ORIGINAL RESEARCH

Efficacy of Weflow Embedded Branch Stents in the Treatment of Stanford Type B Dissection Involving Left Subclavian Artery

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ABSTRACT

Objective • Weflow embedded branch stent was used in the treatment of Stanford type B aortic dissection (TBAD) involving the left subclavian artery (LSA), and the effectiveness of the stent in the short and medium and term was observed.

Methods • The clinical data of 22 patients with TBAD involving LSA treated with Weflow embedded branch stent from the First Hospital of Hebei Medical University from December 2020 to October 2021were retrospectively analyzed. The changes in systolic blood pressure of the left upper limb at the onset and postoperative period, the patency rate of left subclavian artery stent at 1, 6, and 12 months after surgery, the change of true and false lumen diameters, and the occurrence of complications were evaluated.

Results • The patency rate of the left subclavian artery (LSA) branch stent was 100% at 1 month, 6 months, and 12 months after surgery. With the extension of postoperative time, the diameter of the aortic true lumen gradually increased. One month after surgery, the remodeling indexes of the aorta were improved, and with the extension of postoperative time, the diameter of the aortic false lumen decreased gradually. In the perioperative period, 1 case of vision, 1 case of insomnia, 1 case of retrograde type A dissection, 2 cases of type Ia endoleak, and no other new complications. During the follow-up, 2 patients with disappeared endoleak and 1 patient with retrograde dissection was in good condition after treatment.

Conclusions • 1. Weflow embedded branch stent has good safety and reliability in the treatment of TBAD; 2. When LSA is involved, it can effectively improve the blood pressure of the patient's left upper limb, and the patency rate of the branch stent is good within 1 year; 3. Weflow embedded branch stent has a good short-term effect in aortic remodeling, and the medium- and long-term effect needs to be evaluated; 4. Weflow embedded branch stent had no obvious complications during the 1-year follow-up. (*Altern Ther Health Med.* [E-pub ahead of print.])

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INTRODUCTION

Thoracic endovascular aortic repair (TEVAR) is now an important treatment for Stanford type B aortic dissection (TBAD).[1,2] The laminated stent requires approximal anchorage area of 1.5 cm to 2.0 cm when placed, and for the dissection where the breach is close to LSA or retrograde extension involves LSA, it may cover LSA when TEVAR is performed, increasing the risk of complications such as left upper limb ischemia and cerebral ischemia, and an increasing number of consensus shows that revascularization of LSA should be performed during TEVAR, and how to accurately and effectively retain LSA has become an urgent problem.[3-7] At present, composite surgery, elephant trunk stent fenestration, and parallel stent have been widely used in clinical practice, but all have obvious defects.

The branch stent not only avoids the shortcomings of high risk and trauma of compound surgery but also avoids the high risk of internal leakage of Ch-EVAR and reduces the possible risk of infection and internal leakage of F-EVAR. At present, there are more studies on aortic stents worldwide, and there are a wide variety of stents to choose from. Weflow embedded branch stent is independently developed, designed, and produced by our country. This study investigates the short-to-mild-term efficacy of Weflow-embedded branch stents in B-type dissections involving LSA.

MATERIALS AND METHODS

Study Subject

A total of 22 patients with thoracic aortic disease treated by Weflow embedded branch stent TEVAR from the First Hospital of Hebei Medical University from December 2020

to September 2021 were collected. The changes in systolic blood pressure of the left upper limb and the diameter of true and false lumen diameters at the level of each artery were observed through retrospective analysis. The follow-up period was 1 year after surgery and included survival, leakage rate, paraplegia, stent patency, surgery-related complications, and the number of repeat endoluminal repairs.

Inclusion Criteria: 1. Stanford type B aortic dissection diagnosed by clinical and CTA and need to reconstruct the blood supply of left subclavian artery vascular; 2. Selecting a suitable anchoring area for branch stent by the measurement of CTA or radiography; 3. The left common carotid artery (LCCA) was not involved; 4. All were treated for the first time; 5. With the suitable approach in the femoral artery, iliac artery, and brachial artery approach that can perform the endoluminal aortic treatment; 6. The patient is conscious, without mental illness and communication disorders; 7. Patients and their families were informed and consented.

Exclusion criteria: 1. Aortic dissection with total aortic arch involvement or no involvement of the superior arc artery; 2. There is no suitable approach to enter; 4. Combined with other life-threatening diseases; 3. Having a history of aortic surgery or endoluminal repair surgery; 5. Allergic to contrast agents, anesthetic drugs, stents, and the materials of the feeder; 6. Severe heart, liver, kidney, and lung dysfunction.

Preoperative Preparation

After admission, the patient was strictly bedridden, underwent intensive care, comprehensive ECG monitoring, oxygen inhalation, and used nitroprone, uradil, eslore, etc. to quickly control blood pressure and heart rate, blood pressure controlled at 90~110mmHg, heart rate controlled at 80~100 bpm. Patients with pain are given dezocine, pethidine hydrochloride, chlorpromazine, and promethazine analgesia and sedation as appropriate. All patients performed CTA examination before surgery to determine the location of the breach, the extent of the lesion, the proximal and distal diameter of the aorta, the position relationship with important branch vessels, and the diameter of LSA. Comprehensively evaluate the indications and contraindications for Weflow embedded branch stent therapy and complete the preoperative examination.

Surgical Methods

Measurements were performed by the patient's preoperative CTA to determine the suitability of the Weflow embedded branch stent. The patient will be given local or general anesthesia, depending on the situation. The patient was placed in a supine position, and the bilateral inguinal area and both upper limbs were routinely disinfected and draped. The bilateral groin was disinfected and draped, the right femoral artery was placed in an 8F vascular sheath, and two vascular sutras were preset. A puncture of the left brachial artery was inserted into the 6F catheter sheath. A gold-standard pigtail catheter was inserted through the right femoral artery approach to ascending aortogram and determining the location of the opening. It is transported through the left brachial artery accessing guide wire into the right femoral artery puncture sheath and sent into the MPA catheter so that the catheter penetrates the left brachial artery and the right femoral artery approaches, and the traction guide wire of the stent passed through. The body of the stent was placed along the superhard guide wire of the right femoral artery, the external sheath was gradually released, the angle was adjusted, and the traction guide wire was introduced into the left brachial artery through the catheter preset by MPA; Pulling the guide wire, changing the position of the stent to aligning the subclavian opening of the stent with the left subclavian artery. The delivery system successfully reached the predetermined area of the target lesion, the stent successfully released, the delivery system successfully retracted, the stent adhered well, and there was no displacement. A branch stent was placed through the right femoral artery, the branch stent was successfully released, and the radiography was performed again; there was no type I and III internal leakage, the branch stent had smooth blood flow, and there was no thrombosis. Visceral blood supply was normal, and there were no intraoperative complications. The stent was withdrawn, the catheter and sheath were removed, the blood vessel was sutured with a stapler, the puncture point was bandaged under pressure, and the operation was completed. Oral aspirin 100 mg daily after surgery as antiplatelet therapy. All patients are operated on by the same doctor.

Postoperative Follow-up

Strict blood pressure control and symptomatic supportive treatment continued after surgery. Aortic CTA will be reviewed about 1 month after surgery, followed by outpatient or inpatient review for 3, 6, and 12 months, and then will be followed up annually thereafter. Follow-up included LSA patency rate, blood pressure management, whether or not there was a difference in blood pressure in the upper extremities (blood pressure difference > 20 mmHg), whether or not there was symptomatic recurrence, whether or not there were organ or branch vascular ischemia symptoms, whether or not there was thrombosis in the stent, whether the stent was displaced or ruptured. Other complications included retrograde type A dissection, endoleak, stroke, paraplegia, etc.

Statistical Methods

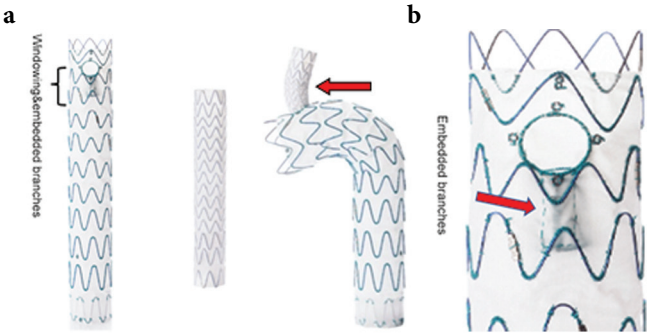
SPSS 21.0 statistical software is adopted. Continuous variables are expressed as $\bar{x} \pm s$, and the median and range represent those that do not conform to the normal distribution. Categorical variables are expressed as frequency and percentage. Repeated ANOVA was used to compare the maximum diameter of the true aortic lumen at the level of each sub-splanchnic artery at the preoperative and postoperative 1, 3, 6, and 12 months. $P < .05$ indicates that the difference is statistically significant.

Stand Design

The Weflow stent is a single embedded branch in the thoracic aortic stent consisting of a thoracic main-inline

stent system and a branched stent system (see Figure 1). Its multi-dimensional design better adapts to blood vessels with different anatomical morphologies, and the proximal oval window + embedded branch structure design. The embedded branch provides a sufficient anchoring area for the branch stent to avoid endoleak. The branch support is placed in the main support through the channel (red arrow). The dense wave at both ends of the stent has good adhesion, reducing the occurrence of type I and type III endoleaks; the spiral segment has good flexural flexibility, which can better conform to a variety of aortic arch morphology; the branch stent uses ePTFE membrane, the surface of the membrane is smooth, which ensures the long-term patency of the left subclavian artery and has good biocompatibility. (Figure 1)

Figure 1. Structure of stent



Release Process of Stent

The body of the stent was placed along the superhard guide wire of the right femoral artery, the external sheath was gradually released, the angle was adjusted, and the traction guide wire was introduced into the left brachial artery through the catheter preset by MPA; Pulling the guide wire, adjusting the position of the stent to aligning the subclavian opening of the stent with the left subclavian artery. A branch stent was placed through the right femoral artery, the branch stent was successfully released, and the radiography was performed again.

Ethics

This study was a retrospective study and was reviewed and approved by the hospital's medical ethics committee in December 2020, with ethics number 247. All patients signed informed consent forms.

RESULTS

General Situation

There were 22 patients, 17 males and 5 females, aged 32-78 (57±12) years old. 19 cases (86.4%) of hypertension, 16 cases (72.7%) of long-term smoking history, smoking index: 250-1000, 3 cases of diabetes (13.6%), 2 cases of coronary heart disease (9.1%), 81.8% (18 cases) of The onset of the disease was acute, and most of them presented as sudden tear-like pain in the chest and back accompanied by profuse sweating. The course of the disease lasted for more than 1 week in 18.2% (4 cases). The superior mesenteric artery was involved in 2 patients, presenting symptoms such as persistent abdominal pain and abdominal distension, and 1 patient suffered from trauma-induced compression fracture in the thoracic vertebra. See Table 1 for details.

Intraoperative and Postoperative Conditions

The success rate of surgery is 100%, the success rate of stent placement is 100%, the dissection breach is well covered, and there is no internal leakage during the intraoperative radiography. The operation time is 105~220 min, the average is 155.0±29.9 min, the usage amount of contrast agent is 200~400 ml, and the average is 200~300ml.

Figure 2. a. Introduction of feeding system; b. Open window positioning; c. Film coated proximal bundle diameter release; d. Quick release of bracket; e. Release from proximal trailing end; f. The Feeding system is retracted, and the embedded guide wire is detached from the feeder outside the body; g. Introduction of feeding system; h. Branch stent release and reconstruction of LSA

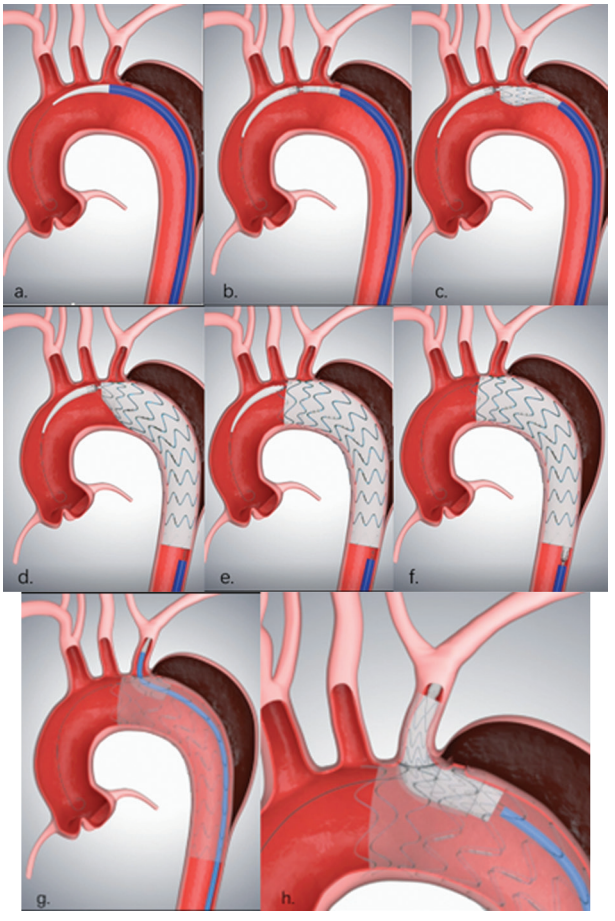


Table 1. General Situation of Patients

Age	57.0±12.0	
Smoker	16	72.7%
Hypertension	19	86.4%
Hyperlipidemia	5	22.7%
Coronary heart disease	2	9.1%
BNP elevation	3	13.6%
Elevated creatinine	2	9.1%
Diabetes	3	13.6%
Chronic obstructive pulmonary disease	1	4.5%
Time from onset to surgery	3.5 (1.3-7.5)	

Table 2. Comparison of stent diameter before and after operation

Time	2cm above the opening of the left subclavian artery (mm)	*P* value	Vertebral artery opening (mm)	*P* value
Before surgery	10.2±2.0		4.8±0.9	
1 month after surgery	10.3±1.8	.999	4.5±1.0	.206
6 months after surgery	10.6±2.4	.999	4.4±0.9	.188
12 months after surgery	11.0±2.0	.457	4.5±1.0	.914

Table 3. Comparison of blood pressure of left upper limb before and after operation(mmHg)

	Hypertension of the left upper limb	Hypertension of the Right upper limb	*P* value
Before surgery	82±15	150±21	.01
After surgery	128±10	127±12	.79
P value	.01		

Table 4. True Lumen Diameter of Aorta at Different Levels (mm)

Time	Horizontal true lumen diameter of abdominal trunk artery	*P* value	True lumen straight at the level of superior mesenteric artery	*P* value	Horizontal true lumen diameter of renal artery	*P* Value	Horizontal true lumen diameter of abdominal aorta	*P* value
Before surgery	17.0±6.3		17.2±5.7		17.5 (11.1~19.0)		16.5 (11.5~18.1)	
1 month after surgery	18.8±5.9	.170	18.0±5.6	.260	17.9 (11.8~18.9)	.815	16.8 (9.3~18.3)	.381
6 months after surgery	20.7±5.3	.001	19.1±4.6	.006	18.2 (13.9~19.3	.017	17.1 (9.9~19.0)	.448
12 months after surgery	20.9±5.2	.001	19.7±4.6	.001	18.5 (14.2~19.5)	.012	17.1 (10.4~19.0)	.027

Table 5. Aortic False Lumen Diameter at Different Levels (mm)

Time	Horizontal false lumen of abdominal trunk artery	*P* value	Horizontal false lumen diameter of superior mesenteric artery	*P* value	Horizontal false lumen diameter of renal artery	*P* value	Horizontal false lumen diameter of abdominal aorta	*P* value
Before surgery	9.650 (0.000~11.500)		6.950 (0.000~9.600)		2.500 (0.000~7.950)		2.500 (0.000~8.725)	
1 month after surgery	5.450 (0.000~12.000)	.350	3.900 (0.000~10.725)	.861	0.000 (0.000~9.025)	.559	0.000 (0.000~9.775)	.999
6 months after surgery	0.000 (0.000~8.650)	.001	0.000 (0.000~7.150)	.017	0.000 (0.000~6.775)	.321	0.000 (0.000~7.525	.999
12 months after surgery	0.000 (0.000~11.880)	.010	0.000 (0.000~6.300)	.005	0.000 (0.000~6.875	.321	0.000 (0.000~6.550)	.999

The postoperative ICU time is 0~4 days, with an average of 1~2 days. On the first day after surgery, two patients with superior mesenteric artery involvement had significant improvement in abdominal pain and abdominal distention and successfully vented and defecated. On the third day after surgery, one patient had sudden chest and back pain; after symptomatic treatment, the patient was considered for reverse tearing, and after reviewing CTA, it was suggested that the reverse tearing was Stanford type A dissection, and then transferred to the Department of Cardiac and Macrovascular Surgery for specialist treatment, and was discharged after recovery.

Postoperative Follow-up

The follow-up data of the patients were obtained through telephone and outpatient follow-up, and the follow-up time ended in October 2022, and none of the 22 patients lost to follow-up. Regular follow-up records were obtained at 1 month, 6 months, and 1 year after surgery. During the follow-up period, all patients had good stent morphology, 100% patency rate of left subclavian branch stents, smooth blood flow, good closure of the opening, no displacement of the stents, disappearance of internal leakage in 2 cases, and 100% thrombosis rate in the false lumen.

Stent Patency

The patency rate of LSA branch stent at 1 month, 6 months, and 12 months after surgery was 100%. (See Table 2)

Changes in Systolic Blood Pressure of Left Upper Limb before (At the Time of Onset) and after Surgery

Among patients with LSA, 18 (81.8%) had systolic blood pressure in the left upper limb significantly lower than systolic blood pressure in the right upper limb and much lower than normal systolic blood pressure. There was no significant difference in systolic blood pressure in both upper limbs in all patients after surgery.

Changes in the Maximum Diameter of True Lumen at the Level of Each Visceral Artery

(1) At the level of the celiac trunk artery, there were statistical differences in 6 months after surgery, 12 months after surgery, and preoperative; that is, the true lumen at the level of the postoperative celiac trunk artery has increased; (2) There were statistical differences in the level of the superior mesenteric artery at 6 months after surgery,12 months after surgery compared with preoperative comparison, that is, the true lumen at the level of the superior mesenteric artery has increased after surgery; (3) At the level of the renal artery, there were statistical differences in 6 months after surgery, 12 months after surgery and preoperative, that is, the true lumen at the level of the renal artery has increased after surgery; (4) At the level of the abdominal aorta, 12 months after surgery compared with the preoperative period, there was a statistical difference, that is, the true lumen at the level of the abdominal aorta has increased after surgery. (See Table 4)

Changes in the Maximum Diameter of the Horizontal False Lumen of Each Splanchnic Artery

(1) At the level of the celiac trunk artery, there were statistical differences in 6 months after surgery,12 months after surgery, and preoperative; that is, the false lumen at the level of the postoperative celiac trunk artery has decreased; (2) There were statistical differences at the level of the superior mesenteric artery, 6 months after surgery and 12 months after surgery compared with preoperative, that is, the false lumen at the level of the superior mesenteric artery has decreased after surgery; (3) There was no statistical difference at the level of the renal artery and below, that is, the level of the renal artery, false lumen and the below has not significantly decreased after surgery. (See Table 5) 22 patients had total thrombosis in their false lumens, of which 8 patients were completely thrombosed and 14 patients were partially thrombosed.

DISCUSSION

Significance of Reconstruction of LSA

In recent years, due to the development and improvement of endoluminal minimally invasive surgery and the continuous improvement and innovation of technology, artificial endoluminal stents have gradually been widely used in the treatment of aortic dissection. Compared with open surgery, its advantages, such as small injury, fast recovery speed, and few surgical complications, have been widely used in clinical practice in the past 20 years, and its short-to-mild-term efficacy has also been widely recognized. There was a debate in the literature about whether or not to rebuild LSA. In a foreign study of 131 patients, it was pointed out that covered LSA did not affect the incidence of ischemia of the arm and spinal cord, stroke, and death and that reconstructed LSA did not have significant benefits but increased the operation time and may even increase the risk of complications such as internal leakage and retro type a dissection.[8] In recent years, a growing amount of research has suggested that LSA revascularization may be more favorable for overall prognostic outcomes. That prophylactic LSA revascularization may better preserve normal perfusion through important branches, thereby reducing the risk of potential complications.[6,9-11] There is growing evidence to support that LSA revascularization is the most appropriate approach. Prophylactic LSA revascularization should be considered in patients at risk of neurologic complications.[12] A meta-analysis by Karaolanis et al.[13] showed that for patients covered by LSA, the stroke rate in patients undergoing left subclavian artery revascularization was 2.8% (95% CI, 1.69% to 4.14%). However, the incidence of stroke in patients without LSA revascularization was 11.8%. To further reduce the incidence of surgical complications, the reconstruction of LSA has become the consensus of many experts and scholars. To this end, in order to cross the "forbidden zone" of traditional TEVAR surgery, various strategies such as composite surgical technique, Ch-EVAR (parallel stent technology), F-EVAR and branch stent have emerged to reconstruct upra-arch branch arteries such as LSA. Each has its strengths and weaknesses. However, at present, no matter what sorts of auxiliary surgical technology cannot perfectly solve the problem of reconstruction of upra-arch branch arteries such as LSA, the surgeon should be familiar with the advantages and disadvantages of each surgical technology and in clinical application, it is necessary to combine the patient's specific anatomical characteristics, the advantages of each auxiliary surgical technology, economic factors, and the operator's experience and expertise to develop a reasonable surgical plan.

Carotid-subclavian bypass is an effective surgical technology. The incidence of bypass-related complications was low: Reoperation rate 2.8% (peri-incision hematoma 2.1%, chyloleak 0.7%); Persistent nerve injury (2.1%); Vertebral artery occlusion (6%); The road patency rate was 99.5%, 98.9% and 98.0% in 1 year, 2 years and 5 years respectively.[14,15] This surgical technology involves related surgical operations. It is necessary to accurately master the patient's neck anatomy and fine operation, which puts forward higher requirements for the surgeon. With the Ch-EVAR, there is a high risk of endoleaks during endovascular procedures using the Ch-EVAR due to the anatomy of the aortic arch and the location of the breach, such as the breach being very close to the origin of the upra-arch branch arteries or between upra-arch branches. The distance between them is too short. The Ch-EVAR has achieved high technical success rates and acceptable mortality in high-risk and emergency patients, but long-term follow-up is required when applying this technique to routine low- and intermediate-risk patients.[16] The advantage of the in vitro pre-fenestration technique is that it can make full use of existing commercial stents and improve the design at any time according to the needs of different diseases. The size of the fenestration position is more accurate and controllable than in-situ fenestration, and the cost is lower. In an in vitro pre-fenestration study by Kuo et al.[17], 32 patients underwent surgical treatment, and the success rate was 93.75%. Demonstrated the feasibility of using stent-graft fenestration to preserve LSA blood flow in TEVAR, and its technical feasibility and short-term results justified the use of this approach in emergency situations. However, the in vitro pre-fenestration technique also has limitations. It only applies to dissections and aneurysms where the LSA opening is not dilated in the arterial lumen. When the main body stent is semi-released in vitro for fenestration, it is easy to cause damage to the delivery system and the distortion of the stent itself and marking materials, which increases the difficulty of positioning and release and increases the risk of graft infection. Moreover, due to the curvature of the aortic arch, it is difficult to align the window with the opening aiming at the branch arteries of the aortic arch, and the risk is greater. At the same time, the preoperative precise measurement, on-table window opening, and intraoperative accurate positioning and release of this technology all require experienced doctors to perform, and the learning curve is long. In-situ fenestration techniques have developed surgical methods such as needle, laser, and radiofrequency puncture. However, its technical success rate, intraoperative safety, and long-term stent-graft stability still need further study.[18,19] Inoue et al.[20] designed a uni-branch stent graft to treat aortic lesions involving LSA. However, the incidence of complications is relatively high, including endoleak, cerebral infarction, and puncture site complications. Although other data from this group reported the feasibility of this branch stent grafting for aortic lesions involving LSA, a high rate of type I endoleak was found in aortic dissection, up to 29%. As technology and materials have evolved, more branched stent grafts with specialized designs have emerged to solve challenging cases involving the ascending aorta and aortic arch. The single-branch stent graft is designed in one piece, which is more in line with the anatomical characteristics of the aortic arch, reducing the risk of endoleak and potential stent migration.[21]

To date, the Castor stent remains the only branching stent in China that can be used for the aortic arch.[3] A multi-center prospective study showed that 73 patients treated with Castor stents had a 97% technical success rate, 4 intraoperative leakage with an endoleak rate of 5%, and 1 death during hospitalization, with no major complications. The median follow-up was 61 months, with mortality of 5% at 1 year and mortality of 7% at 6 years. Six occlusions were found in the branched portion of the stent graft, with a follow-up patency rate of 93%. In China, a study of 122 patients showed that the patency rate of left subclavian artery (LSA) branch stent at 2 weeks, 3 months, 6 months, and 1 year after surgery was 100%, 100%, 99.18%, and 97.54%, respectively. The aortic remodeling index improved 2 weeks after surgery, and the improvement of the aortic remodeling indicator gradually increased with the extension of the postoperative time. In the meta-analysis of Yao Shihua et al.[22], the technical success rate was 97.5%, the intraoperative leakage rate was 0.1%, and the intraoperative LSA stent deformation and stenosis rate was 0.15% among 415 patients with Castor stents. The leakage rate of early type I was 1.6%; The mortality rate at 30 days was 0.96%; The rate of early reintervention was 0.9%; The 1-year survival rate was 99.7%; The patency of half-year LSA was 99.3%, the patency of 1-year LSA was 97.58%, and the patency of 2-year LSA was 95.23%. Castor single-branch stents for type B aortic dissection endovascular repair may be technically relatively easy to handle, safe, and effective, but at present, the variety of domestic branch stents is relatively single, and there is a gap in large-scale application, with the further improvement of stent grafts, more centers need to be controlled and studied, and long-term follow-up should keep going.

There is a clear difference between the Weflow single-embedded branch stent and the Castor single-branch stent. Castor stents' branch stents are sutured to the self-expanding nitinol body without proximal or distal bare stents. The Weflow stent is a split stent with the embedded branch facing the distal end of the main stent. In terms of morphological structure, Castor may be more in line with human anatomy. In this study, 2 patients developed gastrointestinal symptoms such as abdominal pain and slight abdominal distention, and CTA showed that the dissection involved the superior mesenteric artery, considering the possibility of mesenteric ischemia, and the symptoms disappeared after surgery. Acute aortic dissection causing mesenteric ischemia is uncommon but severe. It can rapidly progress to multi-organ failure, and surgical treatment should be performed as soon as possible to restore intestinal blood flow to avoid intestinal necrosis[23]. One patient had reverse tear type A aortic dissection (RTAD); during the operation, the patient's stent release was good, the operation was successful, and when the patient was routinely given antihypertensive drugs during the perioperative period, there was an unexplained fluctuation of blood pressure up to 145/100mmHg. The use of proximal bare stents has been suggested that the incidence of RTAD will be increased, but there have also been reported that the use of bare stents is largely unrelated to the incidence of RTAD.[24-27] Therefore, the reason for the reverse tear is not apparent.

This study is a single-center retrospective study with a small sample size, and a larger multicenter sample study is needed to validate the observations. Follow-up was short, measurement data at multiple time nodes were lacking, and aortic remodeling was not assessed over time. TEVAR has been widely used in the clinic for many years, requiring us to face and deal with an increasing number of stent-related complications. Research on the prognosis and remodeling of the aorta after stenting will better guide current clinical practice and avoid the incidence of controllable complications and risks. It is believed that, with the advancement of equipment and materials, the single branch will be developed into a double branch or even a three-branch stent in the future, and the economic cost will be reduced.

CONCLUSION

Weflow embedded branch stent has good safety and reliability in the treatment of TBAD; When LSA is involved, it can effectively improve the blood pressure of the patient's left upper limb, and the patency rate of the branch stent is good within 1 year.

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