# Intertwining Coil and Catheter During Brain Arterial-Venous Malformation Embolization: A Case Report of a Rare Complication

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Cerebral arteriovenous malformations (AVMs) are rare vascular anomalies associated with a risk of devastating intracerebral hemorrhage. They are often diagnosed following the appearance of seizures, focal neurological signs, or bleeding. In such cases endovascular embolization, which aims to occlude the AVM nidus and reduce risk of hemorrhage, has become a crucial therapeutic approach. Herein, we describe the case of a 62-year-old patient with a history of bleeding caused by cerebral AVM. During urgent endovascular embolization of the patient's AVM, a combination of large-caliber platinum coils and Onyx™ liquid embolic agent was used to achieve hemostasis after catheterizing a primary feeder. However, when the catheter was being pulled back, the proximal part of the coil migrated and became entangled with the catheter, thus remaining partially in the AVM and partially elongated in the access vessel thereby impeding the catheter from being completely removed from the percutaneous access. Surgical access with repair of the axillary artery was necessary to remove the catheter trapped in the coil. The successful outcome of this case demonstrates the importance of early recognition, timely intervention, and multidisciplinary team collaboration in managing AVM complications during neurovascular procedures to optimize patient outcomes.

**Keywords:** brain arteriovenous malformation; coil embolization; catheter; vascular surgery; case report

## Introduction

Brain arteriovenous malformations (AVMs), consisting of tangles of abnormal blood vessels, are rare vascular anomalies associated with a significant risk of devastating intracerebral hemorrhage. They are often diagnosed following the onset of seizures, focal neurological signs or bleeding. Management of symptomatic or high-risk AVMs typically involves a combination of microsurgical resection, stereotactic radiosurgery and endovascular embolization [1,2]. Endovascular embolization, which aims to occlude the AVM nidus and reduce risk of hemorrhage, has become an effective and widely adapted therapeutic approach [3]. However, the procedure is not without risks such as vessel perforation, incomplete occlusion, and device migration. Here we report on a rare and serious complication of device migration and entrapment during endovascular embolization of a brain AVM, underscoring the need for precise procedural techniques and multidisciplinary management in treating this malformation.

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## Case Presentation

A 62-year-old female with a history of bleeding caused by brain AVM and secondary epilepsy was admitted to the emergency room of our hospital. High blood pressure (180/100 mmHg) was detected at admission. An initial neurological examination showed a National Institute of Health Stroke Scale (NIHSS) score of 14, buccal deviation to the right, a left Babinski sign, and isochoric pupils. A brain computed tomography (CT) showed a right parieto-temporal intraparenchymal hemorrhagic lesion (54 × 39 mm) directly related to the AVM with mass effect, flattening of the cortical sulcus, subfalcine herniation, and a midline shift of 9 mm.

While undergoing the CT, the patient experienced episodes of vomiting consistent with intracranial hypertension.

Urgent endovascular embolization of the AVM under general anesthesia was performed by the neuroradiology team via percutaneous right radial access. After catheterizing a primary feeder to the AVM with a 4 Fr Envoy™ Codman catheter, a combination of 4 large-caliber platinum coils (Target® 360 Coil, Stryker Neurovascular, Fremont, CA, USA) and 4 vials of Onyx™ 18 liquid embolic system (Onyx, Medtronic, Inc., Irvine, CA, USA) was used to seal the nidus.

A coil was then deployed near the AVM nidus but its positioning proved challenging due to the tortuous vessel anatomy. While the catheter was being withdrawn for

repositioning, the coil unexpectedly became glued to the catheter's distal tip. As the catheter was being pulled back, the proximal part of the coil migrated and became intertwined with it, remaining partially in the AVM and partially stretched into the access vessel, thereby creating a snare-like effect across multiple vessels (Fig. 1).

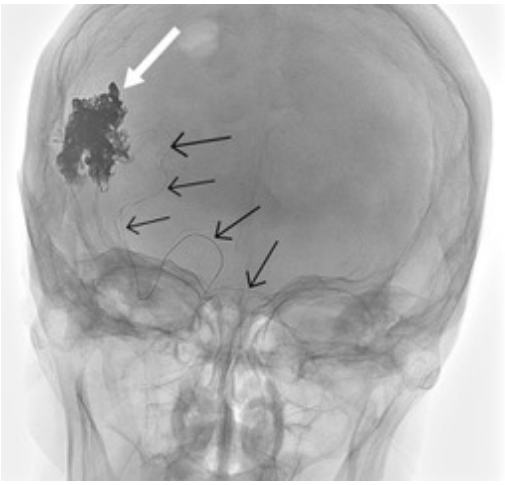

**Fig. 1. Coil (black arrows) trapped between the arteriovenous malformation (AVM) (white arrow) and intracranial arterial vessels.**

Since this unforeseen complication prevented complete occlusion, angiographic checks confirmed that the AVM was only partially embolized.

During the removal of the catheter, as anticipated, high resistance was encountered because of the coil entrapment, so much so that it was not possible to completely remove the catheter that remained in the axillary artery. Selective right arm angiography revealed that both catheter and coil were completely intertwined and trapped in the axillary artery (Fig. 2).

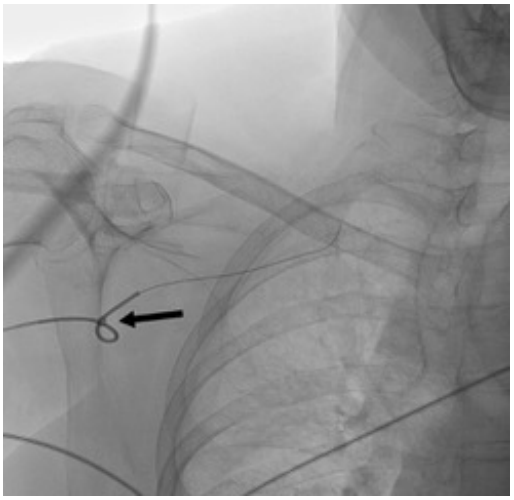

**Fig. 2. Catheter intertwined with coil (black arrow) in the axillary artery.**

After urgent radiologist intervention, a transverse incision was made in the right axillary region by our vascular team to access the distal portion of the axillary artery. Dissection was carefully carried out by way of the surrounding soft tissue to expose the axillary artery while preserving nearby neurovascular structures, including the brachial plexus.
The axillary artery was isolated using vessel loops and was proximally and distally clamped. A longitudinal arteriotomy was then performed on the exposed portion of the axillary artery. The intertwined catheter and coil were extracted from the artery and cut free from their respective proximal ends. The catheter was then withdrawn through the radial artery access, while the stretched coil was left in place to avoid dislodgement of the embolized AVM and any risk of hemorrhagic complications (Figs. 3,4).

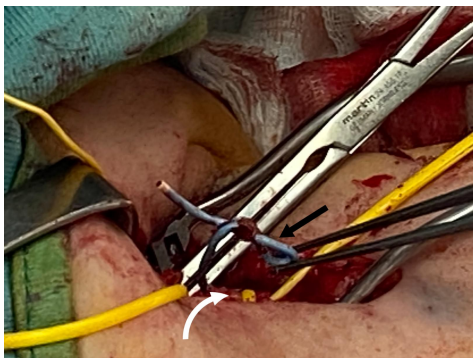

**Fig. 3. Removal of the catheter intertwined with coil (black arrow) from the axillary artery (white arrow).**

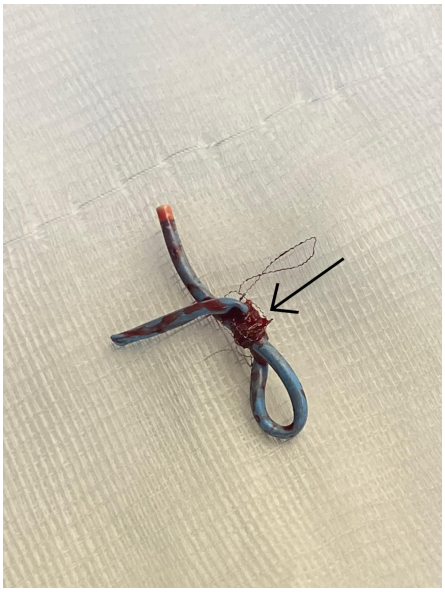

**Fig. 4. Catheter piece removed.** You can see the coil wrapping around part of the catheter (black arrow).

The arteriotomy was closed using a primary running suture with 6-0 prolene.

At the end of the surgical procedure, a duplex ultrasound confirmed adequate blood flow through the axillary artery and into the distal arm. The patient was maintained under single antiplatelet therapy. At discharge, wound dressing every other day and double antiplatelet therapy were recommended. No bleeding, ischemia or nerve injury in the hand took place in the postoperative period.

The patient was discharged under medical treatment with Valproic acid (1 g/die), Oxcarbazepine (900 mg/die), Duoplavin (75 + 100 mg/die), and Gabapentin (300 mg/die) and was doing well 3 months after surgery. Her NIHSS score was reduced to 2, with almost complete remission of all symptoms, and she is under follow-up by the neurosurgery unit. The patient will undergo clinical check-ups every 3 months in the first year, and depending on the clinical condition will be assessed with diagnostic imaging. This case has been reported in line with the Case Report (CARE) Guidelines to ensure the accuracy and completeness of the report (**Supplementary material**).

## Discussion

This case illustrates a rare but serious complication during endovascular embolization of a brain AVM, involving the migration and entrapment of a coil and catheter system within the peripheral arterial vasculature.

While endovascular treatment for brain AVM is often the first choice [3], it is not without risks. Complications such as vessel perforation, incomplete occlusion, and migration of embolic materials can lead to serious consequences, including vascular damage or ischemia [4]. Factors contributing to migration of coil can include tortuous vessel anatomy, adherence of embolic materials (coils and liquid agents such as Onyx™) to the catheter tip, operator difficulties in repositioning devices, a mismatch between coil size and arterial caliber, inadequate positioning of the microcatheter within the aneurysm, and mechanical vasospasm induced by catheter manipulation.

An extensive literature review was conducted to identify any cases similar to ours that describe coil dislodgement and entrapment. No exact matches or directly comparable cases were found, which suggests that the case described herein represents a unique and rare complication.

In our patient, the coil adhered to the catheter tip during repositioning attempts, which caused partial dislodgement of the coil itself and subsequent entrapment in multiple vascular regions from the AVM nidus to the radial and axillary arteries.

Although rare, instances of coil migration during endovascular interventions have been reported in the literature. Such cases often require neurosurgical intervention for recovery rather than a vascular surgical approach [5–8].

A case reported by Kim *et al*. [5] describes coil migration during embolization of a middle cerebral artery aneurysm, for which an emergency left pterional craniectomy was performed to retrieve the migrated coil.

Park *et al*. [8] describe a case involving a 40-year-old man with an unruptured left internal carotid artery aneurysm. During a coil embolization procedure, the third coil detached and migrated into the insular branch of the middle cerebral artery resulting in complete blood flow obstruction to the premotor and motor cortex. After exposing the insular branch of the middle cerebral artery, the coil was identified and removed through arteriotomy [8].

Advancements in endovascular devices aim to reduce the risks associated with catheter entrapment in embolic agents such as Onyx®. Among these, the Sonic microcatheter offers distinct advantages, such as the FuseCath system, which minimizes the risk of distal catheter entrapment. If the distal tip becomes stuck in the embolic agent, the detachable tip allows for safe extraction, reducing force on arteries and lowering hemorrhage risks [9].

Abdalkader *et al*. [10] emphasizes the operative management of migrated coils differentiating approaches based on whether the complication occurs during or after procedure. In cases of intraprocedural migration such as ours, recovery options include endovascular, surgical, or conservative methods. Endovascular techniques are considered first-line, due to their minimally invasive nature, and involve the use of devices such as stent retrievers or specialized tools like the Alligator or Merci devices [11,12].

Despite the existence of endovascular retrieval systems for migrated coils, in our patient's case their application was not feasible due to the unique anatomical and technical challenges associated with AVM. This highlights the need for individualized management strategies in such complex cases.

Migration of endovascular devices into peripheral arteries can result in vascular occlusion and acute ischemia, requiring immediate intervention to prevent limb-threatening complications.

In our case, the timely involvement of the vascular surgery team was pivotal for a successful outcome. Surgical management of entrapped or migrated endovascular devices typically involves careful dissection of the affected vessel, removal of the foreign body, and subsequent vascular repair. In the case presented, a distal axillary artery approach with arteriotomy allowed for the safe retrieval of the trapped coil-catheter system. Vessel loops and proximal/distal clamping ensured vascular control, which minimized the risk of blood loss and additional trauma.

The decision to leave a part of the coil anchored to the AVM nest was taken in collaboration with neuroradiologists and neurosurgeons, because its removal would have required a surgical access to the brain, which was not suitable for the patient's clinical conditions. Therefore, it was decided to leave the coil in place and set up a double antiplatelet therapy.

## Conclusions

This case highlights the complexity of treating brain AVMs through endovascular embolization and the potential for de-

vice migration. The successful management of this complication required the collaborative efforts of both interventional radiology and vascular surgery teams. Timely and careful surgical intervention was essential in preventing ischemic damage and preserving vascular integrity, ensuring a favorable outcome for the patient. The decision to leave part of the coil tethered to the AVM nidus to avoid further intracranial complications reflects a patient-centered approach to complex clinical decision-making. Our case demonstrates the importance of early recognition, prompt intervention, and the ready availability and collaboration of a multidisciplinary team in managing complications to optimize patient outcomes in neurovascular procedures.

## Availability of Data and Materials

All experimental data included in this study can be obtained by contacting the first author if needed.

## Author Contributions

NB and MP designed and performed the research. EC, GG and DT collaborated on data collection and drafting the manuscript. UMB and LC analyzed the data. All authors contributed to important editorial changes in the manuscript. All authors read and approved the final manuscript. All authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

## Ethics Approval and Consent to Participate

Ethics approval was not required for this case report. The patient signed the informed consent. The study adhered to the Declaration of Helsinki.

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This research received no external funding.

## Conflict of Interest

The authors declare no conflict of interest.

## Supplementary Material

Supplementary material associated with this article can be found, in the online version, at https://doi.org/10.62713/aic.3963.

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