Treatment of a Case of Common Carotid Artery Pseudoaneurysm That Developed after Surgery for Hypopharynx Cancer by Covered Stent Placement

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Objective: A case of common carotid artery pseudoaneurysm that developed after treatment for malignant neoplasm of the neck in which rupture could be prevented by covered stent placement is reported.

Case Presentation: A 51-year-old woman developed pseudoaneurysm of the common carotid artery after radiotherapy and surgery for hypopharynx cancer. Since direct surgery was considered difficult due to the risk of rupture, endovascular treatment was performed. The lesion disappeared after placement of a covered stent (Fluency Plus; Bard Peripheral Vascular, Tempe, AZ, USA) in the common carotid artery via the femoral artery. No perioperative complication was observed, and the lesion remained obliterated after 5 months. While the patient died due to recurrence of cancer half a year after surgery, no ischemic stroke or rupture of pseudoaneurysm was noted.

Conclusion: Endovascular treatment using a covered stent was useful for the prevention of rupture of pseudoaneurysm that occurred after treatment for malignant tumor of the neck.

Keywords: carotid blowout syndrome, pseudoaneurysm, covered stent, hypopharyngeal cancer, common carotid artery

Introduction

Sudden bleeding of the carotid artery after treatment of malignant tumor of the head and neck region is called carotid blowout syndrome (CBS), which is reportedly caused primarily by radical neck dissection and radiation. The mortality due to CBS is high at 40%, and pseudoaneurysm of the carotid artery is considered a precursor state of CBS. Therefore, pseudoaneurysm of the carotid artery is considered to need treatment to prevent CBS. Surgical treatment for CBS is highly invasive, and its outcomes are poor.1–3) However, the outcomes of endovascular treatment for CBS have been reported to be more favorable compared with those of other treatments.1,4) In the case reported here, we could prevent CBS by covered stent (Fluency Plus; Bard Peripheral Vascular, Tempe, AZ, USA) placement for common carotid artery pseudoaneurysm following treatment for hypopharynx cancer.

Case Presentation

The patient was a 50-year-old woman with pulsatile mass of the right neck. She had been followed up since September 2014, when she was found to have a pseudoaneurysm in the right common carotid artery on 3D-CTA performed before surgery for recurrent hypopharynx cancer. As a pulsating mass was recently noted in the neck and was suspected to be enlarging, she was referred to our department in December 2014 for detailed evaluation.

She had histories of chemoradiotherapy and left neck dissection for hypopharynx cancer in 2013 and recurrence...
A Case of Carotid Artery Pseudoaneurysm Treated by Covered Stent

Of hypopharynx cancer, pharyngo-laryngeal resection, right neck dissection, and reconstruction with a free jejunal graft in 2014.

On admission, she had a pulsatile mass in the right neck (Fig. 1). Blood chemistry tests showed no particular abnormalities.

3D-CTA left oblique multiplanar reconstruction (MPR) imaging showed a wide-necked saccular aneurysm, which was considered a pseudoaneurysm, in the right common carotid artery at the C6/7 vertebral level (Fig. 2A). On MRI, sagittal T1-weighted imaging showed a flow void suggestive of an aneurysm immediately below the thinned epidermis (Fig. 2B).

Angiography of the right common carotid artery also showed a wide-necked saccular aneurysm with a maximum diameter of 20 mm, which was considered a pseudoaneurysm, at the C6/7 level (Fig. 2C).

Since there was no sign of recurrence of cancer at this point, we selected therapeutic intervention. Although occlusion of the parent artery was the first choice, a method that would permit maximum preservation of the parent artery was evaluated as ischemic tolerance could not be checked. As securing of normal vessels and cure of wound were expected to be difficult after bypass surgery or artificial vessel replacement, we decided to perform endovascular treatment using a covered stent with approval by the institutional review board. Fluency Plus was selected as the covered stent. Fluency Plus, which is not designed for neuroendovascular procedures, requires a delivery system 9 Fr in external diameter and 80 cm in effective length, and a luminal diameter of 9 Fr is necessary for its guiding. Also, the stent is not exposed out of the catheter tip if a guiding catheter with a usual length is used. Therefore, we used a 65-cm 9 Fr Arrow sheath (Arrow International Inc., Reading, PA, USA).

The oral administration of aspirin at 100 mg/day and clopidogrel at 75 mg/day was initiated from 2 weeks before the endovascular treatment. During the procedure, the patient was systemically heparinized while adjusting the activated clotting time to 250–300 seconds. The approach was made via the right femoral artery, and an 8 Fr Launcher (Medtronic Inc., Minneapolis, MN, USA) was guided coaxially to the origin of the right common carotid artery (Fig. 3A). A 0.035-inch guidewire was advanced carefully through the lesion and placed at a point slightly proximal to it. At this time, the distance of entry of the 90-cm Launcher in the sheath and vessel was measured, and treatment using a 65-cm Arrow sheath was confirmed to be possible. After the guidewire was replaced with a Transend EX-14 guidewire (Boston Scientific/Target, Fremont, CA, USA), the diameter of the common carotid artery measured by intra-vascular ultrasound was 7 mm on the distal side and 6 mm on the proximal side of the lesion. The guiding catheter and sheath were replaced by an Arrow sheath, and guiding of a 0.035-inch guidewire to the common carotid artery was attempted again, but it could not be guided due to tortuousness of the vessel. The inner catheter was temporarily inserted distally to the aneurysm, and the wire was changed to a 0.035-inch Amplatz Extra Stiff guidewire (Cook, Inc., Bloomington, IN, USA). This resulted in straightening of the curved part, making the placement of the Arrow sheath possible (Fig. 3B). Since the stent would be placed in the plaque-free common carotid artery, the risk of scattering of debris was expected to be low, and a Fluency Plus with an external diameter of 8 mm and a length of 40 mm was placed while stabilizing the guiding sheath using an Amplatz without distal protection by placing priority on stability. The proximal side of the covered stent stayed in the guiding sheath at its deployment, but the entire stent could be expanded by carefully and slightly withdrawing the guiding sheath. The absence of endoleak and disappearance of the blood flow into the aneurysm were confirmed, and balloon dilatation or additional stenting was not performed (Fig. 3C).

No perioperative complication was noted. Diffusion-weighted imaging performed 2 days after the procedure also showed no ischemic lesions, and the patient was discharged to home 2 weeks after the procedure. After 3 months, dural antiplatelet therapy was changed to clopidogrel alone.
Carotid artery pseudoaneurysm is a late complication of treatment for head and neck malignant tumors. When ruptured, the condition is called CBS, and its incidence is reported to be 4.3% in patients with malignant tumors of the head and neck.\(^1\) The mortality and morbidity of CBS

On CTA performed after 4 months, aneurysm obliteration and patency of the covered stent were confirmed (Fig. 3D). The mass in the neck decreased in size and completely disappeared 5 months after the treatment (Fig. 4). Local recurrence of the tumor was observed 6 months after surgery, and the patient died 7 months after surgery. No CBS or ischemic stroke was observed until death.

**Discussion**

Carotid artery pseudoaneurysm is a late complication of treatment for head and neck malignant tumors. When ruptured, the condition is called CBS, and its incidence is reported to be 4.3% in patients with malignant tumors of the head and neck.\(^1\) The mortality and morbidity of CBS...
are high at 40% and 60%, respectively, and prevention before its occurrence is important. Risk factors of CBS include a body mass index of <22.5 kg/m², hypopharynx/oropharynx cancer, radical lymph node dissection, and irradiation at 70 Gy.5) Our patient, who met all these conditions, is considered to have been at a high risk for CBS.

The treatment for carotid artery pseudoaneurysm is occlusion of the parent artery, in principle, but this approach is impossible when there is no ischemic tolerance.2) Intraaneurysmal embolization may be considered as a measure to achieve temporary hemostasis, but long-term occlusion cannot be expected by this procedure.2) Bypass surgery and artificial vessel replacement should be evaluated,3) but they are difficult to perform as additional procedures to the neck that has been previously operated on or irradiated.1,2) Therefore, endovascular treatment using a covered stent has recently emerged as the first choice.6) However, there have been few reports of prophylactic covered stent placement before hemorrhage although there have been some reports of its implementation in the acute phase of hemorrhage, and we found only those by Mej doubi et al.7) and Gaynor et al.6) on our review of the literature (Table 1). In these reports, the covered stent used was Viabahn (Gore, Flagstaff, AZ, USA). While hemorrhage was controlled adequately in 9 of the 10 cases presented in the two reports, one developed CBS after the treatment and died.

Of the covered stents approved in Japan, only Graftmaster (Abbott Vascular Devices, Redwood, CA, USA), which is a balloon expandable stent, has indication for vascular lesions, and it is used in emergency treatment for coronary artery perforation. However, its maximum diameter is 4.8 mm and is considered insufficient for the common carotid artery.
Fluency Plus, which was used in our patient, is a self-expandable stent approved in Japan to be used in the bile duct. It is covered by expanded polytetrafluoroethylene (ePTFE) membranes, which are used in artificial blood vessels, in a sandwiched fashion, and as it is resistant to luminal stenosis, it is used primary in veins in Western countries. In Japan, there has also been a report of its placement in a peripheral vessel of the iliac artery. However, the available sizes are limited to 8 and 10 mm in external diameter and 40, 60, and 80 mm in length. In addition, the delivery system has an external diameter of 9 Fr and an effective length of 80 cm. Therefore, a usual guiding catheter, which is 90 cm long, cannot be used for its placement in the carotid artery via the femoral artery. Since our patient was a small woman with a lesion at a relatively low position in the common carotid artery, the guiding catheter could be placed in the common carotid artery via the femoral artery using a 9 Fr 65-cm-long Arrow sheath, but it is considered impossible to apply the same method to all patients.

As for cautions in the use of Fluency Plus in the common carotid artery, it must be placed by withdrawing the guiding catheter for lesions at a low position in the common carotid artery, but this involves the risk of fall of the guiding catheter from the common carotid artery into the aorta. In our patient, we could place the stent by stabilizing the guiding catheter using the rigid Amplatz wire with a strong retention force.

In Japan, Niti-S ComVi (Taewong Medical, Seoul, Korea) is available as another ePTFE membrane covered stent. It is more flexible and easier to place than Fluency Plus, but as its minimum size is 50 mm long, we selected Fluency Plus for our patient. Viabahn has also begun to be covered by insurance in Japan from 2017. Its indication in treatment of vascular injuries is “emergency treatment of patients with difficult-to-control blood leakage due to traumatic or iatrogenic vascular injuries of thoracic, abdominal, or pelvic arteries with a reference vascular diameter of 4.0–12.0 mm (except the aorta, coronary artery, brachiocephalic artery, carotid artery, vertebral artery, and pulmonary artery).” Since a variety of sizes ranging in stent diameter of 5–13 mm and length of 2.5–25 cm can be selected, Viabahn is expected to be used more frequently for patients such as ours.

One of the problems with treatment using a covered stent in the head and neck is the patency rate. Concerning the outcomes of treatment using covered stents for pseudoaneurysms of the carotid and vertebral arteries, occlusion of the covered stent was reportedly observed in one (13%) of the eight patients who could be followed up (median follow-up period: 78.5 days) and in three patients (15%) (median follow-up period: 3 months) on a review of reports about treatment using covered stents for traumatic pseudoaneurysms of the extracranial internal carotid artery. Concerning the outcomes of treatment for CBS using covered stents, also, ischemic complications were observed in 5 (29%) of the 17 patients (median follow-up period: 3 months), with occlusion of the covered stent in one patient (6%). In this report, antiplatelet medication was started after the procedure, and the inadequacy of antiplatelet medication is mentioned as a possible cause of ischemic complications and covered stent occlusion. However, Gaynor et al., who treated 15 patients using Viabahn with preprocedural aspirin and clopidogrel loading (mean follow-up period: 5.4 months), reported no ischemic complications with an occlusion rate of 0% and suggested that antithrombotic treatment is important for improving the long-term stent patency rate. In our patient, antiplatelet therapy, which could be introduced from before the procedure, is also considered to have contributed to the prevention of ischemic complications and covered stent occlusion.

Covered stents are rigid compared with bare stents and are reported to be more likely to lead to endoleak particularly when they are placed in curved lesions. Wu et al. noted rebleeding on a later day in 8 of 17 patients and reported its cause to have been endoleak. When endoleak is observed, angioplasty and additional stenting should be evaluated.

In patients with carotid artery pseudoaneurysm complicating malignant neoplasm, covered stent placement in the carotid artery is considered to contribute to improvements in the life prognosis and quality of life by preventing CBS despite problems including ischemic complications and stent occlusion.

### Conclusion

We could prevent CBS in a case of common carotid artery pseudoaneurysm that occurred after treatment for malignant tumor of the neck by covered stent placement. As it is difficult to maintain catheter stability in placing Fluency Plus at a low position of the common carotid artery, modifications of the procedure such as the use of a guidewire that provides strong support are necessary.

### Disclosure Statement

Neither the first author nor any of the coauthors have any conflicts of interest.
References


