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Case Report

The endothelialization on carotid web treated with dual layer stent placement: a case report☆

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ABSTRACT

Carotid webs are known to cause acute ischemic stroke in younger adults and have a high recurrence rate. Herein, we report a case of a symptomatic carotid web in a 51-year-old man who was transferred to our hospital after developing consciousness disturbance and left hemiparesis. He was diagnosed with right middle cerebral artery occlusion and underwent mechanical thrombectomy. Because his carotid web was the likely embolic source, we performed carotid artery stenting using a dual-layer stent to crimp the vessel wall and secure closure of the web pocket. Follow-up angiography was performed at 3 weeks after stenting, and endothelialization on the web pocket was confirmed. The high scaffolding effect of the dual layer stent may promote the endothelialization on the carotid web.

Introduction

A carotid web (CW) comprises intimal hyperplasia without atherosclerotic changes on the posterior wall of the carotid bulb and is thought to represent an atypical fibromuscular dysplasia [1]. Blood turbulence in the web cause thrombus and embolic stroke in younger adults [2,3]. Symptomatic CW has a high recurrence rate (20%-30%) despite antiplatelet therapy [4,5], while stent placement was recently reported to prevent recurrence [1,5,6]. There were few reports of the stent placement using a dual layer stent for the CW. Herein, we report a case of a symptomatic carotid web with angiographically confirmed endothelialization on the web at 3 weeks after carotid artery stenting using a dual layer CASPER stent (MicroVention; Terumo, Tustin, CA).

☆ Competing Interests: All authors declare no conflict of interest.

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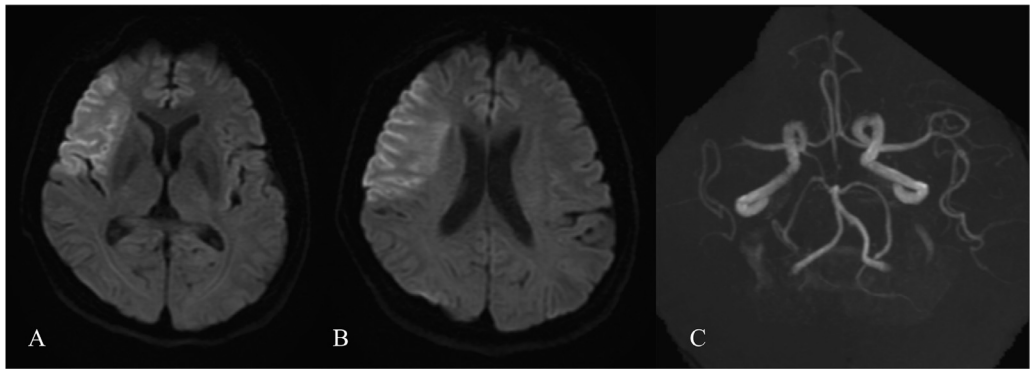

Fig. 1 – Magnetic resonance imaging on presentation showed acute ischemic stroke in the right hemisphere (A, B). Magnetic resonance angiography showed occlusion of the M2 segment of the right middle cerebral artery (C).

Fig. 2 – DSA revealed a shelf-like protrusion on the right internal carotid artery (arrow) and blood turbulence distal to the CW (A). CTA performed before procedure revealed no thrombus in the web pocket (arrow) (B).

Case report

A 51-year-old man presented with consciousness disturbance and left hemiparesis. His initial National Institutes of Health Stroke Scale score was 15. Magnetic resonance imaging revealed acute ischemic stroke with occlusion of the M2 segment of the right middle cerebral artery (Fig. 1). Mechanical thrombectomy achieved complete recanalization with subsequent near-complete recovery of neurological function. No cardioembolic source of embolism, including atrial fibrillation, was identified. Carotid ultrasonography showed a flap-like structure on the wall of the right carotid bulb. Digital subtraction angiography (DSA) revealed a CW, which we considered to be the embolic source. Computed tomography angiography showed no thrombus in the web pocket (Fig. 2). Thus, we started dual antiplatelet therapy and performed stent placement to prevent recurrent stroke at 3 weeks after admission. We performed direct stenting using a CASPER stent with distal filter protection (Figs. 3A and B). Balloon angioplasty was not required because the stent was well crimped to the vessel wall. There were no periprocedural complications. Before discharge, we performed follow-up DSA at 3 weeks after stenting, which confirmed endothelial formation on the web pocket (Figs. 3C and D). The patient was discharged with a modified Rankin Scale score of 0, and had no recurrence of stroke at least 8 months follow up after procedure. The patient provided consent for publication of his case.

Discussion

We report a case of symptomatic CW treated with stent placement using a dual layer CASPER stent. Endothelialization on the web pocket was confirmed 3 weeks after stent placement. In CW patients, a thrombus formed by blood stasis distal to the CW results in embolic stroke [2]. Symptomatic CW has a high rate of ischemic stroke recurrence despite antiplatelet therapy. There are some reports of carotid endarterectomy

Fig. 3 – Intraoperative DSA (A, B). A CASPER stent was deployed (A). The stent and the CW were crimped well to the vessel wall (B). Follow-up DSA 3 weeks after stenting (C, D). Endothelialization on the web pocket (arrowheads) was confirmed in the lateral view (C), and endothelialization on the stent (arrowheads) was confirmed in the oblique view (D).

and carotid artery stenting for CWs, both of which were effective in preventing ischemic stroke recurrence [7]. Pathologically, CWs involve fibroelastic thickening of the intima with no cholesterol-rich atheroma [2]. Additionally, CW patients are young and have less arteriosclerotic vessels, so there are few problems related to the access route and distal plaque embolisms for stent placement. Therefore, carotid artery stenting for CW has a low risk of periprocedural complications compared with stenting for carotid artery stenosis.

We considered that the CW was effectively treated with stent placement when endothelialization on the web pocket was confirmed. In such cases, intimal hyperplasia in the stent may occur later, but ipsilateral ischemic stroke related to the CW cannot occur. Gouveia et al [8] also reported a case of endothelialization on the CW confirmed by DSA at 3 months after stenting. However, to our knowledge there are no other cases with CW endothelialization confirmed earlier than 3 months.

The optimal stent for CW treatment is still unclear. There are 3 types of carotid stents (closed-cell, open-cell, and dual-layer). Previous reports have found no differential effects of treatment with these stents on outcomes or recurrence rate in CW patients [1,6]. Additionally, balloon angioplasty was not required in the majority of stenting procedures for CWs [1,6]. Furthermore, although there are some case reports of treatment with closed-cell stents in CWs that were not crimped well to the vessel wall, there were no associated problems such as in-stent stenosis or recurrent ischemic stroke. Thus, we considered that endothelialization on the web pocket was more important than the radial force, and a dual-layer CASPER stent is suitable for treatment for the CW.

The high scaffolding effect of the CASPER stent may promote the endothelialization on the web pocket. The braided-nitinol outer layer of a dual-layer CASPER stent adheres closely to the vessel wall and has a strong scaffolding effect for endothelization. Additionally, the micromesh of the inner layer facilitates secure closure of the web pocket [9]. There are no in vivo studies examining the time required for full device endothelialization after placement of the CASPER stent. Imamura et al. reported no evidence of ipsilateral stroke from 30 days to 1 year after the procedure when using a protocol that indicated dual antiplatelet therapy for 30 days after stenting with the CASPER stent for carotid artery stenosis [9]. Considering this result, it is possible that the endothelialization of the CASPER stent is completed in 30 days after procedure, at least for the carotid artery stenosis.

When using CASPER stent in the acute phase, adequate periprocedural antiplatelet therapy and monitoring for ischemic complications are needed because of the large amount of metal in CASPER. Symptomatic CWs often cause ischemic stroke recurrence within 1 week of the initial event [5]. It is important to check that there is no thrombus in the web pocket before the procedure. If there is insufficient time for effective antiplatelet drug treatment such as a secondary thrombus was already formed in the acute phase, using CASPER stent is not suitable.

Conclusion

We reported a case of symptomatic CW confirmed endothelialization at 3 weeks after stent placement. The high scaffolding effect of the dual layer CASPER stent may affect for the endothelialization on the CW.

Author contributions

Kohei Ishikawa is responsible for project development, data collection and analysis, literature research and manuscript writing. Koichiro Shindo, Hideki Endo, Ryota Nomura are responsible for literature research, manuscript editing. Ryunosuke Yoshihara is responsible for data collection and literature research. Koji Oka is responsible for data collection and management. Hirohiko Nakamura is responsible for project development and total management.

Ethical statement

All procedures performed in studies involving human participants were in accordance with the ethical standards of the

institution and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. The study was approved by the Ethics Committee of Nakamura Memorial South Hospital (No. S2022010401), and informed consent was obtained from the patient.

Patient consent

This study was approved by the institutional review board, and informed consent was obtained from the patient.

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REFERENCES

[1] Brinjikji W, Agid R, Pereira VM. Carotid stenting for treatment of symptomatic carotid webs: a single-center case series. Interv Neuroradiol 2018;7:233–40. doi:10.1159/000486537.

[2] Choi PM, Singh D, Trivedi A, Qazi E, George D, Wong J, et al. Carotid webs and recurrent ischemic strokes in the era of CT angiography. AJNR Am J Neuroradiol 2015;36:2134–9. doi:10.3174/ajnr.A4431.

[3] Ma Y, Yang B, Jiao L. Teaching neuroimages: pathology and thromboembolism of carotid web. Neurology 2020;94:e762–3. doi:10.1212/WNL.0000000000008965.

[4] Joux J, Chausson N, Jeannin S, Saint-Vil M, Mejdoubi M, Hennequin JL, et al. Carotid-bulb atypical fibromuscular dysplasia in young Afro-Caribbean patients with stroke. Stroke 2014;45:3711–13. doi:10.1161/STROKEAHA.114.007313.

[5] Haussen DC, Grossberg JA, Bouslama M, Pradilla G, Belagaje S, Bianchi N, et al. Carotid web (intimal Fibromuscular Dysplasia) has high stroke recurrence risk and is amenable to stenting. Stroke 2017;48:3134–7. doi:10.1161/STROKEAHA.117.019020.

[6] Haussen DC, Grossberg JA, Koch S, Malik A, Yavagal D, Gory B, et al. Multicenter experience with stenting for symptomatic carotid web. Interv Neuroradiol 2018;7:413–18. doi:10.1159/000489710.

[7] Zhang AJ, Dhruv P, Choi P, Bakker C, Koffel J, Anderson D, et al. A systematic literature review of patients with carotid web and acute ischemic stroke. Stroke 2018;49:2872–6. doi:10.1161/STROKEAHA.118.021907.

[8] Gouveia EE, Mathkour M, Bennett G, Valle-Giler EP. Carotid web stenting. Ochsner J 2019;19:63–6. doi:10.31486/toj.18.0143.

[9] Imamura H, Sakai N, Matsumoto Y, Yamagami H, Terada T, Fujinaka T, Yoshimura S, et al. Clinical trial of carotid artery stenting using dual-layer CASPER stent for carotid endarterectomy in patients at high and normal risk in the Japanese population. J Neurointerv Surg 2021;13:524–9. doi:10.1136/neurintsurg-2020-016250.