

# Treatment of Infected Aneurysm with Combined Endovascular Aneurysm Repair and Abscess Drainage

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## ABSTRACT

**Purpose:** To evaluate the clinical utility of combination therapy with endovascular aneurysm repair (EVAR) and abscess drainage for the treatment of infected aneurysms.

**Materials and Methods:** Between July 2009 and May 2015, 8 patients underwent combination therapy with EVAR and abscess drainage. There were 5 men and 3 women, with a mean age of 75 years  $\pm$  7. Aneurysms were of the thoracic aorta in 5 patients, the abdominal aorta in 2, and the internal iliac artery in 1. Four patients had concurrent infection, including pyelonephritis in 2, pelvic abscess in 1, and suppurative knee arthritis in 1. Three patients had ruptured aneurysms. Abscess drainage was performed percutaneously under computed tomographic guidance in 5 patients, thoracoscopic guidance in 2, and both in 1.

**Results:** Six patients (75%) were discharged without additional intervention except for antibiotic therapy, and the other 2 patients (25%) underwent open repair to control infection and to repair endoleak, respectively. There were no in-hospital deaths. During the mean follow-up period of 48 months  $\pm$  22, all patients were alive except for 1 patient who died of recurrence of rectal cancer at 51 months. There were no aorta- or artery-related adverse events. Overall survival rates at 1 and 5 years were 100% and 80%, respectively. Aneurysm-related event-free rates at 1 and 5 years were 75%.

**Conclusions:** Combination therapy with EVAR and abscess drainage for the treatment of infected aneurysms seems to be a promising strategy as an alternative or “bridge” to open surgery.

## ABBREVIATIONS

CRP = C-reactive protein, EVAR = endovascular aneurysm repair, WBC = white blood cell

Infected aneurysms are estimated to account for 1%–2% of all aortic aneurysms, with iliac arteries involved less frequently (1,2). However, an infected aneurysm is well known as a complex and life-threatening disease because of the high risk of expansion and rupture (3–5). The established treatment strategy for infected aneurysms consists of

long-term administration of antibiotic agents and surgical intervention (2). However, the hospital mortality rate for patients with infected aneurysms is substantially higher than that for patients with noninfected aneurysms and is reported to range from 11% to 36% because patients with infected aneurysms often have severe comorbidities (2,3,6).

Endovascular aneurysm repair (EVAR) was first applied to infected aneurysms in the 1990s, when EVAR had only recently emerged (7). Since then, it has been described as an alternative to open surgery (8–11). Indeed, EVAR is commonly the only therapeutic option in patients at high surgical risk or with aneurysm rupture (11–13). However, there have always been detriments to this strategy. A major disadvantage of EVAR is the lack of resection of infected tissue, which is the essential part of open repair. The remaining infected tissue and fluid can facilitate recurrent infection and sepsis, leading to catastrophic events (11–13).

Abscess drainage is a common procedure following major open surgery. Its efficacy has been reported in patients with

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Table 1. Patient Characteristics

Case No./ Age (y)/Sex	Fever	Pain	Blood Culture	Duration of Preoperative Antibiotic (d)	Comorbidities	Concurrent Infection	Location of Aneurysm
1/74/F	Yes	No	Negative	15	Postoperative status of colon cancer	Pyelonephritis	Thoracic (proximal descending)
2/83/M	Yes	No	<i>E. faecalis</i>	0	Postoperative status of rectal cancer, DM, dyslipidemia, hypertension	Pelvic abscess	Iliac (internal iliac, ruptured)
3/70/M	No	No	<i>Salmonella</i> sp.	0	DM, hypertension, rheumatoid arthritis, steroid administration	None	Thoracic (mid-descending)
4/80/F	Yes	Yes	<i>S. aureus</i>	0	DM	Suppurative knee arthritis	Abdominal (suprarenal)
5/68/M	Yes	No	<i>E. coli</i>	39	DM, hypertension, UTI, hepatitis	Pyelonephritis	Abdominal (infrarenal, ruptured)
6/65/F	Yes	Yes	<i>S. aureus</i>	31	Chronic renal failure, hypertension	None	Thoracic (proximal descending)
7/78/M	Yes	Yes	<i>E. faecalis</i>	7	Postoperative status of TAA	None	Thoracic (mid-descending)
8/83/M	Yes	Yes	<i>S. aureus</i>	0	Postoperative status of lung cancer	None	Thoracic (proximal descending, ruptured)

DM = diabetes mellitus; TAA = thoracoabdominal aortic aneurysm; UTI = urinary tract infection.

graft infection after aortic replacement or EVAR (14–16). Taking these reports into consideration, it is possible that combination therapy with EVAR and abscess drainage is a promising and less invasive therapeutic option for the treatment of infected aneurysms. The present retrospective study was conducted to evaluate the clinical utility of combination therapy with EVAR and abscess drainage for the treatment of infected aneurysms.

## MATERIALS AND METHODS

### Study Design

This retrospective study was approved by the institutional review board of each participating institution. Written informed consent was obtained from all patients except for 1 patient who died during follow-up. We offered this patient's family the choice to opt out of the study by posting the study consent form on our institutional Web site.

### Pretreatment Workup

Diagnosis of an infected aneurysm was based on the following criteria, which are similar to those used by Söreljus et al (17): (i) clinical presentation (pain, fever, or concomitant infection), (ii) laboratory test results (elevation of serum C-reactive protein [CRP] level and white blood cell [WBC] count or positive cultures), and (iii) computed tomography (CT) findings (ie, rapid expansion of aneurysm, saccular aneurysm, multilobular aneurysms, periaortic gas, and periaortic soft-tissue mass). Preoperative administration of antibiotic agents was performed when infection of any kind was evident in elective cases. Abscess

drainage following EVAR was performed based on the aforementioned clinical findings. The criteria for abscess drainage were as follows: (i) presence of a sufficiently large aneurysmal sac to allow an indwelling drainage tube, (ii) a safe access route, and (iii) no apparent endoleak on postoperative contrast-enhanced CT.

### Clinical Presentation

Between July 2009 and May 2015, 8 patients underwent combination therapy with EVAR and abscess drainage for the treatment of infected aneurysms at one of 3 institutions (Table 1). There were 5 men and 3 women, with a mean age of 75 years  $\pm$  7 (range, 65–83 y). At presentation, all patients had fever ( $> 37.5^\circ\text{C}$ ) and 4 patients (50%) had localized pain. WBC count and CRP level were  $11.3 \times 10^9/\text{L} \pm 8.3$  (range,  $4.8\text{--}30 \times 10^9/\text{L}$ ) and  $17 \text{ mg/dL} \pm 11$  (range, 4.5–40 mg/dL), respectively. Blood culture was positive in 7 patients (87.5%). Preoperative administration of antibiotic agents was started in 4 patients (cases 1 and 5–7) and continued for 23 days  $\pm$  15. Emergent EVAR was performed in the 4 remaining patients without preoperative administration of antibiotic agents.

As immunosuppressive factors, 4 patients had diabetes mellitus, 1 had renal failure, and 1 had steroid administration. Four patients had concurrent infection, including pyelonephritis in 2, pelvic abscess in 1, and suppurative knee arthritis in 1. Five patients had thoracic aortic aneurysms (3 at the proximal descending aorta and 2 at the mid-descending aorta), 2 had abdominal aortic aneurysms (1 at the suprarenal aorta and 1 at the infrarenal aorta), and 1 had an internal iliac artery aneurysm. Aneurysm rupture was diagnosed based on

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