

# Choosing the Right Option for Treating EVAR Failure: When to Use and Avoid Endovascular Options

A review of the various indications for reintervening after infrarenal EVAR and the technical options available.

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Endovascular aneurysm repair (EVAR) was originally used to treat patients at high risk for open repair but has become first-line treatment for abdominal aortic aneurysms (AAAs) at most centers. The aortic anatomy is not only the main determinant of the eligibility for EVAR, but it also affects the long-term results and thus the need for reinterventions.<sup>1</sup> Long-term follow-up continues to be recommended by the guidelines to allow the early diagnosis of failure and the performance of reinterventions in the elective setting. This article discusses the endovascular options available for reintervening after EVAR and when to opt and refrain from these techniques.

## INDICATIONS FOR REINTERVENTION

The indication for reintervening after EVAR should be assessed before considering technical options. The definition of clinical success or failure needs to be balanced with the reintervention that is needed. The proportion of patients that become unfit for further reinterventions will naturally increase as the duration of follow-up increases, especially if EVAR had been initially chosen due to an increased risk for open repair. For this reason, the stability or progression of the adverse findings needs to be outweighed with the consequences of a more conservative approach. An example of this is a late occlusion of an iliac limb in a patient who was

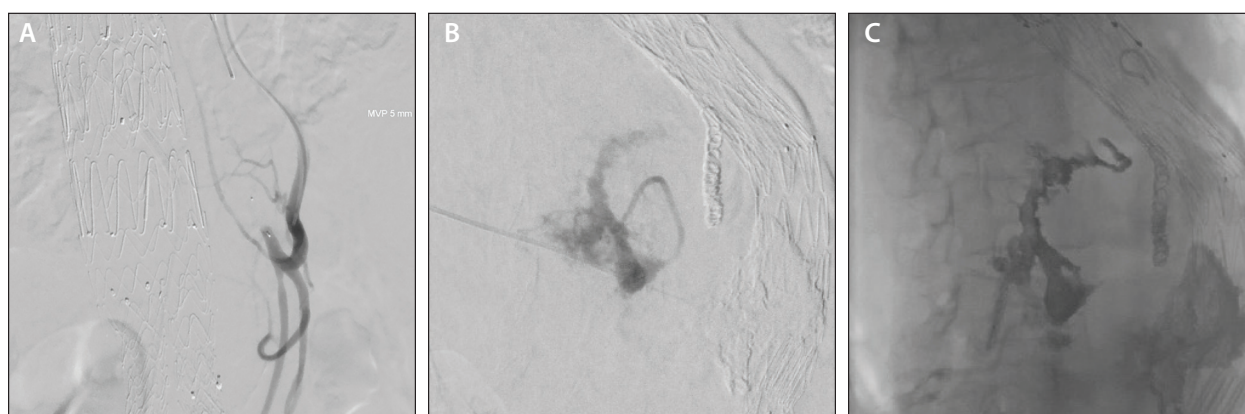


Figure 1. Digital subtraction angiography (DSA) after intraluminal embolization of the proximal part of the IMA due to a type II endoleak (MVP microvascular plug, Medtronic) (A). Intraoperative DSA after translumbar direct puncture of the endoleak nidus (B). Subsequent plain radiograph showing filling of the endoleak with a liquid embolic agent (Onyx, Medtronic) (C).

initially at high risk for AAA repair. However, the majority of patients are at acceptable risk for reinterventions, especially when percutaneous techniques can be applied.

### Type II Endoleaks

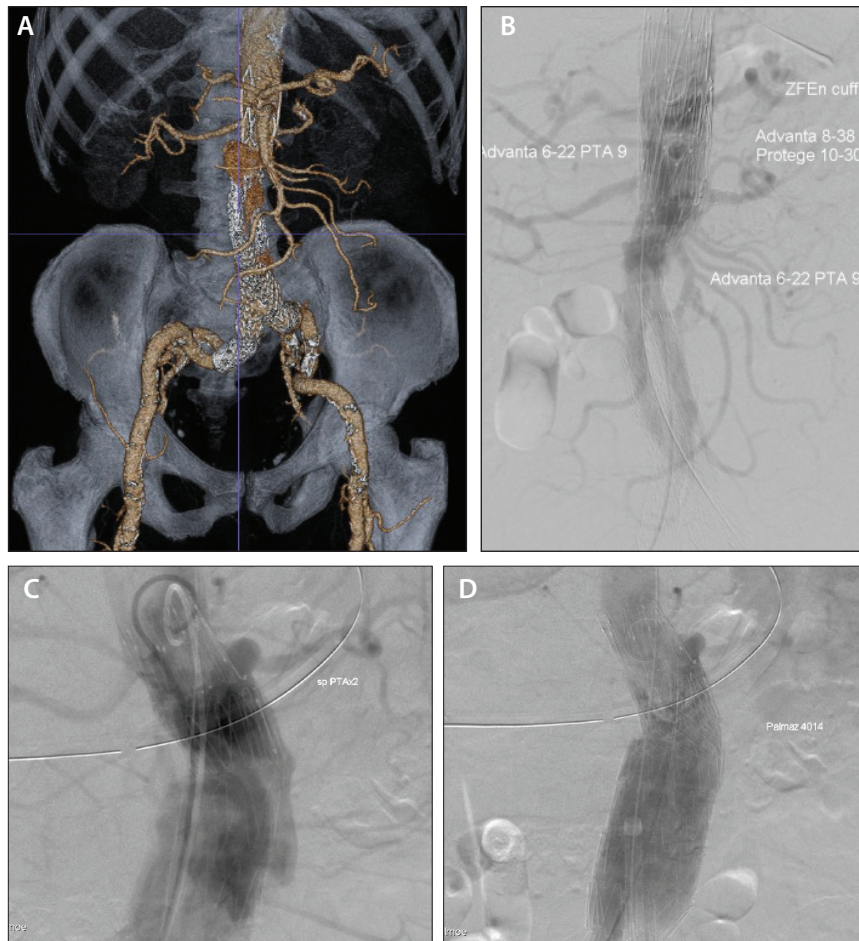
Type II endoleaks are the most frequent type of endoleak after EVAR and are usually associated with the inferior mesenteric (IMA) or lumbar arteries. Most of these endoleaks spontaneously seal early after EVAR and the persistent endoleaks are not commonly associated with aneurysm expansion. For these reasons, preemptive embolization of the small branches from the abdominal aorta is not usually performed. However, clinical failure and rupture specifically caused by type II endoleaks can occur, although it is very infrequent.<sup>2</sup> When the main feeding artery to the endoleak is the IMA, the endoluminal endovascular approach is preferable using coils or plugs, whereas the translumbar approach with liquid embolic agents has shown better results for type II endoleak caused by lumbar arteries (Figure 1).<sup>2</sup> Open surgery is very seldom needed, and laparoscopic ligation of the feeding arteries has been proposed as an attractive alternative based on good results.<sup>3</sup> However, we have not needed to employ the laparoscopic technique, and with no randomized trial data available, we believe that this approach should be reserved for repeated failure of the endovascular techniques with consideration of its greater invasiveness.

As opposed to the previously mentioned endoleaks, those related to accessory renal or branches of the hypogastric artery are usually quite challenging to treat endovascularly after EVAR. The hypogastric artery can be accessed by other collaterals from the contralateral side or femoral branches, but the accessory renals are seldom reachable through direct puncture of the aneurysm, and laparoscopic or open surgical ligation may be the better option. For these reasons, and if the

vessels cannot be preserved, preemptive embolization of these feeders is advisable to avoid an endoleak in the setting of other complications such as dilatation of the aneurysm neck. Preoperative sacrificing of the accessory renal arteries appears to be well tolerated.<sup>4</sup>

### Failure of the Sealing Zones

AAA sac expansion after EVAR is unusual when a good proximal sealing zone has been chosen preoperatively. However, when the anatomic criteria are not respected, the failure rate dramatically increases.<sup>1</sup> AAA sac expansion can occur with or without evident endoleak and can most often be handled by endovascular means, leaving open surgical conversion to be used in unusual cases in which there are a combination of multiple adverse anatomic factors, such as multiple



**Figure 2.** Volume-rendered reconstruction of a follow-up CTA showing a type Ia endoleak after infrarenal EVAR with a graft that had been placed immediately infrarenally (A). Intraoperative DSA after proximal extension with a triple-fenestrated cuff (B). Intraoperative DSA showing a proximal type Ia endoleak that did not respond to repeat PTA with a molding balloon (C). DSA after placement of a Palmaz stent (D).

bilateral renal accessory arteries. The anatomic presentation and the acuteness of the procedure will also determine the choice of the endovascular approach.

Rarely, there will still be a segment of infrarenal aortic wall that will allow the use of proximal infrarenal extension cuffs. However, more commonly, the endograft is positioned directly infrarenally and a proximal extension will involve the visceral segment. This can be done with the use of fenestrated or branched devices with good results (Figure 2A and 2B).<sup>5</sup> The procedures are nevertheless more complex than primary EVAR and most often require custom-made devices, which have long delivery times. If the waiting time is not acceptable, as when rupture has occurred, proximal extension can be achieved with the use of parallel grafts (chimney, periscope, or sandwich [CHIMPS]).<sup>6</sup> The results of employing this option are not as well studied and do not seem to achieve the same levels of success as fenestrated or branched options, mostly due to gutter-related endoleaks. Even if some recent evidence suggests that the natural history of these endoleaks may be more benign than initially suspected,<sup>7</sup> the uncertainty should make use of parallel grafts reserved for very large or acute reinterventions. Moreover, even if CHIMPS have been described through total femoral access, re-EVAR usually implies one brachial access or more, as more aggressive kissing percutaneous transluminal angioplasty (PTA) of the target vessels and the aorta is usually required. Consequently, a hostile aortic arch is a relative contraindication for these procedures.

The other alternative to address proximal sealing zone failure is to attempt an interim procedure that will grant a short-term reexclusion of the AAA sac until a more definitive complex proximal extension can be performed. Palmaz stents (Cordis, a Cardinal Health company) can be used to counteract the repressurization of the aneurysm sac and press the stent graft against the aortic wall (Figure 2C and 2D). They have shown acceptable long-term results after intraoperative placement but do not prevent the continuous dilatation of the sealing zone<sup>8</sup> and therefore should only be used as temporary measures until a more definitive treatment can be performed, such as the use of a fenestrated and branched extension as previously described.

Another option to repair a failing proximal seal is the use of Heli-FX EndoAnchor implants (Medtronic). These anchors have shown better results in the prevention of type Ia endoleaks than in their treatment,<sup>9</sup> likely because the anchors improve apposition but cannot retract an aortic wall that has moved away from an endograft due to neck dilatation. The long-term results are still not

known and will determine the role of this technology in the treatment of EVAR proximal seal failure.

One final endovascular alternative that has been proposed for the treatment of proximal endoleaks is embolization with liquid embolic agents<sup>10</sup>; however, series have been small and results are inferior to the previously mentioned techniques. Therefore, liquid embolics should be reserved for patients who are not candidates for the other endovascular solutions and cannot tolerate open conversion.

Similar to the proximal sealing zone, the distal sealing zone can also fail, particularly when large common iliac arteries had been chosen as sealing zones. The reinterventions are almost universally performed endovascularly with distal extension of the iliac limb. The hypogastric artery should be preserved and oftentimes requires the use of iliac branch devices, which have shown good results in this situation.<sup>11</sup>

### Lower Limb Ischemia

Iliac limb kinking and occlusion have decreased in frequency with the more recent-generation endografts that incorporate more flexible distal components, as well as with the use of cone-beam CT to assess the intraoperative results and the liberal use of adjunctive procedures.<sup>12</sup> Kinks are almost universally handled by endovascular reinforcement of the segment in question with extra stents. However, if the patient presents with acute ischemia, stenting should be preceded by initially removing the thrombus with either catheter-directed thrombolysis or mechanical or pharmacomechanical thrombectomy. On the contrary, when acute ischemia is very severe and combines iliac thrombosis with occlusive disease of the common femoral artery, a hybrid procedure combining open surgical thrombectomy of the iliac segment, thromboendarterectomy of the femoral artery, and stent reinforcement of any possible kinks is the preferred alternative. Open surgical repair still has an important role in these and other rare cases in which the femoral access is causing the complication, such as with femoral pseudoaneurysms.

### Type III Endoleaks

Type III endoleaks are almost always managed with endovascular techniques, either by bridging disconnected components or relining the segments where any fabric tears have appeared. The former is usually a minor procedure, whereas the latter may require a new EVAR when the tear is in the distal part of the main body of the endograft. The visceral arteries may need to be incorporated if an endograft with a short distance to the flow



divider was initially used. Naturally, in cases in which the infrarenal seal is preserved, the risks of this procedure should be weighed against a partial conversion to open repair where the proximal part of the endograft is preserved and only the torn segment is replaced.

### Endograft Infection

Endograft infection is a rare but probably the most feared complication given the dire consequences. In parallel to other surgical infections, the classic approach to this situation is open surgical removal of the foreign material with in situ revascularization using lower limb veins or homografts; otherwise, extra-anatomic revascularization is performed. However, the morbidity and mortality of this open surgical reintervention are quite high.<sup>13</sup> For this reason, we prefer a semiconservative approach with either percutaneous drainage or surgical excision of the aneurysm sac and aggressive antibiotic therapy. The results of this strategy are quite good, but there must be no type I and III endoleaks, which in turn may require the preemptive use of the aforementioned endovascular techniques. Moreover, surgical repair is required if the cause of infection is an aortoenteric fistula.<sup>14</sup>

### SUMMARY

Most failures after EVAR can be managed using endovascular means, and these are currently the first option for the majority of the indications. Open surgical reinterventions are rarely needed. Conservative treatment should also be kept in mind as an option, when major reinterventions would be needed in very-high-risk patients with stable findings. ■

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