ORIGINAL RESEARCH

Effect of TEVAR Combined with Drugs and Drug Therapy Alone on the Efficacy and Safety of Stable Standford B Aortic Dissection

Yong Zhao, BM; Rongzhen Liang, MM; Anshan Liang, BM; Zengfan Wu, MM; Yuansheng Zhang, BM; Xuezheng Wu, BM; Guangquan Ge, BM

ABSTRACT

Objective • Stanford type B aortic dissection is a condition in which the intima of the aorta tears, and TEVAR is an interventional treatment to manage this dissection through intimal repair.To evaluate the medium-term clinical efficacy of endovascular repair (TEVAR) for Aortic dissection and drug Conservative management for Stanford B Aortic dissection aneurysms and further explore whether the former is superior to drug Conservative management in the medium-term efficacy.

Methods • The clinical data of 70 patients with stable Standford type B Aortic dissection admitted to our hospital from March 2016 to March 2020 were retrospectively analyzed. They were divided into the treatment group (n = 47) and the control group (n = 23). The control group patients were treated solely with medication, while the treatment group patients were treated with TEVAR on the basis of the control group patients. The treatment efficacy and safety of the two groups of patients were compared and analyzed. All patients will be followed up once a month for 12 months after discharge and every 2 months thereafter (for a total of 3 years).

Results • The findings highlight the need to carefully weigh the benefits and harms in the treatment of Stanford type B aortic dissection, especially when considering TEVAR surgery. Future research should focus on reducing postoperative complications to optimize treatment strategies and improve overall patient outcomes**.** TEVAR surgery significantly reduces hospital mortality, but is also associated with significantly increased postoperative complications, emphasizing the complexity of treatment decisions. This finding provides critical information about weighing the risks and survival benefits of surgery, helping medical teams and patients make informed treatment choices.The hospital mortality rate of patients in the treatment group was 12.77%, while the hospital mortality rate of patients in the control group was 21.74%. The difference between the two groups was statistically significant ($P < .05$). The incidence of postoperative complications in the treatment group was 23.40%, while the control group did not experience any major complications. The difference between the two groups was statistically significant ($P < .05$). The mortality rate of patients in the treatment group within 30 days of discharge was 0%, while the mortality rate of patients in the control group within 30 days of discharge was 11.11%. The difference between the two groups was statistically significant ($P < .05$). The Kaplan Meier curve showed that the survival rates at 3 years of the control and treatment groups were 56.52% and 95.12%, respectively. The log-rank test showed a statistical difference between the two groups. Univariate and multivariate regression analysis showed that postoperative neurological complications (HR = 32.41; $P = .00$) and preoperative Aortic valve regurgitation (HR = 3.91; $P = .00$) were risk factors for medium-term death.

Conclusion • The TEVAR combination drug is a safe and effective treatment for stable Stanford B Aortic dissection. It can reduce mortality. Compared with drug treatment, it has obvious advantages in medium-term treatment effects. Early rising for high-risk patients can make them have better long-term outcomes. Limitations of the study include its retrospective nature and the use of data from only a single medical center, which may limit the external generalizability of the results. (*Altern Ther Health Med.* [E-pub ahead of print.])

Yong Zhao, BM, Associate chief physician; Donghu Internal Medicine, the Second Affiliated Hospital of Hainan Medical University, Haikou, China. **Rongzhen Liang,** MM, Associate chief physician; Department of Geriatrics, the Second Affiliated Hospital of Hainan Medical University, Haikou, China. **Anshan Liang,** BM, Associate chief physician; Department of Cardiovascular Medicine, Wanning People's Hospital, Wanning, China. **Zengfan Wu,** MM, Associate chief physician; **Yuansheng Zhang,** BM, Associate chief physician; **Xuezheng Wu,** BM, Attending doctor; Department of Cardiovascular Medicine, the Second Affiliated Hospital of Hainan Medical University, Haikou, China. **Guangquan Ge,** BM, Associate chief physician; Department of Cardiovascular Surgery, the Second Affiliated Hospital of Hainan Medical University, Haikou, China.

Corresponding author: Anshan Liang, BM
E-mail: 1248218976@qq.com

INTRODUCTION

Aortic dissection (AD) is one of the clinical chest pain emergencies. Aortic dissection is a very serious cardiovascular emergency. The clinical symptoms are complex and diverse. Our study used data from the MIMIC-III database, a database containing a large amount of clinical information. It is difficult to diagnose and treat. It is easy to cause misdiagnosis and missed diagnosis. Its mortality rate is high, and the progress is extremely fast. If not treated in time, the mortality rate within 24 hours is 33%, the mortality rate within 48 hours is 50%, and the mortality rate within 7 days is as high as 75%.[1-3] Aortic dissection is a catastrophic disease, which can be divided into type A dissection and type B dissection according to the lesion location.[4] For type A dissection, the recognized treatment method is emergency open surgery, which involves aortic replacement, while the treatment plan for type B dissection is still under debate.[5] For those patients who have passed through

the acute phase of Conservative management, the continuous expansion of dissecting aneurysm often requires surgical treatment and artificial vessel replacement.[6] Although traditional thoracotomy techniques and therapeutic effects have greatly improved in recent years, there is still a high mortality rate and incidence of complications.

When considering treatments for aortic disease, we can divide them into traditional treatments and the newer TEVAR treatments. Traditional treatments typically involve open surgery, requiring large incisions directly into the chest or abdominal cavity to repair aortic lesions. This approach is suitable for various aortic diseases but involves a longer recovery period and a greater risk of complications. In contrast, TEVAR is an intimal repair technique that inserts a stent or patch into the aorta through a catheter, avoiding large incisions. It is suitable for conditions such as aortic aneurysm and aortic dissection, with less surgical trauma and faster recovery, but is not suitable for all cases. Therefore, the condition and patient characteristics need to be taken into consideration when selecting a treatment method.

The traditional Stanford type B dissection treatment methods are open chest surgery and medication. Stanford type B dissection refers to a type of aortic dissection, a disease in which blood in the aorta tears or separates between layers of the vessel wall. It usually refers to an aortic dissection in the The portion below the aortic arch, not the ascending segment of the aorta. This type of dissection does not usually require urgent surgical intervention but can be managed with medical therapy and close monitoring.Traditional surgery has high costs, significant trauma, a high perioperative mortality rate, and high incidence of complications. The mortality rate during hospitalization can reach 29.3%. Drug therapy aims to maintain arterial systolic blood pressure at a low level (100-120 mmHg) to prevent further tearing or rupture of the dissection.[7,8] However, the continuous perfusion of false lumens and the expansion of aneurysms often lead to poor long-term prognosis, low false lumen thrombosis rate, and a large proportion of patients treated with medication experience complications related to dissection, requiring further surgical intervention. A new treatment method has emerged in recent years: Thoracic Endovascular Aortic Repair (TEVAR).[9] Its emergence provides a new option for the treatment of Stanford type B dissection. It has the advantages of minimal trauma, a high technical success rate, a low mortality rate, a low complication rate, and fast recovery. In recent years, it has developed rapidly, and the rate of false lumen thrombosis after TEVAR surgery is very high, which can reduce the risk of re-surgical intervention.[10]

Therefore, the main goal of this study was to explore the effectiveness of specific treatments in improving patients' quality of life, with a specific focus on life satisfaction, social functioning, and psychological recovery. We expect this study to reveal the practical benefits of this treatment in patients with chronic schizophrenia and provide additional insights for improving the care of these patients.. The report is as follows.

Table 1. Comparison of clinical data in group 2 (n = 70)

Project	Treatment group (n = 47)	Control group (n = 23)	$t/\chi^2/Z$	*P* value
Age / year	42.3±9.8	43.7±7.8	3.18	.13
Male	33(47.14)	32(45.7)	0.23	.87
BMI/(kg/m^2)	20.7(19.1,23.3)	21.6(18.6,24.2)	0.18	.85
BSA/m^2	1.9(1.8,2.0)	1.9(1.7,2.0)	0.73	.46
Day of onset / d	42.0(24.0,159.0)	36.1(21.6,127.43)	2.22	.17
Medical history of hypertension	31(65.96)	16(69.57)	0.18	.68
History of diabetes	5(10.64)	2(8.69)	0.56	.34
History of smoking	10(21.28)	3(15.0)	0.18	.68
Family history of aortic dissection	26(55.32)	11(47.83)	2.71	.10
History of the aortic root surgery	17(36.17)	13(56.52)	1.12	.28
Aortic regurgitation			1.26	.31
None	25(55.31)	15(65.22)		
mild	10(21.28)	4(17.39)		
moderate	1(2.13)	0(0.0)		
serious	2(4.26)	0(0.0)		
Aortic root diameter / mm	35.7±10.6	33.3±6.0	0.54	.07
EF /%	61.0(57.0,64.0)	65.0(55.0,71.0)	1.24	.21

MATERIALS AND METHODS

Patient selection

In this study, patient recruitment began in March 2016 and ended in March 2020. Follow-up will continue until March 2023 to observe the long-term outcomes of the patients. We selected 70 patients diagnosed with stable Stanford Type B Aortic Dissection, who were admitted to our hospital from March 2016 to March 2020, as the subjects of our study. Inclusion criteria were as follows: (1) Patients met the diagnostic criteria for stable Stanford Type B Aortic Dissection, which was confirmed through Magnetic Resonance Angiography (MRA) or Computed Tomography Angiography (CTA); (2) Patients had received approval from our hospital's Ethics Committee, were informed about the study, and signed consent forms. Exclusion criteria: (1) Mental/psychiatric disorders; (2) Severe dysfunction of important organs such as lungs, liver, and kidneys, or severe diseases of the hematopoietic and immune systems; (3) Unable to cooperate or withdraw midway due to various reasons; (4) Pregnant or lactating women; (5) Before inclusion in the study, the lesion had involved Ascending aorta or Aortic arch dissection. 70 patients were divided into treatment groups and control groups according to different treatment methods. There were 47 cases in the treatment group and 23 cases in the control group. There was no statistically significant difference in clinical data between the two groups ($P > .05$), indicating comparability (Table 1).

Treatment methods

TEVAR is a complex treatment for aortic disease. Surgical procedures include patient selection and evaluation, anesthesia and monitoring, the establishment of arterial access, placement of guidewires and catheters, stent deployment, positioning and adjustment, completion and monitoring of surgery, and postoperative follow-up and recovery. The procedure requires a highly specialized medical team, including cardiovascular surgeons and interventional radiologists, to perform and requires precise guidance from real-time imaging technology. Follow-up and recovery after surgery are also critical factors in success. TEVAR is an interventional surgical procedure used to repair an intimal tear or dissection in the thoracic aorta. By guiding the

prosthetic catheter to the affected aorta, this approach effectively reduces the risk of further dilation. TEVAR is an important method for the treatment of Stanford type B aortic dissection.Overall, TEVAR is a promising treatment requiring precision, expertise, and comprehensive patient management.

Control group: the patients in this group were given simple drug treatment, and the patients with hypertension history were monitored immediately after admission. At the same time, they were given antihypertensive treatment, Sodium nitroprusside or diltiazem intravenous drip combined with oral calcium ion antagonist, angiotensin II receptor inhibitor, Diuretic, and oral β Receptor blockers for heart rate lowering therapy control blood pressure at 100-120 mmHg systolic and 60-70 mmHg diastolic, and heart rate at 60-80 beats per minute.

Treatment group: Patients in this group were treated in combination with TEVAR based on the control group. General anesthesia, lying flat, assisted by a ventilator, and monitored by digital subtraction angiography. The catheter was inserted through the left brachial artery, and the descending aortography was performed. The diameter of the Aortic arch, the dissecting aneurysm, and the location of the primary rupture were measured again. After comparison with the preoperative CTA, the covered stent with a diameter 10%~20% larger than the measured aorta was selected. The first femoral artery was introduced into the artery. A longitudinal incision was made in the groin area, and the Femoral artery was stripped free. A Femoral artery incision was performed, and a 5F catheter was placed. It was confirmed that the catheter was replaced with an ultra-hard guide wire after the true lumen. The stent-type artificial blood vessel pusher was introduced, and the proximal end of the peritoneal part of the stent was overlapped with the distal side of the opening of the left Subclavian artery. After the patient's systolic pressure dropped below 90mmHg, the covered stent was released and the introduction system was withdrawn. After the release, the Aortic arch and the posterior thoracic aorta were examined by angiography. The stent position, whether there was internal leakage, the blood supply of the affected branch, and whether the true and false lumens were widened were observed. After the examination, the guide wire and the aortic conveying sheath were withdrawn. The Femoral artery incision was sutured with 6-0 Prolene slip wire, and the puncture point was forced for 5 minutes and then pressure bandaged.

Follow up methods

After the patient is discharged, a follow-up card will be established and follow-up will be conducted through phone or outpatient services, with outpatient follow-up being the main focus. The follow-up program covers telephone calls and outpatient visits to monitor condition and treatment effects. Telephone follow-up visits will be conducted regularly, and the frequency of outpatient follow-up visits will be based on the patient's specific condition to ensure timely treatment and monitoring. This comprehensive follow-up strategy is designed to provide comprehensive care and timely intervention.The follow-up plan will include telephone follow-up and outpatient follow-up. Telephone follow-up visits will be conducted at 1, 3, and 6 months after surgery to check the patient's overall health, blood pressure control, and quality of life. Outpatient follow-up will be conducted at 3, 6, and 12 months after surgery, with more detailed physical examination and necessary imaging evaluation to monitor the progression of aortic lesions and the effect of treatment. These follow-up visits will help provide personalized treatment, ensuring that the patient's health and treatment outcomes are fully attended to. The follow-up includes imaging examinations, blood pressure control, quality of life, and complications. Interventions requiring reoperation generally refer to the development of device failure, recurrence of vasculopathy, postoperative infection, bleeding, thrombosis, or other procedure-related complications after treatment, requiring additional surgical procedures or interventions to resolve the problem. The specific criteria for these events can vary from study to study. Endpoint events during follow-up include death, intervention requiring reoperation, or interventional treatment during follow-up.

Statistical analysis

We collected all patient data from our hospital's medical records. Statistical analysis was performed using SPSS 21.0 software. Descriptive statistics were used to analyze continuous variables, expressed as ($\bar{x} \pm s$), with t tests for within and between-group comparisons. Analysis of variance (ANOVA) was used for multiple group comparisons of continuous variables. Chi-square tests were employed for categorical variables within and between groups.

Kaplan-Meier curves were generated to compare patient follow-up results between endovascular repair and drug therapy, illustrating survival probabilities over time. The Kaplan-Meier curve is a statistical graph used to describe event rates and survival analyses. It was chosen for research because of its ability to visually demonstrate the probability of a specific event (usually a survival event, such as patient death or disease recurrence) occurring over a certain period of time. This helps compare survival rates between different treatments or groups, revealing potential treatment effects. These curves are essential for visualizing event rates and conducting survival analyses in medical research, showing how the probability of an event (e.g., disease progression or patient death) changes over time.

RESULTS

In-hospital outcomes of patients

In the control group, 5 patients died in hospital, with a fatality rate of 21.74%. Considering the death caused by the rupture of the dissection, other patients were relieved of chest pain and other symptoms after Conservative management and discharged after the condition was stable. All patients in the treatment group received interventional treatment successfully. For those with insufficient proximal anchoring

Table 2. Classification and treatment of the endoleaks

Internal leakage classification	Case number	Dispose	Follow-up
I-form	1	CUFF was added intraoperatively	disappear
I-form	2	A PDA occluder was added during the operation	disappear
I-form	3	CUFF was added intraoperatively	disappear
I-form	4	CUFF was added intraoperatively	disappear
II-form	5	Intraoperative balloon dilation	disappear

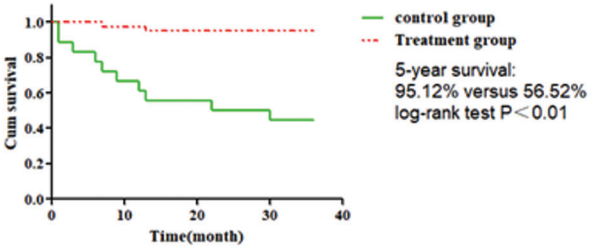
Table 3. Comparison of hospital outcomes between two groups of patients [n, (%)]

		Complication					
Group	Death	Right femoral arteriovenous fistula	Internal leakage	Fever	Stroke	Paraplegia	Total
Treatment group	6(12.77)	2(4.26)	5(10.64)	6(12.77)	0(0.00)	0(0.00)	11(23.40)
Control group	5(21.74)	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
χ^2	4.316						7.255
P value	.031						.027

Table 4. Comparison of 30 day follow-up between two groups of patients after discharge (n = 70)

Group	Time (Months)	Success [Cases(%)]	Death [Cases(%)]
Treatment group	21.4±1.6	62(98.41)	0(0.00)
Control group	21.7±1.4	53(96.36)	6(10.90)
t	0.278	0.823	5.416
P value	.805	.684	.021

Figure 1. Estimated 3-year Overall Cumulative Survival Rates for Two Groups.



area, 2 patients directly closed the opening of the left Subclavian artery, and 6 patients underwent chimneys without left upper limb ischemia and cerebral blood supply insufficiency. In the treatment group, 6 patients died in hospital, with a case fatality rate of 12.77%. Considering the death caused by the rupture of Aortic dissection, 3 patients died of aortic origin, and 2 patients suffered from multiple organ failure, The difference in hospital mortality between the two groups of patients was statistically significant ($P <$ .05). The incidence of postoperative complications in patients in the treatment group was 23.40%. After interventional treatment, 5 cases (10.64%) in the treatment group had recurrent imaging findings of proximal internal leakage. Among them, 2 cases showed disappearance of internal leakage after balloon dilation, and 3 cases had a small amount of internal leakage that was not treated (Table 2); 6 cases experienced short-term fever, which may be related to graft response; 2 cases developed right femoral arteriovenous fistula; The remaining patients recovered well after surgery, with no cases of paraplegia or stroke. The difference in the incidence of complications between the two groups of patients was statistically significant ($P <$ .05), as shown in Table 3. The difference in mortality between the treatment and control groups may reflect the effect of the treatment. If the mortality rate is lower in the treatment group, this may indicate that the treatment used has a positive impact on patient survival. This finding could have an important impact on medical decision-making, potentially prompting clinicians to be more inclined to adopt this treatment to improve patients' chances of survival. Therefore, the results of this study may help guide patients' treatment selection and improve treatment effects and survival rates, which has significant clinical significance in clinical practice.

Patient follow-up results after discharge

59 cases were discharged, 56 cases were followed up, with a follow-up rate of 94.91%. One case was lost due to a change in communication address. There was no death within 30 days in the treatment group, and 2 patients in the control group died within 30 days after discharge, including 1 case of rupture and bleeding of aneurysm of Aortic dissection and 1 case of rupture of dissection. The mortality within 30 days after discharge in the control group and the treatment group was 11.11% and 0% respectively (P = .021). See Table 4 for details. Rupture of Aortic dissection aneurysm is the main cause of death.

Key findings from the study demonstrated significant differences in mortality and event-free survival between treatment and control groups, which have important clinical implications. The treatment group showed better chances of survival and recovery, which may have a positive impact on clinical practice, encouraging medical professionals to be more inclined to adopt this treatment method and improve the recovery and survival status of patients. These results provide strong support for patient treatment options.

As of March 2023, the follow-up period for the control group patients was 1.2-35.6 months, with 3 deaths occurring at the 13th, 22nd, and 30th months. During the follow-up process, 4 cases underwent intraluminal repair surgery, and 1 case underwent thoracotomy surgery; During the follow-up period of 1.3-35.8 months, 2 patients in the treatment group died, respectively in the 7th and 13th months, and 1 patient died of myocardial infarction; A stent was implanted again in a dissecting aneurysm caused by a distal stent rupture in the 6th month. The surgical process was smooth, and the patient died 5 months after the reoperation. The remaining patients had a good quality of life.

The control group's 3-year event free survival rate was 56.52%, while the 3-year event free survival rate of the TEVAR group was 95.12%. The Kaplan Meier curve showed a statistical difference in survival rates between the two groups (log rank test $P <$ .01), as shown in Figure 1.

The 3-year exemption from re-surgical intervention rate in the drug treatment group was 83.33%, while the 5-year exemption from re-surgical intervention rate in the TEVAR group was 100%. The 3-year event-free survival rate refers to the patient not experiencing aortic dissection-related problems for the next 3 years after TEVAR treatment. This

Table 5. Univariate regression analysis affecting the interim death of surgically treated patients

Univariate regression analysis			Multi-factor regression analysis	
Variable	**HR(95%CI)**	***P* value**	**HR(95%CI)**	***P* value**
Age	1.0(0.9~1.1)	.96		
Male	0.9(0.3~3.5)	.94		
BMI	0.9(0.7~1.2)	.50		
BSA	0.9(0.0~28.4)	.99		
The onset of days	1.0(0.9~1.0)	.42		
Medical history of hypertension	0.9(0.18~4.2)	.86		
History of smoking	1.9(0.4~9.0)	.44		
Family history of aortic dissection	1.2(0.3~5.7)	.83		
History of the aortic root surgery	0.2(0.1~1.1)	.07	0.8(0.1~5.7)	.81
There was a preoperative aortic valve regurgitation	2.7(1.5~5.0)	.00	3.9(1.7~9.2)	.00
Preoperative aortic root diameter	1.1(1.0~1.1)	.27		
The length of the operation	0.9(0.7~1.2)	.51		
LOS	1.0(1.0~1.1)	.96		
Intraoperative blood transfusion	1.0(1.0~1.0)	.95		
Postoperative neurological complications	18.9(2.6~137.5)	.00	32.4(3.3~315.7)	.00
Postoperative arrhythmias	1.6(0.2~12.7)	.67		
Postoperative dialysis treatment	3.0(0.6~14.3)	.18	8.1(1.1~58.5)	.04
Postoperative lung injury	2.3(0.5~11.3)	.30		

Table 6. Imaging follow-up results

Group		Control group	Treatment group
n		12	37
Max. diameter of the thoracic aorta, mm, mean-SD	Baseline values	40.7±18.6	42.4±23.1
	end value	48.1±17.3	37.3±12.8
Increasing thoracic aorta diameter		58.33%(7/12)	5.41%(2/37)
The thoracic aorta diameter was unchanged or reduced		41.67%(5/12)	94.59%(35/37)
Max. diameter of the abdominal aorta, mm, mean-SD	Baseline values	28.5±17.4	27.3±14.7
	end value	31.8±15.9	32.7±12.7

shows the effectiveness of TEVAR in the long term, reducing the risk of adverse events, supporting its use as the preferred method of treatment for aortic dissection. The Kaplan Meier curve showed an overall difference between the two groups (log rank test $P < .01$), as shown in Figure 2.

Analysis of risk factors affecting mid-term mortality in patients undergoing surgical treatment

Identification of risk factors is critical as they are associated with patient outcomes. These factors, including advanced age, hypertension, smoking, and diabetes, have been associated with poor outcomes in aortic dissection in previous studies. Active management of these factors, such as controlling blood pressure, smoking cessation, managing diabetes, etc., can help mitigate their negative impact on patient outcomes.Single-factor regression analysis was carried out on the factors that may affect the patient's death. Four factors with $P < .20$ were included in the multi-factor analysis. It was found that postoperative neurological complications (HR = 32.41, 95% CI: 3.33~315.69, $P = .00$) and preoperative Aortic valve regurgitation (HR = 3.91, 95% CI: 1.66~9.24, $P = .00$) were the risk factors for the patient's death, Table 5.

Imaging follow-up

In the treatment group, a total of 37 patients received continuous imaging follow-up data. Among them, 6 patients had stable aortic diameter, while 29 patients had reduced aortic diameter. A total of 94.59% (35/37) of patients had no further aortic growth, while only 5.41% (2/37) of patients had sustained aortic diameter growth. The maximum diameter of the thoracic aorta in this group of cases decreased from the baseline value of 42.4±23.1 mm to 37.3±12.8 mm. In the control group, a total of 12 patients received continuous follow-up data. Among them, 2 patients had stable aortic diameter and 4 patients had reduced diameter, resulting in a total of 41.67% (5/12) patients with no sustained increase in aortic diameter, while 58.33% (7/12) patients had sustained increase in thoracic aortic diameter. The proportion of patients with increased thoracic aortic diameter in the control group was significantly higher than that in the TEVAR group ($P = .001$). The maximum diameter of the aorta in the control group increased from baseline value of 40.7±18.6 mm to 48.1±17.3 mm, with a statistically significant difference compared to the treatment group ($P = .002$). However, there was no significant difference in the changes in the maximum diameter of the abdominal aorta between the two groups ($P = .67$) (see Table 6). Discussion of the

Figure 2. Freedom from late surgical conversion survival estimates according to treatment group.

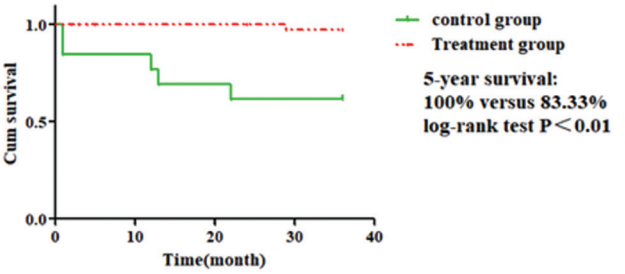


Figure 3. Maximum diameter change of the thoracic aorta

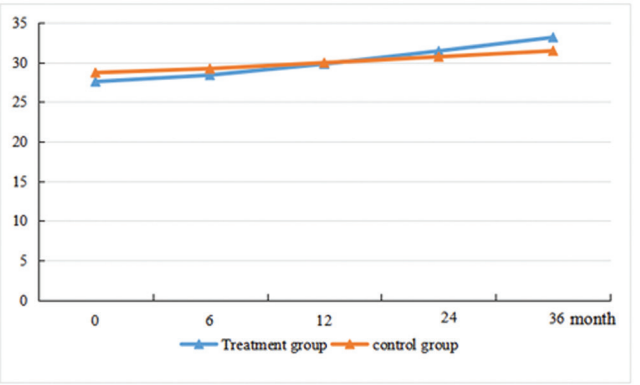
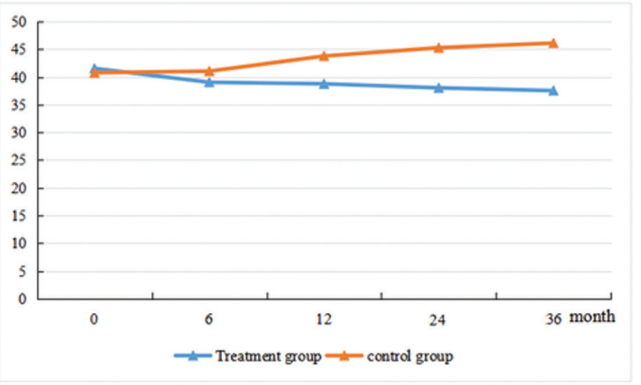


Figure 4. Maximum diameter change of the abdominal aorta.



clinical significance of aortic diameter reduction and its impact on patient health and treatment options needs to be considered. This finding may indicate progression of aortic dissection or the need for closer monitoring of the patient. In addition, it may have an impact on subsequent treatment strategies, such as whether further interventional surgery or drug therapy is neededDuring the follow-up period, the changes in the maximum diameter of the aorta at all levels were shown in Figures 3 and 4. Having learned about the results of our study, let us discuss these findings in depth and how they relate to our research goal.

DISCUSSION

Our findings have important clinical value in the current context of aortic dissection treatment. TEVAR demonstrated lower mortality and higher event-free survival in the treatment of stable Stanford type B aortic dissection, underscoring its effectiveness. What this means for clinical practice is that TEVAR is a preferred treatment option. Additionally, we identified risk factors associated with adverse outcomes, providing guidance for early intervention and patient care. These findings are expected to improve patients' survival and quality of life and promote future research on treatment strategies.

TEVAR as Preferred Treatment

Aortic dissection is a critical thoracic and cardiovascular surgery disease in which the aortic blood penetrates into the middle layer of the aortic wall through the break in the intima to form dissection and hematoma and tear the aorta into true and false chambers.[11] The diseases that cause aortic structural abnormalities mainly include Atherosclerosis, idiopathic degenerative diseases in the middle layer of aorta, Marfan syndrome, aortic inflammation, etc. In addition, trauma, pregnancy, and iatrogenic injury can lead to Aortic dissection. According to relevant reports, the incidence rate of Aortic dissection is 5/100000, and it is increasing year by year.[12] At present, the etiology of Aortic dissection is still unclear. Most people believe that it is the result of a combination of multiple factors, mainly including hemodynamics and the aortic wall's own structural abnormalities. In hemodynamics, hypertension and dissection are closely related. Some studies show that 70.1% of patients with Aortic dissection have hypertension, and 68.97% of patients in our study have hypertension.[1,13,14]

Previous treatments for Standford type B Aortic dissection include medication and surgical thoracotomy. Drug treatment aims to maintain the systolic pressure and left ventricular ejection velocity of patients at a low level, and reduce the incidence of Aortic dissection rupture and branch artery involvement.[15] As a new method for Aortic dissection, TEVAR has the advantages of less trauma, high technical success rate and good prognosis. Through randomized controlled studies, scholars have found that TEVAR can improve 5-year related survival rate and delay disease progression. When anatomy is appropriate, TEVAR treatment should be considered first to improve long-term efficacy.[3] The mortality rate within 30 days after discharge in the treatment group of our central hospital is 0%, which is lower than previous research reports. The surgical mortality rate reported abroad ranges from 0 to 16.0%, while the hospital mortality rate in our center is 12.77% (6/47).[16] The 3-year mortality rate is 3.39%, lower than the 10.9% reported in previous studies. The results of this study indicate that TEVAR surgery combined with medication can effectively prevent dissection rupture and reduce postoperative mortality. Imaging follow-up found that in the treatment group, 94.59% of patients did not continue to increase in the diameter of the thoracic aorta, while the maximum diameter of the thoracic aorta significantly decreased; In the control group, only 41.67% of patients stopped growing and the maximum diameter of the thoracic aorta significantly increased, with a statistically significant difference between the two. Univariate and multivariate COX regression analysis showed that postoperative neurological complications (HR = 32.41; P = .00) and preoperative Aortic valve regurgitation (HR = 3.91; P = .00) were risk factors for medium-term death.

At the same time, in our research results, compared with drug therapy, TEVAR combined with drug therapy can effectively avoid the occurrence of Aortic dissection, but we should see that many TEVAR related complications may affect the postoperative recovery and long-term treatment effects. In this study, patients in the treatment group experienced 6 cases of short-term fever, 5 cases of massive internal leakage, and 2 cases of right femoral arteriovenous fistula after surgery, all of which were related to surgical procedures and grafts. This suggests that the occurrence of complications after TEVAR surgery can affect the quality of life of patients. This issue cannot be ignored and requires further exploration and improvement.

Our findings are clinically important. Postoperative neurological complications are associated with higher mortality, necessitating more aggressive monitoring and management of neurological risks. In addition, preoperative aortic regurgitation is also associated with adverse outcomes, so aortic valve problems should be carefully evaluated and managed before surgery to reduce the risk of postoperative complications. This provides important guidance for improving patient treatment and surgical decision-making, helping to reduce the risk of complications and improve survival and quality of life.

When considering TEVAR as a treatment option, there are some important limitations and risks to consider. First, TEVAR is not suitable for all aortic disease conditions, and its application is limited by multiple factors, including the type and location of the lesion, aortic diameter, and the patient's overall health. In addition, TEVAR involves the use of stents or support devices, which may cause problems such as stent migration, blood leakage, or internal leakage. Regular monitoring and follow-up are required after surgery to ensure the effectiveness of the treatment. However, TEVAR also comes with the risk of complications, such as blood vessel or nerve damage, renal insufficiency, atrial fibrillation, infection,

etc. The long-term cost of treatment, both for patients and the healthcare system, is also a factor to consider. Therefore, when deciding whether to choose TEVAR treatment, patients and medical professionals should fully understand these limitations and risks and consider the potential benefits and risks. A personalized treatment plan and regular follow-up visits are critical to ensuring treatment success.

When choosing between TEVAR or conventional surgery, the type and location of the dissection, as well as the patient's health, need to be considered. TEVAR is generally indicated for type B aortic dissection, especially if it is close to the aortic arch. Compared with traditional surgery, TEVAR has the advantages of shorter recovery time, lower risk of complications, and local anesthesia. However, final treatment decisions need to be made based on individual circumstances and the advice of your physician.

Some common TEVAR complications, such as hemangioma or neurological problems, can have a negative impact on a patient's life. These complications may cause pain, impairment, or require additional medical intervention. Therefore, in treatment decisions, in addition to the severity of the condition and the risks of surgery, the patient's lifestyle and expectations for recovery need to be considered in order to more fully evaluate treatment options. This human perspective is critical to comprehensive patient care and treatment decisions.

Although this study provides useful information about TEVAR treatment of aortic dissection, it also has some limitations. First, the sample size of this study was relatively small, including only a limited number of patients. Therefore, future studies can expand the sample size to obtain more representative results. Secondly, this study is a single-center study and may have certain limitations. Multicenter studies can increase the external validity of research results. In addition, the follow-up period of this study was relatively short, and we were unable to evaluate the long-term effects of TEVAR treatment. Future studies could consider extending follow-up to assess long-term effects and complication rates. Finally, this study did not have a control group, so we cannot directly compare TEVAR with traditional treatments. Future studies may consider setting up a control group to evaluate the efficacy of TEVAR more comprehensively.

The results of this study provide important guidance for clinical practice. Physicians and health care providers should individualize the choice of TEVAR or drug therapy by considering the patient's risk factors and overall health. For patients with TEVAR, detailed information should be provided to help them understand the pros and cons of treatment options and play a key role in shared decision-making. This could help improve outcomes for patients with aortic dissection.

Future studies can further explore the long-term effects of TEVAR treatment, compare the efficacy of different treatment methods, and find better treatment strategies. In addition, more factors regarding patient selection and surgical technique can be studied to optimize the results of TEVAR treatment. In summary, TEVAR treatment of aortic dissection is a challenging and promising field, and future research will help to continuously improve and perfect this treatment method.

Risk Factors for Adverse Outcomes

This study provides important insights for clinical practice, highlighting the effectiveness and relative safety of TEVAR therapy in managing aortic dissection. This has important implications for doctors and healthcare providers because it increases options for treating aortic dissection. In addition, this study provides useful directions for future research, including more in-depth evaluation of long-term effects, multicenter studies, control group studies, and further optimization of patient selection criteria and surgical techniques. These efforts are expected to further enhance the effectiveness of TEVAR therapy, improve patient outcomes, and reduce the risk of complications. This will help optimize clinical practice, improve patients' quality of life and reduce the burden on the medical system.

Limitations

The limitations of our study, including the retrospective study design and single-center nature, are again highlighted. These factors may limit the generalizability of the results because they may be affected by selection bias. Additionally, because the data are from only one hospital, differences in geographic and demographic characteristics may cause the results to appear differently elsewhere. Future research could consider multicenter studies to more fully assess the effectiveness of treatments and better understand differences among different regions and populations.

Overall, this study provides insight into the effectiveness and potential risks of TEVAR in the treatment of aortic dissection. Key findings include that TEVAR shows clear advantages in patient survival and event-free survival compared with medical treatment, but there are certain risks in certain complications. This finding underscores the legitimacy of TEVAR as a treatment option, especially for some high-risk patients. In addition, this study also identified some risk factors, such as neurological complications and preoperative aortic regurgitation, which have important guiding significance for patient treatment and surgical decisions.

The significance of the study is to provide more objective information for the treatment of patients with aortic dissection and help doctors and patients make informed decisions. By identifying potential risk factors, patient risk assessment can be better performed, thereby improving the individualization and effectiveness of treatment options. Additionally, this study provides directions for future studies, including broader cohort studies, to validate these results and further explore treatment strategies for aortic dissection.

CONFLICT OF INTEREST

The authors have no potential conflicts of interest to report relevant to this article.

AUTHOR CONTRIBUTIONS

YZhao and AL designed the study and performed the experiments, RL and ZW collected the data, YZhang, XW and GG analyzed the data, YZhao and AL prepared the manuscript. All authors read and approved the final manuscript.

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REFERENCE

1. Nienaber CA, Kische S, Rousseau H, et al; INSTEAD-XL trial. Endovascular repair of type B aortic dissection: long-term results of the randomized investigation of stent grafts in aortic dissection trial. *Circ Cardiovasc Interv*. 2013;6(4):407-416. doi:10.1161/CIRCINTERVENTIONS.113.000463
2. Wang D, Abuduaini X, Huang X, et al. Development and validation of a risk prediction model for postoperative pneumonia in adult patients undergoing Stanford type A acute aortic dissection surgery: a case control study. *J Cardiothorac Surg*. 2022;17(1):22. doi:10.1186/s13019-022-01769-y
3. Nienaber CA, Kische S, Akin I, et al; Strategies for subacute/chronic type B aortic dissection: the Investigation Of Stent Grafts in Patients with type B Aortic Dissection (INSTEAD) trial 1-year outcome. *J Thorac Cardiov Sur*. 2010;140(6 Suppl):S101-S108, discussion S142- discussion S146. doi:10.1016/j.jtcvs.2010.07.026
4. Yang J, Ji D, Zhu YQ, et al. Hemoperfusion with HA380 in acute type A aortic dissection patients undergoing aortic arch operation (HPAO): a randomized, controlled, double-blind clinical trial. *Trials*. 2020;21(1):954. doi:10.1186/s13063-020-04858-2
5. Jin M, Cheng Y, Yang Y, Pan X, Lu J, Cheng W. Protection of xenon against postoperative oxygen impairment in adults undergoing Stanford Type-A acute aortic dissection surgery: study protocol for a prospective, randomized controlled clinical trial. *Medicine (Baltimore)*. 2017;96(34):e7857. doi:10.1097/MD.0000000000007857
6. Wei L, Meng Y, Zhang G, Qin H; Endovascular Repair of the Thoracic Aorta Combined with Drug Therapy in Acute Uncomplicated Type B Aortic Dissection. *Dis Markers*. 2022;2022(3021599. doi:10.1155/2022/3021599
7. Brunkwall J, Kasprzak P, Verhoeven E, et al; ADSORB Trialists. Endovascular repair of acute uncomplicated aortic type B dissection promotes aortic remodelling: 1 year results of the ADSORB trial. *Eur J Vasc Endovasc Surg*. 2014;48(3):285-291. doi:10.1016/j.ejvs.2014.05.012
8. Yang Y, Sun L, Liu N, Hou X, Wang H, Jia M; Effects of Noninvasive Positive-Pressure Ventilation with Different Interfaces in Patients with Hypoxemia after Surgery for Stanford Type A Aortic Dissection. *Med Sci Monitor*. 2015;21(2294-2304. doi:10.12659/MSM.893956
9. Teixido-Tura G, Forteza A, Rodríguez-Palomares J, et al. Losartan Versus Atenolol for Prevention of Aortic Dilation in Patients With Marfan Syndrome. *J Am Coll Cardiol*. 2018;72(14):1613-1618. doi:10.1016/j.jacc.2018.07.052
10. Chen J, Huang W, Luo S, Yang D, Xu Z, Luo J; Application of rapid artificial cardiac pacing in thoracic endovascular aortic repair in aged patients. *Clin Interv Aging*. 2014;9(73-78. doi:10.2147/CIA.S51410
11. Lin J, Qin Z, Liu X, et al. Retrograde inferior vena caval perfusion for total aortic arch replacement surgery: a randomized pilot study. *BMC Cardiovasc Disord*. 2021;21(1):193. doi:10.1186/s12872-021-02002-9
12. Nagai M, Makita S, Abiko A, Nakamura M. Factors related to long-term prognosis in medically treated type B aortic dissection: a physical predisposing factor. *Int Angiol*. 2012;31(5):427-432.
13. Kato N, Shimono T, Hirano T, et al. Midterm results of stent-graft repair of acute and chronic aortic dissection with descending tear: the complication-specific approach. *J Thorac Cardiovasc Surg*. 2002;124(2):306-312. doi:10.1067/mtc.2002.122302
14. Brunkwall J, Lammer J, Verhoeven E, Taylor P. ADSORB: a study on the efficacy of endovascular grafting in uncomplicated acute dissection of the descending aorta. *Eur J Vasc Endovasc Surg*. 2012;44(1):31-36. doi:10.1016/j.ejvs.2012.03.023
15. Nienaber CA, Fattori R, Lund G, et al. Nonsurgical reconstruction of thoracic aortic dissection by stent-graft placement. *N Engl J Med*. 1999;340(20):1539-1545. doi:10.1056/NEJM199905203402003
16. Eggebrecht H, Nienaber CA, Neuhäuser M, et al. Endovascular stent-graft placement in aortic dissection: a meta-analysis. *Eur Heart J*. 2006;27(4):489-498. doi:10.1093/eurheartj/ehi493