

Type II Endoleaks: Will They Ever Be Conquered?

A review of type II endoleak natural history, frequency in procedures, imaging modalities, and current treatment options.

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Endovascular aneurysm repair (EVAR) has become the first-line treatment for abdominal aortic aneurysms (AAAs). It offers a clear benefit over open repair in terms of perioperative mortality, but it is associated with an increased incidence of secondary interventions. Most secondary interventions are related to endoleaks, with type II endoleaks being the most common. Although there is consensus about the necessity for treatment of type I and III endoleaks, the generally benign natural history of type II endoleaks and the low incidence of rupture allows for debate on the necessity for intervention.

INCIDENCE

Type II endoleaks arise from patent aortic side branches, specifically the inferior mesenteric artery (IMA) and lumbar arteries. Most series report a prevalence of type II endoleak between 10% and 22%.¹⁻³ The incidence is highest in the first 6 months after EVAR. In a systematic review and meta-analysis of the literature, the reported prevalence of type II endoleaks was significantly greater in studies published after 2010 (13% vs 27%).¹ This may reflect improved detection of endoleaks due to advances in imaging rather than a true change in incidence. Anatomic risk factors for the development of type II endoleaks include the presence of a patent IMA, the number of patent lumbar arteries, and the maximum aneurysmal diameter. Age was predictive of the development of type II endoleaks, and smoking seems to be protective, although there is considerable heterogeneity among results reported.¹

NATURAL HISTORY IF LEFT UNTREATED

Indications for intervention on type II endoleaks have evolved as their natural history has been better defined. The majority (60%) of type II endoleaks present at initial implantation will resolve spontaneously over time.⁴ However, delayed type II endoleaks (defined as occurring > 1 year after EVAR) do occur and may be associated with aneurysm enlargement.⁵

The risk of delayed rupture in patients with a type II endoleak is very low, with an estimated 0.9% risk reported in a recent meta-analysis.³ Of note, there was no evidence of sac expansion in 43% of patients who experienced rupture. Although it is a poor predictor, sac expansion is the most common surrogate marker of future rupture. In patients with type II endoleaks and stable sac size, observation has been shown to be a safe strategy.^{4,6} There is general agreement that patients with type II endoleak and sac expansion should be treated.⁷

IMAGING MODALITIES

The gold standard imaging modality for post-EVAR is three-phase CTA, although duplex ultrasound (DUS) surveillance has gained popularity. The standard CT endograft technique includes a noncontrast phase to identify any calcified or radiodense material in the sac, followed by an arterial phase and a delayed-phase, contrast-enhanced series. This has excellent sensitivity to detect the presence of an endoleak. However, as CT is static, it does not demonstrate the direction of flow. In select cases, it can be difficult to differentiate between a type II endoleak and a missed type I or III endoleak. In

equivocal cases, dynamic imaging should be performed to show direction of flow. DUS has the advantage of being less costly than CT, but it is operator dependent. Many practitioners have moved to DUS as the primary mode of post-EVAR surveillance.⁸ MRA, particularly time-resolved MRA, has been shown to be highly concordant with digital subtraction angiography in terms of sensitivity and specificity.⁹

TREATMENT OPTIONS

Preoperative IMA Embolization

Although not widely adopted, there has been interest in preoperative IMA embolization to prevent subsequent type II endoleaks in select centers. The potential benefit is the ease of access to the IMA in the native aorta. Patients who undergo preoperative embolization have significantly lower incidence of type II endoleak and a significantly decreased need for subsequent embolization, and there may be some benefits in terms of sac size. However, there was no demonstrable difference in rupture rate or conversion.^{10,11} Despite the potential benefits, preoperative embolization is not entirely benign. In the largest series of IMA embolizations, there was one death (out of 108 patients) secondary to colonic ischemia.¹⁰ Therefore, it is not clear that adopting a policy of universal IMA embolization preoperatively is safer than selective treatment of enlarging type II endoleaks postoperatively.

Postoperative Embolization of Type II Endoleaks

There are several access options for postimplantation embolization, each with their benefits and disadvantages. The most common approach to postimplantation embolization is transarterial access, with access into the sac via the IMA through the marginal artery or via lumbar through the internal iliac arteries. Typically, this is performed with a coaxial system and a microcatheter delivered to the sac. Microcoils, liquid embolic agents, or a combination of the two are used to obliterate the endoleak. This approach requires a high degree of endovascular skills. Clinical success, defined as no endoleak on follow-up imaging, ranges from 60% to 70% in most large studies.³

Translumbar access is typically performed with the patient in the prone position, and direct puncture of the sac under fluoroscopic guidance is performed after review of the CTA. Fusion imaging can be helpful in identifying the endoleak cavity and choosing an optimal approach.¹² A sheathed needle is advanced under fluoroscopic guidance into the region of the endoleak cavity until there is free return of blood. Wire access is obtained, and a sheath is placed directly into

the sac. This allows for larger access into the nidus and the potential to deliver larger coils as well as liquid embolic agents. The rates of clinical success appear to be higher with translumbar rather than transarterial access, although this may be confounded by the fact that some of the translumbar cases were performed for failed transarterial embolizations.^{3,13}

Recently, there has been increasing interest in transcaval access as an option. Typically, femoral venous access is obtained, and a TIPS needle is used to establish direct access into the aortic sac through the inferior vena cava. As with translumbar access, this allows for placement of a large sheath directly into the nidus, through which coils and liquid embolic agents are delivered. Potential benefits of this approach include patient comfort, as they can be supine during the embolization (unlike with the translumbar approach), as well as the ability to deliver larger coils. There may be less risk of retroperitoneal hematoma than with translumbar access, as any bleeding would be into the inferior vena cava. There is also the theoretical risk of pulmonary embolus associated with nontarget embolization.^{14,15}

Embolization of the Nidus Alone Versus the Nidus Plus Feeding Vessels

As previously noted, the rate of recurrent type II endoleak is not insignificant. Clinical success rates with embolization also widely vary in the literature.³ Several reasons have been suggested for this, including recruitment of new feeding vessels as well as persistent flow through the coil mass. This has led most operators to stress the importance of embolizing both the nidus and the feeding vessels, treating the endoleak like an arteriovenous malformation. However, this approach has not been shown to be clearly better than embolization of the nidus alone.¹⁶

Coils are the most common embolic agent chosen, although the use of liquid embolic agents, such as n-butyl cyanoacrylate or ethylene vinyl-alcohol copolymer (Onyx, Medtronic), is well described. Coils offer more control, but liquid embolic agents may allow for better penetration of the nidus and ease of deliverability. No clear superiority of one agent over another has been demonstrated, and the deciding factor is mostly operator comfort. There are case reports of the use of novel embolic agents that may offer some of the advantages of liquid embolic agents with less CT artifact on postoperative follow-up.¹⁷

Open Surgery

In patients with sac enlargement and persistent type II endoleaks despite embolization, consideration

may be given to surgical treatment. Laparoscopic ligation of the aortic side branches, open sacotomy and oversewing the lumbar arteries and the IMA while preserving the stent graft, and graft explantation have all been described.^{18,19} These approaches are more complex and invasive than embolization and carry the potential for significant morbidity. As such, they are usually reserved for endovascular failures.

Endovascular Aneurysm Sealing

The Nellix Endovascular Aneurysm Sealing (EVAS) system (Endologix, Inc.) is a novel approach to the treatment of AAAs, where a polymer is used to fill an endobag attached to a stent and obliterate the aneurysm lumen. Unlike other devices, this has the potential to obliterate any type II endoleak cavity. The pivotal trial reported a very low rate of endoleak overall at 1 year (4 of 149; 3.1%), and three were type II endoleaks (2.3%).²⁰ The US Food and Drug Administration has requested 2-year follow-up data on the device, with a possible US Food and Drug Administration advisory panel meeting at the end of 2017. The Nellix EVAS system is considered an investigational device and is not available for commercial use in the United States.

CONCLUSIONS

Type II endoleaks are the most common indication for secondary intervention after EVAR. The natural history of type II endoleaks is generally benign. In the setting of sac enlargement, embolization (using a transarterial, translumbar, or transcaval approach) is the mainstay of therapy. Embolization of the feeding vessels and the nidus should be the goal when feasible, although there are no definitive studies demonstrating superiority of embolization of the nidus alone. Open surgery should be reserved for endovascular treatment failures in low-risk patients. ■

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