Technical Note

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Percutaneous Superficial Temporal Artery Access Facilitating Carotid Artery Stenting Performed From Distal Radial Artery

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Abstract

Purpose: The purpose of the study is to describe carotid artery stenting (CAS) via distal transradial access (dTRA) facilitated by additional superficial temporal artery (STA) access, in a patient with complex aortic arch vessel anatomy.
Technique: A 72-year-old woman with a prior history of complex cervical surgery and radiotherapy due to laryngeal malignancy, presented with a symptomatic 90% stenosis of the left internal carotid artery (ICA). Due to high cervical lesion, the patient was rejected from carotid endarterectomy. Angiography demonstrated 90% stenosis of the left ICA and a type III aortic arch. After failure of left common carotid artery (CCA) cannulation with appropriate catheter support via dTRA and transfemoral approaches, CAS was attempted a second time. After percutaneous ultrasound guided access to right dTRA and left STA, a 0.035 inch guidewire introduced to the left CCA from the contralateral dTRA was snared and externalized via left STA to improve wire support for guiding advancement. Thereafter, the left ICA lesion was successfully stented with a 7×30 mm self-expanding stent via right dTRA. All vessels involved were patent at 6-month follow-up.
Conclusion: The STA may be a promising adjunctive access site to increase transradial catheter support for CAS or neurointerventional procedures in the anterior circulation.

Clinical Impact:
Transradial cerebrovascular interventions have been gaining popularity, however, unstable catheter access to distal cerebrovascular structures limits its widespread use. Guidewire externalization technique via additional STA access may improve transradial catheter stabilty and increase procedural success with possibly low access stie complication rate.

Keywords
distal radial artery access, superficial temporal artery, carotid artery stenting, guidewire externalization, neurointervention

Introduction

Carotid artery stenting (CAS) has become an acceptable alternative to carotid endarterectomy (CEA), especially for high risk patients.[1] Traditionally, transfemoral access (TFA) has been used for CAS procedures. More recently, transradial access (TRA) and distal transradial access (dTRA) have gained popularity over TFA for endovascular interventions, as both have lower access site complication rates and better patient comfort. Both TRA and dTRA have shown to be feasible for CAS, especially in patients with severe peripheral arterial disease and with type II and III aortic arches.[2–6] However, a major limitation of the TRA and dTRA techniques is the difficulty of cannulating the common carotid artery (CCA) due to acute angulation between aortic arch vessels. In such cases, conversion to conventional TFA is typically considered. A few case reports have been published on superficial temporal artery (STA) access facilitating CAS in the case of traditional TFA approach failure.[7,8] We report a case of CAS performed from dTRA facilitated by STA access after failure of both dTRA and TFA approaches.

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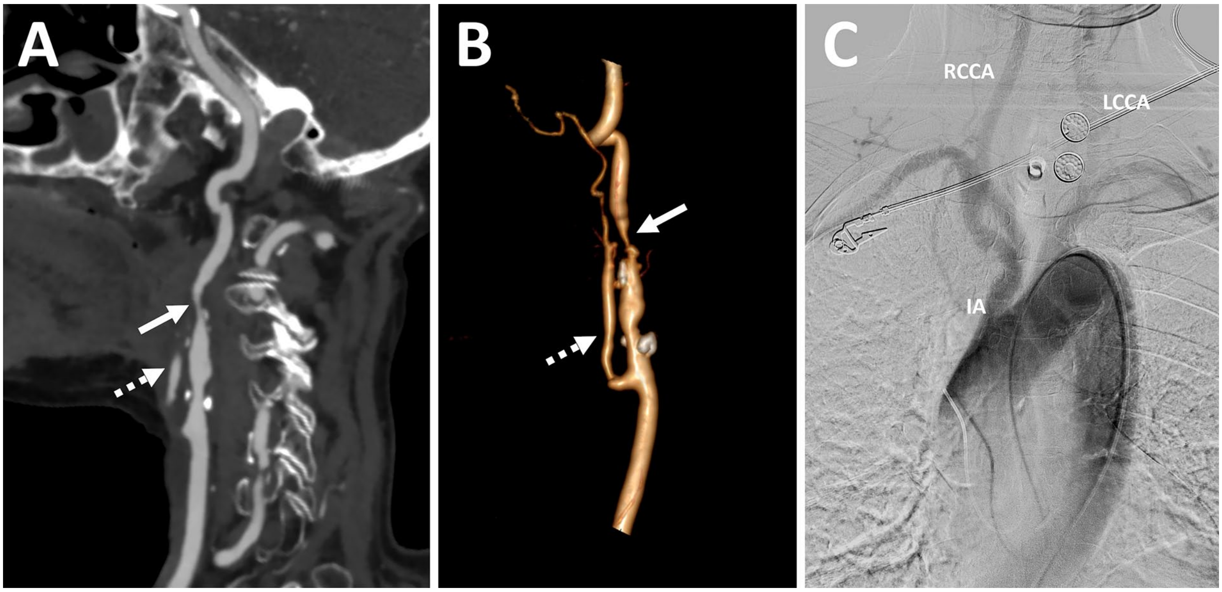

Figure 1. (A) Curved multiplanar reconstruction and (B) volume-rendered image of pre-interventional CT angiography demonstrating 90% stenosis of the left internal carotid artery (white arrow) at C2 vertebral level, white dotted arrow indicates the left external carotid artery. (C) Aortic angiography documenting type III aortic arch. LCCA: left common carotid artery, RCCA: right common carotid artery, IA: innominate artery.

Technique

A 72-year-old female patient was urgently admitted to our department suffering from transient and repetitive visual loss affecting the left eye with a past history of total laryngectomy, cervical block dissection, permanent tracheostomy and cervical radiotherapy due to hypopharynx malignancy. Ultrasonography and computed tomography (CT) angiography confirmed 90% stenosis of left cervical internal carotid artery (ICA) located in a relatively high position at the C2 vertebral level (Figure 1A, B). Due to the cranial lesion, prior cervical surgery and irradiation, CEA with general anesthesia was considered high risk; therefore, the decision was made to perform CAS. The procedure was started via right dTRA approach because dTRA was considered the first-choice access site for CAS at our institute. After uncomplicated catheter delivery to the aortic arch, cannulation of left CCA presented great difficulties due to the sharp angulation between aortic arch vessels. CCA cannulation was eventually achieved by insertion of a 4F Simmons type catheter into CCA orifice but no further advancement was possible. Selective carotid arteriography confirmed critical stenosis of the left ICA. Even after successful cannulation, the catheter did not provide appropriate support for sufficient cranial wire advancement—the wire could only reach the proximal CCA. Proximal wire position did not allow enough stability for guiding catheter exchange. After failing to obtain stable engagement of the left CCA with a variety of catheters over several different wires and various techniques (buddy wire, telescoping, and loop technique), conversion to TFA was considered. Unfortunately, TFA approach resulted in numerous unsuccessful cannulation attempts due to a type III aortic arch (Figure 1C). It was felt that the operator would face similar technical issues from left TRA as well, therefore, left radial route was not attempted. The procedure was terminated and a second attempt using left STA as additional access for facilitating guiding exchange and stenting via dTRA was planned 7 days later. Prior to any procedure, a written informed consent complying with the principles of good clinical practice and institutional regulatory requirements was provided by the patient.

The right wrist was isolated in semipronated position for puncture. After disinfection, distal radial artery was accessed with ultrasound guidance under local anesthesia and a 7F sheath (Glidesheath Slender, 16 cm; Terumo Corp., Japan) was introduced. Systemic anticoagulation was initiated by intra-arterial bolus of 5000 IU of heparin. For the percutaneous access to STA, the left temporal scalp was shaved, prepped and isolated with the head turned to the contralateral side. The left STA was punctured in the preauricular region using ultrasonographic guidance (Chison EBit50 Ultrasound System, China). A 4F transpedal micropuncture sheath (Micropuncture Pedal Set; Cook Medical, USA) was introduced into left STA and a 0.018 inch guidewire (V-18 Control wire; Boston Scientific Corp, USA) was descended through STA, external carotid artery and CCA into the aortic arch in a retrograde fashion (Figure 2A). Control antegrade

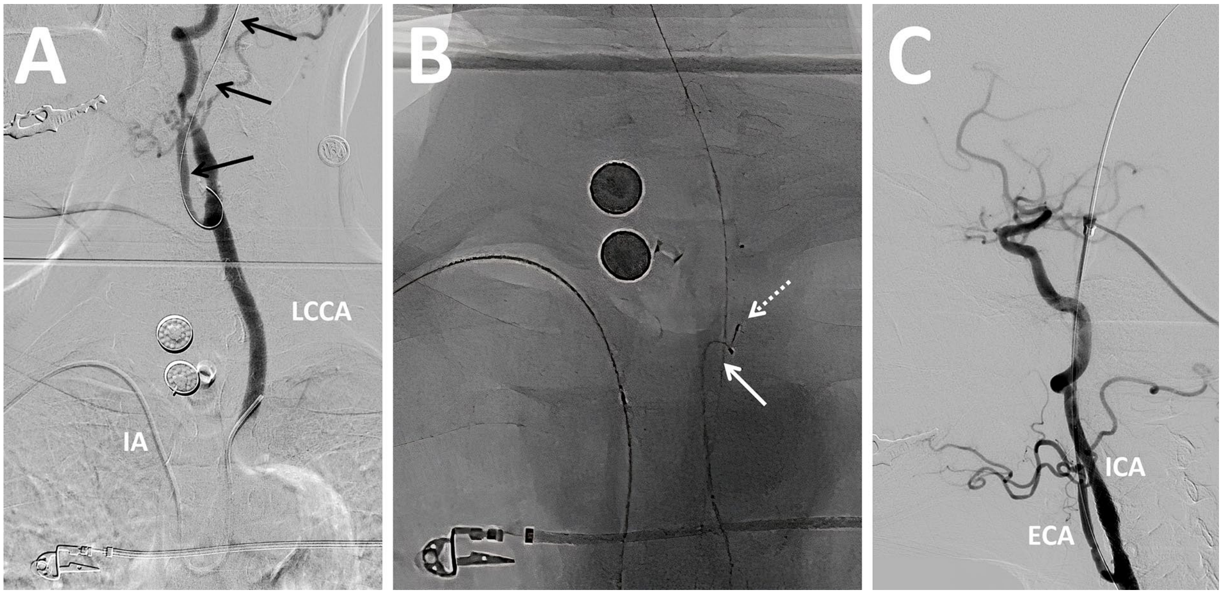

Figure 2. (A) Black arrows demarcate the course of the 0.018 inch guidewire descending from STA access to the ECA. Control antegrade angiography performed from dTRA to facilitate retrograde navigation to the LCCA. Note the acute angle between the IA and the LCCA causing unstable antegrade access to the LCCA. (B) J tip of the 0.035 inch guidewire navigated to the LCCA (white arrow) is being snared (white dotted arrow) for externalization via left STA. (C) Postinterventional angiography performed from left STA access showing good angiographic result. STA: superficial temporal artery, LCCA: left common carotid artery, IA: innominate artery, ECA: left external carotid artery, ICA: left internal carotid artery.

angiography from primary access (dTRA) was performed to confirm wire position. Over the 0.018 inch guidewire, the 4F micropuncture access to STA was then upgraded to 5F introducer sheath (Glidesheath Slender, 10 cm). A 4 to 8 mm snare (Atrieve vascular snare kit; Argon Medical Devices, USA) was advanced through STA to the left CCA to capture the free end of 0.035 inch guidewire (Silverway, 300 cm; Asahi Intecc, Japan) that had been previously introduced into left CCA from right dTRA (Figure 2B). The 0.035 inch guidewire was then pulled up and externalized through the STA access followed by the complete removal of initially introduced 0.018 inch guidewire via STA. A 7F guiding catheter (Guider Softip MP XF, 90 cm; Boston Scientific Corp., USA) was then successfully advanced from dTRA to the distal CCA on the externalized 0.035 inch guidewire, the distal free end of which was being manually stabilized by an assisting operator throughout guiding catheter advancement. After cannulation of ICA with 0.014 inch guidewire (Choice ES, 182 cm; Boston Scientific Corp., USA) via dTRA, the externalized 0.035 inch supporting guidewire was removed through STA. Thereafter, the procedure continued as per usual for carotid stenting from dTRA. A 7×30 mm self-expandable stent (Roadsaver; Terumo Corp., Japan) was successfully delivered and deployed to the left ICA. Subsequently, postdilation was carried out with a 6×20 mm semicompliant balloon (Aviator Plus, Cordis, Ireland) with excellent angiographic result (Figure 2C). Hemostasis of dTRA and STA puncture sites after removal of introducer sheaths was established by placing hemostatic patch (StatSeal, Biolife, USA) on the wound followed by compression with elastic self-adhering wrap (Coban Elastic Wrap, USA) for 3 hours. The patient was discharged on postoperative day 1, on dual anti-platelet therapy (100 mg/d acetylsalicylic acid [ASA] and 75 mg/d clopidogrel) with patent dTRA and STA confirmed by ultrasonography.The patient has not experienced any further cerebral ischemic episodes during a 6-month follow-up period.

Discussion

There has been a clear transition to smaller and smaller caliber vascular access sites for endovascular interventions due to lower complication rate and better postprocedural patient comfort. We described above a CAS procedure via dTRA facilitated by additional STA access, in a patient with complex aortic arch vessel anatomy. In our case, a type III aortic arch prevented selective cannulation of the left CCA via transfemoral route, whereas acute angulation between innominate artery and left CCA resulted in selective but unstable access to left CCA via right TRA. According to authors' experience supported by initial reports in literature,[9] left radial approach usually negatively affects ipsilateral carotid accessibility due to even sharper angles compared with that from contralateral access, therefore, left TRA was not attempted. Because of the failure of TRA and TFA approaches, additional left STA access was used to increase catheter support and facilitate transradial catheter advancement. This was achieved by snaring and externalization of 0.035 inch guidewire through left STA that had been previously introduced into the left CCA from right dTRA.

Superficial temporal artery has been used previously as an additional access to improve catheter trackability for transbrachial[10] and transfemoral[7,8,11] CAS procedures, where guidewire from STA was externalized through the primary (brachial or femoral) access site (so called through-and-through technique). Superficial temporal artery access for transfemoral CAS was initially obtained with surgical exposition by Ivancev et al,[7] later percutaneous ultrasound guided approach was introduced by Syed at al.[8] To the best of our knowledge this is the first to report a through-and through CAS procedure performed via dTRA facilitated by percutaneously accessed STA.

The superficial course of STA allows relatively easy puncture and well-controlled hemostasis with the overlying temporal bone. Even unintentional sacrification of STA is possible without harmful consequences. The STA has a diameter comparable with that of the radial artery and is capable of accommodating catheters with diameters up to 6 to 7 Frenches,[12,13] which may allow STA to be directly used for CCA and coronary interventions.[14,15] On the other hand, STA approach can be challenging in the case of spasm or vessel tortuosity which limits STA percutaneous accessibility. Care should also be taken to avoid facial nerve injury by puncturing too proximally. There is also a potential risk of distal embolization to the internal carotid system if passing through an external carotid artery with severe atherosclerotic involvement.

Based on our experience, transradial extra- or intracranial carotid artery interventions can be challenging as a result of low catheter support due to the acute angulation between aortic arch vessels, which creates great difficulty in gaining stable access in cervical and distal cerebral vasculature. In such cases, positive force on guidewires translates to retrograde movement of catheters and herniation into the aortic arch. This problem is typically more pronounced in the case of arch vessel tortuosity, aortic arch elongation or distortion. In such circumstances, additional STA access may represent a rational alternative to converting to TFA or transcarotid approach. Theoretically, it may be also feasible to utilize STA as a primary access route for other endovascular interventions where conventional access sites are not available. Considering its anatomical features, STA may offer stable access to the coronary arteries or the primary branches of descending aorta potentially with a lower access-site related complication rate; however, further research is required.

Conclusion

Guidewire externalization via additional STA access is a feasible technique to improve transradial catheter support for CAS. This technique may also facilitate future transradial neurointerventional procedures involving the anterior circulation. Superficial temporal artery may be a promising adjunctive or primary access site for endovascular therapies with a potentially low access-site–related complication rate.

Declaration of Conflicting Interests

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