

CAROTID STENTING FOR TREATMENT OF CAROTID WEB WHICH CAUSED STROKE: A REPORT OF 3 CASES

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ABSTRACT

Introduction: Carotid web is a focal variant of fibromuscular dysplasia, creating a septal in the carotid bulb, from which thrombosis can occur and may cause stroke. It is a rare disease and there is not enough evidence to establish optimal treatment.

Case report: We report on three patients with carotid web - related strokes: two males (ages 57 and 68) and one female (age 43). Despite optimal medical treatment, both male patients experienced early recurrent strokes, while the female patient presented with a first - time stroke. All three patients underwent carotid stenting, and during a follow - up period of up to 3 years, there were no procedure - related complications or recurrent stroke events.

Conclusion: Carotid web is a cause of ischemic stroke with a high risk of recurrence. Carotid stenting is a safe and effective option for long - term prevention of stroke recurrence. There fore, carotid artery imaging should be carefully evaluated, with attention paid to carotid web in patients with cryptogenic stroke.

Keywords: Carotid web, stroke, carotid stenting.

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I. INTRODUCTION

Carotid web is defined as an intimal septum with a fibrous tissue structure creating a filling defect on the posterior wall of the carotid bulb. Histologically, it has been considered a variant of intimal fibromuscular dysplasia rather than atherosclerosis of the carotid artery [1, 2]. Carotid web has not been classified among the classical risk factors or causes of stroke. Recently, there is increasing evidence supporting that carotid web is a cause of anterior circulation stroke, with its prevalence in cryptogenic stroke ranging from 9.4% to 37% [2 - 5]. The mechanism of thrombus formation in carotid web is believed to be due to stasis and disturbed blood flow in the carotid bulb [6, 7].

Solely medical treatment seems to be ineffective in preventing recurrent stroke in patients with carotid web - related stroke, with a recurrence rate of up to 17 - 56%

[8, 9]. Currently, there is still insufficient evidence to recommend an optimal treatment approach for stroke associated with carotid web [10]. According to recent studies, carotid stenting and endarterectomy have been shown to be effective in preventing recurrent stroke, with no recurrent events reported [9].

We described 3 cases of recurrent stroke, with carotid web considered as the cause. All 3 patients underwent carotid stenting and had no recurrent stroke events during the follow - up period.

II. CASE REPORT

Case 1

A 57 - year - old male smoker who had a history of stroke three times. The first stroke occurred 7 months prior, with mild right - sided weakness, and was treated with aspirin, clopidogrel, and rosuvastatin for prevention. The second stroke occurred 2 months after the first and presented with mild left - sided

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weakness and Broca's aphasia. CTA brain imaging revealed a left M1 MCA occlusion, which was treated with rtPA and endovascular thrombectomy

(**Figure 1**). The patient was discharged with full recovery and an mRS score of 0, and continued treatment with aspirin and rosuvastatin.

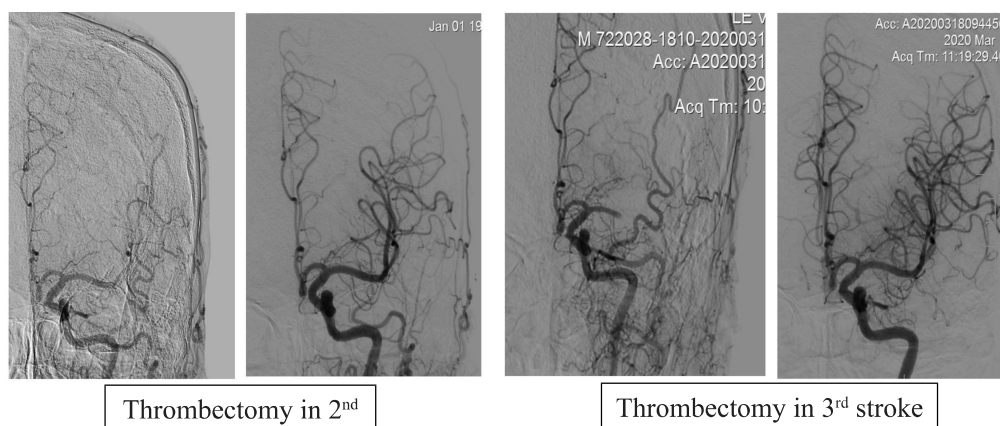


Figure 1: Complete reperfusion of occluded left MCA with mTICI 3/3 in patient 1

The third time, the patient was readmitted with complete left - sided weakness, global aphasia, and central facial palsy. The patient underwent endovascular thrombectomy again and achieved successful recanalization with an mTICI score of 3/3 (**Figure 1**). After the intervention, the patient's mRS score was 1.

The angiography shows a carotid web with flow stagnation in the carotid bulb (**Figure 2**). We decided to place a carotid WALLSTENT™ stent, protected by a Spider FX, after treating with dual antiplatelet therapy (DAPT) for 7 days.

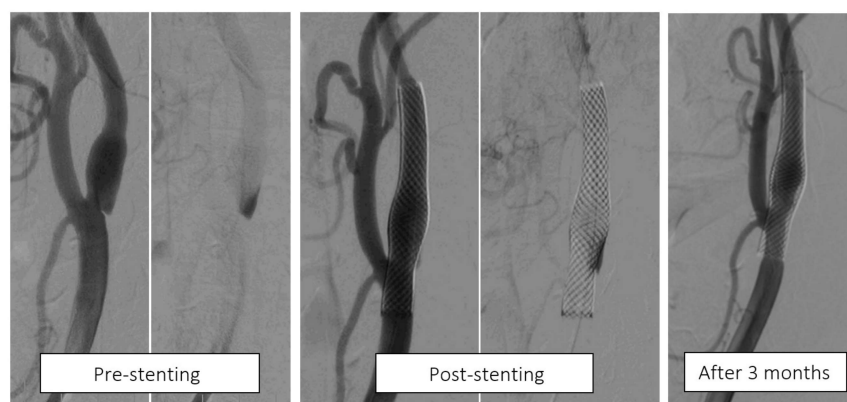


Figure 2: Carotid web in patient 1.

After 3 months of treatment with DAPT, the patient underwent a DSA scan which revealed endothelialization within the stent and reduced flow into the carotid web pouch (**Figure 2**). The patient was switched to aspirin monotherapy and remained stroke - free for 36 months with an mRS score of 0

Case 2

A 68 - year - old male patient with a history of well - controlled hypertension and no smoking history had two episodes of stroke. The first episode resulted in right hemiplegia, aphasia, and gaze deviation, and was determined to be caused by occlusion of the terminal left internal carotid artery (ICA), which was successfully recanalized with an mTICI 3/3 score (**Figure 3**).

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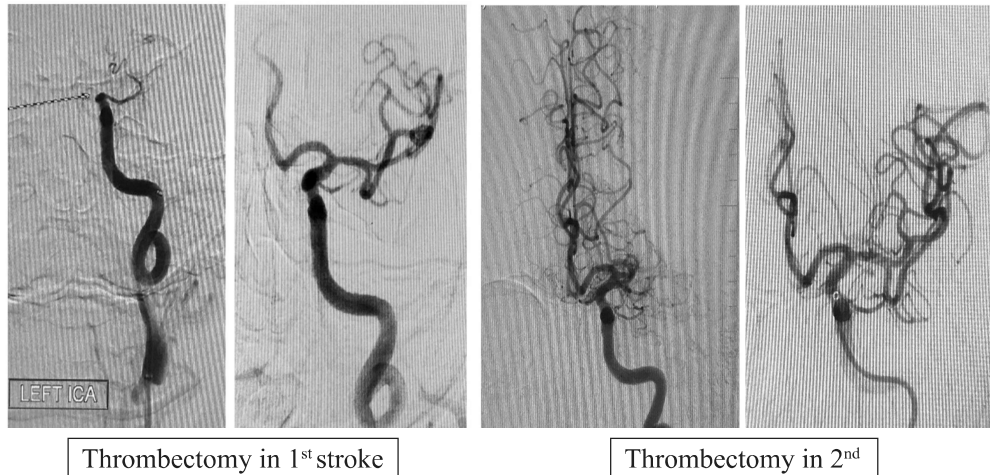


Figure 3: Complete recanalization of the left ICA and MCA in patient 2

The patient experienced a HI2 hemorrhagic transformation after the intervention. After 10 days, the patient was discharged from the hospital with a full recovery (mRS 0) and was treated with aspirin, clopidogrel, and rosuvastatin. Five days after discharge, the patient had a second episode of cerebral infarction with complete right hemiplegia, global aphasia, and gaze deviation, and was readmitted to the hospital for re-intervention to retrieve the clot in the left middle cerebral artery (MCA) with mTICI 3/3 score (**Figure 3**).

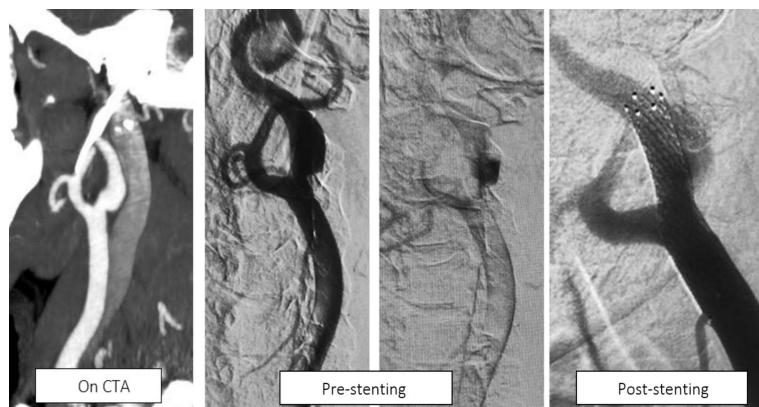


Figure 4: Carotid web in patient 2

Carotid web was identified in the left ICA on both DSA and CTA . The patient received carotid artery stenting (with Protégé™ stent protected by Filterwire EZ) after 5 days of DAPT treatment (**Figure 4**). He remained stroke - free for 34 months with treatment of DAPT followed by aspirin, and had an mRS score of 3.

Case 3

A 43 - year - old female patient was admitted to the hospital with left hemiplegia, central facial palsy, and gaze deviation. MRI showed cerebral infarction due to right middle cerebral artery occlusion, and the patient was treated with intravenous thrombolysis and underwent thrombectomy to achieve mTICI 2b recanalization (**Figure 5**)

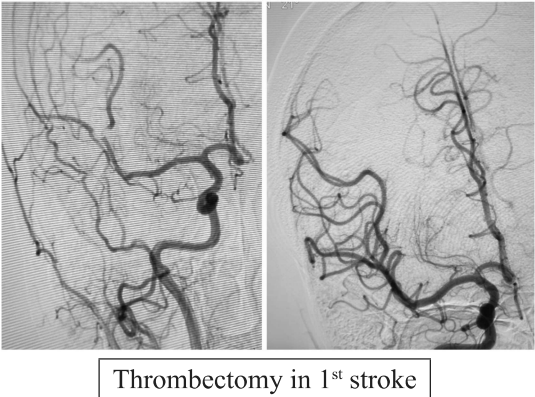


Figure 5. Right MCA occlusion is recanalized after thrombectomy in patient 3

Carotid web was also identified on DSA. After 11 days of treatment with DAPT, a stent was placed in the right MCA (Protégé without embolic filter). The angiography after stent placement shows the disappearance of the contrast stagnation (**Figure 6**). After 3 months of follow-up, no recurrent stroke was observed, and the patient had a mRS score of 2.

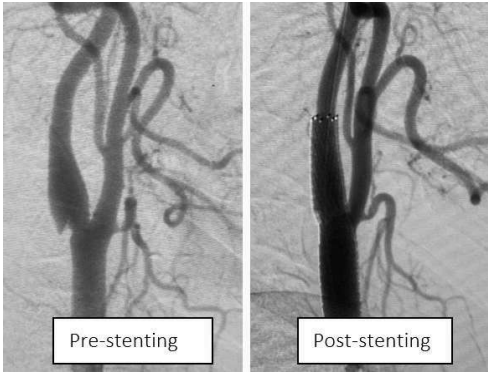


Figure 6. Carotid web in patient 3

Table 1: Clinical characteristics, treatments, and outcomes of 3 patients with carotid web

	Case 1	Case 2	Case 3
Gender	Male	Male	Female
Age	57	68	43
Number of stroke episodes	3	2	1
Medical treatment	DAPT, SAPT, Statin	DAPT, Statin	NA
NIHSS*	15	24	12
The imaging study detects a carotid web	CTA (-) DSA (+)	CTA (+) DSA (+)	CTA: NA DSA: (+)
Type of stent	Closed - cell	Open - cell	Open - cell
Pre - stenting DAPT	7 days	5 days	11 days
Embolic protection device	Yes	Yes	No

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	Case 1	Case 2	Case 3
Peri/post - procedure complications	No	No	No
Angiography after procedure	Contrast stagnation (+)	Contrast stagnation (+)	Contrast stagnation (-)
Angiography after 3 months	Stent endothelialization Contrast stagnation (-)	No	No
Follow - up period	36 months	34 months	3 months
Post - stenting recurrent stroke	No	No	No
mRS	0	3	2

*Last stroke episode

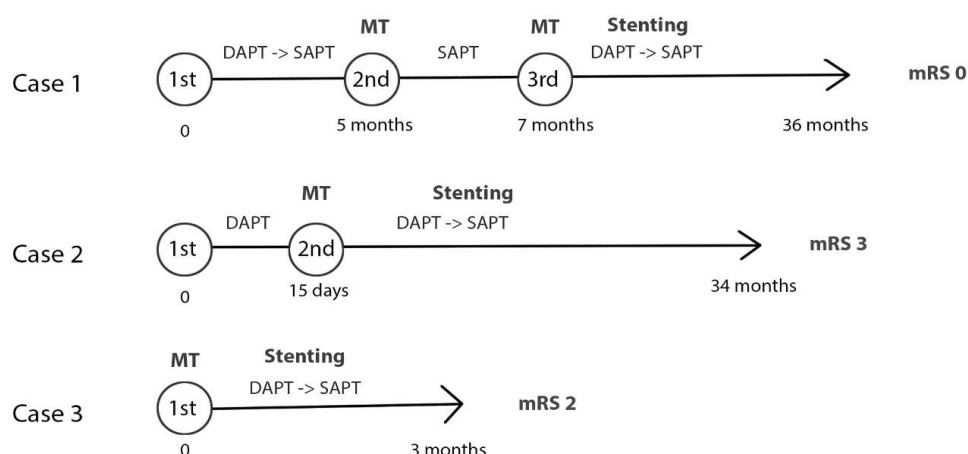


Diagram 1: Timeline of 3 cases

1st, 2nd, 3rd: First, second, third episode, MT: Mechanical thrombectomy, DAPT: Dual antiplatelet therapy: SAPT Single antiplatelet therapy

III. DISCUSSION

All three cases presented above were embolic stroke associated with carotid web, and the first two cases were documented to have recurrent events without any other causes such as atrial fibrillation or valvular heart disease. Therefore, carotid web is highly likely to be the cause of thrombotic events in these three patients. After stent placement, there were no further recurrences, which further confirms carotid web as the cause.

Although the first two patients were treated with SADT and DAPT, respectively, both failed and experienced recurrent stroke. Due to the lack of evidence, SAPT is still considered the first-line prophylactic treatment for recurrent ischemic stroke

according to the AHA/ASA 2022 guidelines [10]. However, case reports have shown a very high recurrence rate of 17 - 56% even with antiplatelet or anticoagulant therapy [8, 9].

According to a recent systematic literature review of 158 patients with carotid web and acute stroke, endarterectomy and stenting of the carotid artery are good options, without documenting any recurrence of stroke [9]. Stenting in carotid web is safer than in atherosclerotic stenosis because it is less prone to injury and has no other risk factors for stroke and cardiovascular disease - related perioperative complications. First, the smooth lumen of the artery does not have the risk of dislodgement and plaque embolization during

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the procedure. Second, the artery is not narrow, so there is no need for pre - and post - stent balloon dilation, which avoids the risk of temporary bradycardia and transient cerebral ischemia.

In all three of our patients, the intervention was successful. In two out of three cases, we used an embolic filter but did not find any clot in the filter. The purpose of the protective mesh is to prevent clots or debris from forming or floating up, but in carotid web, there is no such risk, so we believe that an embolic protection device may not be necessary when placing a stent in carotid web. We used both open - cell and closed - cell stents. Reports from other authors have also shown the effectiveness of both types of stents [11].

In the first two cases, contrast stagnation is still visible after stent placement. In the first patient, after 3 months of follow - up, the stent was completely endothelialized, and contrast stagnation disappeared. This is similar to cases of stent placement in ulceration plaques or flow diverter stent for brain aneurysm treatment [12 - 13]. For the second patient, we did not perform DSA follow-up. For the third patient, the flow stagnation disappeared immediately after placement.

All 3 cases did not have recurrent stroke, with 2 cases followed up for 3 years and the third case for 3 months. This further supports the long - term protective efficacy of carotid web stenting for secondary prevention of stroke related to carotid web.

IV. CONCLUSION

Carotid web is a cause of ischemic stroke with a high risk of recurrence. Carotid stent placement is a safe and effective option for long - term prevention of stroke recurrence. Therefore, carotid artery imaging should be carefully evaluated, with attention paid to carotid web in patients with cryptogenic stroke. However, further large - scale studies are needed to provide more evidence on the indication for stent placement in cases of recurrent or even first - ever stroke related to carotid web.

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