

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/radcr

Case Report

Ostial common carotid artery occlusion and balloon-mounted stenting: Implication of embolic protection device in tandem lesion ☆☆☆

Takashi Mizowaki, MD, PhD^{a,*}, Atsushi Fujita, MD, PhD^b, Jun Imura, MD^a, Masahiro Nakahara, MD^a, Hiroto Tanaka, MD, PhD^a, Yoshiyuki Takaishi, MD, PhD^a, Takeshi Kondoh, MD, PhD^a

^aDepartment of Neurosurgery, Shinsuma General Hospital, 3-1-14 Kinugake-cho, Suma-ku, Kobe, Hyogo, 654-0048, Japan

^bDepartment of Neurosurgery, Kobe University Graduate School of Medicine, Kobe, Hyogo, Japan

ARTICLE INFO

Article history:

Received 17 June 2021

Accepted 22 June 2021

Keywords:

Balloon-mounted stenting

Endovascular treatment

Ostial common carotid artery

Tandem lesion

ABSTRACT

Ostial common carotid artery (CCA) stenosis is rare, compared to extracranial internal carotid artery bifurcation lesions. In cases of a tandem lesion, the proximal lesion usually involves the extracranial internal carotid artery, and the ostial CCA is rarely implicated. A 69-year-old woman who underwent 3 months of antiplatelet therapy for asymptomatic, right ostial, severely calcified CCA stenosis presented with sudden onset left hemiparesis. Radiographic examination revealed an ostial CCA-intracranial artery tandem lesion. After intracranial revascularization using a clot retrieval stent, we performed the endovascular treatment with a balloon-mounted stent using an embolic protection device. This procedure may be superior to others because it is possible to achieve early intracranial revascularization and prevent distal embolism during the complete treatment of proximal lesions.

© 2021 The Authors. Published by Elsevier Inc. on behalf of University of Washington.

This is an open access article under the CC BY-NC-ND license

(<http://creativecommons.org/licenses/by-nc-nd/4.0/>)

Introduction

The tandem lesion (TL) is defined as severe stenosis or occlusion of the extracranial internal carotid artery (ICA) ipsilateral to its intracranial occlusion.[1] Although the proximal lesion in cases of TL usually involves the extracranial ICA, the ostial common carotid artery (CCA) is rarely implicated, and data on the management of ostial CCA lesions are exceedingly

scarce. The present report describes one-staged endovascular treatment (EVT) of CCA-intracranial artery TL using a balloon-mounted stent and intracranial embolic protection device.

Case report

Three months previously, a 69-year-old woman underwent a detailed examination for asymptomatic right CCA stenosis.

☆ Acknowledgments: Not applicable

☆☆ Competing Interests: The authors declare that they have no conflict of interest.

* Corresponding author.

E-mail address: njapxblj@gmail.com (T. Mizowaki).

<https://doi.org/10.1016/j.radcr.2021.06.071>

1930-0433/© 2021 The Authors. Published by Elsevier Inc. on behalf of University of Washington. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>)

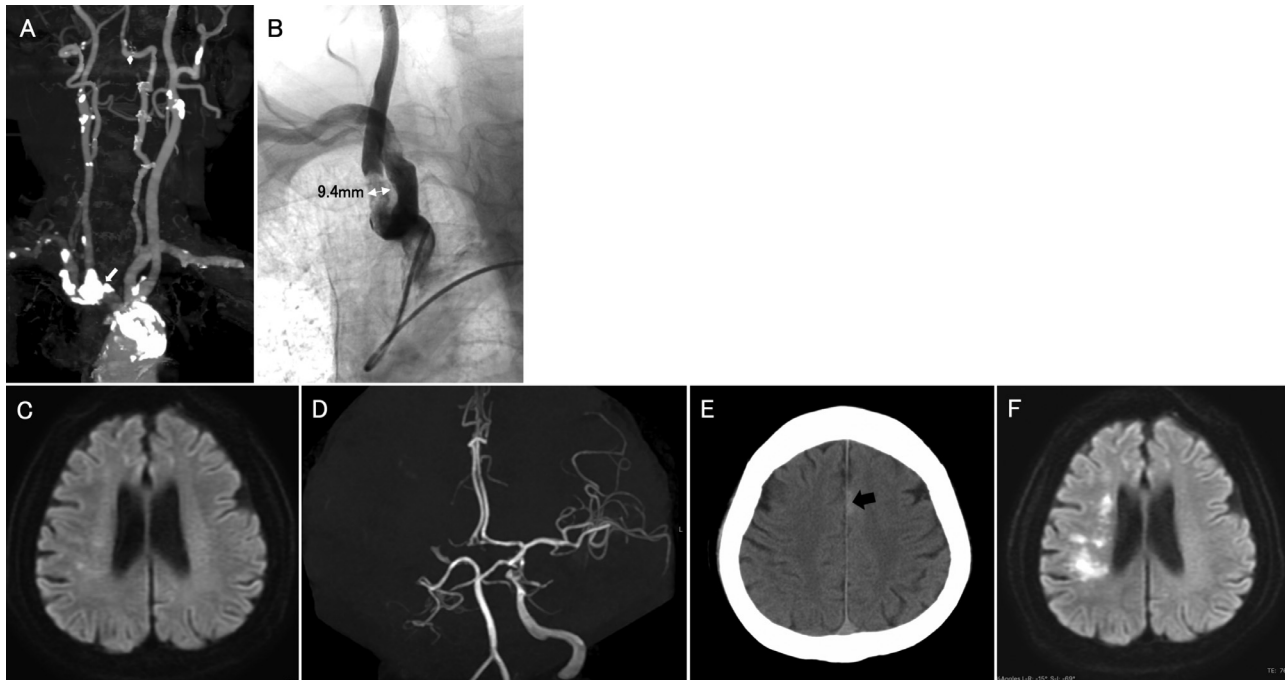


Fig. 1 – (A) CTA shows the severely calcified right ostial CCA. (white arrow)

(B) Angiogram shows poor visualization of the right ostial CCA due to severe calcification (black arrow).

(C) MRI-DWI shows an acute ischemia of the right cerebrum.

(D) MRA shows poor visualization of the right internal cerebral artery.

(E) CT shows slightly traumatic subarachnoid hemorrhage (black arrow).

(F) MRI-DWI shows worsening acute ischemia of the right cerebrum.

Abbreviations: CCA, common carotid artery; CTA, computed tomography; MRI-DWI, Magnetic resonance imaging-diffusion weighted imaging; MRA, magnetic resonance angiography; CT, computed tomography.

Computed tomography (CT) angiography revealed a severely calcified stenotic ostial CCA (Fig. 1A), and angiography revealed a stenotic lesion with delayed anterograde flow (Fig. 1B). The patient was prescribed antiplatelet drugs after the examination. Three months later, she presented with sudden-onset left hemiparesis, which had resulted in a head injury. On arrival, she demonstrated a National Institutes of Health Stroke Scale (NIHSS) score of 4. Diffusion-weighted magnetic resonance imaging (DWI-MRI) revealed an acute ischemia of the right cerebrum (Fig. 1C), and magnetic resonance angiography (MRA) revealed right internal cerebral artery occlusion (Fig. 1D). Conservative treatment of minimum necessary fluid replacement was applied due to the low NIHSS score and traumatic subarachnoid hemorrhage (Fig. 1E). However, worsening of the left hemiparesis, neglect of the left space, and moderate dysarthria were observed 8 hours after onset. The patient's NIHSS score was 11. DWI-MRI revealed worsening an acute ischemia findings (Fig. 1F), and MRA revealed persistent right middle cerebral artery occlusion.

EVT was performed under local anesthesia through the femoral artery approach after systemic heparinization. First, brachiocephalic angiography revealed the right ostial CCA occlusion (Fig. 2A). An 8-French (Fr) strong supportive guiding catheter, Neuro-EBU (Medtronic, Dublin, Ireland) was guided to the brachiocephalic artery. The 0.035-inch guidewire could be inserted into the CCA distal to the occlusion, but the coax-

ial 6 Fr catheter did not pass through the lesion. The 6-Fr catheter was then replaced with a 4-Fr catheter, which was able to cross the lesion. After changing the guidewire in the 4-Fr catheter from 0.035-inch to 0.014-inch (CHIKAI black 200cm; Asahi Intecc Co. Ltd., Aichi, Japan), percutaneous transluminal angioplasty (PTA) was performed twice with a 7.0 mm × 20 mm balloon (Rx Genity, Kaneka Medics, Osaka, Japan) (Fig. 2B). Internal carotid angiography revealed a middle cerebral artery occlusion (Fig. 2C-1). Thrombectomy was successfully performed using a Solitaire 4.0 mm × 40 mm clot retrieval stent (Medtronic, Minneapolis, MN, USA), with continuous machine aspiration through the Penumbra 5 MAX ACE68 reperfusion catheter (Penumbra, Alameda, CA, USA) (Fig. 2C-2). After achieving revascularization of the intracranial lesion, a distal filter EPD (Filter Wire EZ; Boston Scientific, Marlborough, MA, USA) was advanced to the distal extracranial ICA through the Penumbra 5 MAX ACE68 reperfusion catheter and deployed (Fig. 2D-1,2). A guiding catheter was thus lowered into the aorta, but occlusion of the subclavian artery was unexpectedly found (Fig. 2E). A 9 mm × 20 mm balloon-mounted stent (Express Vascular LD; Boston Scientific) was advanced to the aortic arch through the guiding catheter. A 0.014-inch 200 cm guidewire (CHIKAI black) was then inserted into the distal CCA as a buddy wire to the stent (Fig. 2F-1, 2). Angiography after stent deployment confirmed successful revascularization (Figs. 2G and H). The clot was visible in the retrieval stent and

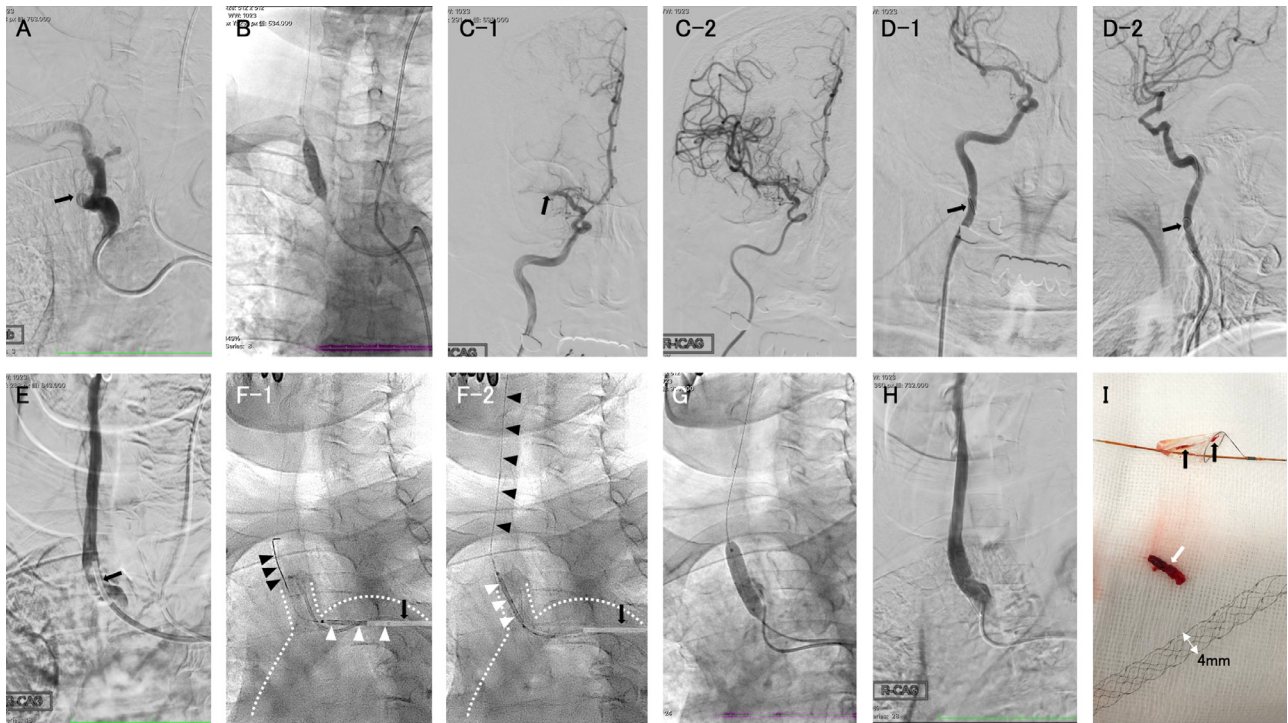


Fig. 2 – The endovascular procedure.

(A) Angiography showing the right CCA occlusion. (black arrow)

(B) Unsubtracted image shows under PTA for the right CCA occlusion.

(C-1) Angiography shows the right middle cerebral artery occlusion. (black arrow)

(C-2) Angiography shows the revascularized middle cerebral artery using a retrieval stent.

(D) Anterior (-D-1) and lateral (-D-2) views of the right internal carotid angiography show deployment of the EPD (black arrow).

(E) Angiography from guiding catheter (black arrow) of ostial CCA suggests residual stenosis.

(F-1) Unsubtracted image shows a 0.014-inch buddy wire (black arrowheads).

(F-2) Pre-deployment of a balloon-mounted stent (white arrowheads), and the tip of the guiding catheter (black arrow).

Dotte lines: aortic arch and brachiocephalic artery

(G) Unsubtracted image shows the deployment of a balloon-mounted stent.

(H) Post-stenting brachiocephalic angiography shows successful recanalization of the CCA and occlusion of the right subclavian artery.

(I) Photograph shows the retrieval stent, retrieval red clot (white arrow), and retrieval EPD with a red clot inside (black arrows).

Abbreviations: PTA, percutaneous transluminal angioplasty; CCA, common carotid artery; EPD, embolic protection device; MCA, middle cerebral artery.

the retrieved filter (Fig. 2I). The total procedure time was 132 min, and the time from puncture to intracranial revascularization was 60 min.

The patient continued treatment with antiplatelet therapy. Three weeks after the EVT, angiography confirmed the intracranial and CCA revascularization. Her NIHSS score was 1 at three months after the onset.

Discussion

The endovascular approach for TL can be categorized as either antegrade (extracranial revascularization followed by intracranial thrombectomy) or retrograde (intracranial

thrombectomy first).[2,3] Some previous studies recommend a retrograde approach in TL, focusing on early intracranial revascularization.[4,5] Similarly, in the present case intracranial revascularization was prioritized and the retrograde approach was adopted, but passing a catheter through the strongly calcified ostial CCA occlusion was difficult, initially. The ostial CCA occlusion greatly increases the difficulty of proximal lesion revascularization from a transfemoral approach, given the lack of guide catheter support. Thus, we used a strongly supported guiding catheter for crossing the lesion.

In terms of ICA angioplasty and stenting, the use of an EPD has been shown to reduce intracranial embolism by >50%.[6] The balloon-mounted stents used for stenosis of the CCA are typically 0.035-inch wire systems, which are difficult to advance over the 0.014-inch wires of the distal EPD. Dumont et al.

performed transfemoral stenting in the setting of ostial CCA occlusion using a balloon-mounted stent without distal EPDs, and embolic complications were rare; only 1 of 14 patients had a transient ischemic event of unknown etiology after balloon deployment.[7] Gregory et al. reported no distal embolism in two cases of CCA stenting for ostial CCA-intracranial TLs without EPD.[8] However, in our case, a red clot was found in the retrieved EPD.

Urgent stent placement is a complex problem for patients with post-treatment intracranial hemorrhage because it requires prophylactic post-antiplatelet therapy.[9] Conversely, disadvantages of PTA alone include the possibility of re-occlusion compared to stenting. Staged treatment for CCA-intracranial artery TL has been previously reported.[10] In our case, the residual stenosis rate was difficult to assess due to a severely calcified lesion; hence, stent placement was performed. After intracranial revascularization, the guiding catheter present in the residual stenotic CCA was lowered into the aorta for accurate assessment of the lesion. A balloon-mounted stent compatible with 0.035-inch wire was selected, but buddy wire was used to enable easy stent induction and stabilization of the EPD. Alternatively, a stent can be inserted into the guiding catheter passing through the lesion and then the guiding catheter can be dropped into the aortic arch to deploy the stent, but this is not preferred for accurate lesion assessment. Since asymptomatic subclavian artery occlusion occurred, due to plaque dislocation, it was necessary to consider a treatment method.

Conclusion

Balloon-mounted stenting can be used with EPD after intracranial revascularization for TLs, including ostial CCA. This method can reduce the risk of new intracranial occlusions while obtaining rapid intracranial revascularization.

Disclosures

Ethics approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Patient consent

Informed consent has been obtained from the patient for this study and publication of this case report with accompanying images.

Consent for publication

Informed consent was obtained from the patient.

REFERENCES

- [1] Jadhav AP, Zaidat OO, Liebeskind DS, Yavagal DR, Haussen DC, Hellinger FR Jr, et al. Emergent management of tandem lesions in acute ischemic stroke. *Stroke* 2019;50:428–33. doi:10.1161/STROKEAHA.118.021893.
- [2] Poppe AY, Jacquin G, Roy D, Stapf C, Derex L. Tandem carotid lesions in acute ischemic stroke: mechanisms, therapeutic challenges, and future directions. *AJNR Am J Neuroradiol* 2020;41:1142–8. doi:10.3174/ajnr.A6582.
- [3] Kang DH, Kim YW, Hwang YH, Kim YS. Endovascular recanalization of acute tandem cervical carotid and intracranial occlusions: efficacy of cervical balloon angioplasty alone then intracranial target recanalization strategy. *World Neurosurg* 2019;126 e1268–e75. doi:10.1016/j.wneu.2019.02.240.
- [4] Lockau H, Liebig T, Henning T, Neuschmelting V, Stetefeld H, Kabbasch C, et al. Mechanical thrombectomy in tandem occlusion: procedural considerations and clinical results. *Neuroradiology* 2015;57:589–98.
- [5] Ozdemir O, Bussiere M, Leung A, Gulka I, Lee D, Chan R, Spence JD, et al. Intra-arterial thrombolysis of occluded middle cerebral artery by use of collateral pathways in patients with tandem cervical carotid artery/middle cerebral artery occlusion. *AJNR Am J Neuroradiol* 2008;29:1596–600. doi:10.3174/ajnr.A1163.
- [6] Mousa AY, Campbell JE, Aburahma AF, Bates MC. Current update of cerebral embolic protection devices. *J Vasc Surg* 2012;56:1429–37. doi:10.1016/j.jvs.2012.05.077.
- [7] Dumont TM, Eller JL, Mokin M, Snyder KV, Hopkins LN, Levy EI, et al. Transfemoral endovascular treatment of atherosclerotic stenotic lesions of the left common carotid artery ostium: case series and review of the literature. *J Neurointerv Surg* 2013;5:539–42.
- [8] Weiner GM, Feroze R, Panczykowski DM, Aghaebrahim A, Ares W, Agarwal N, et al. Endovascular treatment of tandem common carotid artery origin and distal intracranial occlusion in acute ischemic stroke. *World Neurosurg* 2017;97:360–5. doi:10.1016/j.wneu.2016.10.039.
- [9] Soize S, Barbe C, Kadziolka K, Estrade L, Serre I, Pierot L. Predictive factors of outcome and hemorrhage after acute ischemic stroke treated by mechanical thrombectomy with a stent-retriever. *Neuroradiol* 2013;55:977–87.
- [10] Amuluru K, Al-Mufti F, Romero CE. Acute ischemic stroke due to common carotid ostial disease with tandem intracranial occlusion treated with thrombectomy and staged retrograde stenting. *Interv Neurol* 2018;7:445–51. doi:10.1159/000490584.