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Manual external carotid artery manipulation for failed device advance through the stent in carotid artery stent placement. a technical note

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Abstract

We report herein the usefulness of a manual external carotid artery manipulation for failed advancement of devices through the stent in carotid artery stent (CAS) placement with open cell type stent and filter type distal protection device. In all, 22 consecutive patients underwent CAS with filter type protection device between April 2008 and December 2009 in our institution, and failed advancement of the devices through the stent occurred in 4 patients (18%). For all the 4 patients, the devices could be navigated normally through the stent under the manual external carotid artery manipulation. In cases with failed device advance in CAS, this maneuver would be one of the methods to resolve this.

Keywords

carotid artery stent placement; stent; manual carotid artery manipulation; failed device advance

Introduction

Carotid artery stent (CAS) placement is a treatment option for atherosclerosis disease of the cervical internal carotid artery (ICA) in high-risk patients [1]. In Japan, CAS with filter type protection device (PRECISE™ and AngioGuard™, Cordis, Miami Lakes, Fla) was approved in April 2008 by the Ministry of Health, Labor and Welfare of Japan. However, it is occasionally difficult to navigate devices including capture sheathes and aspiration catheters through the deployed stent. This seems to be caused by the protruding struts of the stent due to its open cell type nature of the stent. In such cases, navigate guiding catheter or additional angioplasty were generally recommended. However, such cases carry further risk of thromboembolism and stent fracture. We have introduced a manual external carotid artery manipulation as an alternative and first line method to resolve this situation. We report the usefulness of the manual external carotid artery manipulation in those patients.

Methods

Between April 2008 and December 2009, we performed 22 CAS procedures with open cell type stent and filter type protection device. All patients received aspirin (100 mg/day) and a thienopyridine drug (ticlopidine 200 mg/day or clopidogrel 75 m/day) for at least 3 days before CAS. The patients were placed under general or local anesthesia, a bolus injection of heparin (80 IU/kg) was delivered, and CAS was performed by using AngioGuard™ filter protection system (Cordis, Miami Lakes, Fla). Atropine sulfate (0.5 mg) was injected intravenously just before balloon inflation for predilation, which was achieved with a 4- or 5 × 40 mm balloon catheter (Sterling™, Boston Scientific, Natick, MA); the inflation pressure was 6 atm for 30 s. A self-expandable stent (9- or 10 mm × 40 mm PRECISE™, Cordis, Miami lakes, Fla) was then deployed. Postdilation was achieved with a 6- or 7 × 20 mm balloon catheter (Sterling™); the inflation pressure was 6 atm for 10 s. AngioGuard™ was removed by the capture sheath. In case with flow abnormality at the filter, we evacuated 20–40

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Figure 1

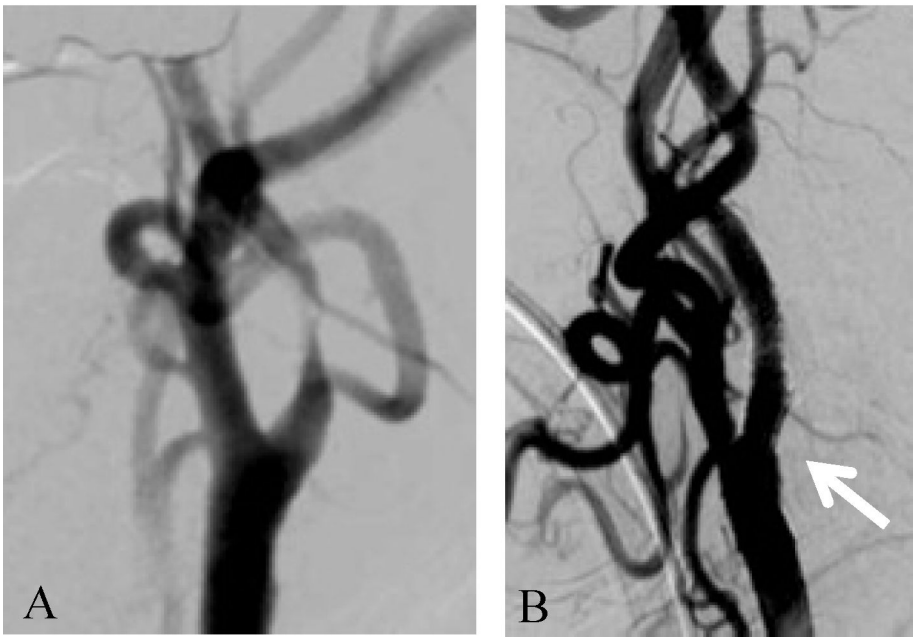

Figure 1. a *Left carotid angiography (anterior-posterior view) before procedure revealed severe stenosis at left ICA.* ***b*** *Arrow indicates the site where the capture sheath was stuck in left carotid angiography (lateral view).*

ml of the standing column of blood in ICA at just proximal to the filter by the aspiration catheter (Thrombuster™, Kaneka, Japan). For patients in whom devices were not normally navigated through the stent, we applied the carotid external pressure method. We gently pressed the neck of the patient, either laterally or vertically, so as to have the stent straight under fluoroscopy. We retried to navigate devices through the stent under this manual external carotid artery manipulation.

For cases that required this method, we retrospectively assessed the type of devices that did not traverse the stent, the lesion where devices could not be advanced, the degree of stenosis (North American Symptomatic Carotid Endarterectomy Trial (NASCET) [2], %), result of the method (successful or unsuccessful), procedure-related complication (subcutaneous hematoma, arterial dissection, ischemic stroke), and restenosis during follow-up period.

Case reports

Case 1 (No. 1, Figure 1). This 61-year-old male suffered from Wernicke's aphasia caused by left ICA stenosis. Angiography revealed 70% ICA stenosis by NASCET. Due to concomitant coronary artery disease and severe stenosis in the vertebrobasilar system, we considered his indication of CAS. Eight Fr-guiding catheters (Guider™, Boston Scientific, Natick, MA) were coaxially advanced to the left common carotid artery (CCA) with 125 cm 5 Fr diagnostic catheter. After post dilatation, we attempted to advance capture sheath through the stent. However, it was stuck inside the stent at the level of carotid bifurcation (Figure 1, arrow). We gently pushed the neck laterally and could advance it through the stent under this maneuver. Then, protect filter was deflated by capture sheath. Finally, angiography revealed no distal embolism and carotid flow was normalized.

Case 2 (No. 4, Figure 2). This 78-year-old male suffered from left hemiparesis. Angiography revealed right ICA 65% stenosis by NASCET with several ulcers. Due to over age and coronary artery disease, we considered her indication of CAS. Because of type III aortic arch anatomy, we chose the right transbrachial approach. Six French long sheaths (Axcelguide™, Medikit, Japan) were coaxially advanced to the right CCA with 125 cm 5 Fr JB2 catheter. Because slow flow occurred after post dilatation, blood aspiration was considered to be essential. We tried to advance Thrombuster III™ aspiration catheter through the stent, but it was stuck at the proximal edge of the stent (Figure 2, arrow). We gently

Figure 2

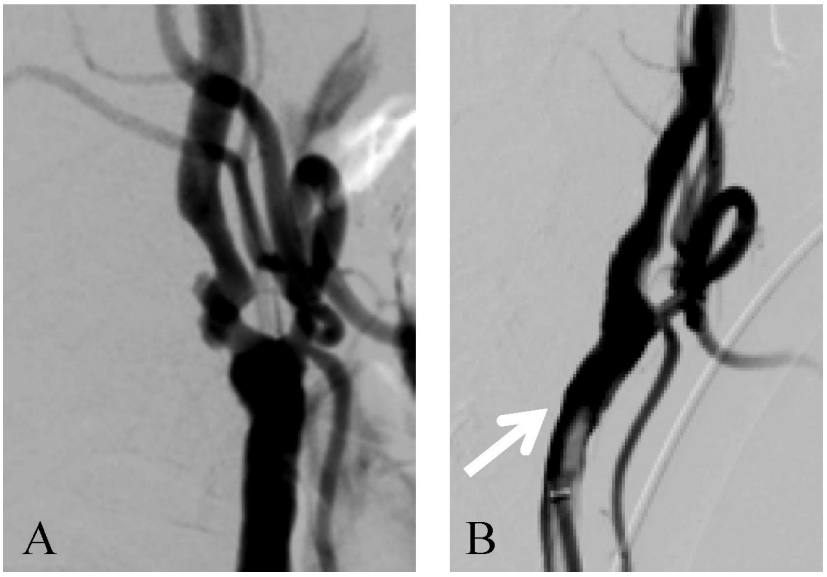

Figure 2. a *Right carotid angiography (anterior-posterior view) before procedure revealed moderate stenosis with several ulcers.* ***b*** *Arrow indicates the site where the capture sheath was stuck in right carotid angiography (lateral view).*

Table 1.
Patients' data underwent external pressure method during CAS

Patients' No./Sex/Age (y)	Degree of stenosis (NASCET, %)	Device	Lesion	Carotid manipulation on	complication
1/M/61	70	Capture sheath	Carotid bifurcation	Success	No
2/M/72	80	Capture sheath	Most stenotic level of ICA	Success	No
3/M/54	90	Balloon catheter for post-PTA	Carotid bifurcation	Success	No
4/M/78	65	Aspiration catheter	Proximal edge of stent	Success	No

Note: ↓ CAS carotid artery stent placement; PTA precutaneous transluminal angioplasty; ICA internal carotid artery.

pushed the neck vertically and could advance it through the stent under this maneuver. We evacuated 30 ml of the standing column of blood in ICA just proximal to the filter by the aspiration catheter (30 ml ×1 time), and flow at ICA was normalized. Then, protect filter was deflated by a capture sheath. Angiography revealed neither distal embolism nor intramural thrombus inside the stent.

Results

Failed advancement of the devices through the stent occurred in 4 patients (18%). In all the 4 patients, we were able to advance the devices through the stent under this maneuver. Patients' characteristics are summarized in Table 1. The devices with difficulty to navigate were 2 capture sheathes, 1 balloon catheter for post dilation, and 1 aspiration catheter. The degree of stenosis was 65–90% by the NASCET method. The lesion where devices could not be navigated initially was 2 carotid bifurcations, 1 most stenotic level, and 1 proximal edge of the stent. No neurological deficits were found in any of the 4 patients, including the patients who developed a carotid dissection, a cervical subcutaneous hematoma, and hypotension/bradycardia. Diffusion-weighted image of magnetic resonance image, performed on post-operative day 1, revealed the development of a hyperintense spot area in 2 patients (50%). However, in both of them, they were all asymptomatic lesions. The median follow-up period after the procedure was 19.5 months (range, 12–21 months). Neither procedure-related complications nor restenosis was found in any of the patients during the procedure and follow-up period.

Discussion

The present series describes our experience with manual external carotid artery manipulation as adjunct to CAS

Journal of Vascular and Interventional Neurology

with open cell type stent and filter protection device for atherosclerotic disease of the ICA origin. This report highlights the unique technical aspects of the maneuver particularly the resolve process for failed device advance through the deployed stent. For all the 4 patients with failed device advance at first attempt, the devices could be navigated normally through the stent under the manual external carotid artery manipulation. Additionally, we did not observe any stroke, arterial dissection, subcutaneous hematoma and restenosis within the follow-up period. Daugherty *et al* reported the usefulness of a vertebral catheter in patients with failed retrieval of an AngioGuard™ distal protection device [3]. Malik *et al* reported that turning the neck, swallowing, and external pressure may be useful when removal of the distal protection device is difficult [4]. However, in their papers, the details of external pressure method for the difficulty in advancement of devices through deployed stents have not been clearly mentioned. Our results support the usefulness and feasibility of this maneuver.

Failed device advancement seems to originate from the following reasons: (1) devices are in close proximity to the sent; (2) there are the protruding struts of stent; and (3) the acute angle between stents and proximal common carotid arteries. In addition to these, character of devices may play an important role in this situation. Three of the four devices that did not traverse the stent were two capture sheathes and an aspiration catheter that possess bigger diameter in their tip than usual catheter based on their original purpose. We must pay much attention when handling these devices through the stent. External carotid artery manipulation may alter device bias, improve the protruding struts and straighten the angle between stents and the proximal carotid artery, changing the trajectory, and helping to accomplish advancement. In general, advancing guiding catheter or additional angioplasty is generally recommended in such cases to facilitate passage. However, those might carry further risk of thromboembolism, stent fracture, and hypotension/bradycardia. Even though a small number of the patients were studied in this method, no complication such as subcutaneous hematoma, dissection, and hypotension/bradycardia was observed. Especially to prevent hypotention/bradycardia, a special precaution was taken to avoid direct pressure on carotid baroreceptors during this manipulation.

This method does not require additional devices and our results would support the feasibility of this maneuver in cases with failed device advance through the deployed open cell type stent.

In addition to the small number of included patients, the present study has another limitation. We did not compare this method with another non-invasive ways such as breath holding, neck turning, and swallowing.

Conclusion

In cases with failed device advance through deployed stent in CAS, the manual external carotid artery manipulation may be one of the methods to resolve this situation and we recommend this as a first line method.

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