Management of AAA Endoleaks

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80 year old male presented with left groin pain, found to have a left groin hemia. On abdominal CT was incidental finding of expanding AAA.

PMH: HTN, hyperlipidemia, chronic renal insufficiency, lower limb neuropathy, colonic polyps, glaucoma, Hep C, hepatocellular carcinoma

Family History:
- Father died of MI at age 44

Social History:
- 1.5 pack per day, 25 years history of smoking cigarettes, quit 40 years ago

Vitals: BP 168/86; HR 68; RR 18; sat 98%; T 97.6

Labs:
CBC 5.2/10.4/29.3/84
BMP: 140/4.1/104/30.0/27/1.1/95
Abdominal CT
Angiogram
Angiogram 2
Angiogram control
Currently, 5 endovascular stent-grafts are approved for clinical use in the United States.

- **Zenith®** (Cook Medical Inc.; Bloomington, Ind)
- **AneuRx® AAAdvantage** (Medtronic, Inc.; Minneapolis, Minn)
- **Gore Excluder® AAA Endoprosthesis** (W.L. Gore & Associates, Inc.; Flagstaff, Ariz)
- **Powerlink®** (Endologix, Inc.; Irvine, Calif)
- **Talent** (Medtronic)
EVAR can have a high incidence of postprocedural complications

- endoleaks
- separation of modular components
- aneurysm enlargement
- stent or hook fractures
- distal migration of the endograft
Unfavorable neck anatomy:

- angle $>60$ degrees
- length $<10$ mm
- severe calcification
- aortic neck thrombus
Importance

- Continued growth of the aneurysm sac is associated with a risk of rupture.
- Mortality of ruptured aneurysm following EVAR is equivalent to mortality of patient without EVAR.
  - 18 patients with EVAR/233 patients without EVAR.
  - In-hospital mortality 38.9% vs 38.1%.

Surveillance following EVAR

Controversial roles

- Contrast enhanced CT/Non-contrast enhanced CT
- MRA/MRI
- Doppler ultrasound
- Contrast enhanced ultrasound

Follow-up schedule:
- 1 month/6 month/1 year and annual after that

www.downstatesurgery.org
Overall incidence of endoleaks ranges from 20 to 40%.

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<tbody>
<tr>
<td>1</td>
<td>297/2463 (12%)</td>
<td>51/1768 (2.8%)</td>
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<tr>
<td>2</td>
<td>191/2463 (7.7%)</td>
<td>136/1768 (7.7%)</td>
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<td>3</td>
<td>297/2463 (12%)</td>
<td>5/1768 (0.3%)</td>
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<td>5</td>
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<td>8/1768 (0.4%)</td>
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Types of endoleaks

- Type 1: Leak from endograft fixation point
- Type 2: Leak from arteries arising from sac
- Type 3: Leak from graft defect or modular junction
- Type 4: Graft porosity
- Type 5: Endotension/origin variable
Types of endoleaks

Figure 1 - Illustration of endoleaks using the Veith classification (Veith et al.).
Type 1 endoleak

Subgroups

- 1A Proximal fixation
- 1B Distal fixation
- 1C around iliac occluder for monoiliac EVAR

High pressure

Associated with rupture

Treated by:

- Graft extension
- Balloon expandable stents
- Embolization
**Type 2 endoleak**

- **Subgroups**
  - 2A single artery (simple)
  - 2B multiple arteries (complex)
Type 2 endoleak: treatment

- If aneurysm is stable or diminished in size, continued follow-up without intervention.
- If aneurysm increasing in size, embolization should be attempted.
- Embolization will fail unless the sac (which acts similar to a nidus in an AVM) can be reached.
- Embolization will be successful if inflow, sac and outflow can be occluded.
Type 2 endoleak: embolization

- Embolic materials:
  - Coils
  - N-isobutyl-cyanoacrylate (glue)
  - Thrombin
  - Onyx (ethylene-vinyl alcohol polymer)
  - Gelfoam
  - Fibrin glue
Type 2 endoleak embolization

- If transarterial embolization is unsuccessful, then translumbar embolization should be performed
Type 2 endoleak: results of therapy

42 patients with type 2 endoleaks and serial enlargement of the aneurysm sac

49 procedures
- 44 translumbar embolization with glue and coil
- 9 IMA embolizations
- 7 iliolumbar or hypogastric embolizations

Average follow-up following treatment 23 months
-Persistent or recurrent endoleak observed in 70%
-No change in aneurysm growth pre and post treatment

Type 2 endoleak: results of therapy

- 95 patients underwent 140 embolizations
- Coils, glue, gelfoam
- Univariate analysis
  - Smokers more likely to have continued sac enlargement
  - Patients with hyperlipidemia more likely to fail

Freedom from sac expansion >5 mm was 44% at 5 years

Sarac TP, J Vasc Surg, 2012
Type 3 endoleak

**Subgroups**

- 3A junctional separation (modular devices)
- 3B endograft fracture or perforation
  - Minor <2 mm
  - Major >2 mm
Type 4 endoleak

- Endograft fabric porosity
- Usually observed angiographically at the time of implantation
- Spontaneous resolution
- No treatment necessary
Type 5 endoleak

Subgroups

- Occult leak due to very slow flow
- Accumulation of serous fluid within the successfully excluded aneurysmal sac

Incidence 1% to 5%

Van Marrewijk et al, J Vasc Surg, 2002 Mar
Type 5 endoleak: significance

- Depend if cause is occult leak or sac hygroma
  - Occult endoleaks may present with life threatening bleeding following rupture
  - Rupture without hemodynamic instability has also been reported from sac hygroma
Type 5 endoleak: treatment

- Translumbar aspiration has been reported to be successful for hydromas

- Relining endograft with additional stent grafts

Cerna M et al, J Vasc Surg, 2009 Sep

Salameh MK et al, J Vasc Surg, 2008 Aug
New devices are developed to stabilize the stent graft and diminish the incidence of endoleaks.

- Nellix is an investigational EndoVascular Aneurysm Sealing (EVAS) system.
- Early data suggest lower incidence of endoleaks for 2 years follow up.

Krievins DK, Eur J Vasc Endovasc Surg, 2011 Jul
Aptus Endosystems - Innovative helical anchor technology
The Zenith® stent-graft uses suprarenal fixation. The barbs secure the stent-graft to the suprarenal wall, which reduces the risk of migration and enhances the endograft-vessel attachment.

The Excluder® endograft uses 8 pairs of “anchors” for infrarenal attachment.
The Anaconda (Vascutek, part of Terumo CardioVascular Systems Corp.; Ann Arbor, Mich) is another device, undergoing clinical trials in the United States, that represents the next generation of stent-graft systems for AAA repair. This is the only graft system that enables repositioning of the graft after deployment.
Conclusions

- EVAR requires periodic imaging to exclude expansion of the aneurysm sac following the procedure.
- Sac expansion is usually associated with an endoleak.
- Type 1 and 3 endoleaks require expedited treatment.
Conclusions

- Type 2 endoleaks may be observed if the sac size is stable or decreasing.
- Even when treatment is attempted, overall success is disappointing.
- True type 5 endoleaks may be treated with translumbar aspiration.
Which one of the following complications occurs most commonly after successful repair of an AAA in a 58-year-old man?

A. Sexual Dysfunction
B. Ischemic colitis
C. Renal failure
D. Peripheral embolization
E. Leg paralysis
Which of the following statements is correct regarding endovascular repair of infrarenal AAA?

A. The most common complication with this technique is graft thrombosis.

B. Tube grafts are preferable to bifurcated grafts for endovascular repair of infrarenal AAAs.

C. Anatomic limitations prohibiting endovascular repair include a short neck and large angulation of the aneurysm.

D. Iliac stenosis is an absolute contraindication to endoluminal repair.

E. Use of the technique is more likely to be feasible for large aneurysms.
Regarding endovascular repair of AAAs, which if the following statements is false?

- A. Aneurysm rupture may occur in patients with successful repair in the absence of endoleaks.
- B. Type II endoleaks are caused by patent lumbar, inferior mesenteric, or hypogastric arteries.
- C. Types I and III endoleaks do not need any intervention.
- D. Endoleaks may develop at any time after endograft placement.
- E. Endotension is defined as aneurysm pressure in the absence of an endoleak.


