a high risk of visceral ischemia. TBAD patients with visceral ischemia had a higher mortality rate than those without visceral ischemia.[13] Our results showed that the number of tears was higher in the TEVAR group than in the OMT group. The contributing factor to the difference may have been the lower number of patients in the OMT group compared to the TEVAR group.

Negative remodeling was an important late complication of aortic dissection. This mainly includes aneurysmal degeneration and dissection rupture, which was shown to be associated with persistent impact on the false lumen wall. This impact originated from the blood flow through the intimal tears.[14] TEVAR could induce positive remodeling of aortic dissection.[15] Our study found that after TEVAR, the false lumen was filled with thrombus in 21.24% of patients, whereas in the OMT-treated group, the false lumen was completely occluded in only 1.59% of patients. TEVAR reduced the pressure in the false lumen by covering the entry tear and blocking blood flow, which promoted true lumen expansion and false lumen reduction.[16,17] Additionally, TEVAR could lower blood flow velocity in the false lumen, providing favorable conditions for thrombus formation.[2] Complete thrombosis of the false lumen was considered a desirable outcome after treatment for aortic dissection.[18] The improved 5-year survival rate and reduced disease progression after TEVAR were hypothesized to be associated with false lumen thrombosis induced by stent-graft implantation.[5]

Considering the characteristics of TBAD patients, TEVAR was adopted as the active management method in our center. First, the age of onset of aortic dissection was lower in our center than in other countries. The mean age of patients in our study was 54.62 $\pm$ 12.24 years, whereas Tolenaar et al.[19] reported an average age of 63.5 $\pm$ 14.0 years based on data from the International Registry of Acute Aortic Dissection. Previous studies have also indicated that Chinese patients with acute aortic dissection were approximately 10 years younger than their Western counterparts.[20] Young aortic dissection patients had a reduced proportion of true lumen blood supply than older patients, which resulted in increased visceral and lower extremity malperfusion.[21] Therefore, the patients might face a higher risk of complications if they underwent OMT. Qin et al.[22] indicated that patients with TBAD receiving OMT had a higher risk of adverse aortic events and mortality than those receiving TEVAR. Additionally, Hossack et al.[23] suggested that aortic-related mortality was significantly higher in patients treated with OMT than in those treated with TEVAR. Second, during OMT, blood pressure and heart rate should be strictly monitored and controlled, and follow-up supervision should be closely monitored. However, blood pressure control in our country is insufficient, with only 51.6% of hypertension patients being aware of their condition. Furthermore, treatment and control rates are only 45.8% and 16.8%, respectively.[24] Consequently, uncontrolled hypertension increased the risk of complications and progression of TBAD. Third, in chronic TBAD patients who underwent TEVAR, the effect of promoting aortic remodeling was lower than that of TBAD patients who underwent TEVAR in the acute and subacute phases.[2] Finally, compared with open surgery, TEVAR had significantly reduced perioperative complications and mortality.[15] For these reasons, we had chosen to treat uncomplicated TBAD more aggressively with TEVAR. Patients who refused TEVAR were given OMT

Table 5. Mortality and anatomical features during follow-up

Variables	TEVAR group (n = 466)	OMT group (n = 126)	p *value*
Death	96(20.60)	54(42.86)	0.000
Death in the year of first admission	38(8.15)	33(26.19)	0.000
Deaths after the year of first admission	46(9.87)	17(13.49)	0.242
Unknown	12(2.58)	4(3.17)	0.713
In-hospital death	18(3.86)	16(12.70)	0.000
Out-of-hospital deaths	78(16.74)	38(30.16)	0.001
Death within 30 days	23(4.94)	19(15.08)	0.000
Death after 30 days	73(15.67)	20(15.87)	0.955
Unknown	0(0.00)	15(11.90)	0.000
Dissection related death	26(5.58)	17(13.49)	0.002
Non-dissection related death	34(7.30)	9(7.14)	0.953
Unknown	36(7.73)	28(22.22)	0.000
Non-dissection related death			
MODS	5(1.07)	0(0.00)	0.590
Malignant tumor	4(0.86)	3(2.38)	0.348
Infection	8(1.72)	0(0.00)	0.213
Stroke	2(0.43)	0(0.00)	1.000
Intracerebral hemorrhage.	2(0.43)	0(0.00)	1.000
Uremia	2(0.43)	3(2.38)	0.115
Trauma	1(0.21)	0(0.00)	1.000
Myocardial infarction	10(2.15)	1(0.79)	0.532
Aspiration	0(0.00)	1(0.79)	0.213
sudden death	0(0.00)	1(0.79)	0.213
False lumen status			
Completely thrombosed	99(21.24)	2(1.59)	0.000
Partially thrombosed	264(56.65)	10(7.94)	0.000
Patent	95(20.39)	41(32.54)	0.004
Unknown	8(1.72)	73(57.94)	0.000

Data were presented as n (%). TEVAR, Thoracic endovascular aortic repair. OMT, Optimal medical treatment. MODS, Multiple organ dysfunction syndrome.

only. In total, 17.28% of patients were treated surgically for progression or complications of aortic dissection in the chronic phase. This was lower than the 45.9% reported by Lou et al.[25] This difference might be attributed to the 22.22% loss to follow-up rate in the OMT group.

Limitations of the study

First, this study was a single-center retrospective observational study; therefore, selection bias was unavoidable, which could be compensated for by a prospective randomized controlled study. Second, due to the long period of this study, the loss to follow-up rate was 18.79%, especially in the OMT group, where timely CTA follow-up imaging data could not be obtained. Therefore, we were unable to determine the percentage of patients with abdominal aortic aneurysm formation. Finally, some patients were followed up by telephone, and we were unable to obtain precise morphological and re-intervention information on aortic dissection in these patients.

Conclusions

TEVAR treatment could reduce the long-term mortality of TBAD patients, and a dissection length of over 150 mm was a risk factor for TBAD patient mortality.

STAR★METHODS

Detailed methods are provided in the online version of this paper and include the following:

- KEY RESOURCES TABLE

Table 6. Results of Cox proportional hazard regression analyzing the predictors for the composite endpoint of death in 150 patients

Variables	HR (95% CI)	p value	HR (95% CI)	p value
TEVAR	0.481(0.340–0.681)	0.000	0.531 (0.365–0.774)	0.001
Age	1.289(0.921–1.806)	0.139	1.129 (0.785–1.623)	0.513
Male	0.731(0.445–1.201)	0.216		
BMI	0.959(0.669–1.376)	0.822		
SBP	1.404(0.995–1.982)	0.053	1.234 (0.861–1.767)	0.252
DBP	0.931(0.656–1.321)	0.688		
Smoking	1.186(0.851–1.652)	0.313		
Drinking	1.050(0.753–1.465)	0.774		
Coronary heart disease	1.406(0.875–2.260)	0.160	1.438 (0.867–2.386)	0.159
History of myocardial infarction	0.954 (0.303–2.999)	0.935		
Stroke	1.098(0.690–1.746)	0.693		
Chronic kidney disease	1.014(0.573–1.794)	0.963		
Hypertension	1.179(0.774–1.795)	0.444		
Diabetes mellitus	1.550(0.907–2.650)	0.109	1.266 (0.701–2.286)	0.434
Marfan syndrome	1.215(0.170–8.689)	0.846		
Connective tissue disease	0.908(0.445–1.855)	0.792		
COPD	1.927(0.900–4.122)	0.091	1.749 (0.767–3.988)	0.184
PAD	0.499(0.070–3.567)	0.488		
Complicated TBAD	1.559(0.949–2.562)	0.080	1.431(0.843–2.429)	0.184
History of operation	0.659(0.346–1.253)	0.203		
Vertical length of TBAD	2.435(1.331–4.457)	0.004	2.307 (1.228–4.335)	0.009
Number of tears	1.397(0.889–2.197)	0.147	1.119 (0.699–1.792)	0.639
Primary tear size	1.096(0.778–1.546)	0.600		
The distance from the primary tear to the LSA	1.034(0.730–1.464)	0.850		

TBAD, Type B aortic dissection. TEVAR, Thoracic endovascular aortic repair. BMI, Body Mass Index. SBP, Systolic blood pressure. DBP, Diastolic blood pressure. COPD, Chronic obstructive pulmonary disease. PAD, Peripheral arterial disease. LSA, Left subclavian artery.

SUPPLEMENTAL INFORMATION

Supplemental information can be found online at https://doi.org/10.1016/j.isci.2023.108359.

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AUTHOR CONTRIBUTIONS

Conception and design: Q.T., J.C., and X.Q.

Administrative support: X.Q. and Z.Q.

Provision of study materials or patients: Q.T., J.C., and X.Q.

Collection and assembly of data: Q.T, Y.W., X.S., J.Q., M.H., and H.Y.

Data analysis and interpretation: Q.T., J.C., Y.W., and Q.L.

Manuscript writing: All authors. Final approval of manuscript: All authors.

DECLARATION OF INTERESTS

The authors declare no competing interests.

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REFERENCES

1. Lombardi, J.V., Hughes, G.C., Appoo, J.J., Bavaria, J.E., Beck, A.W., Cambria, R.P., Charlton-Ouw, K., Eslami, M.H., Kim, K.M., Leshnower, B.G., et al. (2020). Society for Vascular Surgery (SVS) and Society of Thoracic Surgeons (STS) Reporting Standards for Type B Aortic Dissections. Ann. Thorac. Surg. *109*, 959–981. https://doi.org/10.1016/j.athoracsur.2019.10.005.
2. MacGillivray, T.E., Gleason, T.G., Patel, H.J., Aldea, G.S., Bavaria, J.E., Beaver, T.M., Chen, E.P., Czerny, M., Estrera, A.L., Firestone, S., et al. (2022). The Society of Thoracic Surgeons/American Association for Thoracic Surgery Clinical Practice Guidelines on the Management of Type B Aortic Dissection. Ann. Thorac. Surg. *113*, 1073–1092. https://doi.org/10.1016/j.athoracsur.2021.11.002.
3. Erbel, R., Aboyans, V., Boileau, C., Bossone, E., Bartolomeo, R.D., Eggebrecht, H., Evangelista, A., Falk, V., Frank, H., Gaemperli, O., et al. (2014). 2014 ESC Guidelines on the diagnosis and treatment of aortic diseases: Document covering acute and chronic aortic diseases of the thoracic and abdominal aorta of the adult. The Task Force for the Diagnosis and Treatment of Aortic Diseases of the European Society of Cardiology (ESC). Eur. Heart J. *35*, 2873–2926. https://doi.org/10.1093/eurheartj/ehu281.
4. Clough, R.E., Barillà, D., Delsart, P., Ledieu, G., Spear, R., Crichton, S., Mounier Vehier, C., Peacock, J., Sobocinski, J., and Haulon, S. (2019). 's Choice - Long-term Survival and Risk Analysis in 136 Consecutive Patients With Type B Aortic Dissection Presenting to a Single Centre Over an 11 Year Period. Eur. J. Vasc. Endovasc. Surg. *57*, 633–638. https://doi.org/10.1016/j.ejvs.2018.08.042.
5. Nienaber, C.A., Kische, S., Rousseau, H., Eggebrecht, H., Rehders, T.C., Kundt, G., Glass, A., Scheinert, D., Czerny, M., Kleinfeldt, T., et al. (2013). Endovascular repair of type B aortic dissection: long-term results of the randomized investigation of stent grafts in aortic dissection trial. Circulation. Circ. Cardiovasc. Interv. *6*, 407–416. https://doi.org/10.1161/circinterventions.113.000463.
6. Brunkwall, J., Kasprzak, P., Verhoeven, E., Heijmen, R., Taylor, P., ADSORB Trialists, Alric, P., Canaud, L., Janotta, M., Raithel, D., et al. (2014). Endovascular repair of acute uncomplicated aortic type B dissection promotes aortic remodelling: 1 year results of the ADSORB trial. Eur. J. Vasc. Endovasc. Surg. *48*, 285–291. https://doi.org/10.1016/j.ejvs.2014.05.012.
7. Nienaber, C.A., Rousseau, H., Eggebrecht, H., Kische, S., Fattori, R., Rehders, T.C., Kundt, G., Scheinert, D., Czerny, M., Kleinfeldt, T., et al. (2009). Randomized comparison of strategies for type B aortic dissection: the INvestigation of STEnt Grafts in Aortic Dissection (INSTEAD) trial. Circulation *120*, 2519–2528. https://doi.org/10.1161/circulationaha.109.886408.
8. Famularo, M., Meyermann, K., and Lombardi, J.V. (2017). Aneurysmal degeneration of type B aortic dissections after thoracic endovascular aortic repair: A systematic review. J. Vasc. Surg. *66*, 924–930. https://doi.org/10.1016/j.jvs.2017.06.067.
9. Gouveia E Melo, R., Mourão, M., Caldeira, D., Alves, M., Lopes, A., Duarte, A., Fernandes E Fernandes, R., and Mendes Pedro, L. (2022). A systematic review and meta-analysis of the incidence of acute aortic dissections in population-based studies. J. Vasc. Surg. *75*, 709–720. https://doi.org/10.1016/j.jvs.2021.08.080.
10. Veger, H.T.C., Pasveer, E.H., Westenberg, J.J.M., Wever, J.J., and van Eps, R.G.S. (2021). Wall Shear Stress Assessment of the False Lumen in Acute Type B Aortic Dissection Visualized by 4-Dimensional Flow Magnetic Resonance Imaging: An Ex-Vivo Study. Vasc. Endovascular Surg. *55*, 696–701. https://doi.org/10.1177/15385744211017117.
11. Fattori, R., Montgomery, D., Lovato, L., Kische, S., Di Eusanio, M., Ince, H., Eagle, K.A., Isselbacher, E.M., and Nienaber, C.A. (2013). Survival after endovascular therapy in patients with type B aortic dissection: a report from the International Registry of Acute Aortic Dissection (IRAD). JACC Cardiovasc. Interv. *6*, 876–882. https://doi.org/10.1016/j.jcin.2013.05.003.
12. Liu, D., Luo, H., Lin, S., Zhao, L., and Qiao, C. (2020). Comparison of the efficacy and safety of thoracic endovascular aortic repair with open surgical repair and optimal medical therapy for acute type B aortic dissection: A systematic review and meta-analysis. Int. J. Surg. *83*, 53–61. https://doi.org/10.1016/j.ijsu.2020.08.051.
13. Howard, C., Sheridan, J., Picca, L., Reza, S., Smith, T., Ponnapalli, A., Calow, R., Cross, O., Iddawela, S., George, M., et al. (2021). TEVAR for complicated and uncomplicated type B aortic dissection-Systematic review and meta-analysis. J. Card. Surg. *36*, 3820–3830. https://doi.org/10.1111/jocs.15827.
14. Xu, H., Piccinelli, M., Leshnower, B.G., Lefieux, A., Taylor, W.R., and Veneziani, A. (2018). Coupled Morphological-Hemodynamic Computational Analysis of Type B Aortic Dissection: A Longitudinal Study. Ann. Biomed. Eng. *46*, 927–939. https://doi.org/10.1007/s10439-018-2012-z.
15. Tracci, M.C., and Clouse, W.D. (2021). Management of Acute, Uncomplicated Type B Aortic Dissection. Tech. Vasc. Interv. Radiol. *24*, 100749. https://doi.org/10.1016/j.tvir.2021.100749.
16. Miura, S., Kurimoto, Y., Maruyama, R., Yamamoto, M., Fusegawa, M., Sasaki, K., Masuda, T., Nishioka, N., and Naraoka, S. (2023). Thoracic Endovascular Aortic Repair on Zone 2 Landing for Uncomplicated Type B Aortic Dissection with Measurement of Intra-False Lumen Pressure. Ann. Vasc. Surg. *60*, 120–127. https://doi.org/10.1016/j.avsg.2023.06.020.
17. Munshi, B., Parker, L.P., Norman, P.E., and Doyle, B.J. (2020). The application of computational modeling for risk prediction in type B aortic dissection. J. Vasc. Surg. *71*, 1789–1801.e3. https://doi.org/10.1016/j.jvs.2019.09.032.
18. Li, D., Peng, L., Wang, Y., Zhao, J., Yuan, D., and Zheng, T. (2020). Predictor of false lumen thrombosis after thoracic endovascular aortic repair for type B dissection. J. Thorac. Cardiovasc. Surg. *160*, 360–367. https://doi.org/10.1016/j.jtcvs.2019.07.091.
19. Tolenaar, J.L., Froehlich, W., Jonker, F.H.W., Upchurch, G.R., Jr., Rampoldi, V., Tsai, T.T., Bossone, E., Evangelista, A., O'Gara, P., Pape, L., et al. (2014). Predicting in-hospital mortality in acute type B aortic dissection: evidence from International Registry of Acute Aortic Dissection. Circulation *130*, S45–S50. https://doi.org/10.1161/circulationaha.113.007117.
20. Huang, B., Chen, Z., Lu, H., Zhao, Z., Hui, R., Yang, Y., and Fan, X. (2019). Influence of Age on Clinical Presentation, Therapeutic Options, and Outcome in Chinese Patients

with Acute Aortic Dissection. Int. Heart J. *60*, 1373–1380. https://doi.org/10.1536/ihj.18-532.

21. Wu, S., Cao, C., Lun, Y., Jiang, H., Wang, S., He, Y., Sun, J., Li, X., He, Y., Huang, Y., et al. (2022). Age-related differences in acute aortic dissection. J. Vasc. Surg. *75*, 473–483.e4. https://doi.org/10.1016/j.jvs.2021.08.086.
22. Qin, Y.L., Wang, F., Li, T.X., Ding, W., Deng, G., Xie, B., and Teng, G.J. (2016). Endovascular Repair Compared With Medical Management of Patients With Uncomplicated Type B Acute Aortic Dissection. J. Am. Coll. Cardiol. *67*, 2835–2842. https://doi.org/10.1016/j.jacc.2016.03.578.
23. Hossack, M., Patel, S., Gambardella, I., Neequaye, S., Antoniou, G.A., and Torella, F. (2020). Endovascular vs. Medical Management for Uncomplicated Acute and Sub-acute Type B Aortic Dissection: A Meta-analysis. Eur. J. Vasc. Endovasc. Surg. *59*, 794–807. https://doi.org/10.1016/j.ejvs.2019.08.003.
24. Joint Committee for Guideline Revision (2019). 2018 Chinese Guidelines for Prevention and Treatment of Hypertension-A report of the Revision Committee of Chinese Guidelines for Prevention and Treatment of Hypertension. J. Geriatr. Cardiol. *16*, 182–241. https://doi.org/10.11909/j.issn.1671-5411.2019.03.014.
25. Lou, X., Chen, E.P., Duwayri, Y.M., Veeraswamy, R.K., Jordan, W.D., Jr., Zehner, C.A., and Leshnower, B.G. (2018). The Impact of Thoracic Endovascular Aortic Repair on Long-Term Survival in Type B Aortic Dissection. Ann. Thorac. Surg. *105*, 31–38. https://doi.org/10.1016/j.athoracsur.2017.06.016.
26. Fillinger, M.F., Greenberg, R.K., McKinsey, J.F., and Chaikof, E.L.; Society for Vascular Surgery Ad Hoc Committee on TEVAR Reporting Standards (2010). Reporting standards for thoracic endovascular aortic repair (TEVAR). J. Vasc. Surg. *52*, 1022–1033.e15. https://doi.org/10.1016/j.jvs.2010.07.008.
27. Lombardi, J.V., Hughes, G.C., Appoo, J.J., Bavaria, J.E., Beck, A.W., Cambria, R.P., Charlton-Ouw, K., Eslami, M.H., Kim, K.M., Leshnower, B.G., et al. (2020). Society for Vascular Surgery (SVS) and Society of Thoracic Surgeons (STS) reporting standards for type B aortic dissections. J. Vasc. Surg. *71*, 723–747. https://doi.org/10.1016/j.jvs.2019.11.013.

STAR★METHODS

KEY RESOURCES TABLE

REAGENT or RESOURCE	SOURCE	IDENTIFIER
Software and algorithms		
SPSS 25.0	IBM	https://www.ibm.com/analytics/spss-statistics-software

RESOURCE AVAILABILITY

Lead contact

Further information and requests for resources and reagents should be directed to and will be fulfilled by the lead contact, Xiao Qin (dr_qinxiao@163.com).

Materials availability

This study did not generate new unique reagents.

Data and code availability

- All data reported in this paper will be shared by the lead contact upon request.
- This paper does not report original code.
- Any additional information required to reanalyze the data reported in this paper is available from the lead contact upon request.

EXPERIMENTAL MODEL AND STUDY PARTICIPANT DETAILS

This study was approved by the Ethics Committee of the First Affiliated Hospital of Guangxi Medical University. Since this was a retrospective study, the informed consent requirement was waived. All participants are Asian. Demographic information including age and gender are provided in Table 1. The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

METHOD DETAILS

Study population

Between January 2008 and June 2022, a total of 974 patients were considered to suffer from TBAD by retrospectively searching the medical record system at our center, and 862 patients were finally confirmed by a CTA. Patients with intermural hematomas or penetrating aortic ulcers were excluded. Patients with TBAD retrograde to the ascending aorta and undergoing total aortic arch replacement were also excluded. The remaining 729 patients ultimately met the criteria for inclusion in our analysis. The patients were divided into the TEVAR and OMT groups, according to whether the patient received TEVAR or not. Complicated and uncomplicated TBAD patients were also studied.

Surgical approach and technique

After admission, all patients were given medication to maintain their heart rate at 60–80 beats/minute and systolic blood pressure at 100–130 mmHg. In the TEVAR group, preoperative CTA was performed to assess the condition of the aorta. The proximal anchoring zone of the stent graft depended on the distance of the primary entry tear from the left subclavian artery. If the distance between the primary entry tear and the left subclavian artery was greater than 2 cm, the proximal anchoring zone of the stent graft was located in the area distal to the left side of the left subclavian artery. If the distance between the primary entry tear and the left subclavian artery was less than 2 cm and if the left subclavian artery did not involve the left dominant vertebral artery, left upper extremity arteriovenous fistula, or left intramammary artery-coronary artery bypass grafting, we covered the origin of the left subclavian vessel. If the left subclavian artery involved the left dominant vertebral artery, left upper extremity arteriovenous fistula, or left intramammary artery-coronary artery bypass grafting, we reconstructed the left subclavian artery using the following surgical procedures, including bypass, chimney, or fenestration techniques. If the stent graft had to cover the origin of the left common carotid artery, we reconstructed the left common carotid vessel by endovascular or bypass approaches. Endovascular reconstruction was typically used in patients older than 60 years or for emergency surgery. Figure S2 shows the surgical approach.

Optimal medical treatment

The goal of OMT was to control systolic blood pressure at 100–130 mmHg and heart rate at 60–80 beats/min. Alpha- and beta-blockers, calcium channel blockers, angiotensin receptor blockers, angiotensin-converting enzyme inhibitors, and diuretics were selected according to guideline recommendations and the patient's condition. Combination drug therapy would be considered the preferred regimen.[2]

Follow up

Contact names, phone numbers, addresses, and other basic information were obtained from the electronic medical record system. Patients returned for CTA at regular intervals, and the interval between CTA examinations depended on the findings of the previous CTA examination. Telephone follow-up was used for patients who did not return regularly. All-cause death was adopted as the primary endpoint in this study.

Definitions

Primary technical success was defined as the successful introduction and deployment of stent grafts without open repair and the absence of type I and type III endoleaks.[26] Endoleaks were defined as the flow of contrast into the false lumen from a variety of routes during follow-up.[27] Migration was defined as stent-graft movement greater than 10 mm from the original landing area, or resulting in the development of symptoms or the need for re-intervention during follow-up. Abdominal aortic dissection dilatation was defined as the enlargement of the post-operative false lumen by more than 10 mm in the cross-section compared to the pre-operative false lumen. History of operation was defined as any surgery other than aortic surgery performed before the current admission. The size of the primary entry tear was the maximum width of the primary entry tear on the cross-sectional image of CTA. Additionally, this measurement was done axially. The number of tears was the number of intimal tears that were identifiable on CTA images. The vertical distance of aortic dissection was the distance in the vertical direction from the top of the dissection to the distal of the dissection. Additionally, the measurements were linear measurement over axial slices.

QUANTIFICATION AND STATISTICAL ANALYSIS

Continuous variables were presented as the mean and standard deviation or median/interquartile range and compared univariately using the t-test. Categorical variables were expressed as absolute and relative frequencies, and differences between the two groups were assessed using a chi-square test or Fisher exact test. The Kaplan-Meier method was used to calculate the overall survival for the two groups. The log rank test was used to compare the difference in overall survival between the two groups. Univariable analysis and multivariable Cox proportional hazard regression were adopted to estimate risk factors with a plausible relationship to the outcome. Variables with p values less than 0.2 in the univariable analysis would be subjected to multivariable analysis. For continuous variables, cut points were selected to divide the data into two groups, and the cut points are shown in Table S1. A p value less than 0.05 was considered statistically different. SPSS Statistics (version 25.0; IBM Cor., Armonk, NY, USA) was used for statistical analysis.