CASE REPORT

Waffle Y technique: pCONus for tandem bifurcation aneurysms of the middle cerebral artery

Anastasios Mpotsaris,¹ Hans Henkes,² Werner Weber¹

¹Department of Radiology and Neuroradiology, Klinikum Vest, Recklinghausen, Germany

²Department of Diagnostic and Interventional Neuroradiology, Klinikum Stuttgart, Stuttgart, Germany

Correspondence to

Dr A Mpotsaris,
Department of Radiology and
Neuroradiology, Klinikum Vest,
Dorstener Str 151,
Recklinghausen 45657,
Germany;
anastasios.mpotsaris@
klinikum-vest.de

SUMMARY

Broad based bifurcation aneurysms are challenging. Various endovascular techniques aim at stabilizing the coil package in the aneurysm. Among these, the waffle cone technique provides a viable alternative to Y stenting in selected cases, incorporating a less complex delivery, and the reduced inherent risk of a single stenting procedure compared with the use of two stents in Y configuration. Unlike conventional stents, the distal end of the new pCONus device opens like a blossoming flower inside of the aneurysm to facilitate the waffle cone technique. In a case with tandem unruptured broad based middle cerebral artery bifurcation aneurysms, the complex anatomical challenge was resolved by a unique combination of both techniques: two pCONus deployed in Y configuration, offering stable neck coverage for coiling both aneurysms. The angiographic results with complete occlusion of both aneurysms and the uneventful clinical course at 90 days with continued daily administration of dual antiplatelet therapy are encouraging.

BACKGROUND

The subgroup of broad based bifurcation aneurysms is a technically challenging one.¹ Different endovascular techniques have been proposed in order to stabilize the delivered coil package in the aneurysm, among these the so-called waffle cone technique.² Few results have been published so far; case reports and small series of up to 10 cases.^{3–9} The intracranial stents used were conventionally designed ones (eg, Solitaire AB (eV3/Covidien, Irvine, California, USA) or the Enterprise (Codman & Shurtleff, Raynham, Massachusetts, USA)). In our case, with rare tandem middle cerebral artery (MCA) bifurcation aneurysms, we used a new device, the pCONus (Phenox GmbH, Bochum, Germany), which is designed for improving the waffle cone technique. It is an intraluminal stent and has received European approval for the treatment of broad based intracranial bifurcation aneurysms (CE mark received January 2013). The implant features a distal end that opens like a blossoming flower and its four petals rest on the inside of the aneurysm along the neck. The body of the device remains in the parent artery; it detaches electrolytically. A coiling microcatheter can then be introduced through its lumen, followed by a conventional coiling procedure. In this case two pCONus were placed in Y configuration.

CASE PRESENTATION

The 54-year-old patient underwent surgery of the cervical spine for a disc herniation. Surgery was complicated by an intraoperative iatrogenic injury of the vertebral artery. This complication was endovascularly treated by an acute stent placement. Angiography also revealed two unruptured broad based MCA bifurcation aneurysms on the right side in a tandem configuration, located at the superior and inferior branch of the MCA. A careful interdisciplinary discussion with the patient resulted in favor of treatment with an endovascular approach. Clinically relevant comorbidities of the patient were elevated arterial blood pressure and hypercholesterolemia, both medically treated. Due to the stent in the vertebral artery, the patient was medicated with acetylsalicylic acid (ASA) 100 mg/day.

INVESTIGATIONS

DSA (including three-dimensional rotational imaging) was performed to assess the aneurysm configuration (figures 1–5).

TREATMENT

After pretreatment with ASA 100 mg/day and clopidogrel 75 mg/day, and a laboratory control indicating sufficient dual platelet function inhibition, the intervention was performed under general anesthesia. A transfemoral approach with a long 6 F sheath was chosen, in conjunction with a 0.057 distal access catheter placed in the distal intracranial portion of the internal carotid artery. The centre of

Figure 1 Subtracted image of the tandem aneurysm formation on the right middle cerebral artery bifurcation.

CrossMark

To cite: Mpotsaris A, Henkes H, Weber W. *BMJ Case Rep* Published online: [please include Day Month Year] doi:10.1136/bcr-2013-010921

Figure 2 Unsubtracted image: first pCONus deployed in the aneurysm at the superior middle cerebral artery (MCA) branch. The four intra-aneurysmal markers show the base of each of the four petals or waffle-like configuration of the distal end of the device. The shaft is in the M1 segment of the MCA. Proximally, the delivery microcatheter and the detachment zone marker can be visualized.

the aneurysm at the superior branch of the MCA was catheterized with a 0.021 inch microcatheter. A pCONus with a 6 mm crown was delivered through this microcatheter and deployed in the aneurysm. After electrolytical detachment, the device was passed with a 0.010 inch microcatheter and the aneurysm was occluded with bare platinum coils. The coiling microcatheter was then withdrawn. The shaft of the first pCONus was then catheterized with the 0.021 inch microcatheter. The shaft was exited at the level of the MCA bifurcation, and the tip of the microcatheter was inserted into the centre of the aneurysm at the inferior branch of the MCA. A second pCONus (5 mm) was delivered through the meshes of the first device in Y technique.

Figure 3 Unsubtracted image, no contrast agent. The aneurysm was coiled through the first pCONus. Then the second pCONus was deployed in Y technique. The four distal markers can be seen in the adjacent aneurysm at the inferior branch of the middle cerebral artery.

Figure 4 Unsubtracted image. Final result with both pCONus devices deployed in Y technique and the tandem aneurysms coiled.

In a final step, the coiling microcatheter was navigated through the second implant and the aneurysm was coiled uneventfully. The procedural steps are illustrated in figures 2–4.

OUTCOME AND FOLLOW-UP

The final angiographic result showed complete occlusion (Raymond class 1) of both aneurysms. Patency of the parent MCA was preserved. The patient was discharged without any new neurological deficit. There were no procedure related complications. A standardized telephone interview after 30 days resulted in a modified Rankin Scale grading of 0; the patient reported no new symptoms. Follow-up DSA imaging at 90 days showed complete occlusion of both aneurysms.

Figure 5 Subtracted image. Follow-up DSA after 90 days, showing complete occlusion of both aneurysms.

DISCUSSION

This is the first case with a Y configuration of two pCONus devices. The waffle cone technique was initially proposed for complex broad based bifurcation aneurysms as an alternative to Y stenting, incorporating the advantages of a less complex delivery procedure and the reduced inherent risk of a single stenting procedure compared with the use of two (different) stents in Y configuration.² The present case featured a rare configuration of two aneurysms on the MCA bifurcation, closely adjacent to each other but not interconnected. This called for a new technical approach. The pCONus was designed to increase stability of the intra-aneurysmal part of the device compared with conventional tube-like configured intracranial stents, like the Solitaire AB or Enterprise. Furthermore, it can be retrieved and placed again even after full deployment. This is a technical advantage that is only shared with the Solitaire AB. Consequently, in the present case, we chose to position a pCONus in each aneurysm; conventional coiling was not feasible due to the unfavorable dome-neck ratio of the aneurysms (>0.7), and a single stent would not have covered both necks. Y stenting would have been an option but we anticipated potential difficulties with catheterizing the aneurysms after deployment of the crossing stents. A potential redirection of flow into the aneurysm is a drawback of the waffle cone technique; the unusually wide pore size of 4 mm of the pCONus leads to a very low surface coverage of approximately 5%. This may contribute to a decrease or absence of flow redirection in this case. The anatomical characteristics allowed for a Y configuration of two pCONus devices, offering stable neck coverage for a coiling procedure for both aneurysms. The initial anatomical results with complete occlusion of both aneurysms postinterventionally and in the control at 90 days, as well as the uneventful clinical course during follow-up with continued daily administration of ASA and clopidogrel, are encouraging.

Contributors AM: conception and design, analysis and interpretation of the data, and drafting and revising the article. HH: conception and design, acquisition and interpretation of the data, and revising the article critically for important intellectual content. WW: conception and design, acquisition and interpretation of the data, and revising the article critically for important intellectual content.

Competing interests AM and WW have no competing interests. HH is co-founder and share-holder of the company that produces the pCONus device (phenox GmbH, Bochum, Germany).

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

REFERENCES

- 1 Sychra V, Klich J, Werner M, *et al*. Waffle-cone technique with Solitaire AB remodeling device: endovascular treatment of highly selected complex cerebral aneurysms. *Neuroradiology* 2011;53:961–72.
- 2 Horowitz M, Levy E, Sauvageau E, *et al*. Intra-extra-aneurysmal stent placement for management of complex and wide-necked-bifurcation aneurysms: eight cases using the waffle cone technique. *Neurosurgery* 2006;58(4 Suppl 2):ONS-258–62.
- 3 Padalino DJ, Singla A, Jacobsen W, *et al*. Enterprise stent for waffle-cone stent-assisted coil embolization of large wide-necked arterial bifurcation aneurysms. *Surg Neurol Int* 2013;4:9.
- 4 Park HR, Yoon SM, Shim JJ, *et al*. Waffle-cone technique using Solitaire AB stent. *J Korean Neurosurg Soc* 2012;51:222–6.
- 5 Liu W, Kung DK, Policeni B, *et al*. Stent-assisted coil embolization of complex wide-necked bifurcation cerebral aneurysms using the 'waffle cone' technique. A review of ten consecutive cases. *Interv Neurol* 2012;18:20–8.
- 6 Yashar P, Kan PT, Levy EI. Horizontal deployment of an intracranial stent via an antegrade approach for coil embolization of a basilar apex aneurysm: technical note. *J Neurointerv Surg* 2011;3:355–7.
- 7 Cho JS, Kim YJ. Modified 'y-configured stents with waffle cone technique' for broad neck basilar top aneurysm. *J Korean Neurosurg Soc* 2011;50:517–19.
- 8 Gruber TJ, Ogilvy CS, Hauck EF, *et al*. Endovascular treatment of a large aneurysm arising from a basilar trunk fenestration using the waffle-cone technique. *Neurosurgery* 2010;67(3 Suppl Operative):ons140–4.
- 9 Yang TH, Wong HF, Yang MS, *et al*. "Waffle cone" technique for intra/extra-aneurysmal stent placement for the treatment of complex and wide-necked bifurcation aneurysm. *Interv Neurol* 2008;14(Suppl 2):49–52.

Learning points

Although data on Y stenting and the waffle cone technique are scarce, a few conclusions may be drawn:

- ▶ An intra-aneurysmal stent may be used to assist coil occlusion of wide neck bifurcation aneurysms.
- ▶ Deployment of this device inside the aneurysm may be easier than catheterization of one or both efferent vessel(s), as required for conventional stent assistance.
- ▶ The design of the pCONus might be advantageous compared with the use of conventional intracranial stents for a waffle cone approach.
- ▶ Its mesh configuration allows for application of a Y configuration by using two crossing devices,
- ▶ In selected anatomically suited cases, these two techniques, Y stenting and waffle cone, can be successfully combined.

Copyright 2013 BMJ Publishing Group. All rights reserved. For permission to reuse any of this content visit <http://group.bmj.com/group/rights-licensing/permissions>.
BMJ Case Report Fellows may re-use this article for personal use and teaching without any further permission.

Become a Fellow of BMJ Case Reports today and you can:

- ▶ Submit as many cases as you like
- ▶ Enjoy fast sympathetic peer review and rapid publication of accepted articles
- ▶ Access all the published articles
- ▶ Re-use any of the published material for personal use and teaching without further permission

For information on Institutional Fellowships contact consortiasales@bmjgroup.com

Visit casereports.bmj.com for more articles like this and to become a Fellow