

# Embolization of Giant Post-Traumatic Arteriovenous Renal Fistula using the Penumbra Occlusion Device

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A 48 year-old-man with history of abdominal trauma came to the emergency department reporting back pain. The patient underwent abdominal ultrasonography for lumbar pain with detection of voluminous vascular alteration. Immediately, computed tomography angiography (CTA) was performed that demonstrated renal artero-venous fistula with aneurysmatic dilatation. After multidisciplinary discussion, an endovascular treatment was decided upon. Angiography confirmed a high-flow renal AV fistula, and the aneurysmatic dilatation and very tortuous renal artery. The complex anatomic situation was resolved with neuro derived embolic metallic spirals. Complete exclusion of the fistula and aneurysm was obtained. CTA after the endovascular procedure demonstrated that renal perfusion was completely preserved.

**Keywords:** Arteriovenous Malformations; Embolization; Post Traumatic; Renal

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## INTRODUCTION

Renal artery aneurysm (RAA) concomitant with a renal arteriovenous fistula (RAVF) is extremely rare, often an acquired renal vascular abnormality, and usually caused by biopsy, percutaneous nephrostomy, or trauma [1–3]. This pathology is usually complex and difficult to treat using normal techniques. Previously, nephrectomy was an optional treatment for RAA and RAVF [4]. Recently, endovascular treatment has offered a viable alternative with a high technical success rate and low procedure-related morbidity and mortality.

Here, we report the endovascular management of a post-traumatic giant renal aneurysm with high-flow AVF using a new hybrid coil, the Penumbra occlusion device (POD).

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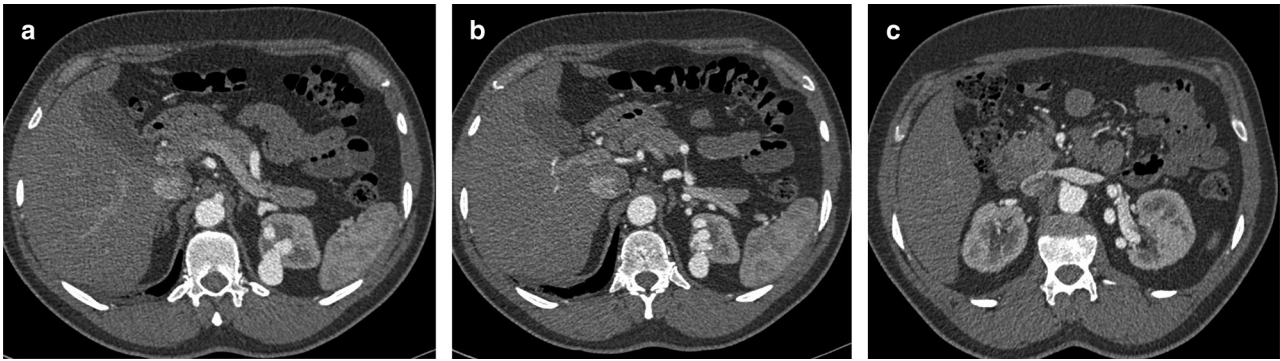
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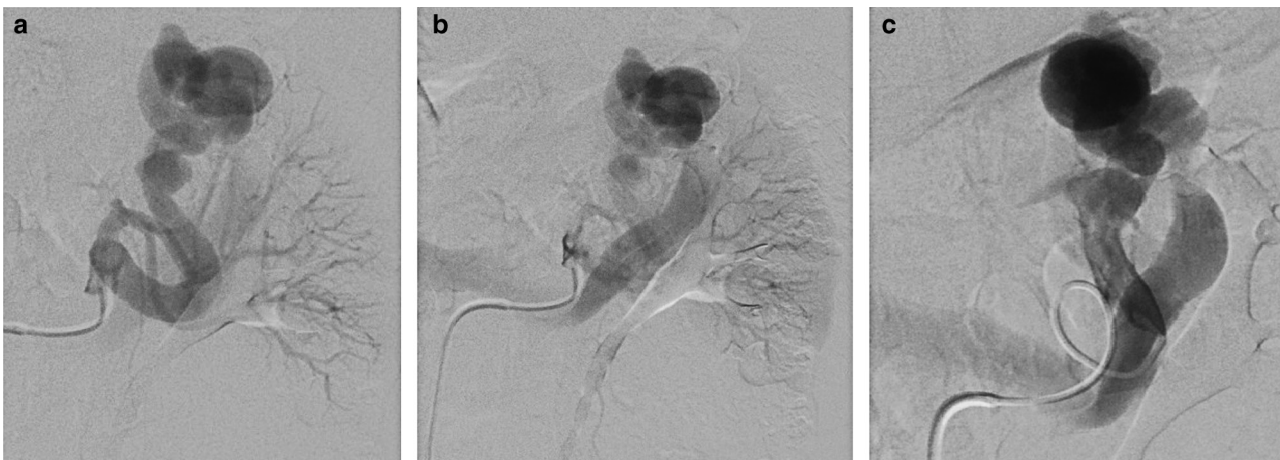
## CASE PRESENTATION

A 48-year-old male patient initially presented with a 6-month history of left flank pain. The pain was dull, intermittent, and non-radiating. His history included a bicycle accident from 10 years ago, the trauma from which had been in the left flank. On physical examination, a continuous bruit was audible over the left flank. Ecocolordoppler (ECD) evaluation revealed a large cystic lesion at the left renal superior polar, with increased flow velocity and decreased arterial resistance; mixing of arterial and venous waveform was also observed. A computed tomography angiography (CTA) was performed which revealed contrast opacification of the renal vein during the arterial phase, suggesting RAVF. A RAA was also observed occupying the mid and higher poles of the left kidney and measured  $4 \times 3$  and  $7 \times 3$  cm<sup>2</sup>, respectively (Figure 1a–c).

The main renal artery was the possible feeder artery to the AVF which was seen directly opening into the RAA, suggesting an ultrashort segment of fistulous communication. The main renal vein appeared to be directly communicating with the pseudoaneurysm and was also dilated grossly with aneurismal morphology. The morphology and extension of the vascular lesion was well demonstrated on the angiogram (Figure 2a–c).



**Figure 1** (a–c) Computed tomography angiogram (CTA) demonstrates renal arteriovenous fistula with aneurysmatic dilatation.



**Figure 2** (a–c) Angiography confirms a high-flow arteriovenous fistula and the aneurysmatic dilatation.

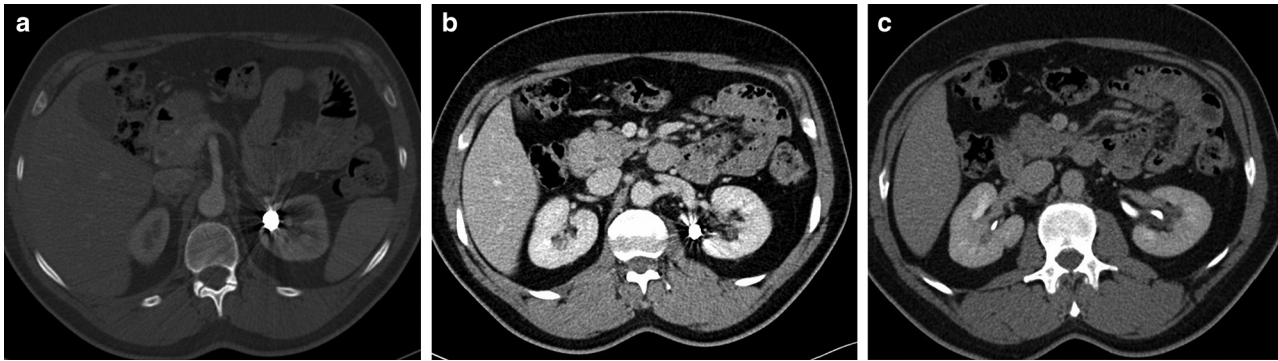


**Figure 3** (a–c) The embolization technique and final angiography that demonstrates completed fistula and aneurysmatic dilatation occlusion with complete renal perfusion.

The patient was referred to our department for endovascular management. A 4-F introducer sheath (Terumo, Tokyo, Japan) was placed using an ultrasound-guided Seldinger technique through the right common femoral artery, under local anesthesia.

The left renal artery was then catheterized using a 4-F Simmons 1 catheter. Digital subtraction angiography revealed similar findings to the CTA, consistent

with giant AVF fed by RA. Subsequently, the 4-F arterial sheath was upsized to a 6-F guiding sheath to gain access into the renal artery ostium. A POD was placed at the junction of the feeding artery and the first part of the AVF through a 0.027-inch microcatheter (Progreat, Terumo, Tokyo, Japan) (Figure 3a–c). The position was then confirmed by means of an angiogram, and the device was completely released.



**Figure 4** (a–c) CTA post-embolization confirms the complete exclusion of AV fistula and aneurysm with complete renal perfusion.

Follow-up CTA (Figure 4a–c) showed non-filling of the sac with complete vascular exclusion. A repeat Doppler study after 12 h showed complete non-filling of the AVF. After an unremarkable recovery, the patient was discharged in a stable condition and patient is being followed for 1 year.

### **Ethical Approval and Informed Consent**

Ethical approval was not required. Written informed consent was obtained from the patient on the day of procedure.

### **DISCUSSION**

Renal AVF is generally secondary to those processes that are invasive to the renal parenchyma or renal vascular system (approximately 70%), such as biopsy, percutaneous nephrostomy, and trauma; it might also be congenital. Its proper management has been controversial [1]. Symptomatic patients and those with large AVFs are referred for treatment, the main aim of which are eradication of the AVF and its consequent symptoms, along with preservation of the renal parenchyma. Indications for treatment are progressive increases in the size of AVF; non-resolving hematuria; and hemodynamic features, especially decompensation, hypertension, and high-output heart failure.

Surgery in the form of arterial feeder ligation and total or partial nephrectomy is considered as the last resort. Coil embolization is now the standard endovascular approach to the management of symptomatic AVF [5,6]. However, transcatheter embolization of large, high-flow AVF always carries a significant risk for migration of embolic material into the pulmonary arteries and the use of the Amplatzer vascular plug is unsuitable for vessels that are too small or too large [7–9]. This risk can be minimized using a POD system. This new hybrid coil (Penumbra Inc, Alameda, California, USA) is designed specifically to achieve occlusion in relatively large arteries. The POD is a 0.020-inch system with a specific anchoring segment (double nitinol coating with a precise loop) to grip the vessel wall. The POD delivery only requires the use of a 0.025-inch microcatheter. After these anchor loops are

deployed, the device then transitions to a soft packing segment with a smaller diameter and increased softness to nest tightly and create a dense, cross-sectional plug [10].

The POD has many advantages over other embolic materials. Its position after the release is checked with contrast injection and can be retracted, if required, and repositioned. Its migration risk is less than those of coils. Furthermore, there is no need for a large sheath to put the POD system into the vessels. This case illustrates the feasibility of the use of the POD in the treatment of renal AVF with giant pseudoaneurysm with complete preservation of renal parenchyma.

### **Ethics Statement**

- (1) All the authors mentioned in the manuscript have agreed to authorship, read and approved the manuscript, and given consent for submission and subsequent publication of the manuscript.
- (2) The authors declare that they have read and abided by the JEVTM statement of ethical standards including rules of informed consent and ethical committee approval as stated in the article.

### **Conflicts of Interest**

The authors declare that they have no conflicts of interest.

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