Case Report
Mini-arteriotomy to remove misplaced Gugliemi detachable coils: case report and technical note

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Abstract: Coil-related thromboembolic complications due to misplacement of coils in embolization of the intracranial aneurysms might result in severe neurological deficits. We describe an unusual case of a ruptured posterior communicating artery (PcomA) aneurysm in a woman who underwent a Mini-Arteriotomy to rescue error embolism in the left middle cerebral artery (MCA). This surgical procedure might be considered as an alternative route in selected patients with coil-related thromboembolic complications. This novel technology gives us a simple and practical method to remedy the misplacement of coils in a wide region of the cerebral vascular after interventional treatment.

Keywords: Cerebral aneurysm, coil, complication, arteriotomy

Introduction

Recently, coil endovascular surgeries have been the priority selection in the treatment of cerebral aneurysms. The growing number of coiling procedures may result in an increasing incidence of hazardous technical complications, such as coil-related thromboembolic complications due to misplacement of coils including protrusion, unraveling, fracture, migration of coils and even error embolism into the parent artery [1, 6-9]. These technical complications can cause potentially disastrous consequences, such as thromboembolic vessel occlusion, leading to serious ischemic stroke. Knowledge of how to remove the misplaced coils is crucial for the prevention of major neurological complications. Thus far, a limited number of devices and techniques have been introduced to address these complications [1-11]. There is no single device or technique available for the removal of all these coils because each situation is unique. Here, a novel technique which can be used relatively widely to remove the misplaced coils is described.

Case report and technique

A 28-year-old right handed female suffered with a sudden headache at 4 hours before her admission. Her brain computed tomographic (CT) scan revealed subarachnoid hemorrhage (Figure 1) and her clinical status was Hunt and Hess grade II on admission. Digital subtraction angiography (DSA) on the second day showed a relatively narrow-necked aneurysm at the left posterior communicating artery (PComA), which adapted to the interventional therapy (Figure 2A, 2B). Endovascular treatment was then performed under general anesthesia and systemic heparinization. For this patient, we used GDCs (Guglielmi Detachable Coils; Boston Scientific Corporation, Natick, MA, USA) for aneurysmal coiling. Standard methods of coils delivery were used as described in the literature. Unfortunately, an error embolization of 5 GDCs implantation revealed a densification coiling in the left MCA under a mistake work position (Figure 3A-C), which was confirmed under rotation and 3D reconstructed imaging. It was found that the left MCA was embolized, but the aneurysm remained (Figure 4A, 4B).

One hour later, the patient was transferred to the operating room for emergency surgery immediately. In persistent heparinization status, a left pterion craniotomy was performed. The aneurysm was found following dissection of the sylvian fissure and then was clipped with a standard aneurysm clip (Sugita standard aneurysm clip, holding force: 155gf; Mizuho Ikakogyo, Tokyo, Japan). Under microscope, with the indication of the inside silver like GDCs the expanded MCA could be found easily. Then the
MCA was isolated with temporary clips at the proximal site of M1 and distal site of M2 apart from the endovascular coils. Firstly, we made an incision about 1.5 mm in the expanded M1 teased by the cusp of No. 7 injection needle with a skin test syringe. Through the incision the GDCs could be found clearly, with catching the headend three coils were fished out thread likely with micro-forceps respectively. As located in the M2, another two coils were out of our reach. With the same method, we made another tiny incision about 1 mm in the expanded M2 and fished out the other two coils. Confirming all the misplaced coils were removed, two incisions were sutured only in two and one stitches with 10-0 silk thread (Cordis Co.) respectively. After releasing the temporary clips at distant and proximal site one by one, no bleeding was checked over. Throughout the process, the MCA was temporary obstructed in 15 minutes. The patient was conscious post-operation with partial aphasia. Fortunately, she was recovered entirely seven days later without hemi-paralysis. Slightly ischemia in temporal lobe was revealed in the Second day’s CT scan after the surgery (Figure 5A-C), and ischemia progressed six days later (Figure 5D-F) without deteriorating on consciousness and aphasia. Two weeks later the ischemia recovered (Figure 5G-I), and it was changed into a malakoplakia in temporal lobe six months later (Figure 5J-L). At nine months later DSA showed patency of the MCA with no stenosis and expansion (Figure 6). The patient was neurologically intact at the one-year follow-up evaluation.

Discussion and review of the literatures

Coil-related thromboembolic complications due to misplacement of coils in embolization of the intracranial aneurysms include protrusion, unraveling, fracture, migration of coils and error embolism into the parent artery might result in severe neurological deficits. The cause of error embolism in our case seems to be related to the mistake work position and detaching the GDC coils without confirming under another point of view or a rotation angiography. A limited number of procedures and devices, including medical approaches, endovascular retrieval using devices, such as a retriever and snare, and surgical removal have been introduced to address the problem of the mentioned unexpected coils [1-11]. The removal of a simple displaced coil floating free in the large intracranial circulation, such as the carotid artery or the M1 segment, can be achieved successfully by the use of available equipment for retrieval, including the retriever and snare [4, 11]. If it stays at the internal carotid artery, stent implantation can be available to push the coil to the vessel wall [5, 6, 9]. However, these devices have limitations when multiple whole-loop coils displaced in a relatively small cerebral arteries. As it was reported, when the coils are still partly within or near the aneurysm, removal of the displaced coils by opening the dome of aneurysm is relatively easy [10]. For fear of tearing the MCA by direct M1 arteriotomy, Mariak et al. reported a successful case where the migrated coil in the MCA was removed by an arteriotomy through a small branch of the M2 segment [7]. Chen et al. removed the coils under the arteriotomy through the proximal A1 near the internal carotid artery bifurcation basing on the good collateral circulation from the contralateral A1 was confirmed [1]. Deshmukh et al. [2] and Heuer et al. [3] have described two cases where migrated coils were removed by arteriotomies of the M1, respectively. However, no single device or technique as mentioned above was applicable for all these coils because each one presented a unique situation.

In our case of 5 whole-loop coils error embolized in M1 and M2 segment, the application of the snare loop was quite difficult because of the potential risk of vascular wall injury, furthermore, it was difficult to implant a stent in the smaller full filled vessel, even if to be implanted reluctantly, the coils and stent themselves would result in ischemia or vessel occlusion eventually. Therefore, emergency craniotomy of
MCA arteriotomy was the only available remedy to take out the GDCs.

With the successful experience of arteriotomy in the case, we found a novel technique which can be used relatively widely as a routine procedure to remove the misplaced coils after interventional treatment. Here, we call our technique of operation as a Mini-Arteriotomy. As the incision was only about 1-2 mm and could be sutured only in one or two stitches with no more difficulty, it could be carried out without narrowing the vessels in general all kinds of cerebral arteries which could be exposed in the anatomy that coils misplaced or migrated. The light-reflecting of the inside coils and the expanded vessels would be helpful to locate the misplaced focus, and if there is no indication of the coils, DSA imaging would be necessary to locate it. Under microscope, we

Figure 2. 3D reconstructed imaging revealed an aneurysm at left PComA with a relatively narrow neck.

Figure 3. A Mistake embolization of 5 GDCs implantation revealed a densification coiling under a mistake work position.
used the cusp of No.7 injection needle putting onto a skin test syringe to tease the vessel wall and made a 1-2 mm incision, the GDCs coils could be found clearly, and could be fished out thread likely with a micro-forceps smoothly. If the coils are multiple or scattered and could not be took out within a sole incision, two or more incisions are also feasible and the whole process would cost us a little time under our control, for only one or two stitches were required to close the incision without bleeding. It should be pointed out that persistent heparinization and an emergency alternative to surgery were necessary to avoid thrombogenesis and prevent ischemia. The thrombus with the coils would increase the difficulty of taking out coils from the micro-incision and would result in cerebral ischemia. Besides, in heparinization status, craniotomy and aneurysm clipping were safety with no more bleeding.

As a result of the more widespread use of coil- ing, a new population of patients is emerging who are referred for surgery after coiling [10]. There are several reasons for requiring surgery after an aneurysm has been treated with coils occlusion. This difficult issue of surgical treat- ment after partial coiling emphasizes the abso- lute necessity of a combined team of endovas- cular and surgical specialists working very closely in the treatment of aneurysms [10]. But based on past experience, the surgeons were reluctant or not confident to carry out surgical operation to remedy the failure of misplaced coils after the interventional therapy. However, this novel technology gives us a simple and practical method to remedy these mistakes in a wide region of the cerebral vasculars, and it can also increase our neurosurgeons’ courage to conquer this difficult issue.

Conclusions

We described our experiences of removing the error embolized coils located in the MCA via Mini-Arteriotomy, which was found to be effective in our case with good results. This surgical procedure might be considered as an alternative route in selected patients with coil-related thromboembolic complications due to interventional misplaced coils. This novel technology gives us a simple and practical method to rem-
edy these misplaced coils in a wide region of the cerebral vascular after interventional treatment.

Disclosure of conflict of interest
None.
Abbreviations

aSAH, Aneurysmal subarachnoid hemorrhage; MCA, Cerebral middle artery; DSA, Digital subtraction angiography; PcomA, Posterior communicating artery; CT, Computed tomography; GDCs, Guglielmi detachable coils.

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References


Figure 6. Nine months later DSA showed patency of the MCA with no stenosis and expansion.