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CORRESPONDENCE

Removal of a Distally Migrated and Wedged Small Detachable Coil Using a 4MAX Penumbra Reperfusion Catheter

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Introduction

Migration of a detachable coil during embolization of a cerebral aneurysm is not rare [1–6]. Surgery and techniques using wires, snares, and stent-retrievers have been used for the retrieval of the migrated coils [1–5]; however, surgical removal is time-consuming and the other endovascular techniques need to introduce the devices through the coil mass for removal. Recently, a small coil which had migrated and became wedged in the distal posterior cerebral artery, was successfully retrieved using a 4MAX reperfusion catheter (Penumbra, Alameda, CA, USA).

Case Presentation

A 54-year-old female presented to the emergency department with severe headache. On brain computed tomographic angiography, aneurysms were observed at the vertebrobasilar artery junction with distinct subarachnoid hemorrhage. It was decided to perform a coil embolization and the patient was moved to the angiosuite. With the patient under general anesthesia, an 8F sheath was placed in the right common femoral artery. A 7F Envoy guiding catheter (Cordis, Miami, FL, USA) was inserted into the distal segment of the dominant left vertebral artery. In the rotational angiogram, two vertebrobasilar artery junction aneurysms were observed as mirror images. The frame coil for the smaller aneurysm was inserted first to address the concern that it might be obscured by the coil mass in the larger aneurysm, on working angle. An Axium 1.5 mm × 3 cm helical coil (Medtronic, Irvine, CA, USA) was inserted into the neck of the larger aneurysm after filling most of the dome using two microcatheters; however, after the detachment, the coil was observed to exit the aneurysm neck and migrate to the right distal posterior cerebral artery (PCA). After changing the guiding catheter to an 8F Guider (Stryker Neurovascular, Natick, MA, USA), an Enterprise 4.5 mm × 22 mm stent (Codman, Miami, FL, USA) was placed in the vertebrobasilar artery junction to prevent further herniation of the detached coil. After introducing the Prowler Select plus microcatheter (Codman & Shurtleff, Raynham, MA, USA) using Synchro microwire (Stryker Neurovascular, Fremont, CA, USA) through the coil mass, a Solitaire 4 mm × 20 mm stent-retriever (Medtronic) was temporarily deployed and withdrawn without success (Fig. 1). A high resistance was felt on further attempting to insert the microwire through the coil mass. To avoid hemorrhagic complications due to vessel injury during wiring, it was decided to aspirate the coil using a 4MAX Penumbra reperfusion catheter. The 4MAX catheter was introduced to the right distal PCA using the same microwire and microcatheter and gradually pushed at the end to maximally adhere to the coil, followed by manual aspiration using a 50 ml syringe. After a maximum duration of aspiration of 1 min, the catheter was withdrawn while maintaining the negative pressure. The withdrawal of the coil mass was not observed during the first two attempts; however, changes in the shape of the coil mass were observed. In the third attempt, the proximal portion of the coil was separated and sucked into the catheter tip and it was withdrawn out of the guiding catheter. The retrieved coil, which was coated with a white thrombus was found to be partially sucked into the catheter tip (Fig. 2). The operation was completed after an additional coil filling of the smaller aneurysm. After recovery from the anesthesia the patient showed no neurological abnormalities. No signs of cerebral infarction were observed in diffusion weighted images performed 2 days later. In the catheter angiography performed 13 months later, the aneurysm was well occluded without any specific findings in the right PCA.

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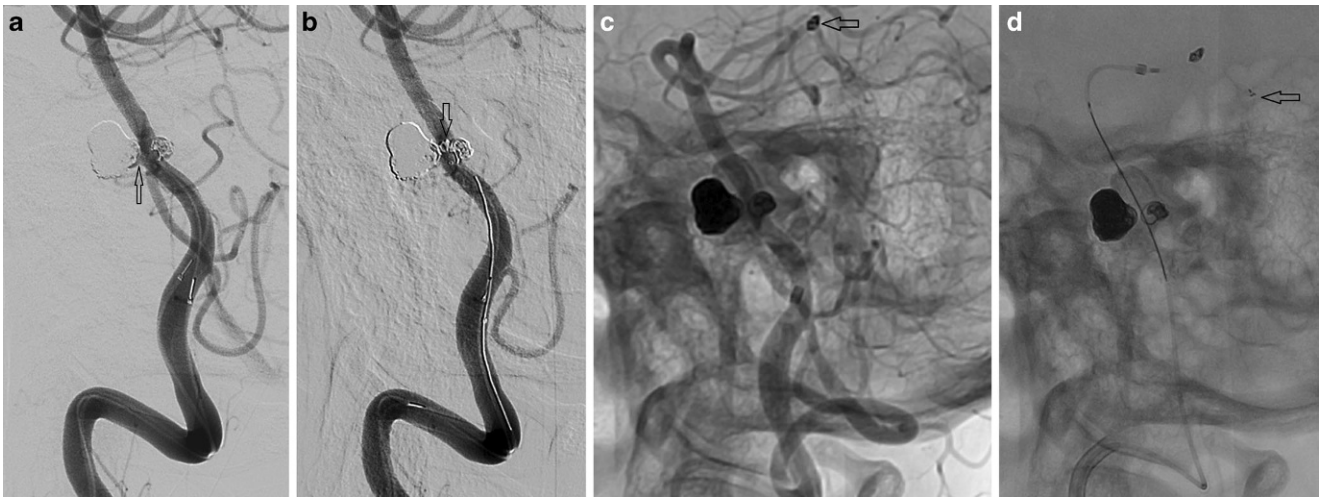

Fig. 1 **a** Control angiogram during coil embolization of two proximal basilar artery aneurysms. The neck remnant (*arrow*) is noted in the larger aneurysm. **b** After the detachment of the 1.5 mm × 3 cm coil from the neck remnant, the coil (*arrow*) herniated to the parent vessel lumen. **c** Angiogram showing the migration of the herniated coil to the distal posterior cerebral artery. **d** The image captured when the Solitaire stent-retriever was temporarily deployed to remove the migrated coil. The arrow indicates the distal marker of the stent-retriever. The attempt was unsuccessful

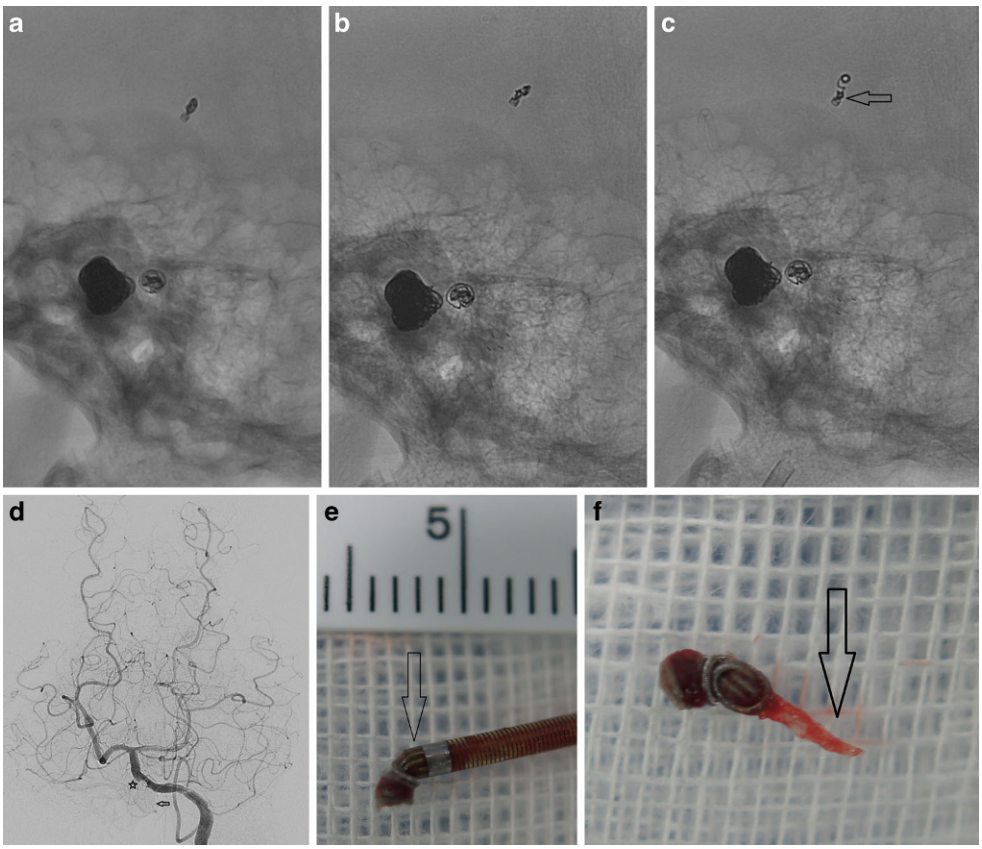

Fig. 2 **a** The image captured during the first attempt of the suction of the coil mass using 4MAX penumbra catheter. **b** The image captured during the second attempt of the suction of the coil mass using the same catheter. Separation of a part of the coil mass is noted. **c** The image captured during the third attempt of the suction of the coil mass using the same catheter. Separation of the coil mass is evident and a part of coil (*arrow*) is attached to the catheter tip. **d** Final anteroposterior angiogram of the left vertebral artery showing an intact right posterior cerebral artery. Complete occlusions of both (*star, arrow*) aneurysms are noted. **e** Photograph of the catheter tip harboring a part of the coil mass (*arrow*) inside the catheter lumen. **f** Photograph of the removed coil mass showing a thick white thrombus (*arrow*) around the coil mass

Discussion

Coil migration has been reported since the introduction of coil embolization for cerebral aneurysms [1–6]. Observation with hydration or deployment of a stent over the migrated coil can be considered instead of coil retrieval when the diameter of the parent artery is large enough and the coil length is short [6]. Surgery, wires, snares, and stent-retrievers had been used for coil retrieval in inevitable cases [1–5]; however, surgical removal is time-consuming, and parts of the device must be inserted through the coil mass during the endovascular salvage procedures using wire, snare, and stent-retriever.

As shown in the animal experiment conducted by Nikoubashman et al. [7] there are risks for further distal migration of the coil mass and vessel damage during insertion of stent-retriever devices. Although they described techniques in which the microcatheter did not pass through the coil mass, use of these techniques in patients might not be possible owing to the high risk of vascular damage. Most of the reported bail-out procedures and devices are of little help when complete occlusion is induced by a lengthy coil and an intermingling thrombus.

The main difference of the suction catheter compared to the stent-retriever is that the catheter does not have to pass through the occlusion site. In the initial stages of the coil migration, the microwire, microcatheter or other devices could pass relatively easily through the coil mass; however, as the thrombus is formed in and around the coil over time, insertion of these devices becomes difficult and the risk for hemorrhage rapidly increases. Retrieval using a suction catheter is the only available alternative in such cases. The thrombus formed could change the surface of the coil mass enhancing the adherence to the catheter tip. The suction catheter can also be used more safely over the stented vessel segments. It prevented a possible tangle between the stent-retriever and the Enterprise stent during the coil retrieval in the presented case. Although the tapered design of the 4MAX catheter might contribute to distal access in this case, the author thinks the treatment success is also transferable to other aspiration or distal access catheters with sufficient internal diameter because the ratio of the vessel and catheter diameters is one of the most important factors for the success of contact aspiration [8].

Conclusion

Aspiration removal using a 4MAX Penumbra reperfusion catheter could be used for the retrieval of a migrated and wedged coils, when no other endovascular option is feasible because of complete occlusion.

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Compliance with ethical guidelines

Conflict of interest H.-J. Kwon declares that he has no competing interests.

Ethical standards All procedures reported in this article were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. The institutional review board of Chungnam National University Hospital approved this study and informed consent to publish was obtained from the patient in question. This article does not contain any studies with animals performed by the author.

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