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Multiple stenting using anchoring technique with balloon guiding catheter for common carotid artery dissection after aortic arch replacement: A case report

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ABSTRACT

INTRODUCTION AND IMPORTANCE: Common carotid artery (CCA) dissection is a minor complication during aortic arch replacement (AAR). Although endovascular treatment can be considered for symptomatic CCA dissection despite internal therapy, no report has mentioned about carotid stenting for CCA dissection after vascular graft replacement.

CASE PRESENTATION: The patient was a 68-year-old man presented with recurrent transient right hemiparesis. CECT and arteriography showed the progressive CCA dissection associated with AAR and decreased cerebral blood flow. MRI showed no evidence of infarction. Epilepsy, electrolyte abnormalities, hypoglycemia, spinal cord disease were considered as differential diagnoses of transient paralysis, but all were negative. Considering these findings, we diagnosed the patient with transient ischemic attacks (TIAs) caused by CCA dissection. He was treated with multiple stents deployed through vascular grafts using anchoring technique with balloon guiding catheter. Angiography demonstrated reconstitution of the CCA and internal carotid artery 1.5 years after the intervention, and no further TIAs were observed. MRI scan showed no evidence of infarction.

CLINICAL DISCUSSION: After AAR, the alteration of anatomy and lack of elasticity of vascular grafts make it quite difficult to access lesions. The adoption of a distal access catheter (DAC) and balloon inflation of a guiding catheter (BGC) are useful approaches.

CONCLUSION: To our knowledge, this is the first case report of successful multiple carotid stenting through vascular grafts for the treatment of CCA dissection. The main take-away lessons are the following three.

- The treatment for CCA dissection after aortic arch replacement is challenging.
- Anchoring technique using BGC is useful to resolve the difficulty by the alteration of anatomy and lack of elasticity of vascular grafts.
- Multiple stenting through vascular grafts was highly tolerable and achieved the excellent long-term outcome.

1. Introduction

Common carotid artery (CCA) dissection is a minor complication of aortic arch replacement (AAR) [1]. CCA dissection can cause stroke despite internal treatment. Although several studies have reported on the use of endovascular stent-assisted angioplasty for carotid artery dissection, no report has mentioned about CCA dissection treated with multiple stenting after AAR [2–5]. Here, we report a case of symptomatic CCA dissection that progressively extended from nearby the vascular grafts. We treated cervical reflux with multiple stenting through the vascular grafts. This case report has been reported in line with the SCARE Criteria [6].

2. Presentation of case

The patient was a 68-year-old man who underwent total AAR for a distal arch aortic aneurysm in KKR Otemae hospital on November

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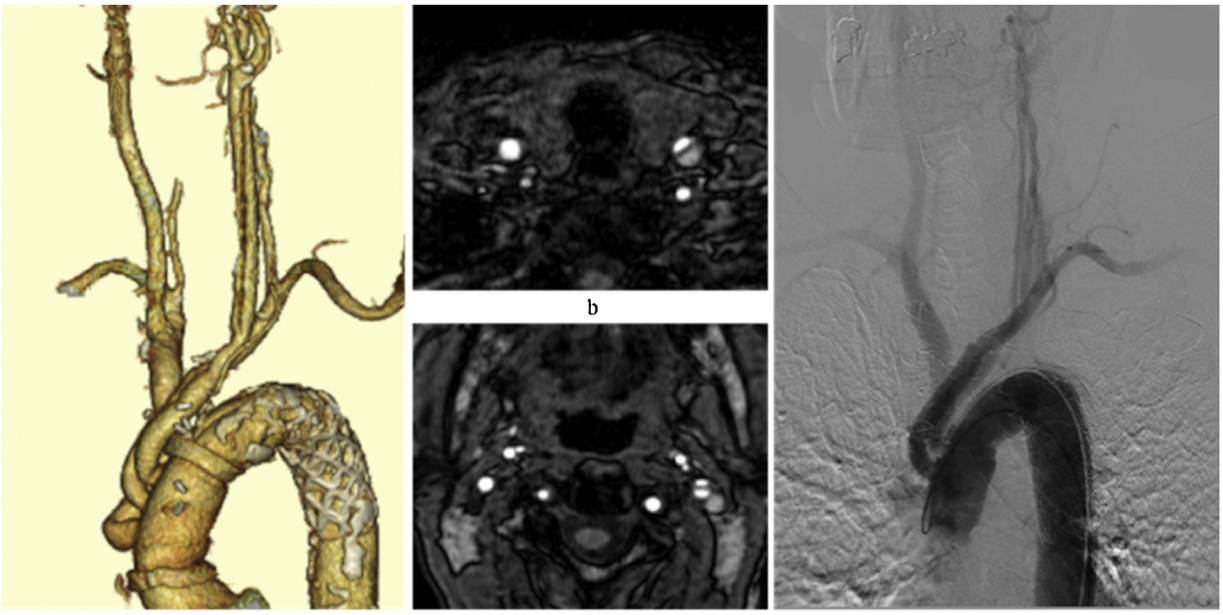

Fig. 1. Preoperative images. CECT and angiography detected the CCA dissection caused by AAR.

16, 2017. Postoperative contrast-enhanced computed tomography (CECT) revealed left CCA dissection near the vascular grafts (Fig. 1a, b). The dissection was caused by the cannulation during AAR. Initially, he was followed up conservatively because the condition was asymptomatic. However, he presented with recurrent transient right hemiparesis 1 month later. CECT and MRI demonstrated that blood flow into the aneurysm diminished, but the false lumen extended to the ICA (Fig. 1c). MRI showed no evidence of infarction. The symptoms lasted for <24 h. There was no drug history, other surgical history, family history, or psychosocial history that could be associated with the disease. Epilepsy, electrolyte abnormalities, hypoglycemia, spinal cord disease were considered as differential diagnoses of transient paralysis, but all were negative. Cerebral arteriography showed that the entry point was 7 cm distal from the distal end of the vascular grafts (Fig. 1d). It also demonstrated that blood flow through the false lumen reached the ICA and that the cerebral blood flow decreased. The CCA dissection involving the ICA was not indicated for direct surgery. Considering the above findings, we diagnosed the patient with transient ischemic attacks (TIAs) caused by CCA dissection and planned stent placement covering the entry point. After receiving a detailed explanation of the surgery, the patient provided written informed consent.

The patient received clopidogrel (75 mg daily) and aspirin (100 mg daily) from 1 week before the intervention. Endovascular treatment was performed by neurosurgeons (T.M, T.S and H.N) certified as a neuro-endovascular treatment specialist. A 0.035-inch half-stiff guidewire (Radifocus, Terumo) was introduced into the external carotid artery (ECA) using a 4-Fr JB2 shaped catheter (Medikit), and then, a 4-Fr intermediate catheter (Cerulean, Medikit) and a 6-Fr coaxial catheter (Cerulean DD6, Medikit) catheters were exchanged for the JB2 catheter to reduce the difference in diameter between catheters (Fig. 2a). A 9-Fr occlusion balloon-guiding catheter (OPTIMO, Tokai medical) could be deployed at the CCA vascular graft under full heparinization with an activated clotting time of >300 ms. Then, the balloon of Optimo was inflated to achieve better support for deployment of stents and distal protection device (anchoring technique) (Fig. 2b). After confirmation of tolerance to proximal inflation, a distal protection balloon (GuardWire, Medtronic) was deployed at the ECA to prevent an embolism associated with retrograde blood flow. Initially, a closed-cell stent 10–24 mm (Carotid Wallstent, Boston Scientific) was placed over the entry point (Fig. 2c). Blood flow into the false lumen reduced but still reached the ICA (Fig. 2d). Then, Carotid Wallstent 10–31 mm was placed over the first one. Blood flow markedly reduced, and thrombosis of the false lumen was expected (Fig. 2e). No debris was found on suctioning through Optimo. Post-procedure angiography demonstrated that the cerebral blood flow improved (Fig. 2f, g).

MRI performed 1 week after the intervention demonstrated that the dissection diminished, and no relapse was noted 1 year after the intervention (Fig. 3a, b). In addition, no infarction was seen on each MRI scan. Angiography performed 1.5 years after the intervention demonstrated that the dissection recovered without in-stent stenosis (Fig. 3c). No ischemic episode was reported for 1.5 years after the intervention.

3. Patient perspective

After undergoing surgery for an aortic aneurysm, there was a slight pain. The cardiovascular surgeon explained the cause of the pain was a carotid artery dissection that occurred during the operation. However, there was no obvious symptom other than that, and I was not worried so much because I was not prescribed any medication. After that, paralysis of limbs occurred repeatedly. At that time, I didn't expect this to happen due to the carotid artery dissection. Anyway, I was anxious.

The neurosurgeons explained that the blood flow into the brain was decreasing because the carotid artery dissection progressed. Fortunately, although I did not have any cerebral infarction, I understood that there was a high risk of cerebral infarction without treatment. To be honest, I have just finished the aortic surgery, so I was depressed. But, I received a polite explanation, so I felt the need for surgery.

Immediately preoperative medication was started. I understood the risk of surgery, but I wasn't so worried because the burden on the body was not too great under local anesthesia. They also spoke to me politely during the operation and explained to me the situation. It seemed to be more difficult than usual to reach the dissociation beyond the vascular graft, but there was no particular

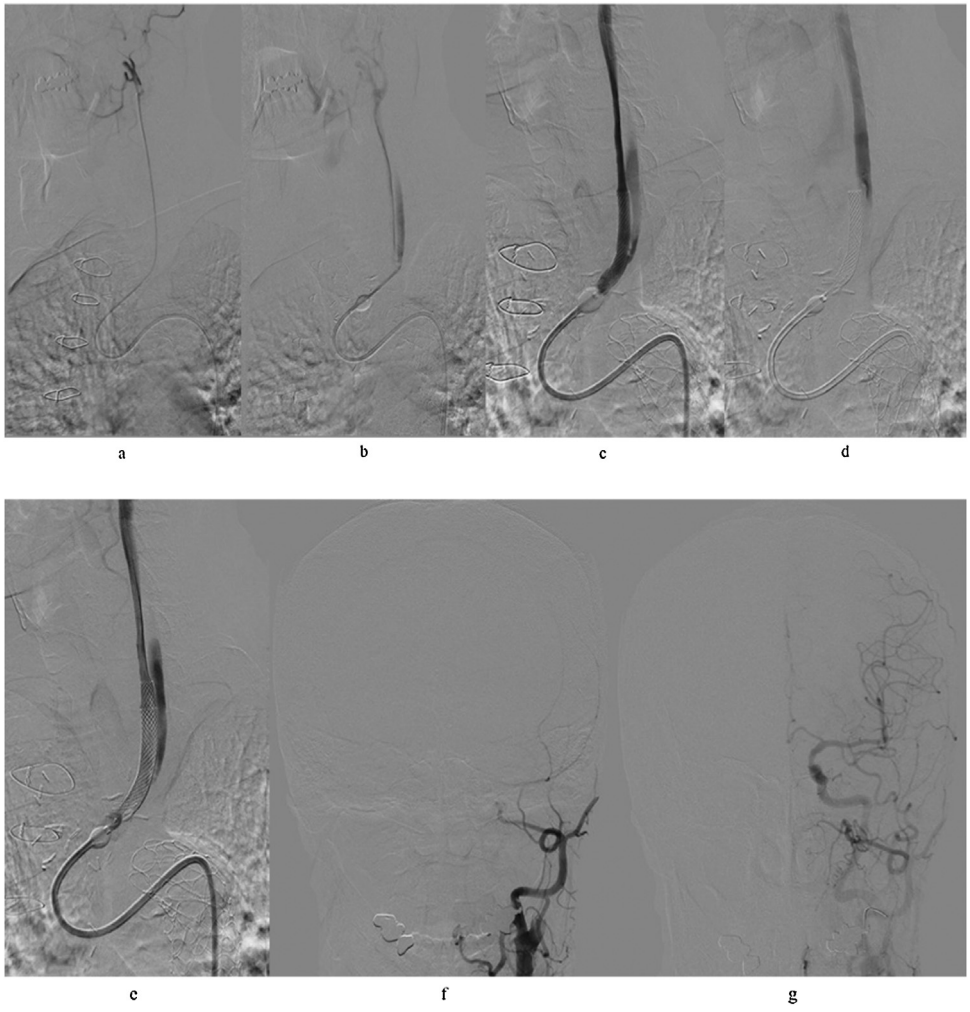

Fig. 2. Intraoperative images. Angiography demonstrated that multiple stents improved cervical reflux and cerebral blood flow in the iatrogenic CCA dissection patient.

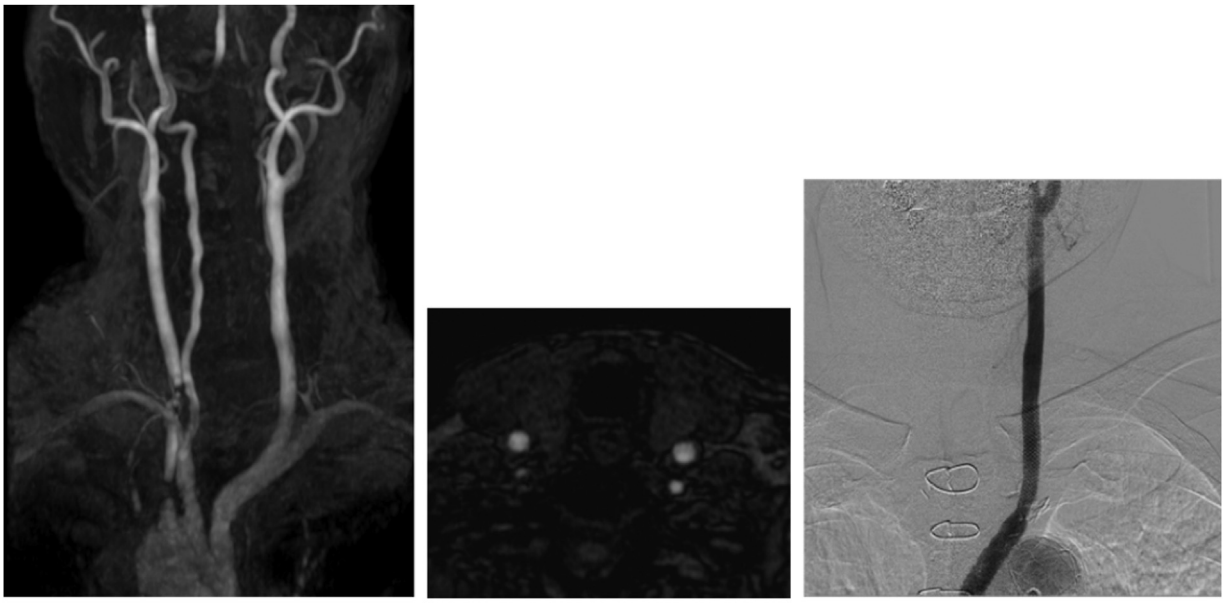

Fig. 3. Postoperative images. Angiography and MRA demonstrated reconstitution of the CCA and ICA.

pain during the operation. There was no particular symptom even after the operation was over, and I felt it was normal.

After the operation, they explained to me that there was still blood flow into the dissected artery wall, but thrombus could be expected. They also explained the need for adding another stent if the dissection looked worse again. Fortunately, there was no symptom after discharge, and it was found that blood flow to the dissected artery wall disappeared one month later. I felt sincerely happy that they treated me safely. When I had several attacks, I was afraid to walk outside, but after having been treated, I feel happy in my daily life.

I am very pleased to hear that there is no sign of recurrence even one year after operation. I hope that the patients like me can share the benefits of such treatment.

4. Discussion

To our knowledge, this is the first successful case of multiple stenting for progressive CCA dissection after AAR. CCA dissection is a rare cause of cerebral ischemia, with only few case reports [7–10]. In particular, CCA dissection involving the ICA is thought to have a high risk of cerebral ischemia, as observed in our case [2]. The excellent long-term outcomes, including excellent neurological function and angiography and MRI findings, confirmed the efficacy of multiple stenting through vascular grafts for the carotid dissection. The results suggest that it is possible to pass a thoracic aorta stent and vascular grafts for endovascular angioplasty of the distal carotid artery.

Endovascular stenting can be considered in selected cases of carotid dissection [2–5]. The criteria are as follows: 1) neurological symptoms despite internal treatment; 2) reduced cerebral perfusion owing to narrowing of the true lumen; 3) thromboembolic infarction owing to occlusion of cerebral arteries; 4) progression of dissection even with internal treatment); 5) contralateral carotid stenosis or occlusion; and 6) no systematic hemorrhage.

Even when the condition meets the above-mentioned criteria, endovascular stenting for iatrogenic CCA dissection should be carefully considered because of several factors. First, stent deployment might worsen the dissection owing to radial force on the vessel wall intima, and thus, a longer closed-cell stent is better. Second, multiple stenting is one of the options for extensive dissection or recanalization despite a single stent [2]. Third, after carotid artery replacement, the vascular graft should be far enough from the entry point and not to be covered by the stent, as in our case. Finally, the several approaches might be necessary to access lesions. After AAR, the anatomy of vessels changes and the angle between vascular grafts sometimes becomes quite steep. In addition, lack of elasticity of vascular grafts and friction between vascular grafts and catheters make it quite difficult to access lesions. The adoption of a distal access catheter and balloon inflation of a guiding catheter as an anchor (anchoring technique) to achieve better support for deployment of stents and distal protection device are useful approaches. In fact, vascular grafts was able to withstand balloon inflation of a guiding catheter and distal protection device was not able to be deployed without this technique. Retrograde carotid artery stenting with puncture of the ICA is another option. However, it was not applicable in the present case because the dissection involved the ICA.

Consideration of the risk of complications is also important. Intraoperative complications associated with multiple stenting for carotid dissection might include thrombus embolization and dissected wall damage [3]. Postoperative complications might include symptomatic stent stenosis and recanalization through stents. Perioperative antiplatelet therapy is necessary, and intraoperative heparinization should be strictly controlled. In the case of intraoperative embolization, arterial injection of antiplatelet drugs or endovascular treatment using an aspiration catheter or a stent retriever should be considered. Direct surgery should be prepared for urgent major complications, such as carotid artery rupture.

5. Conclusion

After AAR, the alteration of anatomy and lack of elasticity of vascular grafts make it quite difficult to access lesions. The adoption of a distal access catheter and balloon inflation of a guiding catheter are useful approaches. Multiple stenting deployed through vascular grafts could be a best treatment for CCA dissection after carotid artery cannulation during AAR.

Declaration of Competing Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Ethical approval

This study was carried out in accordance with the recommendations of KKR Otemae Hospital Institutional Review Board with written informed consent from the subject. The protocol was approved by the Institutional Review Board. (No.2018001)

Consent

We obtain written and signed consent to publish a case report from the patient

This manuscript include a statement as follows: “Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request”. at the end of the manuscript.

Author contribution

Takeshi Shimizu: Conceptualization, Methodology, Investigation, Data Curation, visualization, writing-original draft

Tomoyuki Maruo: Conceptualization, Resources, Methodology, Data curation, Reviewing

Hajime Nakamura: Conceptualization, Methodology, Data Curation, Reviewing

Yukitaka Ushio: Reviewing and Supervision

Haruhiko Kishima: Reviewing and Supervision

Registration of research studies

Not applicable.

Guarantor

Corresponding author is Dr.Tomoyuki Maruo accept full responsibility for the work and/or the conduct of the study, had access to the data, and controlled the decision to publish.

Provenance and peer review

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