

## Transcatheter Embolisation with Onyx of a Persistent Type 1a Endoleak

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### Abstract

**Purpose:** To report the novel management of a persistent type 1 endoleak with Onyx embolisation.

**Case Report:** A 75-year-old male presented with a type 1a endoleak 4 years after endovascular aortic aneurysm repair (EVAR). The patient was unfit for open surgery and received an aortic cuff with chimneys for renal arteries. Six months later, enlargement of aneurysm sac was detected. Aortography confirmed the diagnosis and the endoleak entry site was selectively catheterised and embolised with Onyx. Follow-up imaging with computed tomography (CT) and contrast-enhanced ultrasound at 12 months showed no residual endoleak and stable sac size.

**Conclusions:** Type 1 endoleak after EVAR can be treated successfully with Onyx embolisation when standard endovascular techniques have failed and surgical options are unsuitable due to severe comorbidity.

**Keywords:** Type 1 Endoleak; Onyx; Embolisation

### Introduction

Type 1 endoleak is a manifestation of a sealing failure and is defined as a persistent blood flow within the aneurysm sac at the attachment site. It is associated with a significant pressure increase in the aneurysm sac and an increased risk of aneurysm rupture. Treatment always should be considered.

Standard endovascular treatment includes the insertion of an aortic cuff, which gives additional coverage more proximally, or placement of a balloon-expandable stent inside the endograft to improve sealing. If it doesn't exist any additional landing zone, chimney or periscope grafts or visceral artery bypass can be useful to extend landing zones. Transcatheter embolisation with coils, glue and thrombin, N-butyl cyanoacrylate (BCA) or Onyx is rarely performed to solve type I endoleaks [1].

We describe a case of a patient who underwent Onyx embolisation of a type 1 endoleak after failure of a chimney graft.

### Case Report

A 75-year-old male patient, who had undergone endovascular aneurysm repair (EVAR) with a bifurcated endograft (Endurant

32x16 mm), was referred to our center four years later for abdominal pain. His medical history was remarkable for smoking, hypertension, diabetes, dyslipidemia and atrial fibrillation. He suffered from severe atherosclerosis with cerebral, coronary and peripheral artery disease. In the same procedure of EVAR, he received right superficial femoral artery angioplasty and left femoropopliteal bypass for intermittent claudication. The patient recalled having had two myocardial infarctions treated with coronary stenting and was admitted last year for stroke. At admission, physical examination exposed a pulsatile abdominal mass with stable hemodynamic indicators. Laboratory evaluation revealed a hemoglobin of 7.2 gr/dL and a hematocrit of 22.2. Other findings were within normal parameters. Computed tomography (CT) showed ruptured abdominal aortic aneurysm due to a proximal type I endoleak with an aneurysm sac diameter of 71 mm. Due to patient's severe comorbidity, surgical options were rejected and urgent endovascular treatment was decided. Proximal landing zone was extended with an aortic cuff (32 x 64 mm) and chimneys for renal arteries (Advanta 7x36 mm and Viabahn 6x50 mm). Despite immediate technical success, postoperative CT diagnosed the persistence of type 1a endoleak with stable aneurysm sac diameter (Figure 1). Six months later, CT showed enlargement of the aneurysm sac up to 85mm with a recalcitrant endoleak (Figure 2). The patient was asymptomatic with an anodine physical examination. Embolisation with Onyx was planned. Access was gained through left brachial artery with a 5-F (French) sheath. A bolus of 7.000 U of intravenous heparin was then administered. Verapamil was infused to prevent vasospasm of brachial artery. Aortograms performed in different projections through an angiographic 5-F pigtail catheter identified the presence and location of the type 1a endoleak (Figure 3). A 5-F70-cmFlexor Ansels heath was placed over a Rosen



**Figure 1:** Postoperative CT after chimney grafts how edan aneurysm sac diameter of 71 mm.

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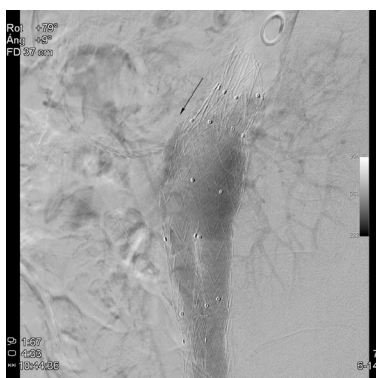
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**Figure 2:** Six months later, aneurysm sac diameter grew up to 85 mm.



**Figure 3:** Angiogram in lateral projection identified the anterior location of the endoleak.



**Figure 4:** Selective catheterisation of the leak entry site was achieved.

guide wire. The leak entry site was selectively catheterised with 2,4F Progreat micro catheter and 0,016 Terumo guide wire (Figure 4). Embolisation started with four 10/4 Tornado microcoils. Coil delivery was obtained by saline flush and by push technique using a Terumo guide wire. A 2,5F Rebar microcatheter, compatible with DMSO, was placed in that position before Onyx injection. After filling the catheter dead space with DMSO, Onyx injection was started at a slow rate. Initially, 2 vials of Onyx 18 were used because its lower viscosity allows superior penetration into the aortic sac. Then, 4 vials of Onyx 34 were employed because its greater viscosity is useful to minimize

the risk of reflux into the aorta. Completion angiogram demonstrated successful aneurysm exclusion (Figure 5). Hemostasis was achieved by manual compression. He was discharged home the day after. At 12-month follow-up, contrast-enhanced ultrasound confirmed absence of endoleak and CT showed stable aneurysm sac diameter (Figure 6).

## Discussion

Type I endoleak constitutes a high risk for continued aneurysm expansion and rupture and should be treated quickly upon detection. Extender cuffs, balloon-angioplasty and bare stents can deal with most of type I endoleaks. Chimney and periscope grafts or visceral artery bypass might sometimes be necessary to extend landing zones. When these techniques cannot resolve the leak, catheter-based procedures can be performed. Coils, glue, thrombin, N-BCA and Onyx are some of the embolic agents frequently employed [1].

Several studies have reported coil embolisation with good results. However, recanalisation and continued transmission of systemic pressure through the thrombus and coils are potential concerns.

N-BCA and Onyx are liquid embolic materials that have successfully managed arteriovenous malformations and their safety profile seems more favorable.

N-BCA is a fast-acting liquid adhesive polymer comprised of N-butyl cyanoacrylate, ethiodised oil and tantalum powder. Tantalum powder imparts radiopacity to the embolic mixture. N-BCA acts by rapid polymerization, ethiodised oil being the component that



**Figure 5:** Technical success was obtained with Onyx embolisation.



**Figure 6:** Twelve months after Onyx embolisation, CT demonstrated a stable aneurysm sac diameter of 85 mm.

increases polymerization time. Upon contact with body fluids or tissue, the mixture polymerizes into a solid material [2].

Onyx is a non-adhesive liquid embolic agent comprised of ethylene vinyl alcohol (EVOH) copolymer and micronized tantalum powder dissolved in dimethyl sulfoxide (DMSO). When injected into an aqueous medium, the DMSO diffuses and is eventually exhaled through alveolar diffusion. This process leaves the EVOH/tantalum mixture to precipitate within the vessel lumen.

The benefits of Onyx over N-BCA include less thrombogenicity and inflammation, since no protein denaturation occurs. Onyx is cohesive and non-thrombogenic allowing for better packing of the lesion. Its texture is well suited for occupying spaces and conforming to irregular surfaces. Moreover, Onyx can be delivered more slowly than N-BCA and embolisation can potentially be better controlled. Onyx injections are slow and precise, allowing controlled angiography during injection.

Disadvantages include time consuming procedure, high cost and transient patient experience of foul breath. Tantalum powder causes significant CT artefact and any residual or recurrent endoleak may not be visualized. Contrast-enhanced ultrasound may be a better follow-up imaging modality in these cases [3].

There is limited published experience of type 1 endoleak embolisation with Onyx. The latest series reported six patients with no recurrent endoleaks at up to 10 months of follow-up [4]. Another series reported 100% technical success with Onyx embolisation of type 1 endoleak in six patients. However, in this series one patient experienced early occlusions of renal artery chimney grafts and a late stent graft migration with aneurysm rupture occurred in another patient [5]. One study reported a single successful case of Onyx embolisation for a proximal type 1 endoleak [6].

In our experience, Onyx is usually employed with successful results to treat brain arteriovenous malformations. This is the first

case we perform Onyx embolisation for a type 1 endoleak after EVAR. Technical success was obtained. Absence of endoleak was maintained at 12-month of follow-up by contrast-enhanced ultrasonography. CT demonstrated stable aneurysm sac area. No procedure-related complications occurred.

Although the early results of this technique are promising, further follow-up is needed to assess the efficacy of this treatment. The durability of this technique remains unknown. The effect of pressure transmission into the sac has not been studied. Well-designed studies involving Onyx are needed before this treatment is more broadly recommended.

## Conclusion

Type 1 endoleak after EVAR can be treated successfully with Onyx embolisation when standard endovascular techniques have failed and surgical options are unsuitable due to severe comorbidity.

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