Irretrievable unraveled coil remaining in the vascular lumen between the cerebral aneurysm and puncture site

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Objective: Unraveled coils can be removed during cerebral aneurysm embolization. However, if the unraveled coil is engaged with other indwelling coils, its retrieval is sometimes difficult. We report 2 patients in whom unraveled coils were irretrievable, and were left in the vascular lumen between the aneurysm and the puncture site, rather than being forcibly retrieved.

Methods: We stretched the unraveled coil as much as possible in the parent artery, and withdrew the catheters. The unraveled coil remained in the vascular lumen between the aneurysm and the puncture site. The tail of the unraveled coil was cut and, making a small incision at the puncture site, the remaining part was buried with ligation in the subcutaneous tissue. Systemic heparinization and antiplatelet therapy were performed after the procedure.

Results: Neither patient experienced complications attributable to the unraveled coil in the vascular lumen. Coil compaction occurred in one patient who underwent further coil embolization. The residual unraveled coil was not affected by the procedure and remained stable in the vascular lumen.

Conclusion: We consider that leaving the unraveled coils in the vascular lumen is an acceptable alternative to forcible retrieval.

Key Words: cerebral aneurysm, endovascular treatment, unraveled coil

Introduction

In the course of coil embolization of intracranial aneurysms, unraveling of the coil changes its structure from spiral to that of a core wire. Most unraveled coils can be retrieved by pulling back the delivery wire in the microcatheter. Alternatively, retrieval devices such as a snare wires are available, but if the distal tip of the unraveled coil is entangled with other indwelling coils, retrieval may be difficult. Herein we report 2 patients whose unraveled coils were irretrievable, and were left in the vascular lumen between the aneurysm and the puncture site, instead of being forcibly retrieved. We detail our manipulations and report post-procedure management of these patients.

Case Reports

1. Case 1

This 62-year-old woman presented with subarachnoid hemorrhage (Hunt and Hess grade 2). Diagnostic angiography revealed a right internal carotid-posterior communicating artery (IC-PC) aneurysm and the patient underwent coil embolization on onset day. Using the transfemoral approach, a guiding catheter was placed in the right internal carotid artery (ICA) and a microcatheter (Tracker Excel-14; Boston Scientific, Natick, MA, USA) was advanced into the aneurysm. Heparinized saline (10-20 IU/hour) was perfused through a guiding catheter and a microcatheter without systemic heparinization. GDC-18 2D (8.0 mm × 30 cm; Boston Scientific, Natick, MA, USA) framing coil was successfully deployed into the aneurysm, which was packed with GDCs of gradually decreasing size. The 6th coil (GDC-10 Soft, 4.0 mm
×8.0 cm) unraveled during positioning. At first we pulled back the delivery wire in an attempt to retrieve the unraveled GDC. However, the unraveled part extended as far as the proximal ICA and the distal tip of the coil could not be detached from other coils deployed in the aneurysm. Pulling back the unraveled coil with the microcatheter shifted the coil mass toward the ICA. We abandoned retrieval of the unraveled coil, and stretching it as much as possible in the femoral artery without cutting it. We then withdrew the catheters under direct fluoroscopic observation. After removal of the sheath, the unraveled GDC was left in the vascular lumen between the aneurysm and the puncture site. We applied manual compression, then cut the part of the coil protruding from the puncture site to a length of about 2.0 cm. The tail of the unraveled GDC was ligated to the subcutaneous tissue through a small skin incision and buried at the puncture site (Fig. 1). The patient awoke from general anesthesia without neurological deficits. Persistent systemic heparinization was performed for 72 hrs after the procedure; the activated clotting time (ACT) was maintained at 200–250 sec. In addition, the patient received aspirin (100mg/day) for 6 months starting from the postoperative day 1.

Post-operative computed tomography (CT) showed neither hemorrhagic nor thromboembolic complications. On skull radiographs obtained on the 3rd postoperative day, the unraveled coil in the vascular lumen showed no interval changes in configuration (Fig. 2). The patient was discharged without any deficits. CT and cerebral angiograms obtained 6 months later showed neither new ischemic lesions nor aneurysmal recanalization.

2. Case 2

This 60-year-old woman presented with oculomotor nerve palsy. Head MRA disclosed a left IC–PC aneurysm and she underwent coil embolization. As her aortic arch and common carotid artery were highly tortuous we chose direct left common carotid puncture rather than the transfemoral approach. Heparinized saline (10–20 IU/hour) was perfused through the catheters without systemic heparinization. GDC-18 2D (10 mm×30 cm) framing coil was successfully deployed and the aneurysm was packed with GDCs of gradually decreasing size. The 8th GDC-10 Soft coil (4.0 mm ×8.0 cm) failed to enter the aneurysm, unraveling during withdrawal. Its distal tip was entangled with the indwelling GDC mass and, during the retrieval attempt, became extended as far as the proximal ICA. Therefore, after removal of the guiding and microcatheters, the unraveled GDC was left in
the vascular lumen between the aneurysm and the puncture site. After manual compression, its tail was cut and the residual coil portion was ligated to the subcutaneous space of the neck. Systemic heparinization (ACT 200–250 sec) and aspirin (100mg/day) were administered after the procedure. Skull radiographs on the 3rd postoperative day showed no changes in the GDC left between the aneurysm and the neck (Fig. 3). The patient was discharged without neurological deficits except for oculomotor paralysis, which improved in 3 months. However, as follow-up angiography performed 6
months post operation showed coil compaction in the
anerysm, the patient underwent further GDC embolization
via the transcarotid approach. The unravelled GDC remained
stable without shifting in the vascular lumen, and it did not
affect the subsequent procedure.

Discussion

Coil unraveling or fracturing reportedly occurs in fewer
than 2% of patients undergoing endovascular treatment for
intracranial aneurysms\textsuperscript{6}. Unraveled coils can be retrieved by
pulling back the delivery wire or microcatheter, or by using a
snare wire or other devices\textsuperscript{1,3,5-10}. However, retrieval of
unraveled coils may result in intimal injury or aneurysmal
rupture\textsuperscript{11}. Moreover, if the distal tip of the unraveled coil is
entangled with an indwelling coil mass, forcible retrieval may
shift the coil mass from the aneurysm to the parent artery.
Alternatively, the unraveled coil may be detached in the
parent artery. For our patients, we decided against forceful
retrieval and left the coils in the vascular lumen between the
aneurysm and the puncture site.

Various techniques were reported to manage stretched
coils in the parent artery. In a patient undergoing endovascular
treatment for a carotid cavernous fistula, Gupta et al\textsuperscript{12} left an
irretrievable coil in the arterial tree after cutting it at the
level of the femoral sheath. Sedat et al\textsuperscript{13} buried an unravelled
coil in the subcutaneous part of the neck. They delivered
anticoagulation and antiplatelet therapy after the procedure
to prevent thromboembolic complications. We performed 72
hrs systemic heparinization and 6-month antiplatelet therapy
after the procedure.

If a part of the unravelled coil remains in the parent artery
it may be moved distally by the blood flow and become
entangled in the parent artery, increasing the risk of
thromboembolic complications. Therefore, we ligated the
tail of the unraveled coil that protruded from the vascular lumen
to the subcutaneous tissue and tethered it to prevent any
bending. Post-operative skull radiographs showed no changes
in the unraveled coils in the vascular lumen and neither
patient experienced local pain or inflammation. In case 2, the
unraveled coil in the parent artery remained stable inside the
vascular lumen during the subsequent coil embolization
procedure. Nakahara et al\textsuperscript{14} reported that 1.8 Fr non-
detachable balloon system, which was left in the parent
artery, was covered by fibrous tissue during long-term
anticoagulant therapy. The caliber of unravelled coil is less
than 1.8 Fr system. We believe that unravelled coils left in the
vascular lumen will be covered by endothelial cells
proliferating during the administration of post-procedure
medications.

Recently, coil unraveling has decreased owing to the
development of a stretch resistant (SR) coil which provides
safer endovascular treatment\textsuperscript{7}. Should SR coil unraveling
occur, it can be difficult to stretch the coil intentionally and
the coil mass may come out of the parent artery. As an
alternative solution, the use of an intracranial stent can be
used to trap the unravelled coil in the parent artery.

Conclusion

The retrieval of coils that unravel during aneurysm
embolization is sometimes difficult. However, we found that
burying and tethering the proximal end of the coil in the
subcutaneous space at the puncture site is an acceptable
alternative rather than forceful retrieval of the coils. Post-
procedure anticoagulation and antiplatelet therapy are
necessary to prevent thromboembolic complications.

References

1) Fiorella D, Albuquerque FC, Deshmukh VR, et al:
Monorail snare technique for the recovery of stretched
platinum coils: technical case report. Neurosurgery 57:
E210; discussion E210, 2005.
2) Gupta AK, Purkayastha S, Krishnamoorthy T, et al:
Endovascular treatment of direct carotid cavernous
fistulae: a pictorial review. Neuroradiology 48:831–839,
2006.
endovascular coil retrieval from intracranial vessels:
of non-detachable balloons in endovascular treatment for
cerebral aneurysms. Neurol Med Chir (Tokyo) 34:353–
5) Prestigiacomo CJ, Fidlow K, Pile-Spellman J: Retrieval
of a fractured Guglielmi detachable coil with use of the
Goose Neck snare “twist” technique. J Vasc Interv Radiol
during cerebral aneurysm embolization after direct carotid
puncture: two case reports. Cardiovasc Interv Radiol
with a new soft stretch-resistant coil. J Neuroradiol
8) Standard SC, Chavis TD, Wakhloo AK, et al: Retrieval of
a Guglielmi detachable coil after unraveling and fracture:
case report and experimental results. Neurosurgery