Received: 11.06.2014 / **Accepted:** 13.08.2014
DOI: 10.5137/1019-5149.JTN.11711-14.1

Case Report

Endovascular Stenting of an Extracranial-Intracranial Bypass Stenosis: A Technical Note

Ekstrakraniyal-İntrakraniyal Bypass Stenozunun Endovasküler Yolla Stentlenmesi: Teknik Not

Yung-Hsiu CHEN, Chi-Jen CHEN, Ying-Sheng KUO, Ying-Chi TSENG

Taipei Medical University, Shuang-Ho Hospital, Department of Medical Imaging, New Taipei City, Taiwan

Corresponding Author: Ying-Chi TSENG / E-mail: x2mickey@yahoo.com.tw

ABSTRACT

The use of an extracranial-intracranial (EC-IC) bypass has been a choice to improve the safety of parent vessel occlusion during the management of aneurysm. However, the prognosis and subsequent patency of bypass graft are variable and have seldom been managed by endovascular treatment. A 38-year-old gentleman presented to our hospital with intermittent headache. Subarachnoid hemorrhage caused by an internal carotid artery aneurysm was disclosed on the subsequent examination. He received an EC-IC bypass later. However, graft stenosis was found during follow-up. To solve the stenosis, an endovascular stent was inserted by us. There is seldom report of endovascular treatment of the graft. Here we share our experience under such circumstances.

KEYWORDS: Cerebral revascularization, STA-MCA bypass, Interventional radiology

ÖZ

Ekstrakraniyal-İntrakraniyal (EK-IK) bypass, anevrizmaların tedavisi sırasında komşu damarların oklüzyonunun daha güvenli bir şekilde yapılabilmesi için bir seçenektir. Ancak prognoz ve bypass greftinin açık kalma durumu değişkenlik göstermektedir ve bu durum nadiren endovasküler yolla tedavi edilir. Otuzsekiz yaşında erkek hasta hastanemize intermitan baş ağrısı şikayeti ile başvurdu. Muayenesinde internal karotid arter anevrizmasına bağlı subaraknoid kanama tesbit edildi. Ardından hastaya EK-IK bypass uygulandı. Ancak hastanın takibinde greft stenozu tesbit edildi. Stenozu tedavi etmek amacıyla tarafımızdan hastaya endovasküler yolla stent yerleştirildi. Greftin tedavisi için endovasküler yol nadiren bildirilmiştir. Biz makalede bu durumla ilgili kendi deneyimimizi sunmaktayız.

ANAHTAR SÖZCÜKLER: Serebral revaskülarization, STA-MCA bypass, Girişimsel radyoloji

INTRODUCTION

The cause of spontaneous subarachnoid hemorrhage (SAH) is rupture of a cerebral aneurysm in about 85% of the cases (8). Patients often have a rapid onset of severe headache, vomiting and even conscious drowsiness. Because parent vessel occlusion is not well tolerated by all individuals, the use of an extracranial-intracranial (EC-IC) bypass has been advocated in order to improve the safety of this procedure. The subsequent patency and prognosis of the bypass graft has been managed by surgical treatment (6). However, endovascular management is seldom reported (3). We describe a case of stenting performed after stenosis which was noted after the operation.

CASE REPORT

A 38-year-old gentleman with a smoking history was to our emergency department stating that he had been suffering from intermittent headache for five days, and had just had severe vomiting. On neurological examination, the patient was alert, with a Glasgow coma scale score of 15. Brain computed tomography was done and revealed subarachnoid hemorrhage at bilateral basal cisterns and the Sylvian fissure (Figure 1).

The patient underwent cerebral angiography later and it revealed a 2.2 (neck) mm x 1.3 (height) mm aneurysm at the right supraclinoid segment of the internal carotid artery (ICA) (Figure 2). Rupture of the aneurysm was suspected. The aneurysm was essentially a blister-like aneurysm, which has a high risk of premature rupture during surgery. Therefore, we decided to perform temporal occlusion of the right cervical ICA (Figure 3). An eclipse balloon was placed into the distal third of the right cervical ICA and inflated till occlusion of the right ICA. However, we stopped the occlusion 10 minutes later because the collateral flow was too low to take the risk of trapping the ICA. Given this condition, the neurosurgeon decided to perform right EC – IC bypass in order to increase collateral circulation. A saphenous venous graft (SVG) was chosen and the middle cerebral artery (MCA)-M2 was used as the recipient vessel (Figure 4)

Afterwards, the right ICA was trapped surgically from the cervical ICA to the proximal part of the posterior cerebral

Figure 1: Brain computed tomography (CT) with contrast showed SAH at bilateral basal cisterns and Sylvian fissure.

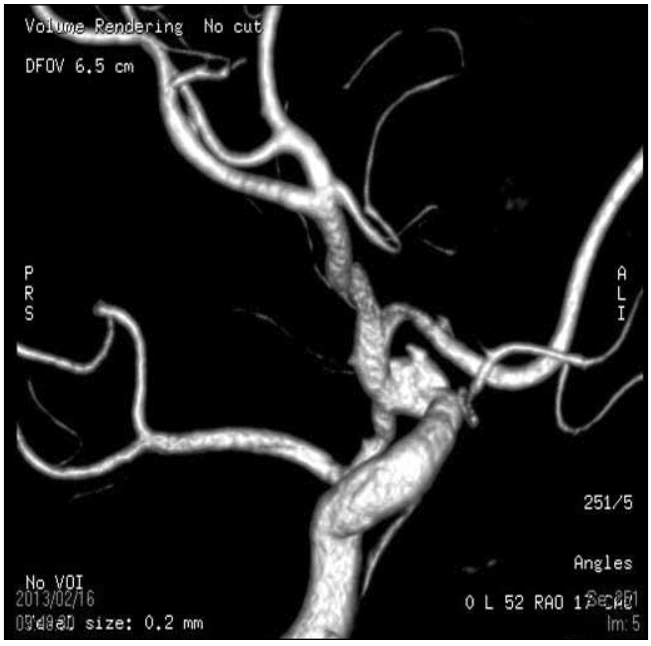

Figure 2: Angiogram volume rendering image revealed the presence of a 2.2 (neck) mm x 1.3 (height) mm aneurysm at the dorsal wall of right supraclinoid ICA.

artery (PCA), where the aneurysm orifice was located. The neurosurgeon performed the operation uneventfully. The patient sustained the operation well, but had fever after the operation. After antibiotic treatment, he was discharged safe and sound ten days later.

However, stenosis near the ECA-graft anastomosis site was noted on angiography during the follow-up period (Figure 5). He was asymptomatic. However, there was a tight stenosis over 90%, which was pretty worrisome to the neurosurgeon.

Figure 3: Angiogram showed temporal occlusion of the right cervical ICA by using an inflated eclipse balloon, injection via the left CCA showed collateral flow from the left ICA to the right MCA via A-COM, but only part of the M1 was filled.

Figure 4: Brain CT angiogram showed good patency of the graft after the EC-IC bypass operation with interposition of saphenous graft.

Further intervention was suggested. We decided to perform angioplasty and stenting to help him. Heparin was given before the stenting. A 5 mm x 30 mm stent (Cordis, Bridgewater, New Jersey, USA) was deployed to cover the stenosis. We then used an inflated balloon (5 mm x 15 mm, Cordis, Bridgewater, New Jersey, USA) for post-dilation (Figure 6A,B). After the procedure, angiogram showed less than 10% diameter stenosis and increased flow of the graft (Figure 7A,B). The patient tolerated the procedure well. He had no neurologic defect and was mobile soon after the procedure. So far, he is doing pretty well.

Figure 5: Tight stenosis near the ECA-graft anastomosis site (white arrow) noted on the angiography during regular follow-up. Note that the right ICA was trapped and a blind end was left near the bifurcation.

DISCUSSION

The incidence of SAH is at around 6 to 8 cases per 100,000 patient years (2). SAH may occur spontaneously or from head injury. When it occurs spontaneously, the cause is usually aneurysm rupture. To prevent further rupture, surgical obliteration of the aneurysm has been the mainstay of treatment for decades. Surgical treatment to prevent re-bleeding consists of clipping the ruptured berry aneurysm.

EC-IC bypass is the surgical approach chosen when the intracranial aneurysm is too difficult to approach. The idea of EC-IC bypass was first realized by Yasargil and Donaghy in 1967 to treat Moya-Moya disease (9). It has evolved over time. After clipping of the parent artery proximal and distal to the aneurysm, which means occlusion of the ipsilateral ICA, the external carotid artery (ECA) can provide significant collateral vessels to supply the distal circulation.

Although intraoperative inspection is routine for neurosurgeons, the assessment does not always guarantee the patency of the EC-IC bypass. The bypasses remained patent in only about 90% of cases (4,7).

In this case, stenosis near the anastomosis site was noted on the follow-up angiogram. Angioplasty or stenting for bypass graft stenosis has long been debated in the cardiac literature. However, re-stenosis was common in cases undergoing angioplasty alone for saphenous venous graft stenosis (5). To our knowledge, there were few previous discussions about

Figure 6A, B: Intraoperative angiography during stenting of the EC-IC bypass graft.

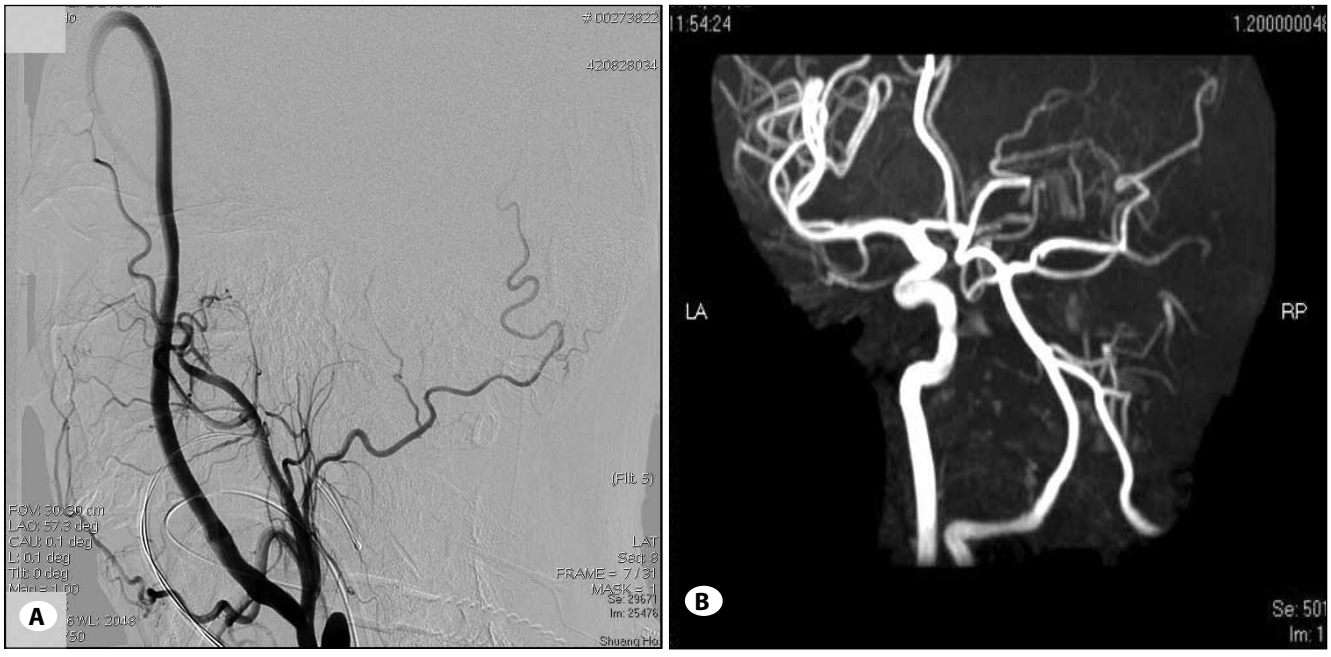

Figure 7: A) After stenting and PTA of the bypass graft, angiogram showed less than 10% diameter stenosis and increased flow of the graft. **B)** MR Angiography showed the EC-IC bypass was functioning well after the stenting.

stenting of an EC-IC bypass graft. Ko et al. (1) have described a patient who was pretreated by preventive angioplasty and stenting for ECA stenosis to ensure sufficient blood flow to the superficial temporal artery (STA) before STA-MCA anastomosis for ICA occlusion. Maselli et al.(3) have mentioned a case of endovascular stenting of an EC-IC saphenous vein high-flow bypass graft in a complex bilateral carotid aneurysm, which was a successful management and was similar to our circumstances. Qahwash et al. (5) have described three cases who presented with delayed symptomatic graft stenosis after EC–IC bypass for aneurysms. Their series suggest a benefit to stenting in conjunction with angioplasty for delayed SVG stenosis.

We provide our experience that stenting can be a feasible option in the future management of stenosis of the EC-IC bypass graft. Follow-up regarding the patency and efficiency of the post-stent graft is still needed.

CONCLUSION

EC-IC bypass has been a management method for aneurysms that are difficult to treat. We report a patient who has undergone a successful EC-IC bypass surgery, but suffered from graft stenosis months later. Further study and follow-up is needed for the clinical outcome and its role in the management for future similar cases.

REFERENCES

1. Ko JK, Lee SW, Lee TH, Choi CH: External carotid artery angioplasty and stenting followed by superficial temporal artery to middle cerebral artery anastomosis. J Korean Neurosurg Soc 46: 488-491, 2009
2. Linn FHH, Rinkel GJE, Algra A, Van Gijn J: Incidence of subarachnoid hemorrhage. Role of region, year, and rate of computed tomography: A meta-analysis. Stroke 27(4): 625-629, 1996
3. Maselli G, De Tommasi C, Ricci A, Gallucci M, Galzio RJ: Endovascular stenting of an extracranial–intracranial saphenous vein high-flow bypass graft: Technical case report. Surg Neurol Int 2: 46, 2011
4. Mendelowitsch A, Taussky P, Rem JA, Gratzl O: Clinical outcome of standard extracranial-intracranial bypass surgery in patients with symptomatic atherosclerotic occlusion of the internal carotid artery. Acta Neurochir (Wien) 146:95–101, 2004
5. Qahwash O, Alaraj A, Aletich V, Charbel FT, Bulsara KR, Ho W, Valyi-Nagy T, Amin-Hanjani S: Endovascular intervention for delayed stenosis of extracranial-intracranial bypass saphenous vein grafts. J Neurointerv Surg 5(3):231-236, 2013
6. Sekhar LN, Natarajan SK, Ellenbogen RG, Ghodke B: Cerebral revascularization for ischemia, aneurysms, and cranial base tumors. Neurosurgery 62 Suppl 3:1373-1408; discussion 1408-1410, 2008
7. Sundt TM Jr, Piepgras DG, Marsh WR, Fode NC: Saphenous vein bypass grafts for giant aneurysms and intracranial occlusive disease. J Neurosurg 65: 439–450, 1986
8. Van Gijn J, Rinkel GJE: Subarachnoid haemorrhage: Diagnosis, causes and management. Brain 124 (2): 249-278, 2001
9. Yaşargil MG: Anastomosis between the superficial temporal artery and a branch of the middle cerebral artery. In: Yaşargil MG (ed). Microsurgery Applied to Neurosurgery. Stuttgart: Georg Thieme, 1969: 105–115