CASE REPORT

Endovascular recanalisation with drug coated balloon for chronic symptomatic middle cerebral artery total occlusion

Jun Zhang,¹ Xiao Zhang,² Jin-Ping Zhang,³ Ju Han⁴

¹Department of Neurology, Shandong Provincial Qianfoshan Hospital, Shandong University, Jinan, Shandong, China

²Department of Neurology, Shandong Provincial Qianfoshan Hospital, Shandong University, Jinan, Shandong, China

³Department of Neurology, Shandong Provincial Qianfoshan Hospital, Shandong University, Jinan, Shandong, China

⁴Department of Neurology, Shandong Provincial Qianfoshan Hospital, Shandong University, Jinan, Shandong, China

Correspondence to
Professor Ju Han,
hanjujack@163.com

Accepted 16 February 2018

SUMMARY

The optimal treatment for patients with chronic symptomatic middle cerebral artery (MCA) total occlusion is not well established. In addition to medical therapy, vessel recanalisation with stenting has shown much promise, especially for patients with recurrent ischemic symptoms. Nevertheless, the incidence of symptomatic in-stent restenosis (ISR) is high, and is associated with an unfavorable prognosis. Drug coated balloons (DCBs) have been proven to be effective in treating and preventing ISR. However, the feasibility of DCBs for de novo intracranial atherothrombotic stenosis has not been previously described, especially for total occlusion lesions. Here we reported a patient with chronic left MCA total occlusion successfully treated with DCBs, with a good outcome at the 1 year follow-up. More studies are warranted to further compare the efficacy of DCBs and stentings for intracranial revascularisation.

BACKGROUND

Chronic total occlusion of the middle cerebral artery (MCA) is not uncommon in cerebral angiography. Fortunately, most patients are asymptomatic. However, others with inadequate collateral circulation may present with recurrent ischemic symptoms despite medical treatment.¹ The optimal treatment for these patients remains a medical dilemma.² With the advancement of endovascular devices and operation techniques, angioplasty and stenting have been promoted as potential treatments for such patients.³ However, the incidence of symptomatic in-stent restenosis (ISR) is high, and is associated with symptomatic infarcts in the territory of the stented artery, which could lead to the need for repeat intervention. Drug coated balloons (DCBs), coated with the antiproliferative drug paclitaxel, are well recognised as inhibiting intimal hyperplasia and preventing ISR. Promising initial results have

Figure 1 (A) Total occlusion of the left middle cerebral artery (MCA) M1 segment (arrow). (B) Pial collaterals extending from the left anterior cerebral artery territory (arrow). (C) The lesion was pre-dilated with a 2.25×15 mm Gateway balloon. (D) Angiogram after pre-dilatation. (E) The distal lesion was dilated with a 2.0×20 mm drug coated balloon (DCB). (F) The proximal lesion was dilated with a 2.5×17 mm DCB. (G) Post-dilatation angiogram shows resolution of the occlusive lesion. (H) Post-dilatation angiogram shows good antegrade perfusion to the left MCA territory.

To cite: Zhang J, Zhang X, Zhang J-P, et al. *BMJ Case Rep* Published Online First: [please include Day Month Year]. doi:10.1136/bcr-2017-013693

Figure 2 (A, B) One year follow-up angiogram shows that there was no restenosis of the left middle cerebral artery (MCA) M1 segment, and good antegrade perfusion to the left MCA territory.

been reported on the application of DCBs in ISR of the intracranial, coronary, and leg arteries.^{4–7} In the present case, we illustrated the feasibility of endovascular recanalisation with DCBs for chronic symptomatic MCA total occlusion and the follow-up outcome.

CASE PRESENTATION

A 48-year-old male smoker with a history of hypertension presented with recurrent transient ischemic attacks with right-sided weakness for 2 months. There were three episodes of hemiplegia on the right extremity, with no evident inciting factors or other accompanying symptoms. Each episode lasted for no more than 2 min, with complete recovery in between. Although given dual antiplatelet treatment (DAPT), statins, antihypertensives, and lifestyle interventions, including smoking cessation, the patient suffered progression of symptoms.

An angiogram followed by hydration showed total occlusion of the left MCA M1 segment with Thrombolysis in Cerebral Infarction (TICI) grade 0 (figure 1A). The collateral circulation was compensated by the left anterior cerebral artery (figure 1B). The risks and benefits of all feasible treatment options were discussed with the patient and his family. They were explicitly told about the off-label use of the coronary DCBs. Given his recurrent symptoms, endovascular recanalisation of the left MCA with DCBs was planned.

Under general anesthesia, the lesion was traversed with an Excelsior SL-10 soft microcatheter (Stryker Neurovascular, Cork, Ireland) and Synchro² microguidewire (Stryker Neurovascular, Utah, USA). After withdrawing the microguidewire, the distal lumen of the lesion was confirmed through the microcatheter. Thereafter, the microguidewire reached the M3 segment, and the microcatheter was withdrawn. The lesion was initially pre-dilated with a 2.25×15 mm Gateway balloon (Boston Scientific, Minnesota, USA), obtaining an adequate angiographic result (figure 1C, D), which facilitated the advancement of the DCBs over the lesion. We sequentially delivered 2.0×20 mm and 2.5×17 mm DCBs (SeQuent Please, B Braun, Germany) to the distal and proximal lesions, and the balloons were left inflated for 60 s to facilitate drug penetration into the vessel wall (figure 1E, F).

After withdrawing the DCBs, repeat angiogram showed that the occlusion was completely recanalized, with good antegrade perfusion to the left MCA territory (TICI grade 3) (figure 1G, H). Postoperatively, blood pressure was strictly maintained <130/80 mm Hg to prevent reperfusion injury. There were no

periprocedural neurological complications. The patient was discharged with DAPT, and clopidogrel was withdrawn after 90 days. At the 1 year follow-up, the patient remained asymptomatic with good angiographic results and improved lumen gain (figure 2A, B).

DISCUSSION

Intracranial atherosclerotic stenosis is a major cause of cerebral ischemic stroke, especially for Asian patients. Within this patient population, it is not uncommon to discover total occlusion of a cerebral artery supplying the corresponding vascular territory. In the CICAS study,⁸ 25.9% of strokes had total occlusion of an intracranial artery. The risk of recurrent stroke increased with the degree of stenosis, with the highest incidence of 7.27% for total occlusion. Thanks to well developed collaterals, patients with chronic total occlusion may not suffer from stroke symptoms, or their symptoms may be minor. Conversely, the prognosis for those with total occlusion resulting in hemodynamic impairment is poorer. For this patient, the etiology of the recurrent transient ischemic attacks could probably be attributed to hemodynamic impairment from total MCA occlusion. Therefore, medical management alone may be inadequate for these patients, and revascularisation may be beneficial.

In previous case reports,^{3,9} the feasibility of endovascular recanalisation with stenting for chronic MCA total occlusion has been proven, whereas symptomatic ISR was not uncommon. Our case showed that simple DCB dilatation without stenting for symptomatic chronic MCA occlusion was feasible, and there was no restenosis during the 1 year follow-up. Previous studies showed that a paclitaxel coated balloon can effectively inhibit intimal hyperplasia and decrease the risk of restenosis.^{4,5} Furthermore, with DCB angioplasty, there is no permanent implant scaffold, and DAPT duration can be reduced to 30–90 days to minimize the bleeding risk. In Miglionico *et al's* study,¹⁰ DCBs were highlighted as the first choice alternative to drug eluting stents in challenging settings, such as chronic total occlusion lesions. However, because DCBs were initially designed for coronary stenosis, they might be somewhat rigid for intracranial artery usage. Hence it is important to prepare the lesion with adequate pre-dilatation,^{11,12} and DCBs specialized for intracranial artery are expected to be available soon.

Contributors Study concept and design: JH. Cases data collection: JZ, XZ, and J-PZ. Analysis and interpretation of the data: JH and JZ. Drafting of the manuscript: JH and JZ. Study supervision: JH. All authors were involved in critically analyzing the paper and approve the contents of the paper. All authors also agree to be accountable for all aspects of the work submitted for publication.

Funding This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Competing interests None declared.

Learning points

- ▶ Chronic middle cerebral artery (MCA) occlusion may cause ischemic symptom due to hemodynamic impairment, despite medical therapy.
- ▶ For symptomatic chronic MCA occlusion, revascularisation with drug coated balloons (DCBs) is feasible with an acceptable clinical and imaging outcome.
- ▶ Adequate pre-dilatation may be helpful to the advancement of coronary DCBs over the lesions.

Patient consent Obtained.

Ethics approval The study was approved by Shandong Provincial Qianfoshan Hospital.

Provenance and peer review Not commissioned; externally peer reviewed.

© BMJ Publishing Group Ltd (unless otherwise stated in the text of the article) 2018. All rights reserved. No commercial use is permitted unless otherwise expressly granted.

REFERENCES

- 1 Yamauchi H, Higashi T, Kagawa S, *et al.* Chronic hemodynamic compromise and cerebral ischemic events in asymptomatic or remote symptomatic large-artery intracranial occlusive disease. *AJNR Am J Neuroradiol* 2013;34:1704–10.
- 2 Gorelick PB, Wong KS, Bae HJ, *et al.* Large artery intracranial occlusive disease: a large worldwide burden but a relatively neglected frontier. *Stroke* 2008;39:2396–9.
- 3 Ma N, Mo DP, Gao F, *et al.* Endovascular recanalization for chronic symptomatic middle cerebral artery total occlusion. *J Neurointerv Surg* 2013;5:e15.
- 4 Vajda Z, Güthe T, Perez MA, *et al.* Neurovascular in-stent stenoses: treatment with conventional and drug-eluting balloons. *AJNR Am J Neuroradiol* 2011;32:1942–7.
- 5 Scheller B, Speck U, Abramjuk C, *et al.* Paclitaxel balloon coating, a novel method for prevention and therapy of restenosis. *Circulation* 2004;110:810–4.
- 6 Scheller B, Hehrlein C, Bocksch W, *et al.* Two year follow-up after treatment of coronary in-stent restenosis with a paclitaxel-coated balloon catheter. *Clin Res Cardiol* 2008;97:773–81.
- 7 Tepe G, Zeller T, Albrecht T, *et al.* Local delivery of paclitaxel to inhibit restenosis during angioplasty of the leg. *N Engl J Med* 2008;358:689–99.
- 8 Wang Y, Zhao X, Liu L, *et al.* Prevalence and outcomes of symptomatic intracranial large artery stenoses and occlusions in China: the Chinese Intracranial Atherosclerosis (CICAS) Study. *Stroke* 2014;45:663–9.
- 9 Wan Y, Lo WT, Liu YX, *et al.* Endovascular revascularization of symptomatic chronic middle cerebral artery occlusions: Two case reports. *Interv Neuroradiol* 2016;22:84–7.
- 10 Miglionico M, Mangiacapra F, Nusca A, *et al.* Efficacy and safety of paclitaxel-coated balloon for the treatment of in-stent restenosis in high-risk patients. *Am J Cardiol* 2015;116:1690–4.
- 11 Kleber FX, Mathey DG, Rittger H, *et al.* How to use the drug-eluting balloon: recommendations by the German consensus group. *EuroIntervention* 2011;7:K125–K128.
- 12 Vajda Z, Güthe T, Perez MA, *et al.* Prevention of intracranial in-stent stenoses: predilatation with a drug eluting balloon, followed by the deployment of a self-expanding stent. *Cardiovasc Intervent Radiol* 2013;36:346–52.

Copyright 2018 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