# A multicenter experience with infected abdominal aortic endograft explantation

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## ABSTRACT

**Objective:** Endovascular aneurysm repair (EVAR) is widely used with excellent results, but its infectious complications can be devastating. In this paper, we report a multicenter experience with infected EVAR, symptoms, and options for explantation and their outcome.

**Methods:** We have reviewed all consecutive endograft explants for infection at 11 French university centers following EVAR, defined as index EVAR, from 1998 to 2015. Diagnosis of infected aortic endograft was made on the basis of clinical findings, cultures, imaging studies, and intraoperative findings.

**Results:** Thirty-three patients with an infected aortic endograft were identified. In this group, at index EVAR, six patients (18%) presented with a groin or psoas infection and six patients (18%) presented with a general infection, including catheter-related infection (n = 3), prostatitis (n = 1), cholecystitis (n = 1), and pneumonia (n = 1). After index EVAR, eight patients underwent successful inferior mesenteric artery embolization for a type II endoleak within 6 months of index EVAR and one patient received an additional stent for a type Ib endoleak 1 week after index EVAR. Median time between the first clinical signs of infection and endograft explantation was 30 days (range, 1 day to 2.2 years). The most common presenting characteristics were pain and fever in 21 patients (64%) and fever alone in 8 patients (24%). Suprarenal fixation was present in 20 of 33 endografts (60%). All patients underwent endograft explantation, with bowel resection in 12 patients (36%) presenting with an endograft-enteric fistula. Methods of reconstruction were graft placement in situ in 30 patients and extra-anatomic bypass in 3 patients. In situ conduits were aortic cryopreserved allografts in 23, polyester silver graft in 5, and autogenous femoral vein in 2. Microbiology specimens obtained from the endograft and the aneurysm were positive in 24 patients (74%). Gram-positive organisms were the most commonly found in 18 patients (55%). Early mortality (30 days or in the hospital) was 39% (n = 13) in relation to graft blowout (n = 3), multiple organ failure (n = 6), colon necrosis (n = 3), and peripheral embolism (n = 1). At 1 year, the rates of patient survival, graft-related complications, and reinfection were 44%, 10%, and 5%, respectively.

**Conclusions:** Abdominal aortic endograft explantation for infection is high risk and associated with graft-enteric fistula in one-third of the cases. Larger multicenter studies are needed to better understand the risk factors and to improve preventive measures at index EVAR and during follow-up. (J Vasc Surg 2016;■:1-9.)

Extensive use of endovascular aneurysm repair (EVAR) following prospective multicenter trials as a primary treatment modality for abdominal aortic aneurysm[1,2] is associated with short series of endograft infection, a rare complication with an incidence between 0.4% and 3%[3-10] but with a postoperative mortality as high as 30%, comparable to infection of open aortic grafts.[5,8] One large multi-institutional study recently published in the *Journal of Vascular Surgery*[10] suggested that in these cases, complete removal of the infected endograft with débridement of infected tissue and in situ or extra-anatomic replacement may be the option most likely to eradicate the infectious process despite a high early postoperative mortality. Furthermore, because of the low incidence of endograft infection, diagnosis may be delayed, and optimal strategy of care has yet to be defined. The aim of this study was to assess the outcomes of aortic endograft infection following EVAR

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*The names of the AURC collaborators participating in the study can be found in the Appendix at the end of this article.

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and to report the technical challenges of aortic endograft explantation in a consecutive series of patients treated in 11 French tertiary vascular centers that are members of the Association Universitaire de Recherche en Chirurgie (AURC, French University Surgeons Association). The AURC is a nonprofit academic association for clinical research in vascular surgery founded 30 years ago. France has 32 university hospitals, and in each of them there is a member of the AURC heading the department of vascular surgery. In our study, 11 university hospitals participated. Results were analyzed by the leading author and a clinical research assistant and were reviewed by all members of the AURC participating in the study.

## METHODS

After approval by the Institutional Review Boards of the university medical center members of the AURC participating in the study, institutional databases were analyzed to identify all consecutive patients who had undergone explantation of an infected abdominal aortic endograft between January 1998 and January 2015. Patient consent was waived by all Institutional Review Boards because of the retrospective nature of the study. Records were reviewed at these institutions regardless of where EVAR, defined as index EVAR, was performed. Patients with an endograft implanted primarily in an infected field to treat an aortoenteric fistula or an infected aneurysm were excluded from the study.

For each patient, demographic and index EVAR details with subsequent follow-up were examined. Clinical indicators of endograft infection were analyzed along with results of cultures, computed tomography, and white blood cell scan. Operative details including strategy of intervention and material used for reconstruction were reviewed.

When endograft infection was suspected, an institutional algorithm including computed tomography angiography (CTA) with injection of contrast material and blood cultures before initiation of antibiotics was applied. In case of doubt, a tagged white blood cell scan was performed to confirm the diagnosis of endograft infection. Whereas complete removal of the endograft was recommended by the AURC group, choice of revascularization was left to the vascular surgeon, depending on the presence of gross contamination or enteric fistula, bleeding, or other emergent situations.

Postoperative outcomes examining morbidity and mortality were evaluated on electronic medical records and reviewed on site for missing details. The postoperative period was defined as duration of hospitalization regardless of the number of days or within 30 days of the explantation. Data are reported as median with range using nonparametric tests. Kaplan-Meier plot was used to illustrate 1-year survival. All data were entered in a password-encrypted database, and analyses were performed using SPSS software version 23 (IBM Corp, Armonk, NY).

**Table I.** Clinical presentation before initial endovascular aneurysm repair (*EVAR*) and events following EVAR (n = 33)

| Patient characteristics | Median (range) or No. (%) |
|---|---|
| Age, years, median (range) | 69 (57-87) |
| Male gender | 33 (100) |
| Current smoking | 20 (60) |
| Hypertension | 19 (57) |
| Heart failure | 18 (54) |
| Chronic lung disease | 12 (36) |
| Hostile abdomen | 8 (24) |
| Previous aortic surgery | 3 (9) |
| ASA class 3 and 4 | 25 (75) |
| Patients with early post-EVAR infection | 12 (36) |
| Groin or psoas abscess following index EVAR[a] | 6 (18) |
| Early general post-EVAR infection[b] | 6 (18) |
| Post-EVAR endovascular procedures | 10 (30) |
| Embolization for type II endoleak | 8 (24) |
| Embolization of both hypogastric arteries[c] | 1 (3) |
| Additional stent for type Ib endoleak | 1 (3) |

*ASA*, American Society of Anesthesiologists.
[a]Including one groin abscess, two false femoral artery aneurysms, one infected femoral crossover bypass after index EVAR in a patient with an aortomonoiliac endograft, and two patients with a psoas abscess following coil embolization for a type II endoleak (n = 1) and for a hypogastric aneurysm (n = 1).
[b]Infection with bacteremia following central venous catheter infection (n = 3), bacterial prostatitis (n = 1), cholecystitis (n = 1), and pneumonia (n = 1).
[c]Embolization of one hypogastric artery before EVAR, followed by contralateral hypogastric artery embolization during EVAR.

## RESULTS

**Patient demographics, index EVAR, and possible sources of infection.** Between January 1998 and January 2015, 33 patients with a median age of 69 years (range, 57-87 years) were treated for an aortic abdominal endograft infection in 11 French university centers. During the study period, a total of 6057 EVARs were carried out in the 11 tertiary centers. Of the 33 infected endografts reported in our series, 18 index EVARs were initially performed in the 11 tertiary centers with a ratio of endograft infection of 0.3% (95% confidence interval, 0.2%-0.4%).

Demographics and clinical presentation at index EVAR are presented in Table I, and events following index EVAR are presented in Table II. Indications for EVAR were an aortic aneurysmal disease in 32 patients and an aortic pseudoaneurysm following prior open aortic repair in 1 patient. The endograft was deployed in abdominal aortic aneurysms with a median diameter of 60 mm (range, 50-93 mm) and a median diameter of the aortic neck of 23 mm (18-31 mm). The median length of the aortic neck was 20 mm (10-38 mm). Aortic