OPEN ACCESS

CASE REPORT

Novel microguidewire-assist (MGA) manoeuver for coil embolisation of an unruptured middle cerebral artery aneurysm

Kazushi Maeda, Ryosuke Otsuji, Junji Uno, Hidefuku Gi

Department of Neurosurgery, Baba Memorial Hospital, Sakai, Osaka, Japan

Correspondence to
Dr Kazushi Maeda,
kamaedayakenajin@yahoo.co.jp

Accepted 1 August 2018

SUMMARY

We describe here a novel yet very simple technique, called microguidewire-assist (MGA) manoeuvre, for coil embolisation of unruptured intracranial aneurysms. A 79-year-old woman with a small, broad-necked middle cerebral artery (MCA) bifurcation aneurysm that incorporated the orifice of the acute-angled M2 superior trunk underwent coil embolisation. Since the balloon assist technique was not feasible, we inserted and retained only the microguidewire through M1 to the M2 superior trunk; subsequently, with appropriate use of the microguidewire, coil embolisation was completed. The MGA manoeuvre resulted in slight vessel straightening and subsequent changes in the angulation of the aneurysmal neck, with which stable placement of the platinum coil was successfully accomplished. For coil embolisation of small, broad-necked MCA aneurysms that partially straddle the M2 trunk, this manoeuvre might provide an effective therapeutic alternative if other techniques are not feasible.

BACKGROUND

Since several decades, surgical treatment (aneurysm clipping) has been the first choice for treatment of middle cerebral artery (MCA) aneurysms, with highly satisfactory results.[1 2] On the other hand, recent progress in endovascular treatment has been remarkable, and reports on endovascular treatment (coiling) of MCA aneurysms is increasing.[3–5] However, MCA aneurysms remain technically challenging to treat by endovascular coil embolisation because of the complex anatomy of the MCA bifurcation. MCA aneurysms often have wide necks and are branched, which make coil embolisation unfavourable. Balloon or stent assist techniques are useful tools for treating these complex lesions, although they are sometimes limited in their use due to the acute angle of the M2 segment branch. In such situations, various modifications are required. Here, we describe a novel yet very simple technique, called the ‘microguidewire-assist (MGA) manoeuvre’, which can be used for coil embolisation. Since this method is very simple and can be safely performed, it should be considered before using complicated procedures. Although numerous novel methods using various devices will surely be devised in the future, since no similar cases appear to have been reported, we would like to propose and record our simple method here.

CASE PRESENTATION

A healthy 79-year-old woman was followed up annually for several years for an asymptomatic, unruptured aneurysm of the left middle cerebral artery at the M1/2 bifurcation (figure 1A) that had been diagnosed during a medical check-up, but since the size of the aneurysm gradually increased, and therewith the patient experienced increased anxiety. The patient wished for a less invasive treatment, and thus, endovascular treatment was proposed (PHASES score[6] 7, UIATS score[7]; Treatment 12/Conservative 10). The size of the aneurysm, which incorporated the left M2 superior trunk, was 3.87 mm in height and 3.5 mm in width, and the neck was 3 mm wide. The patient was prescribed aspirin (100 mg/day) and clopidogrel (75 mg/day) from 1 week prior to the endovascular treatment.

TREATMENT

Technique

The procedure was performed under general anaesthesia and systemic heparinisation via the transfemoral approach, using a biplane flat-panel angiographic unit. A guiding catheter (Launcher 8Fr×90 cm Straight: Medtronic, Minneapolis, Minnesotta, USA) was introduced into the proximal portion of the cervical segment of the left internal carotid artery through an intermediate catheter (TACTICS Microcatheter, Technocrat Corporation Aichi, Japan). We initially planned to perform coil embolisation using the balloon-assist technique. However, although the balloon catheter could be appropriately positioned within the left M2 superior trunk, it caused kinking of the artery and, hence, was not inflated. Further, the branching angle of the M2 superior trunk was so acute that we feared vascular injury due to retention of the balloon catheter. Therefore, we introduced the balloon catheter (SHOURYU SR 4×10 mm, Kaneka Medix, Osaka, Japan) into the left M2 inferior trunk, rather than the M2 superior trunk. However, since the aneurysm was wide necked and was partially straddling the M2 superior trunk, we abandoned this method due to frequent coil protrusion into the M2 superior trunk (figure 1B). We ultimately deemed that it was necessary to place the balloon catheter into the M2 superior trunk for neck remodelling. Thus, the balloon catheter was positioned into the M2 superior trunk using a microguidewire (TENROU 1014, Kaneka Medix, Osaka, Japan). However, as

Check for updates

To cite: Maeda K, Otsuji R, Uno J, *et al*. *BMJ Case Rep* Published Online First: [*please include* Day Month Year]. doi:10.1136/bcr-2018-224864

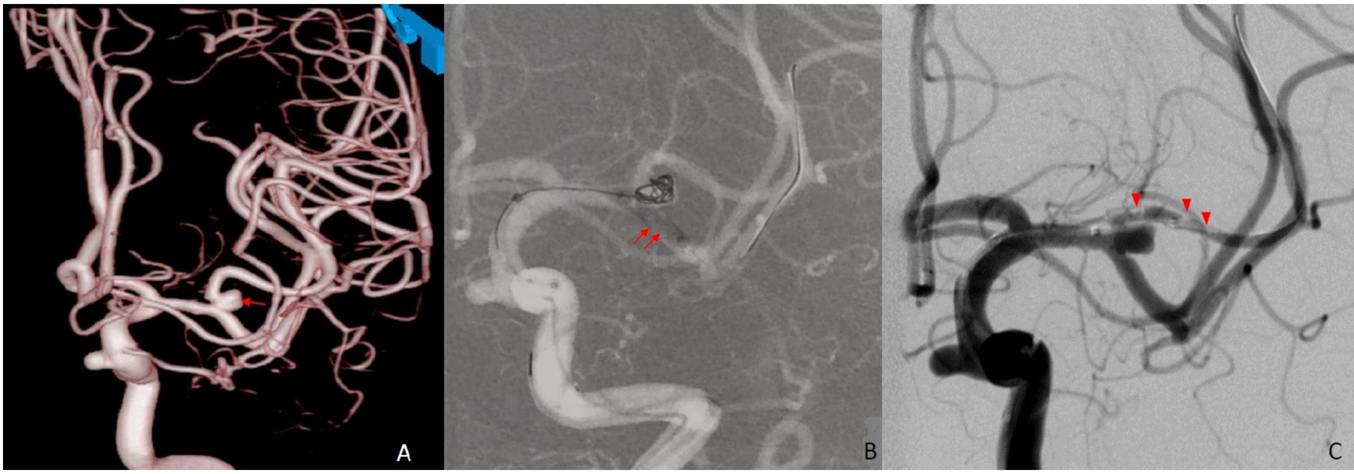

Figure 1 (A) Three-dimensional angiographic reconstruction demonstrated an unruptured aneurysm (arrow) of the left middle cerebral artery at the M1/2 bifurcation. The M2 superior trunk was incorporated into the aneurysmal sac. The size of the wide-necked aneurysm was 3.87×3.5 mm and the neck was 3 mm wide. (B) When the balloon was placed in the inferior trunk (double arrow), the framing coil protruded in to the parent artery. Double arrow: inflated balloon (SHOURYU SR 4×10 mm, Kaneka Medix, Osaka, Japan). (C) After introducing the microcatheter into the M2 superior trunk, kinking (arrowheads) of the M2 superior trunk was seen. Hence, this method was not adopted.

expected, due to the acute branching angle of M1 and the M2 superior trunk, we managed to position the catheter appropriately, which caused significant stretching and kinking of the M2 superior trunk and could have led to vascular injury (figure 1C). Thus, only the microguidewire was retained in the superior trunk, and the balloon catheter was withdrawn to M1. This resulted in relief of the excessive stretch on the M2 superior trunk. Additionally, the guidewire placement resulted in M1 being slightly pushed down, leading to linearisation from M1 to the aneurysm neck (figure 2A, B).

As depicted in figure 3A–F, coil embolisation was performed as follows:

1. The microguidewire alone was introduced into the distal portion of the M2 superior trunk. This resulted in linearisation from M1 to the aneurysm (figure 3A, B), so that the microcatheter could be placed into the neck of the wide-necked aneurysm.
2. Maintaining the distal position of the microguidewire, the first framing coil (Orbit Galaxy Complex Fill Detachable Coils (3 mm×8 cm), Codman & Shurtleff, Raynham, Massachusetts, USA) was carefully placed into the aneurysm (figure 3C).
3. Once the framing was achieved, the microguidewire was withdrawn to the proximal portion of the M2 superior trunk, thereby relaxing the stretch to approximately the original position. Coil stability within the aneurysm was confirmed by microguidewire tension release, after which the framing coil was detached (figure 3D).

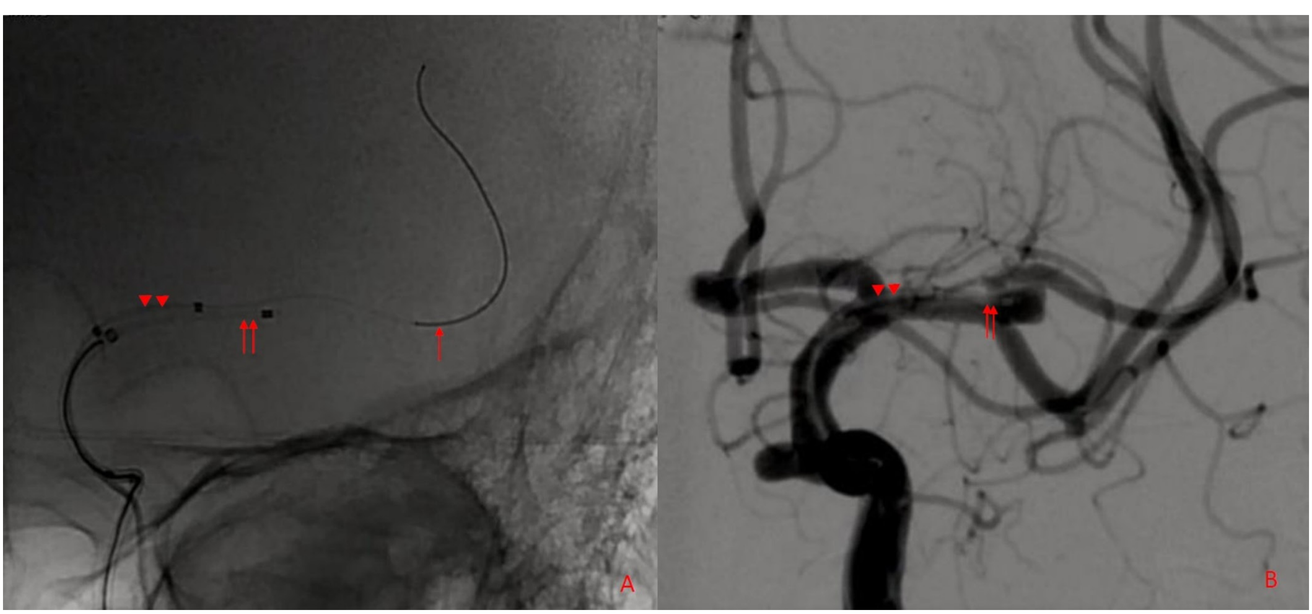

Figure 2 Digital angiography. (A) With the microguidewire retained in the superior trunk (arrows), the balloon catheter (arrow heads) alone was withdrawn to M1. Although the microguidewire was left in position, excessive stretch of the M2 superior trunk was alleviated. microcatheter (double arrow). Digital subtraction angiography. (B) There is no kinking of the M2 superior trunk. Microguidewire=TENROU 1014, Kaneka Medix, Osaka, Japan; Balloon catheter (arrowheads), microcatheter (double arrow).

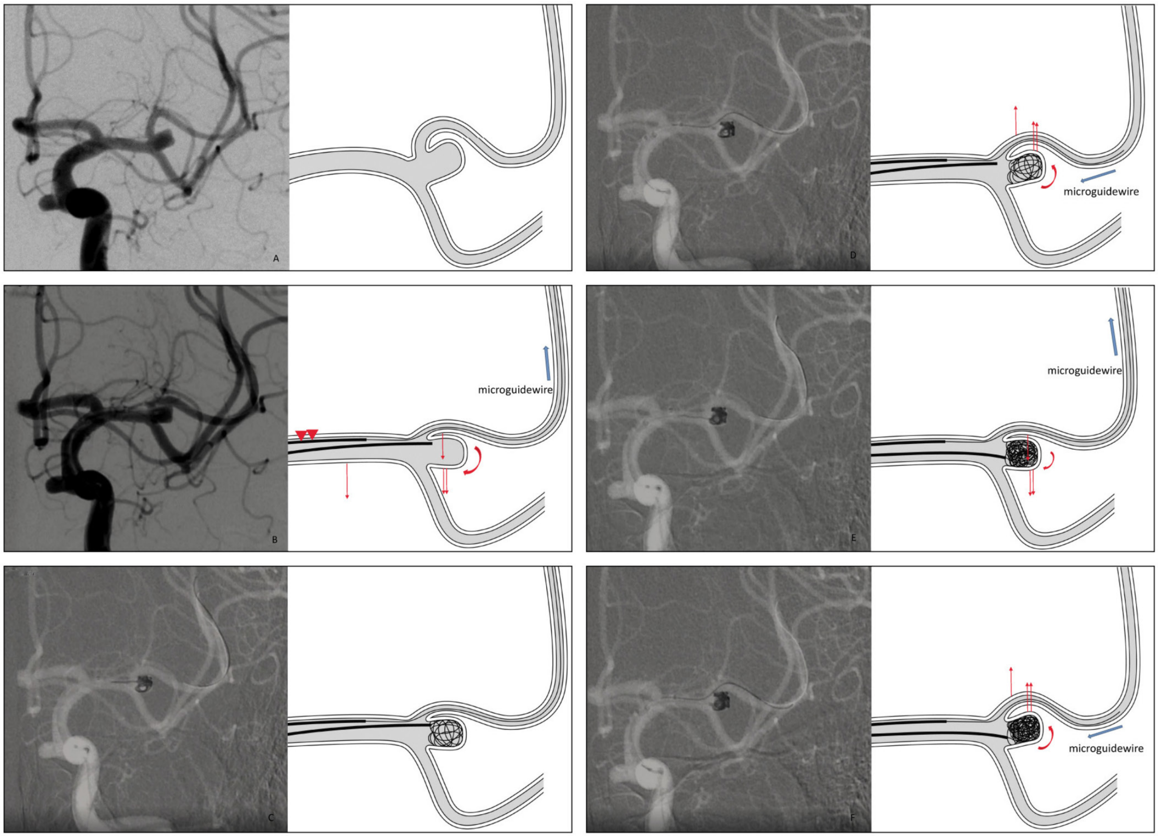

Figure 3 (A) The branching angle of the M2 superior trunk was extremely acute. (B) The microguidewire was navigated into the M2 superior trunk distally (arrow heads: balloon catheter, the respective arrows indicate the direction of movement). This resulted in M1 being slightly pushed down, with consequent linearisation from M1 to the aneurysm neck, allowing the microcatheter to be navigated into the aneurysmal neck. (C) With the microguidewire positioned distally, the framing coil (Orbit Galaxy 3 mm×8 cm) was inserted into the aneurysm. (D) The microguidewire was withdrawn proximally, and coil stability was confirmed by microguidewire tension release. Then, the framing coil was detached. Each arrows indicated the direction of movement. (E) During insertion of the filling coil, with the microguidewire at the proximal portion of the M2 superior trunk, the microcatheter was unstable and the coil kept protruding. Hence, the microguidewire was again navigated distally, the microcatheter was stably placed into the framing coil and the coil was successfully inserted. (F) Finally, by repeating the same procedure, the final coil was inserted and detached successfully. The respective arrows indicate the direction of movement.

4. Steps 1–3 were repeated for insertion of the filling and finishing coils (figure 3E, F), while stretch on the blood vessel was released to confirm that the inserted coil did not collapse.

Finally, the aneurysm was satisfactorily occluded without complications (figure 4A).

OUTCOME AND FOLLOW-UP

The procedure continued uneventfully. At the 11 months follow-up, the patient was neurologically intact, and MR angiography performed 11 months after the treatment showed obstruction of the aneurysm (figure 4B).

DISCUSSION

Recent progress in endovascular treatment has been remarkable, especially in the field of coil embolisation, and numerous techniques, including balloon remodelling and the stent-assist technique, have been used to embolise wide-necked aneurysms in recent years.[8] In some cases, however, especially when using the balloon remodelling technique, navigating the balloon catheter after the microguidewire is difficult due to the acute angle of the branch, or tortuosity of the parent artery itself. The same applies to the stent-assisted technique. A well-known method of overcoming this obstacle is the 'sheep technique'.[9] In this technique, a microguidewire or microcatheter with good operability is first passed through the target vessel, and then, once the vessel is adequately stretched, the balloon catheter is advanced along it. However, despite successful placement of the balloon catheter itself, the body of the balloon catheter or inflation of the balloon might cause vascular injury due to excessive stretch of the vessel. We conceived a novel method for treating wide-necked small MCA aneurysms that involve the acute angle of the M2 superior trunk, utilising a MGA manoeuvre. The MGA manoeuvre, simply put, consists of repeated insertion and withdrawal of the microguidewire. When inserting the coils, the microguidewire is placed distally, resulting in linearisation of the artery from M1 to the aneurysm and subsequent stabilisation of the microcatheter, following which the coil is inserted. When releasing the coils, the microguidewire is withdrawn proximally and returned to its initial position in the vessel to confirm stability of the inserted coil. Cho *et al*[10] reported a novel approach using microguidewire protection for embolisation of wide-necked aneurysms that incorporate the orifices of tortuous acute-angled arteries, in which the microguidewire is used to support the coil and prevent coil protrusion into the parent artery. They adopted their technique in 10 of 11 MCA aneurysms. Another report by the same author[11] stated that while embolising wide-necked aneurysms, use of modified coil protection ensured a more stable coil frame. Although the latter technique seemed to be usable in our case,

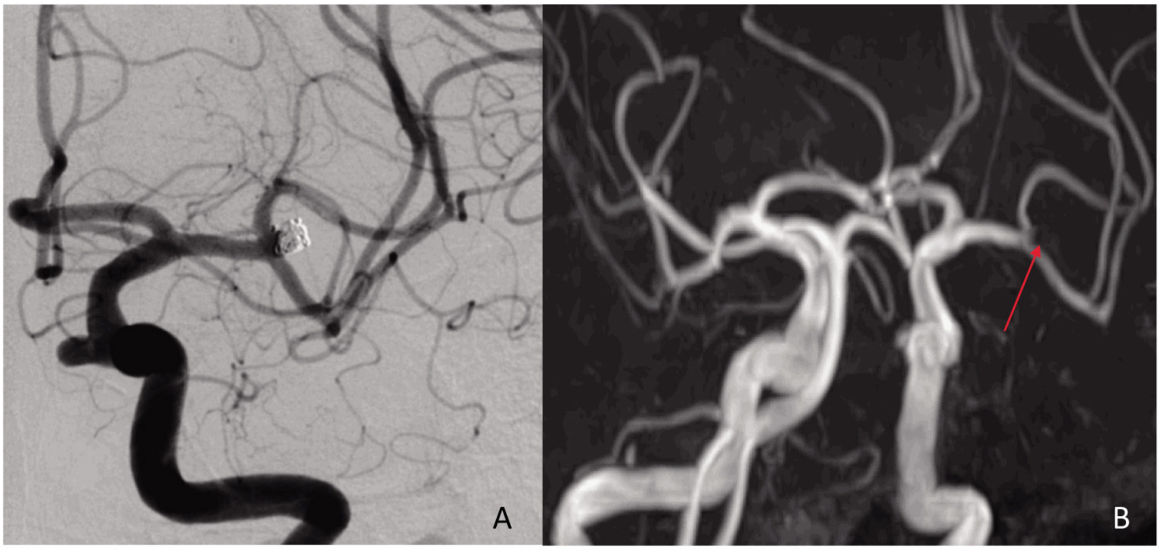

Figure 4 (A) Final angiogram showing obstruction of the aneurysm. (B) MR angiography performed 11 months after the treatment showed obstruction of the aneurysm (arrow).

use of an additional microcatheter instead of the balloon would have added to the cost of the procedure.

Reportedly, microguidewire protection or modified coil protection techniques are not advocated as a first-line technique for embolisation of wide-necked aneurysms because the efficiency and safety of these techniques have not yet been confirmed in a large enough patient population.[10 11] While we also agree with this, the MGA manoeuvre may have value in settings where conventional remodelling techniques are contraindicated due to aneurysmal configuration and vascular anatomy. Although we report here only a single case of use of the MGA manoeuvre, there are many more types of cases where coil embolisation can be safely accomplished with a little ingenuity, simple technique and awareness. Again, it should be borne in mind that coil embolisation is possible due to conformational changes resulting from slight blood vessel movement. Our MGA manoeuvre is very simple and cost-effective, as well as possibly safe. Our simple, safe and cost-effective MGA technique can be attempted for coil embolisation in cases where the configuration of the aneurysm and the accompanying vessel precludes the performance of balloon-assisted coil embolisation.

Learning points

- ► The treatment of middle cerebral artery (MCA) aneurysms by endovascular coil embolisation remains technically challenging because of the complex anatomy of the MCA bifurcation.
- ► The microguidewire-assist manoeuvre may have value particularly for the treatment of wide-necked small MCA aneurysms associated with tortuous and acute-angled branch vessels.
- ► This method is very simple, safe and cost-effective.

Contributors KM and RO were involved in the management of the procedure and manuscript preparation. JU contributed to the review, editing and report design. HG was the gurantor and was responsible for the overall review.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

REFERENCES

1 Smith TR, Cote DJ, Dasenbrock HH, *et al*. Comparison of the efficacy and safety of endovascular coiling versus microsurgical clipping for unruptured middle cerebral artery aneurysms: a systematic review and meta-analysis. *World Neurosurg* 2015;84:942–53.

2 Steklacova A, Bradac O, Charvat F, *et al*. "Clip first" policy in management of intracranial MCA aneurysms: Single-centre experience with a systematic review of literature. *Acta Neurochir* 2016;158:533–46.

3 Iijima A, Piotin M, Mounayer C, *et al*. Endovascular treatment with coils of 149 middle cerebral artery berry aneurysms. *Radiology* 2005;237:611–9.

4 Vendrell JF, Menjot N, Costalat V, *et al*. Endovascular treatment of 174 middle cerebral artery aneurysms: clinical outcome and radiologic results at long-term follow-up. *Radiology* 2009;253:191–8.

5 Lubicz B, Graca J, Levivier M, *et al*. Endovascular treatment of middle cerebral artery aneurysms. *Neurocrit Care* 2006;5:93–101.

6 Greving JP, Wermer MJ, Brown RD, *et al*. Development of the PHASES score for prediction of risk of rupture of intracranial aneurysms: a pooled analysis of six prospective cohort studies. *Lancet Neurol* 2014;13:59–66.

7 Etminan N, Brown RD, Beseoglu K, *et al*. The unruptured intracranial aneurysm treatment score: a multidisciplinary consensus. *Neurology* 2015;85:881–9.

8 Raper DM, Webster Crowley R, Liu KC, *et al*. Endovascular techniques and devices for the treatment of intracranial aneurysms: a review of neurointerventional outcomes. *J Neurosurg Sci* 2016;60:104–15.

9 Toyoshima A, Sugiu K, Tokunaga K, *et al*. Usefulness of the "sheep technique" in the endovascular treatment for cerebral aneurysms. *Journal of Neuroendovascular Therapy* 2013;7:3–10.

10 Cho YD, Kang HS, Kim JE, *et al*. Microguidewire protection of wide-necked aneurysms incorporating orifices of tortuous acute-angled vessels: a novel approach. *Neuroradiology* 2014;56:553–9.

11 Cho YD, Rhim JK, Park JJ, *et al*. Modified coil protection for proper coil frame configuration in wide-necked aneurysms. *Neuroradiology* 2015;57:705–11.