

# The effect of aortic esophageal fistula treatment after TEVAR with artificial vessel bypass(Single center clinical experience)

Tiansheng Tang<sup>1</sup>, Taoyuan Wang<sup>2</sup>, Zhiwei Ding<sup>2</sup>, Changjuan Wu<sup>2</sup>, Kaitao Jian<sup>2</sup>, and Jianshi Liu<sup>2</sup>

<sup>1</sup>Tianjin Medical University

<sup>2</sup>Affiliation not available

September 25, 2021

## Abstract

**Objective:** To investigate the effect of aortic esophageal fistula treatment after thoracic aortic endovascular repair (TEVAR) with artificial vessel bypass. **Methods:** The clinical data of 6 consecutive patients who received surgical treatment at Shanghai Deda Hospital from September 2019 to June 2021 due to aortic esophageal fistula after TEVAR were retrospectively analyzed. There were 6 males, aged (47.7±8.2) years old (range: 35-56 years old). All patients had recurrent fever, and 4 patients had positive blood cultures. According to the specific conditions of the patients, all patients underwent artificial blood vessel bypass and jejunostomy under general anesthesia without extracorporeal circulation. One case underwent artificially infected vascular segment resection and esophageal repair at the same time. 5 cases underwent artificial infection vascular resection, 4 of them underwent esophageal repair, and 1 case had a large intraoperative fistula and local resection of the esophagus. Sensitive antibacterial drugs were continued after the operation for 6 to 8 weeks. **Results:** There were 2 deaths in hospital, 1 case of large cerebral infarction early postoperatively, and 1 case of septic shock. The remaining 4 patients recovered well after the operation and were discharged. The follow-up period was 2 to 23 months. During the follow-up period, the remaining patients had no recurrence of infection and esophageal fistula. **Conclusion :**In patients with aortic esophageal fistula after TEVAR, the establishment of artificial vascular bypass, the resection of the infected vascular segment, contemporaneous or staged esophageal repair, regular anti-infective treatment can obtain a good prognosis.

## 1.Introduction

Thoracic aortic endovascular repair (TEVAR), as a minimally invasive treatment for aortic diseases, has been used more and more clinically, but problems such as stent leakage, re-intervention and infection are still very serious. According to literature reports, the incidence of AEF (aortic esophageal fistula) after TEVAR is 1.9%, but the condition is dangerous and complicated, and the mortality rate is high<sup>[1]</sup>. For AEF after TEVAR, most scholars believe that open surgery is the root treatment of AEF<sup>[2-5]</sup>. Aortic replacement combined with esophagectomy and debridement at the same time or by stages is an effective treatment, but complications such as hemorrhage and sepsis may occur<sup>[6-8]</sup>. However, the specific surgical methods, aortic reconstruction methods, and esophagus resection or repair are still inconclusive. The Department of Cardiovascular Surgery of DeltaHealth Hospital uses ascending aorta-abdominal aorta bypass, ascending aorta-brachiocephalic bypass, removal of infected vessels with stents, and repair or resection of esophageal fistulas at the same time or in stages. Achieve better clinical efficacy, the single-center experience is now reported as follows.

## 2. Clinical information

### 2.1 General information

The clinical data of 6 consecutive patients who received surgical treatment at Shanghai Deda Hospital from September 2019 to June 2021 due to stent infection after TEVAR were retrospectively analyzed (Table 1). There were 6 males, aged ( $47.7\pm 8.2$ ) years old (range: 35-56 years old). TEVAR was performed in 2 cases due to descending aortic aneurysm and 4 cases due to Stanford B aortic dissection. Three patients exceeded the abdominal aorta below the diaphragm level during TEVAR. Two patients underwent the “chimney” technique to implant the stent in the left subclavian artery during TEVAR operation.

All patients had symptoms of recurrent fever. There were 4 cases of positive blood culture before the second operation, including 1 case of *Staphylococcus epidermidis*, 1 case of *Staphylococcus aureus*, 1 case of *Pseudomonas aeruginosa*, 1 case of *Stenotrophomonas maltophilia*; 2 cases of second time before operation. The blood culture was negative. Before the operation, the patient was diagnosed with esophageal fistula through multi-slice spiral CT angiography (Figure-1a), gastroscopy (Figure-1b), and upper gastrointestinal angiography (Figure-1c).

## 2.2 Surgical method

According to the patient’s condition, 1 case was planned for the contemporaneous operation, and 5 cases for the staged operation plan (Table 2). details as follows:

In the first stage, a series of extra-anatomical bypass operations were performed. Choose Vascutek 16\*30mm straight blood vessel intervacular 20mm “Y” type artificial blood vessel end-to-side anastomosis, a small branch of “Y” type artificial blood vessel end-to-side anastomosis with the main vessel, self-made three branches and abdominal aortic bypass vessel (Figure-2a) . The ascending aorta was grafted to the innominate artery, left common carotid artery, left subclavian artery, and abdominal aorta bypass through a combined thoraco-abdominal incision (Figure-2b). After all these bypass operations, the proximal aortic arch (between the innominate artery and the left common carotid artery) is disconnected. The stumps on both sides of the aortic arch were sutured continuously. After the thoracic incision is closed, a jejunostomy is performed to provide enteral nutrition.

After 2 to 4 weeks, the second stage of surgery will be performed. In 4 patients, the infected TEVAR stent was removed through the left thoracic incision (Figure 3-a) and the ruptured esophagus was repaired (Figure 3-b). One patient had a large esophageal fistula and was difficult to repair. Partial esophagus resection was performed.

## 2.3 Postoperative treatment

According to the results of bacterial susceptibility culture, regular antibacterial drugs were given for 6 to 8 weeks after the operation. Postoperative combined support by jejunostomy and intravenous nutrition, observe the patient’s infection control, no fever, no abnormalities in blood routine and C-reactive protein, chest tube drainage fluid properties are normal, blood culture is negative, re-examination of chest CT shows no obvious abnormalities. After encapsulated empyema and other conditions, the antibacterial treatment was gradually stopped, the upper gastrointestinal angiography and oral methylene blue were re-examined, it was clear that the esophagoesophageal fistula had healed, and the liquid diet gradually became excessive and normal diet.

## 2.4 Treatment results

There were 2 hospitalized deaths in the whole group, and 1 case had a large area of cerebral infarction after one-stage operation. In one case, the esophageal fistula was large during the second-stage operation and could not be repaired. Part of the esophagus was removed and septic shock occurred after the operation. The remaining 4 patients recovered well after the operation and were discharged. During the follow-up period, all the surviving patients had returned to normal living conditions without recurrence of infection and esophageal fistula. CT angiography of the whole aorta showed no obvious abnormalities in the morphology and blood flow of the bypass graft, and no obvious lesions in the aortic stump (Figure 4).

## 3. Discussion

Thoracic aortic endovascular repair (TEVAR) is increasingly used for thoracic aortic aneurysms and aortic dissections. This is mainly due to the less invasiveness of this procedure compared with aortic graft replacement. Aortic esophageal fistula (AEF) is a relatively rare but life-threatening disease [9], and some cases of AEF are caused by complications after TEVAR surgery [10, 11]. A voluntary national survey conducted in Italian universities and hospital centers showed that 19 of 1113 patients (1.7%) who received TEVAR treatment between 1998 and 2008 developed AEF or main bronchial fistula during follow-up [10]. A European multi-center study showed [12] that the total number of cases of TEVAR surgery was 2387, and 36 (1.5%) had AEF during the follow-up period.

Several potential causes of AEF after TEVAR have been reported [1, 13, 14]. First of all, the self-expanding force of the stent graft may cause direct erosion of the aorta, resulting in pressure necrosis of the esophageal wall. Second, the stent graft blocks the proper esophageal artery, resulting in avascular necrosis of the esophageal wall. Finally, the stent graft may also be infected, leading to infectious erosion of the esophageal wall. Regardless of the cause, the result is very serious, potentially fatal, and must be resolved with the highest possible curative effect.

Regarding the timing of surgery, we believe that if the diagnosis of AEF after TEVAR is clear, the control of sepsis should be given priority. Among the 6 patients in this group, 5 patients were relatively stable and had no signs of hemorrhage and progressively worsening septic shock due to fistula of adjacent organs. Sensitive antibacterial drugs were given priority, followed by elective surgical treatment. One patient with repeated gastrointestinal bleeding underwent emergency endovascular surgery to control the bleeding, and underwent surgical treatment within a limited time.

Many treatments have been used for AEF after TEVAR, mainly conservative and surgical treatments [15, 16]. Akashi et al. [17] reported that conservative treatment often has fatal consequences, and conservative treatment is not recommended. Uno et al. [18] found that another TEVAR operation or combined esophageal stent implantation can isolate the aortic blood flow and achieve the goal of controlling bleeding to treat AEF. However, after deployment of the internal graft, some patients are at risk of uncontrollable mediastinal infection and death. Most scholars believe that open surgery is the root treatment of AEF [2-5]. Aortic replacement combined with esophagectomy and debridement at the same time or in stages is an effective treatment, but complications such as hemorrhage and sepsis may occur [6-8].

A European multicenter study showed [12] that 36 patients with AEF after TEVAR were clinically confirmed. According to different treatment methods, patients were divided into 4 groups. The 1-year mortality rate of the conservative treatment group reached 100%, which is consistent with the results of other studies [19, 20]. The second group of patients only received esophageal stent treatment, and the survival rate after 1 year was 17%. In the third group, patients underwent esophagectomy without aortic replacement, and the 1-year survival rate was 43%. The fourth group underwent both esophagectomy and aortic replacement surgery and implanted stents. The 1-year survival rate of patients in this group was slightly higher, at 46%. However, in other published studies, when a radical surgical protocol is used, the 1-year survival rate has been shown to exceed 50% [21, 22]. A multi-center study in Japan has shown [8] that 39 clinically identified patients with AEF after TEVAR, through different treatment options, have also confirmed that esophagectomy combined with aortic replacement can provide a long-term treatment strategy for patients with AEF after TEVAR. , Has a higher survival rate.

At present, patients with AEF after TEVAR are mainly used for cardiopulmonary bypass or even hypothermic circulatory arrest to remove the diseased tissue and perform in-situ aortic reconstruction surgery. This method is more traumatic to patients, and most patients suffer from long-term infections, poor general conditions and poor coagulation function, and relatively severe problems such as intraoperative bleeding. At the same time, in situ reconstruction of the aorta also has a higher possibility of infection recurrence. [23, 24] Related reports used aortic bypass and removal of artificial stents to successfully treat patients with AEF after TEVAR. For this reason, according to the patient's condition, we adopt contemporaneous and staged surgical methods. First, the ascending aorta is transplanted to the innominate artery, left common carotid artery, left subclavian artery, and abdominal aorta bypass to reconstruct the aortic vascular channel. After that, both ends of the

infected aorta are sealed and severed, which is convenient for exposure, does not require the assistance of cardiopulmonary bypass, has less bleeding, and is easy to control. The aorta was dissected at 1 to 2 cm distal to the arterial stent, without considering the reconstruction of intercostal vessels, and no patients had spinal cord ischemia or paraplegia after the operation. This operation does not require the assistance of cardiopulmonary bypass, and it is more beneficial for high-risk patients, especially those with involvement of the branches of the arch (needing hypothermic circulatory arrest).

After the operation, it is very important to give regular antimicrobial treatment according to the results of drug sensitivity culture. The treatment cycle is generally 4-6 weeks, which is mainly determined according to the patient's infection control status. No fever, no abnormal blood routine and C-reactive protein indicators, chest tube drainage fluid had normal traits, negative blood culture, and no obvious abnormal encapsulated empyema on chest CT, so the antibacterial treatment was gradually stopped. We believe that ascending aorta-abdominal aortic artificial blood vessel bypass grafting combined with the removal of infected vessels and stents, and local exclusion and drainage for the treatment of stent infections after TEVAR can achieve better clinical results; the timing of surgery and The treatment cycle of antibacterial drugs in the later period needs to be determined according to the specific conditions of the patient. In summary, raising awareness and individualized diagnosis and treatment measures are the key to improving the survival rate of AEF after TEVAR.

#### CONFLICT OF INTERESTS

The authors declare that there are no conflict of interests.

#### ETHICS STATEMENT

This Clinical retrospective study was approved by the ethical commission of DeltaHealth Hospital, Shanghai, People's Republic of China.

Written consent was obtained from all patients.

#### References

1. Eggebrecht H, Mehta RH, Dechene A, Tsagakis K, Kuehl H, Huptas S, et al. **Aortoesophageal Fistula After Thoracic Aortic Stent-Graft Placement A Rare but Catastrophic Complication of a Novel Emerging Technique** . *Jacc-Cardiovascular Interventions* 2009; 2(6):570-576.
2. Sattah AP, Secrist MH, Sarin S. **Complications and Perioperative Management of Patients Undergoing Thoracic Endovascular Aortic Repair** . *Journal of Intensive Care Medicine* 2018; 33(7):394-406.
3. Jeon YJ, Kim HK, Kim WS, Cho JH, Sung K. **Repair of aortoesophageal fistula with homograft aortic replacement and primary esophageal closure** . *The Journal of thoracic and cardiovascular surgery* 2020.
4. Li S, Gao F, Hu H-o, Shi J, Zhang J. **Risk Factors for Mortality in Patients with Aortoesophageal Fistula Related to Aortic Lesions** . *Gastroenterology Research and Practice* 2020; 2020.
5. Sugiyama K, Iwahashi T, Koizumi N, Nishibe T, Fujiyoshi T, Ogino H. **Surgical treatment for secondary aortoesophageal fistula** . *Journal of Cardiothoracic Surgery* 2020; 15(1).
6. Yamazato T, Nakamura T, Abe N, Yokawa K, Ikeno Y, Koda Y, et al. **Surgical strategy for the treatment of aortoesophageal fistula** . *Journal of Thoracic and Cardiovascular Surgery* 2018; 155(1):32-40.
7. Al Rstum Z, Tanaka A, Safi HJ, Estrera AL. **Extra-anatomical ascending-thoraco-abdominal bypass for aortic fistula after thoracic endovascular aortic repair** . *European Journal of Cardio-Thoracic Surgery* 2019; 56(6):1199-1201.

8. Watanabe M, Sato M, Fukuchi M, Kato H, Matsubara H. **Treatment of aorto-esophageal fistula developed after thoracic endovascular aortic repair: a questionnaire survey study** . *Esophagus* 2020; 17(1):81-86.
9. McNamara JJ, Pressler VM. **Natural history of arteriosclerotic thoracic aortic aneurysms** . *The Annals of thoracic surgery* 1978; 26(5):468-473.
10. Isasti G, Gomez-Doblas JJ, Olalla E. **Aorto-esophageal fistula: an uncommon complication after stent-graft repair of an aortic thoracic aneurysm** . *Interactive cardiovascular and thoracic surgery* 2009; 9(4):683-684.
11. Chiesa R, Melissano G, Marone EM, Marrocco-Trischitta MM, Kahlberg A. **Aorto-oesophageal and Aortobronchial Fistulae Following Thoracic Endovascular Aortic Repair: A National Survey** . *European Journal of Vascular and Endovascular Surgery* 2010; 39(3):273-279.
12. Czerny M, Eggebrecht H, Sodeck G, Weigang E, Livi U, Verzini F, et al. **New insights regarding the incidence, presentation and treatment options of aorto-oesophageal fistulation after thoracic endovascular aortic repair: the European Registry of Endovascular Aortic Repair Complications** . *European Journal of Cardio-Thoracic Surgery* 2014; 45(3):452-457.
13. Hance KA, Hsu J, Eskew T, Hermreck AS. **Secondary aorto-esophageal fistula after endoluminal exclusion because of thoracic aortic transection** . *Journal of Vascular Surgery* 2003; 37(4):886-888.
14. Rawala MS, Badami V, Rizvi SB, Nanjundappa A. **Aorto-esophageal Fistula: A Fatal Complication of Thoracic Endovascular Aortic Stent-Graft Placement** . *The American journal of case reports* 2018; 19:1258-1261.
15. Kahlberg A, Grandi A, Loschi D, Vermassen F, Moreels N, Chakfe N, et al. **A systematic review of infected descending thoracic aortic grafts and endografts** . *Journal of Vascular Surgery* 2019; 69(6):1941-+.
16. Chen C, Kim JW, Shin JH, Kwon Y, Kim J, Lee IJ. **Management of life-threatening aorto-esophageal fistula: experiences learned from eight patients** . *Acta Radiologica* 2021; 62(4):447-452.
17. Akashi H, Kawamoto S, Saiki Y, Sakamoto T, Sawa Y, Tsukube T, et al. **Therapeutic strategy for treating aorto-esophageal fistulas** . *General thoracic and cardiovascular surgery* 2014; 62(10):573-580.
18. Uno K, Koike T, Takahashi S, Komazawa D, Shimosegawa T. **Management of aorto-esophageal fistula secondary after thoracic endovascular aortic repair: a review of literature** . *Clinical journal of gastroenterology* 2017; 10(5):393-402.
19. Canaud L, Ozdemir BA, Bee WW, Bahia S, Holt P, Thompson M. **Thoracic endovascular aortic repair in management of aorto-esophageal fistulas** . *Journal of Vascular Surgery* 2014; 59(1):248-254.
20. Luehr M, Eitz CD, Nozdrzykowski M, Garbade J, Lehmkuhl L, Schmidt A, et al. **Emergency open surgery for aorto-oesophageal and aorto-bronchial fistulae after thoracic endovascular aortic repair: a single-centre experience** . *European Journal of Cardio-Thoracic Surgery* 2015; 47(2):374-383.
21. Okita Y, Yamanaka K, Okada K, Matsumori M, Inoue T, Fukase K, et al. **Strategies for the treatment of aorto-oesophageal fistula** . *European Journal of Cardio-Thoracic Surgery* 2014; 46(5):894-900.
22. Kawamoto S, Sato M, Motoyoshi N, Kumagai K, Adachi O, Saito T, et al. **Outcomes of a staged surgical treatment strategy for aorto-esophageal fistula** . *General thoracic and cardiovascular surgery* 2015; 63(3):147-152.
23. Cheng L, Zhu J, Liu X, Liu W, Hu H, Zhang J, et al. **A Successful Three-Stage Surgical Treatment for Aorto-esophageal Fistula After Thoracic Endovascular Aortic Repair and Esophageal Stent Repair** . *Annals of Thoracic Surgery* 2016; 102(6):E503-E505.

24. Ochoa Chara CI, Zafar MA, Velasquez C, Saeyeldin A, Elefteriades JA. **Complex two-stage open surgical repair of an aorto-esophageal fistula after thoracic endovascular aortic repair** . *Journal of vascular surgery cases and innovative techniques* 2019; 5(3):261-263.

#### Hosted file

Table.docx available at <https://authorea.com/users/435974/articles/538633-the-effect-of-aortic-esophageal-fistula-treatment-after-tevar-with-artificial-vessel-bypass-single-center-clinical-experience>

#### Hosted file

Figure.docx available at <https://authorea.com/users/435974/articles/538633-the-effect-of-aortic-esophageal-fistula-treatment-after-tevar-with-artificial-vessel-bypass-single-center-clinical-experience>