Acute management of aortobronchial and aortoesophageal fistulas using thoracic endovascular aortic repair

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Background: **Aortobronchial fistula (ABF) and aortoesophageal fistula (AEF) are rare but lethal if untreated; open thoracic surgery is associated with high operative mortality and morbidity. In this case series, we sought to investigate outcomes of thoracic endovascular aortic repair (TEVAR) for emergency cases of ABF and AEF.**

Methods: **We retrospectively reviewed all patients with AEF and ABF undergoing TEVAR in three European teaching hospitals between 2000 and January 2009. Eleven patients were identified including 6 patients with ABF, 4 patients with AEF, and 1 patient with a combined ABF and AEF. In-hospital outcomes and follow-up after TEVAR were evaluated.**

Results: **Median age was 63 years (interquartile range, 31); 8 were male. Ten patients presented with hemoptysis or hematemesis; 4 developed hemorrhagic shock. All patients underwent immediate TEVAR, and 3 AEF patients required additional esophageal surgery. Five patients died (45%), including 3 patients with AEF, 1 patient with ABF, and 1 patient with a combined ABF and AEF, after a median duration of 22 days (interquartile range, 51 days). The patient with AEF that survived had received early esophageal reconstruction. Causes of death were: sepsis (n = 2), acute respiratory distress syndrome (ARDS) (n = 1), thoracic infections (n = 1), and aortic rupture (n = 1). Median follow-up of surviving patients was 45 months (interquartile range, 45 months). Six additional vascular interventions were performed in 3 survivors.**

Conclusion: **TEVAR does prevent immediate exsanguination in patients admitted with AEF and ABF, but after initial deployment of the endograft and control of the hemodynamic status, most patients, in particular those with AEF, are at risk for infectious complications. Early esophageal repair after TEVAR appears to improve the survival in case of AEF. Therefore, TEVAR may serve as a bridge to surgery in emergency cases of AEF with subsequent definitive open operative repair of the esophageal defect as soon as possible. In patients with ABF, additional open surgery may not be necessary after the endovascular procedure. (J Vasc Surg 2009;50:999-1005.)**

Fistulas between the thoracic aorta and the esophagus or lungs are rare. Aortobronchial fistula (ABF) and aortoesophageal fistula (AEF) usually arise in thoracic aortic disease such as aneurysms or after previous thoracic aortic surgery.[1-5] ABF has been reported in patients with pulmonary diseases like tuberculosis and intrapulmonary Aspergillus abscess, or after bronchial stenting or previous lobectomy.[6-8] AEF has been associated with esophageal carcinoma, ingestion of foreign bodies, and even iatrogenic esophageal perforation or Barrett's esophagus.[9-12] Both ABF and AEF often present with acute hemoptysis or hematemesis. Due to the excessive bleeding, ABF and AEF are lethal if untreated, although open thoracic aortic repair of ABF and AEF is associated with high mortality and morbidity in this critically-ill population.[1-5,13] Thoracic endovascular aortic repair (TEVAR) has shown to be an effective method for treatment of thoracic aortic disease.[14-16] TEVAR is less invasive than open thoracic aortic surgery and is associated with decreased operative duration. Since the introduction of TEVAR, several cases of successful endovascular management of ABF and AEF have been reported.[6,7,9-11,17] However, it is unclear if these promising reports were exceptional cases. Furthermore, several reported cases were performed in subacute settings instead of emergencies, and long-term outcomes are often missing. If patients with ABF or AEF are treated with TEVAR alone, the esophageal or bronchial defect is not repaired. Lung tissue and the esophagus are non-sterile cavities in which risks of graft infections after endovascular treatment for fistulas are likely to be permanently increased, which is crucial when considering long-term outcomes. In this series, we evaluated the in-hospital and follow-up outcomes of emergency cases of ABF and AEF treated with TEVAR, to assess the applicability of endovascular therapy for these rare entities.

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METHODS

We retrospectively reviewed all patients with AEF and ABF undergoing TEVAR in Policlinico San Donato IRCCS, Milan, Italy, the University Medical Center Utre-

Table I. Characteristics of 11 patients undergoing TEVAR for ABF and AEF

Gender/age	*Fistula type*	*Medical history*	*Fistula cause*	*Symptoms*	*Shock/infection*
1. M/46	ABF	Bentall procedure + CABG in 2001, aortic arch replacement in 2002	Previous aortic surgery	HMP, TP, DP, F	N/Y
2. F/63	ABF	Bentall procedure in 1996, aortic graft for TAA in 2003	Previous aortic surgery	HMP, TP	Y/N
3. M/30	ABF	Repair of aortic coarctation in 1977	TAA (64 mm)	HMP, DP	N/N
4. M/60	ABF	Aortic graft for type A aortic dissection in 2003, aortic graft for TAA + PTCA + CVA in 2004	Previous aortic surgery	HMP, TP	N/N
5. M/77	ABF	COPD, CAD, CRI, HT	Ruptured TAA	HMP, TP, DP	N/N
6. M/68	ABF	Type B dissection in 1985, aortic graft for TAA in March 2008, aortic graft infection in August 2008	Aortic graft infection*	HMP	N/Y
7. M/65	AEF	TEVAR for TAA in 2007, HT	Previous TEVAR	TP	N/N
8. F/40	AEF	Aortic graft for type A aortic dissection in 2007, 2x open repair of AEF in 2007	Previous aortic surgery	HMT	Y/N
9. F/71	AEF	COPD, HT	Ruptured TAA (65 mm)	HMT, TP, DP	Y/N
10. M/31	AEF		Ingestion chicken bone	HMT, TP, dysphagia	Y/N
11. M/75	ABF + AEF	TEVAR for TAA 3 months ago, COPD, CRI, HT	Previous TEVAR	HMP, HMT, TP, DP	N/N

ABF, Aortobronchial fistula; *AEF,* aortoesophageal fistula; *TP,* thoracic pain; *HMP,* hemoptysis; *HMT,* hematemesis; *DP,* dyspnea; *F,* fever; *COPD,* chronic obstructive pulmonary disease; *CAD,* coronary artery disease; *CRI,* chronic renal insufficiency; *HT,* hypertension; *TAA,* thoracic aortic aneurysm; *TEVAR,* thoracic endovascular aortic repair; *CABG,* aorto-coronary bypass graft; *PTCA,* percutaneous coronary angioplasty; *CVA,* cardiovascular accident.
*This patient was admitted with an infected Dacron prosthesis of the thoracic aorta that was treated by intravenous antibiotic therapy 2 months prior to the development of acute hemoptysis.

cht, and the St Antonius Hospital, Nieuwegein, both located in The Netherlands. Approval of the human ethics committee was obtained in all institutions. Between the year 2000 and January 2009, 11 cases treated with TEVAR were identified, including 6 patients with ABF, 4 patients with AEF, and 1 patient with a combined ABF and AEF.

Median age of patients was 63 years (range, 30 to 77 years; interquartile range 31 years); 8 were male (73%). Causes of fistula were: previous open thoracic aortic surgery with implantation of Dacron prosthesis (n = 4), thoracic aortic aneurysm (TAA) (n = 3), previous TEVAR (n = 2), ingestion of a chicken bone (n = 1), and infection of a Dacron graft of the thoracic aorta since 2 months, which was treated by intravenous antibiotic therapy (n = 1). All patients showed an acute presentation of symptoms. Ten patients suffered from progressive hemoptysis and/or hematemesis; 4 patients developed hemorrhagic shock due to excessive bleeding. Hemorrhagic shock was present in 3 out of 4 patients with AEF. The Classification of Hemorrhage from the American College of Surgeons[18] was used to assess if patients were in hemorrhagic shock on admission. Patients with blood loss ≥1500 mL, a pulse rate ≥120 beats/minute, respiratory rate ≥30 breaths/minute, and a decreased blood pressure were classified as admitted in hemorrhagic shock (hemorrhage class III or class IV). If these admission data were not available retrospectively, patients were only classified as "admitted in shock" if the physician had reported this explicitly. All patients that suffered from hemorrhagic shock received vasopressors to increase the blood pressure. In 3 other patients, bacteremia was diagnosed by blood cultures. One of these patients suffered from an infected Dacron prosthesis of the thoracic aorta, which was treated with ceftriaxon 2 g/day. After 2 months, the patient developed massive hemoptysis and bronchoscopy revealed ABF, which was treated by TEVAR. The other patient was admitted with acute hemoptysis, thoracic pain, dyspnea, and fever. Computed tomography angiography (CTA) scan diagnosed ABF, which was treated with TEVAR. Blood cultures turned out positive and the patient received Augmentin (GlaxoSmithKline, Brentwood, Middlesex, UK) 4dd1200 mg during 3 months. In both patients, there was no evidence of septic shock when TEVAR was offered and no vasopressors were needed. Cause and presentation of the fistula for the 11 patients are depicted in Table I.

Ten fistulas were diagnosed using CTA scan; diagnosis was made using bronchoscopy in 1 patient with ABF. TEVAR was preferred over open thoracic aortic surgery at these institutions because of emergency. Operations were performed under general anesthesia. The endovascular device was inserted through the common femoral artery in all cases; the angiographic catheter was positioned into the thoracic aorta via a guidewire from the right brachial artery in 3 patients. Patients were treated with the following endografts: Gore TAG (W.L. Gore & Associates, Flagstaff, Ariz) (n = 4), Medtronic Talent (Medtronic Vascular, Santa Rosa, Calif) (n = 3), Medtronic Valiant (n = 3) and Gore Thoracic Excluder (n = 1). Details regarding diameter, total length, and number of endografts used during the initial endovascular procedure are depicted in Table II. All patients received perioperative antibiotics intravenously. Surviving patients received oral antibiotics after discharge; duration of antibiotic therapy ranged from 4 weeks to 3 months.

Table II. Characteristics of the initial endovascular procedure and additional therapy

Vascular access	*Graft details*	*Number of grafts*	*PLZ/coverage left SCA*	*Additional thoracic surgery*	*Additional antibiotic therapy*
1. CFA + BA	Excluder, 34 × 200	1	2/Y	—	Augmentin 4dd1200 mg, 3 months
2. CFA	TAG, 28 × 150	1	4/N	—	Amoxicillin 3dd500 mg, 10 weeks
3. CFA + BA	Talent, 32 × 150	2	2/Y	—	Augmentin 3dd 625 mg, until death
4. CFA	Talent, 38 × 100	1	2/Y	—	Cefuroxim 2dd 500 mg, 3 months
5. CFA	TAG, 37 × 200	1	3/N	—	Not applicable
6. CFA	Valiant, 36 × 110	1	2/Y	—	Ceftriaxon 2 g/d IV*
7. CFA + BA	Valiant, 42 × 150	1	3/N	Esophageal exclusion, drainage aneurysm sac, and mediastinum after 17 days	Metronidazole/cefuroxim, 4 weeks
8. CFA	Valiant, 30 × 150	1	3/N	—	Not applicable
9. CFA	TAG, 27 × 150	1	4/N	Esophageal exclusion after 18 days	Not applicable
10. CFA	TAG, 28 × 100	1	2/Y	Neck exploration after 1 day, esophagectomy and gastric tube after 4 days	Augmentin 3dd 625 mg, 3 months
11. CFA	Talent, 42 × 110	1	2/Y	—	Not applicable

Graft details describe the mean diameter of the endograft in mm and the total length of the endograft(s) in mm. All patients received perioperative intravenous antibiotics (IV); surviving patients were prescribed oral antibiotics. *PLZ,* Proximal landing zone; *left SCA,* left subclavian artery; *CFA,* common femoral artery; *BA,* brachial artery.

*This patient already received antibiotic therapy prior to thoracic endovascular aneurysm repair (TEVAR) because of infected Dacron prosthesis of the thoracic aorta.

The following outcomes were investigated: successful exclusion of the fistula during initial TEVAR, complications, additional open surgery, vascular re-interventions, mortality, hospital length of stay, and long-term follow-up. Mortality after TEVAR was compared between ABF and AEF using the Fisher's exact test; the survival after TEVAR was demonstrated using Kaplan Meier life table analysis (SPSS version 15.0, SPSS Inc, Chicago, Ill).

RESULTS

Complete exclusion of the fistula was successfully achieved during initial TEVAR in 9 patients (82%). In the remaining 2 patients, a second endograft was successfully placed in 1 patient after 2 days because of considerable type 1 endoleak, and the last patient died after 2 days due to aortic rupture, which was probably caused by endoleak type 1. The left subclavian artery was covered during the endovascular procedures in 6 patients (54%). Median hospital length of stay was 15 days (range, 2 days to 89 days; interquartile range, 15 days).

Additional thoracic surgery. Additional open thoracic surgery was performed in 3 patients with AEF. A 31-year-old male (patient 10) suffered from AEF after ingestion of a chicken bone 8 days earlier. He required neck exploration 1 day after TEVAR to evacuate a large amount of blood and a clot that had caused respiratory insufficiency. A few days later, abdominal esophagectomy with gastric tube reconstruction was performed. Another patient, a 71-year-old female in whom the AEF was caused by a ruptured TAA, received bipolar esophageal exclusion including cervical esophagostomy and jejunostomy 18 days after TEVAR (patient 9). The last patient who received additional open surgery was a 65-year-old male in whom AEF was caused by previous TEVAR (patient 7). He had undergone successful TEVAR for AEF, but 1 week after discharge he was readmitted with mediastinitis, which was treated by drainage of the mediastinum and aneurysm sac, followed by esophageal exclusion and jejunostomy.

Mortality. Four patients died during hospitalization and 1 patient died shortly after discharge (45%). Median time interval until death was 22 days (range, 2 to 89 days; interquartile range, 51 days). The Fig depicts the survival after TEVAR for ABF and AEF; no patients died during the initial endovascular procedure. Two out of 4 patients who were admitted with hypovolemic shock eventually expired after 7 and 89 days due to infectious complications (patients 8 and 9). Death occurred in 3 patients with AEF, 1 patient with ABF and 1 patient with combined ABF and AEF, Fisher's exact test: $P = .133$.

The patient with the combined ABF and AEF died from delayed aortic rupture 2 days after TEVAR (patient 11). A 40-year-old female was admitted with hypovolemic shock after recurrent AEF and showed recurrent hemoptysis after TEVAR, followed by development of mediastinitis and sepsis. She died 1 week after TEVAR (patient 8). Another patient who had developed ABF after a ruptured TAA showed type 1 endoleak after 2 days, requiring placement of an additional endograft (patient 5). After the re-intervention, the patient developed renal failure and acute respiratory distress syndrome (ARDS), which resulted in death 22 days after initial TEVAR. The 65-year-old male who was re-admitted with mediastinitis died 36

Table III. Outcomes of 11 patients undergoing TEVAR for ABF and AEF

Successful TEVAR	*LOS (days)*	*Complications*	*Additional vascular intervention*	*Fistula-related death*	*Length of follow-up*
1. Y	7	—	—	—	49 months
2. Y	15	—	—	—	41 months
3. Y	22	Endoleak type 1, brachial claudication	Endovascular ballooning after 3 days, transposition left SCA after 6 months	—	61 months
4. Y	8	Brachial claudication	—	—	54 months
5. N	22	Endoleak type 1, renal failure, ARDS	TEVAR after 2 days	ARDS	22 days
6. Y	60*	Horner syndrome	Left-sided carotid subclavian bypass prior to TEVAR	—	3 months
7. Y	7	Mediastinitis	—	Sepsis	36 days
8. Y	7	Recurrence hemoptysis, mediastinitis	—	Sepsis	7 days
9. Y	89	Aortic rupture at proximal endograft neck, thoracic infections	TEVAR after 40 days	Thoracic infections	89 days
10. Y	19	Bleeding after 24 hours, infolding of inner endograft	TEVAR after 1 day, embolectomy and insertion giant Palmaz stent after 9 months	—	15 months
11. N	2	Aortic rupture	—	Aortic rupture	2 days

Successful was defined as complete exclusion of the fistula during initial thoracic endovascular aneurysm repair (TEVAR). *LOS,* Hospital length of stay in days; *SCA,* subclavian artery; *ABF,* aortobronchial fistula; *AEF,* aortoesophageal fistula; *ARDS,* acute respiratory distress syndrome.
*This patient was already hospitalized for 2 months because of an infected Dacron prosthesis of the thoracic aorta; he was discharged 14 days after TEVAR.

days after endovascular exclusion of AEF, due to sepsis. The last patient who died was the 71-year-old female who had received bipolar esophageal exclusion for AEF. She suffered from aortic rupture at the proximal endograft neck, which was treated with placement of a second endograft. The patient developed respiratory failure due to severe thoracic infections, resulting in death after an intensive care unit (ICU) stay of almost 3 months.

The patient with AEF who received early esophageal repair a few days after TEVAR was the only patient with AEF who did not expire (patient 10).

Follow-up. Median follow-up of surviving patients was 45 months (range, 3 to 61 months; interquartile range, 45 months). Six additional vascular interventions were performed in 3 survivors during this period.

A left-sided carotid subclavian bypass was performed prior to TEVAR to extend the proximal landing zone in a 68-year-old male with ABF after an infected aortic graft prior to TEVAR. Postoperatively the patient suffered from Horner's syndrome due to damage of the sympathic nerve fibers (patient 6).

The patient with AEF after ingestion of a chicken bone needed a repeat TEVAR 1 day after the initial procedure. The manipulation during the open surgical procedure resulted in severe bleeding that necessitated deploying of a longer endograft inside the first one. Nine months after discharge, he presented with thrombosis of both popliteal arteries, which was treated with embolectomy. CTA scan showed infolding of the second endograft, and a giant Palmaz stent (Cordis, Miami Lakes, Fla) was placed in the second endograft with resolution of the complication.

The other survivor who required re-interventions was a 30-year-old male (patient 3) who had developed TAA with concomitant ABF after open repair of an aortic coarctation. During TEVAR, the ABF was excluded but coverage of the left subclavian artery was necessary in order to have a safe proximal landing zone. Endovascular ballooning was performed 3 days after the first endovascular procedure because of a type 1 endoleak, with immediate good results. After discharge, the patient suffered from brachial claudication, which was treated successfully with transposition of the left subclavian artery. The other 3 survivors did not require re-intervention, although 1 suffered from mild brachial claudication due to coverage of the left subclavian artery during initial TEVAR. Outcomes of TEVAR are depicted in Table III.

DISCUSSION

In this case series, TEVAR prevented immediate exsanguination caused by ABF or AEF; no patients died during the initial endovascular procedure. However, 5 out of 11 patients with ABF or AEF died of complications between 2 days and 3 months after the initial endovascular procedure (Fig).

Aortobronchial and aortoesophageal fistulas are scarce and usually arise in thoracic aortic disease or after previous thoracic aortic repair. ABF and AEF regularly present with excessive bleeding; repair of the fistula is the only curative treatment.[1-5] Adequate management of ABF or AEF consists of control of hemorrhage, repair of the bronchial or esophageal defect, control of infectious complications, and maintenance of sufficient distal perfusion.

Traditional surgical repair of ABF usually occurs by a posterolateral thoracotomy, followed by resection of the involved aortic area of the fistula and replacement of this part by a prosthetic graft. Bronchial or lung surgical repair may consist of primary closure or partial resection of lung tissue. The bronchial segment of the fistula has been treated conservatively in cases in which the exclusion of the aortic side of the fistula was considered adequate. In the literature, in-hospital mortality of open surgery for ABF ranges from

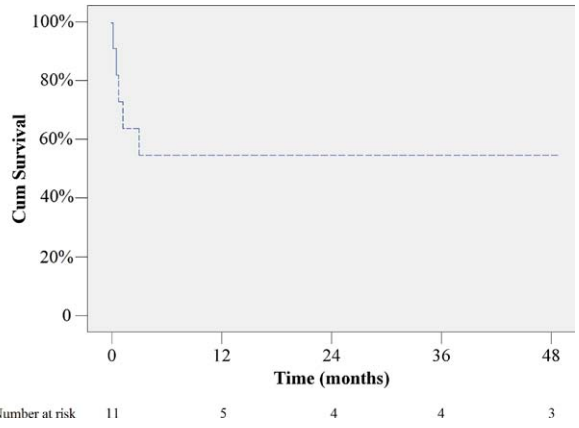

Fig. Survival after TEVAR for aortobronchial fistula (ABF) and aortoesophageal fistula (AEF) (N = 11). This Fig depicts the survival after thoracic endovascular aneurysm repair (TEVAR) for ABF and AEF. No deaths occurred after 3 months. Median follow-up of surviving patients was 45 months (range, 3 to 61 months; interquartile range, 45 months).

15% to 24%.[1,2] The most frequently used approach for open AEF repair is a left thoracotomy, followed by aortic replacement with a prosthetic or cryopreserved homograft, or an extra-anatomic bypass in case of severe mediastinal sepsis.[5,19] Open thoracic surgery for AEF is, however, associated with a high operative mortality, which is usually caused by exsanguination of the patient.[3-5] Precise mortality rates of classic surgery are missing in the literature, due to the rare occurrence of AEF.

TEVAR is less invasive than open thoracic surgery and allows prompt exclusion of thoracic aortic fistulas and control of hemorrhage. No patients died of exsanguination during TEVAR in our series. However, the follow-up outcomes after TEVAR were poor. Many patients in our evaluation developed infectious complications or recurrent bleeding within the first 3 months after the initial endovascular procedure, which reasonably leaded to death in 5 cases (45%). Endovascular treatment of ABF or AEF alone does not allow debridement of the potentially contaminated thoracic cavity. Additionally, the fistula is not repaired and a connection between the lungs or esophagus with the endograft, the thoracic aorta, and the thoracic cavity is maintained. This results in continued exposure to contaminated contents of the esophagus or lungs and high risk of serious infections. Therefore, additional surgical repair of the fistula, which may include debridement of the thoracic cavity, supported by broad-spectrum antibiotic therapy for at least several months, most likely will improve outcomes after successful endovascular treatment.

In the literature, numerous cases of endovascular management of ABF[6-8,20-22] and AEF[9-11,23-25] have been reported, some with a fatal outcome.[22-24] Antibiotic therapy was frequently prescribed,[6,8,10,11,20,22,24,25] additional open surgical repair was performed in several cases,[6,9,11,25] and sometimes no additional therapy was offered.[21,23] Since case reports often represent exceptional single cases, it is difficult to draw valid conclusions regarding the applicability of endovascular management of ABF and AEF on the basis of these reports. Larger cases series of TEVAR for ABF demonstrated a mortality between 0% to 25% at 3 years after the endovascular procedure.[17,26] Our results are inconsistent with these reports. We have several hypotheses for the inferior outcome in our series. A possible explanation for the different outcome is the indication for TEVAR. In the Wheatley et al[17] and Bockler et al[26] series, endovascular management was preferred in patients with ABF because of co-morbid diseases and previous thoracotomy.[17,26] In our series, TEVAR was indicated because of emergency treatment in all patients. This difference could have affected our results.

Another substantial difference with these previous series is that we also evaluated outcomes of 4 patients with AEF and 1 patient with combined ABF and AEF, besides 6 patients with ABF. Deaths in our series included the patient with combined ABF and AEF and 3 out of 4 patients with AEF; only 1 of 6 patients with ABF expired. It appears that patients with AEF have a worse outcome after TEVAR compared to patients with ABF, although strong conclusions cannot be made due to the small sample size of this series.

Differences in outcomes after TEVAR between ABF and AEF have not been described previously in the literature. In this series, 3 out of 4 patients with AEF were admitted with hemorrhagic shock (Table I), while only 1 of 6 patients with ABF suffered from shock. Hemorrhagic shock is generally accepted as a risk factor for mortality and the association of AEF and shock may have led to poorer outcomes in this series. Two of 3 patients with AEF and shock expired; death was, however, caused by infectious complications instead of exsanguination. ABF and AEF are often associated with infections due to the presence of open air and esophageal contents in the chest. Exposure to esophageal contents is possibly more virulent than exposure to the open air as well, resulting in increased risks of infective complications after TEVAR for AEF compared to ABF.

Although no additional thoracic surgical procedures were performed in case of ABF, 3 out of 4 patients with AEF received additional esophageal surgical repair; 1 patient within a few days after TEVAR and the remaining 2 patients underwent delayed repair after more than 2 weeks (Table II). The patient, in whom esophageal surgery was performed a few days after the initial endovascular procedure, was the only patient with AEF who did not expire; the remaining patients died of infectious complications (Table III). This finding suggests a more aggressive surgical approach of AEF, shortly after initial stabilization by TEVAR.

Topel et al[19] recently published promising results of a combined approach for management of AEF. They used TEVAR as a bridging procedure in the acute setting, which was followed by in situ repair with cryopreserved homografts and long-term antibiotic therapy. This combined approach could be a valuable option for emergency cases of AEF, and possibly a more aggressive surgical strategy after

initial TEVAR could have prevented some lethal complications in our series.

CONCLUSION

Endovascular management of emergency cases of ABF and AEF is associated with poor results. Patients with AEF treated with TEVAR appear to have an inferior outcome compared to patients with ABF. TEVAR does prevent immediate exsanguination in patients admitted with AEF and ABF but after initial deployment of the endograft and control of the hemodynamic status, most patients, in particular those with AEF, are at risk for infectious complications. Early esophageal repair appears to improve the survival in case of AEF. Therefore, TEVAR may serve as a bridge to surgery in emergency cases of AEF with subsequent definitive open operative repair of the esophageal defect as soon as possible. In patients with ABF, additional open surgery may not be necessary after the endovascular procedure.

AUTHOR CONTRIBUTIONS

Conception and design: FJ, BM
Analysis and interpretation: FJ, RH, ST, HV, FM, BM
Data collection: FJ, RH, ST, HV
Writing the article: FJ, BM
Critical revision of the article: RH, ST, HV, FM, BM
Final approval of the article: FJ, RH, ST, HV, FM, BM
Statistical analysis: FJ
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INVITED COMMENTARY

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Mercifully, fistulous communications between the aorta and the aerodigestive tract are rare. Death may come quickly from exsanguination, or be prolonged due to sepsis. The former threat is remedied by prompt treatment of the defect in the aorta, the latter