Snare-assisted Trans-brachial Stenting for the Cervical Internal Carotid Artery Stenosis of Patient with Aorto-Iliac Occlusion

Technical Case Report

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Summary

We describe a case of endo-luminal stent placement with Snare-assist for a cervical internal carotid artery stenosis in which percutaneous access was obtained via the brachial artery.

A 68-year-old man with known disease of the carotid, peripheral, and coronary arteries, with Human T-cell Lymphotropic Virus type-1 (HTLV-1) Associated Myelopathy (HAM) presented for endoluminal revascularization of a severe, progressive right internal carotid artery stenosis, but with aorto-iliac occlusion.

Transfemoral access was complicated by an aorto-iliac occlusion. A trans-brachial approach was successfully attempted, and a SMARTer stent (Cordis Endovascular, Miami Lakes, FL) was successfully placed through a 7-French Shuttle-SL guide sheath (Cook, Bloomington) under Snare-assist.

The trans-brachial approach is becoming an increasingly viable alternative route for stent placement in patients with contra-indicated or complicated femoral access routes. As devices become increasingly more pliable and smaller, the trans-brachial route will be used with increasing frequency in the select patient population for stenting of both the cervical and intracranial circulation.

Introduction

As endovascular alternatives to conventional surgery like carotid-endarterectomy continue to evolve for various neurovascular pathologies by development of devices for interventional neuroradiology in recently, the limitations of endovascular techniques are becoming clear. One major limitation is the need for access routes through large-caliber vessels that can accommodate implantable devices such as stents. Although such access is not a problem for most patients who require endovascular treatment, a subset of patients (as many as 10%) exists for whom comorbid or confounding medical conditions portend an increased risk to the transfemoral approach. These conditions include morbid obesity, severe peripheral vascular disease, previous ilio-femoral bypass graft placement, and aorto-iliac occlusion. The development of more pliable, smaller-profile endovascular delivery devices has made it possible to treat pathologies in this patient group safely by using alternative routes for access via smaller-caliber vessels, such as the radial¹ or brachial artery.

We report the use of a trans-brachial approach for stent-guided percutaneous transluminal angioplasty of a stenotic lesion of the cervical internal carotid artery in a patient who was a poor candidate for trans-femoral catheterization.

Figure 1 Patient suffered repeatedly ischemic attack. (Left). Left inferior temporo-occipital old infarction had been already pointed out by Brain MRI on 11/Mar/03. (Right). Right parietal subcortical and lateral to motor cortex scattered subacute infarction were also detected by MRI on 4/May/04.

terization or access by direct-puncture for common carotid artery due to HAM. Advantages of this approach over trans-radial² and common carotid artery routes are discussed.

Methods

Presentation of Case History

A 68-year-old man who experienced a left

mild haemiparesis including face due to right multiple cerebral infarction resistant to medication of antiplatelet on lateral to motor cortex and temporo-parietal subcortex (figure 1) was found to have a progressive, severe right cervical internal carotid artery stenosis with contra-lateral left internal carotid artery occlusion during a Doppler ultrasound examination on 6/May/04, compared to the previous study

Figure 2 (Left). Brain MR-A on 4/May/04 suggested left internal carotid artery occlusion. (Middle). Cervical MR-A on 6/May/04 suggested high-grade stenosis of the right internal carotid artery. (Right). Patency of bilateral brachial artery was confirmed by MRA of Aortic arch on 21/May/04 as pre-operative evaluation.

Figure 3 Xe-CT Cerebral Blood Flow(CBF) study on resting status. (Left). Study on 7/Jan/03 indicated normal cerebral blood flow. (Right). Follow-up study on 25/May/04 indicated Bilateral Misery Perfusion.

Figure 4 (Left). MR-Angiography on 24/Dec/03 suggested a high-grade stenosis of the abdominal aorta with aorto-femoral shunting. (Right). Digital subtraction angiogram (DSA) on 27/Jul/04 revealed bilateral aorto-iliac artery occlusion.

Figure 5 Preliminary trans-radial trial to evaluate accessibility for supra-aortic vessels was performed after Coronary Angiography on 10/Jun/04 with 4-French diagnostic catheter. (Left). Right common carotid artery orifice was confirmed as access route. (Middle). Right common carotid angiogram revealed short segmental internal carotid artery stenosis. (Right). Left Vertebral Artery osteum stenosis was also complicated.

on 11/Mar/03 (figure 2). This examination revealed over 70% stenosis of the right internal carotid artery. Xe-CT was performed on 25/May/04 and revealed misery perfusion of bilat-

eral internal carotid artery territory (figure 3). Initially, Carotid EndArterectomy was scheduled since the aorto-iliac occlusion had been detected (figure 4) in the course of pre-opera-

Figure 6 Snare-assist technique was reviewed. (Left). Loop of Goose-NeckSnare via 6Fr. sheath introducer (TERUMO, JAPAN) attached the tip of 6-French CX-UII catheter co-axially with Shuttle sheath. (Middle). Then, CX-UII was caught and withdrawn by GooseNeck-Snare. (Right). Shuttle sheath was raised up over CX-UII and finally supported with Goose-NeckSnare during the stent-delivery and distal protective procedure.

Figure 7 Stent-delivery apparatus was relatively hard thus required stiff guidewire to obtain trackability. (Left). Initially, AQUA was introduced into the distal cervical external carotid artery and then exchanged into Amplatz for navigation of the guiding sheath. (Middle). Pre-dilatation was required, therefore, 0.035-inch guidewire-system was exchanged for 0.014-inch Dejavu that was introduced into distal cervical internal carotid artery, to advance mono-rail type PTA balloon-catheter over it and cross the stenotic lesion. (Right). As satisfactory caliber was obtained by Pre-dilatation, stent-delivery system was navigated uneventfully.

tive evaluation, but restless confusion and motor weakness of bilateral lower extremities were appearing after Coronary Angiography (CAG) on 10/Jun/04 as preoperative evaluation. And, MRI of brain on the same day confirmed fresh cerebral infarction of left watershed supposed to be caused by transient ischemia due to hypotension during the procedure of CAG for preanesthetic evaluation after supra-aortic angiogram (figure 5). So the patient was not considered an optimal candidate for carotid endarterectomy because of the presence of coexisting medical conditions, and he was scheduled for endoluminal carotid revascularization³.

Procedural Technique

Attempts were made on 27/Jul/04 to cannulate bilateral brachial arteries that were prepared and draped in usual sterile fashion. After access of the right brachial artery was obtained with 18-gauge micropuncture needle, a 6-Fre-

nch long (25 cm) sheath was inserted. Then, in the same manner, access of the left brachial artery was obtained and 7-French Shuttle-SL (Cook) sheath (80 cm) was inserted; Initially, heparin (3,000 IU) was administered intravenously for the sake of systemic heparinization to achieve an activated coagulation time (ACT) of 308 seconds from 114 seconds as control. After that, Shuttle-SL was advanced with 6-French CX-UII diagnostic catheter (125 cm / Cathex, JAPAN) by coaxial manner, over a 0.035-inch AQUA (180 cm / Cordis) hydrophilic wire, and system was navigated through the brachial artery, through the subclavian artery, and was reconstituted into the ascending aorta. Then, GooseNeck-Snare (ev3/Micro Therapeutics, Inc. 2 Goodyear, Irvine, CA 92618, USA) was inserted through the right brachial artery, into the subclavian artery via 6-French long sheath introducer, and reconstituted into the aortic-arch. With the use of a fluoroscope for a

Figure 8 Post-dilatation was performed under distal-protective devices. (Left). Delivery of stent was performed without the distal protective balloon, because GuardWire plus was not available due to shrinkage during inflation. (Middle). Then, post-dilatation was performed under NaviBalloon type-D, distal protectives. (Right). Satisfactory Angioplasty was obtained.

guidance, reintroduced AQUA was selectively inserted through the Snare-loop, through the subclavian artery, into the right brachial artery. Then, CX-UII was advanced over AQUA through the Snare, and captured by GooseNeck (figure 6). Under these status, AQUA was pull back and reinserted selectively into the right distal cervical external carotid artery. After that, Snare was slacken slightly, and CX-UII was advanced over AQUA into the external carotid artery.

Then CX-UII was fastened by GooseNeck again, and slung up to maintain its position. As AQUA was thought to be not stiff enough to draw Shuttle up into the right common carotid artery, it was removed and 0.035-inch 180 cm-length Amplatz super-stiff guide-wire was passed through CX-UII into the distal cervical external carotid artery, to achieve greater stability with CX-UII. At last, Shuttle was advanced over CX-UII, and through Snare, into the common carotid artery, just proximal to carotid bifurcation. Additional diagnostic angiography

revealed right internal carotid artery progressive stenosis as 95%, worsened than we had expected. Then, IntraVascular UltraSonogram (IVUS) was performed for the evaluation of the lesion, by Avamar F/X (2.9-French, 150 cm length, Volcano, Brussels, Belgium) over 0.014-inch. 180 cm-length Dejavu micro-guidewire that was advanced into the distal cervical internal carotid artery through the lesion. IVUS revealed the vessel caliber (about media to media), of normal internal carotid artery distal to the lesion as 6.5 x 5.9 mm, of normal internal carotid artery proximal to the lesion as 8.5 x 7.9 mm, and about intima of the most stenotic lesion as 2.6 x 2.9 mm. So, pre-dilatation was required before Stent delivery. Initially, GuardWire plus (PercuSurge, Medtronic, Minneapolis, MN) was scheduled to use as the distal protective⁴, but it was not available for use due to air-leak detected on the way of preparation, and no spare was reserved.

Then we gave up to use it, and chose Navi-Balloon type-D (Kaneka Medics, Osaka, JA-

Figure 9 Post-operative Magnetic Resonance Imaging was reviewed. (Left). DWI on 30/Jul/04 revealed minimal distal thrombosis only. (Right). Contrast-Enhance MR-Angio could visualized satisfactory intraluminal blood flow signal of the stenting portion, in spite of signal reduction effect due to Nitinol strut.

PAN), in substitution. Balloon angioplasty with a 4.0 x 20-mm Amiia balloon (Cordis) by mono-rail manner with Dejavu as pre-dilatation resulted in suboptimal recanalization (figure 7), so a 8.0 x 20-mm SMARTer stent (Cordis) was advanced over AQUA and deployed across the stenotic lesion in the internal carotid artery as its proximal end on the carotid bifurcation. During these procedure, Shuttle-SL required to be supported with GooseNeckSnare. The residual stenosis was treated by temporary inflation for 30-seconds of a 6.0 x 20-mm PowerFlex-P3 (Cordis) balloon at 10-atm in the waist (residual stenosis) of the stented lesion with the distal protection by NaviBalloon coaxially (figure 8), as post-dilatation under premedication by a mixture of methyl- prednisolone sodium succinate (250 mg) and atropine sulfate (0.5 mg) intravenously administered. Collected debris was sucked through Eliminate (Clinical Supply, Gifu, JAPAN) catheter over the shaft of NaviBalloon.

After angiographic evidence of successful recanalization, satisfactory dilatation to 6.1 x 4.1 mm about diameter of most stenotic lesion, and close-contact between stent and vessel wall were confirmed on IVUS. And the effect of the

heparin had partially reversed with intravenous drip infusion of protamine sulfate (35 mg) in saline (100 cc) and ACT changed 329-sec. into 148-sec. Then, all the procedure performed uneventfully except for transient restlessness during distal protection, sheaths were withdrawn to remove and haemostasis was accomplished by manual manner.

And the patient was transferred to the Intensive Care Unit.

Results

Post-procedural Course

The patient remained without additional neurological deficit and was observed overnight. He was not suffered any hypotension nor bradycardia, and maintained under drip infusion of ozagrel sodium (160 mg/day) for five days since procedure. Medications prescribed after stenting included cilostazol (200 mg daily) as well as aspirin (100 mg daily). Scheduled brain MRI obtained on Day-4 after procedure demonstrated asymptomatic fresh lacunar infarction of 2 mm diameter medial to motor cortex on DWI only (figure 9). And routine cervical carotid MR-Angio with Gd as contrast

medium revealed excellent patency of the right internal carotid artery. The patient was rather improved in motor weakness of lower extremities, and getting stable on standing or short-stance gait, then discharged in stable condition on 17/Aug/04 after rehabilitation training. And so, he was encouraged by this procedure and getting positive and desire to treat for aorto-iliac obstruction.

Discussion

The trans-brachial approach was an easy method for diagnostic angiography compared with the trans-femoral approach that required rest in bed for several hours, and remains a more attractive option than direct common carotid artery puncture in setting of contra-indicated femoral access, because of an occlusion of the abdominal aorta with aorto-femoral shunting. Problems with direct puncture to the common carotid artery include insufficient distance from the puncture site to the carotid bifurcation to allow for sufficient sheath insertion required for stent delivery, and more importantly, neck hematomas caused by direct carotid puncture are difficult to control and compress, resulting in potential airway compromise and emergent intubation. On the other hand, the trans-radial approach has been increasing in popularity among cardiologists for coronary interventions.

The anatomy of the coronary vessels and the ease of access when approaching these vessels from the brachio-cephalic artery have made this approach an excellent alternative to trans-femoral coronary intervention, resulting in angiography success rates exceeding 95%. And there has been growing interests in trans-radial cerebral angiography⁵. But, there is one potential problem associated with trans-radial route, that is post-operative radial artery occlusion, although it will not be noticed by a patient with collateral ulnar vascular supply (as indicated by Doppler examination). This occlusion is increased in the case of using 6-French sheath system or larger, and was likely a result of leaving the sheath in place for several hours after the procedure, because few radial artery occlusion occurred after immediate sheath removal inversely. As our case had contra-lateral internal carotid artery occlusion, and so radial artery was required to be preserved for high-flow bypass in the case of which needed more collater-

al circulation. In contrast, vessel injury rate was fewer in the case of trans-brachial approach than trans-radial approach. Then, Snare-assist technique was useful and easy strategy for support to keep guiding catheter or sheath in desirable position, even in the case of arteriosclerotic aortic-arch serpiginous elongation.

Conclusions

The femoral artery is a large-caliber vessel that easily tolerates insertion of sheaths even over 7-French, through which almost any neuro-endovascular procedure can be performed safely and able to use arterial closure devices, so trans-femoral approach remains the primary and optimal access route to catheterize for the most patients. But for patients required transcatheter neuro-intervention with a contra-indication to trans-femoral access, an excellent alternative access route must be sought. The increasing availability of smaller-profile stents that can be delivered through 6- or 7-French systems has allowed endovascular surgeons to use the trans-brachial approach that provides an excellent access route for external and intracranial vessel stenosis for which stenting is required. And Snare-assist technique assures success in these procedure with increasing reliability and safety.

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