TECHNICAL NOTE doi: 10.2176/jns-nmc.2022-0083

Neurol Med Chir (Tokyo) 62, 384-389, 2022 Online June 24, 2022

Bilateral Distal Transradial Approach for Coiling of Basilar Artery Aneurysm: A Technical Note

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Abstract

Distal transradial approach (dTRA) for neuroendovascular procedures has received much attention in recent years as a newer and less invasive alternative to the conventional transfemoral or transradial approaches. We present the case of an 89-year-old woman with a basilar artery aneurysm requiring simultaneous catheterization of the bilateral vertebral arteries who was successfully embolized using bilateral dTRA. The aneurysm was accessed from the right vertebral artery using the right dTRA. Control angiograms during the procedure were performed from the left vertebral artery via the left dTRA. The operator's posture was ergonomically comfortable, and the catheters were easy to handle during the procedure. To the best of our knowledge, this is the first case of a bilateral dTRA used for neuroendovascular procedures. Bilateral dTRA is a safe and minimally invasive method for patients and ergonomically comfortable for operators.

Keywords: bilateral distal transradial approach, distal radial artery, anatomical snuffbox, cerebral aneurysm, embolization

Introduction

Recently, the transradial approach (TRA) for neuroendovascular procedures has attracted attention as a less invasive alternative to the transfemoral approach (TFA).[1,2] TRA has several benefits compared with TFA, such as a lower incidence of fatal bleeding, access site-related major complications, avoidance of shaggy or diseased aorta, shorter hemostasis time, and postoperative patient satisfaction.[3,4] A certain learning curve is required; however, TRA use has spread due to advances in devices and increased experience of operators.[5] More recently, the distal transradial approach (dTRA), an advanced version of TRA, has been introduced in interventional cardiology.[6] In dTRA, the radial artery is punctured in the anatomical snuffbox more distally than that in conventional TRA. The advantages of dTRA over TRA include intraoperative patient comfort, shorter hemostasis time, shorter postoperative bed rest, with the greatest advantage being the superior ergonomics and comfort for the operator, especially in the left-hand approach.[6-9] There have been few reports on dTRA for neuroendovascular procedures,[10,11] and we have previously reported on the usefulness and feasibility of dTRA in selected cases.[12,13]

Here, we report the first case of bilateral dTRA for coiling of a basilar artery-superior cerebellar artery (BA-SCA) aneurysm, which required simultaneous catheterization of the bilateral vertebral arteries.

Case Report

An 89-year-old woman, who could walk with assistance, presented to the emergency room with headache, nausea, and incomplete right oculomotor palsy. Computed tomography (CT) showed no apparent hemorrhage; however, a 23-mm round mass was observed in the right basal cistern. CT angiography also demonstrated a partially thrombosed right BA-SCA aneurysm, with a canalized portion measuring 8 × 9 × 17 mm (Fig. 1A). After considering the patient's age and general condition, palliative coil embolization was performed to prevent impending rupture.

Examination of the access route to the aneurysm re-

Received March 15, 2022; Accepted April 12, 2022

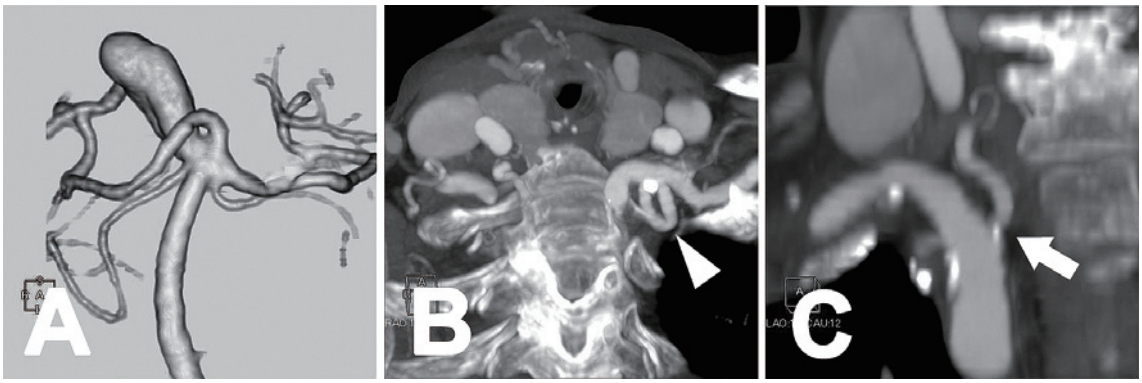

Fig. 1 Computed tomography angiography showing a partially thrombosed right basilar artery-superior cerebellar artery aneurysm (A); strong tortuosity in the proximal left vertebral artery (B, arrowhead) and stenosis at the origin of the right vertebral artery (C, arrow) are noted.

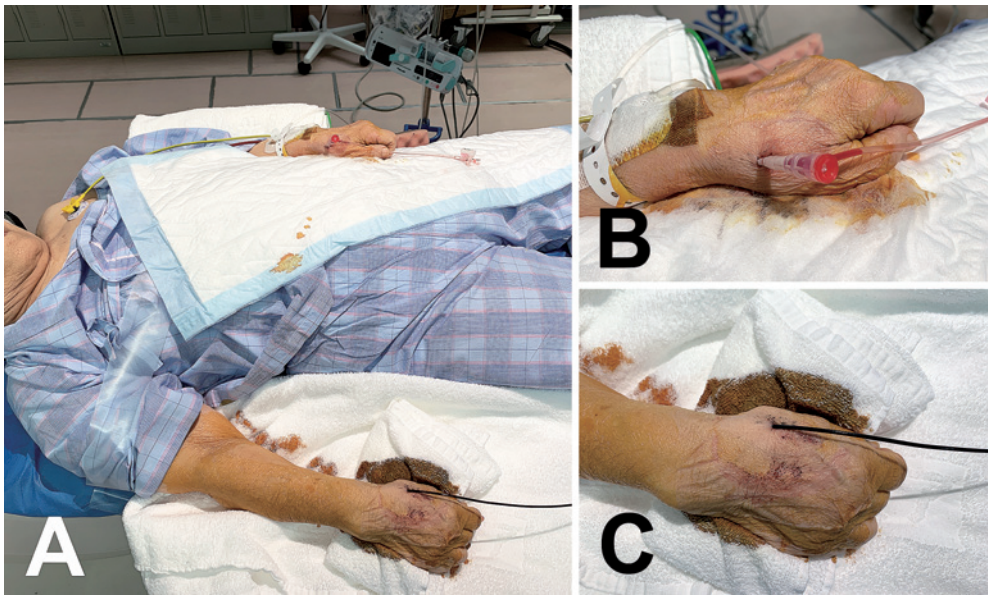

Fig. 2 Patient's hand position immediately after coil embolization. The right hand was placed along the body and the left hand was placed on the abdomen (A); 4F sheaths are inserted via the anatomical snuffbox on the left (B) and on the right (C).

vealed that the origin of the left vertebral artery was extremely tortuous with loops (Fig. 1B), and the right vertebral artery also had stenosis at its origin (Fig. 1C). In addition, the left subclavian and brachiocephalic arteries were tortuous, suggesting that TRA was more suitable than TFA. It was considered appropriate to access the aneurysm via the right vertebral artery; however, passing a large guiding catheter through the stenotic portion at the origin appeared dangerous. Therefore, we decided to use a smaller intermediate catheter as a guiding catheter. However, in this situation, obtaining angiograms from the right vertebral artery during coil embolization was impossible; therefore, another catheter was placed via another puncture at the origin of the left vertebral artery. Simultaneous catheterization of the bilateral vertebral arteries was necessary; however, we decided to treat this case with bilateral dTRA because we had experience with left vertebral artery access via the left distal radial artery.[12,13] The modified Allen's test was negative (normal) for both hands, and ultrasound examination showed that the inner diameter of the radial artery at the snuffbox was 2.5 mm on the right side and 2.3 mm on the left side. These values are sufficiently larger than that of the outer diameter of the 4F sheath.

Coil embolization was performed under local anesthesia with mild sedation. The right arm was positioned for usual TRA, whereas the left hand was placed on the abdomen (Fig. 2). Both wrists were slightly extended on the radial side and placed with the anatomical snuffbox facing upwards. After disinfection of the snuffbox and wrist in the region of the bilateral radial arteries, the patient was cov-

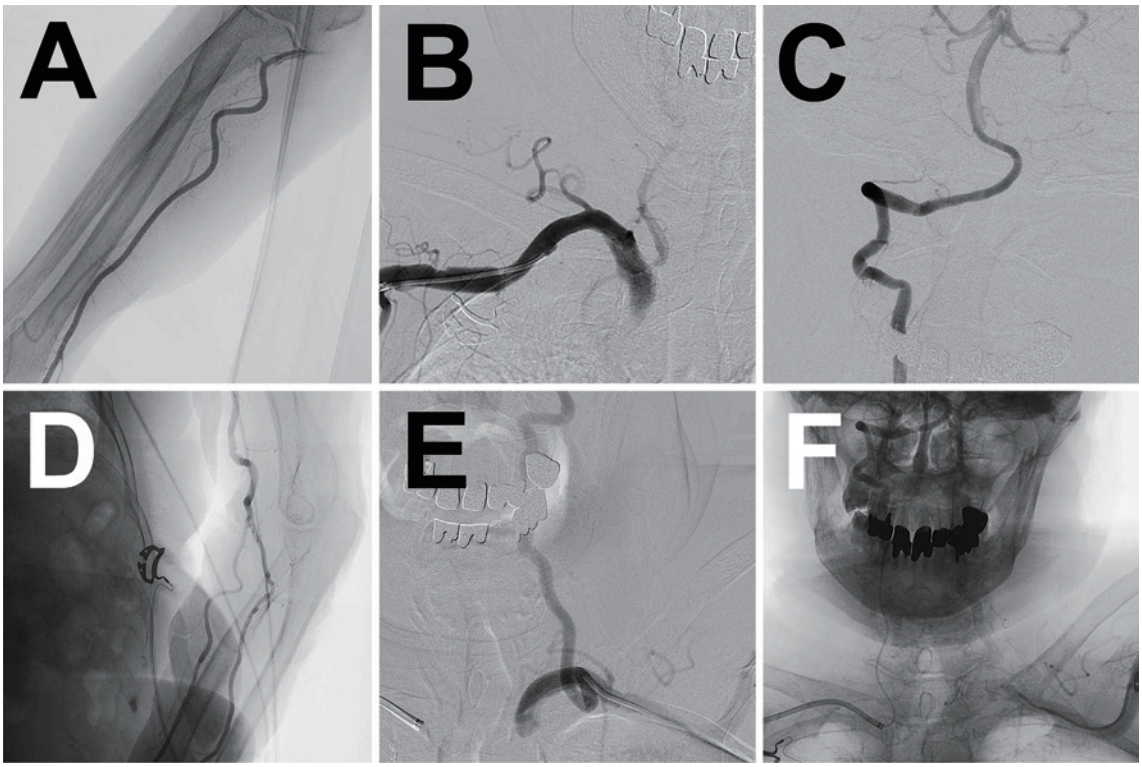

Fig. 3 Right radial arteriography (A). Right subclavian angiography shows stenosis at the origin of the right vertebral artery (B). An intermediate catheter is placed in the right V2 portion (C). Left radial arteriography (D). Left subclavian angiography shows strong tortuosity in the proximal vertebral artery (E). Simultaneous catheterization of bilateral vertebral arteries (F).

ered with a sterile drape with two holes. All operators stood on the right side of the patient, as usual. The right radial artery in the anatomical snuffbox was punctured using a 20-G needle. A 0.025" hydrophilic guidewire was carefully advanced into the radial artery in the forearm and a 4F short sheath was inserted subsequently. After radial arteriography (Fig. 3A), a 0.035" guidewire was advanced to the brachial artery, and the short sheath was exchanged for a 4F long guiding sheath (ASAHI FUBUKI Dilator Kit; Asahi Intec, Aichi, Japan). After advancing the guiding sheath to the right subclavian artery (Fig. 3B), an intermediate catheter (ASAHI FUBUKI 4.2F; Asahi Intec) was carefully passed through the stenosis at the origin of the right vertebral artery and advanced to the V2 segment (Fig. 3C). Subsequently, the left radial artery was punctured in the anatomical snuffbox, and a 4F short sheath was inserted in a similar manner as in the right hand (Fig. 3D). A small J-shaped 4F diagnostic catheter was carefully hooked to the origin of the tortuous left vertebral artery on the control angiogram (Fig. 3E). Under simultaneous catheterization of bilateral vertebral arteries (Fig. 3F), a microcatheter (Headway Duo; MicroVention-Terumo, Tustin, CA, USA) was carefully advanced into the right BA-SCA aneurysm through the FUBUKI 4.2F catheter in the right vertebral artery, and coils were placed within the aneurysm. Control angiograms performed on the left vertebral artery during the procedure provided good visualization of the basilar artery and lesion (Fig. 4A). Obliteration of the aneurysm was achieved (Fig. 4B). After the procedure was completed, the sheaths were removed, and three hours of compression using hemostasis bandages (STEPTY; Nichiban Co., Ltd. Tokyo, Japan) were administered to ensure good hemostasis in both hands.

The postoperative course was uneventful, and the patient was discharged six days after the procedure. The patency of both radial arteries was confirmed via pulsation at the wrist and snuffbox.

Informed consent to submit this case report was obtained from the patient. This study was approved by the Okazaki City Hospital Clinical Research Ethics Committee (approval number: 2020-1).

Discussion

The "radial-first" policy has already been established in percutaneous coronary interventions (PCI).[14,15] It is now also used in neuroendovascular procedures due to its lower invasiveness and high safety compared with TFA.[1,2] TRAs are associated with reduced rates of access-related complications, such as major bleeding or pseudoaneurysms, shorter hospital length of stay, and increased patient satisfaction.[3,4] TRA has a required learning curve;[1]

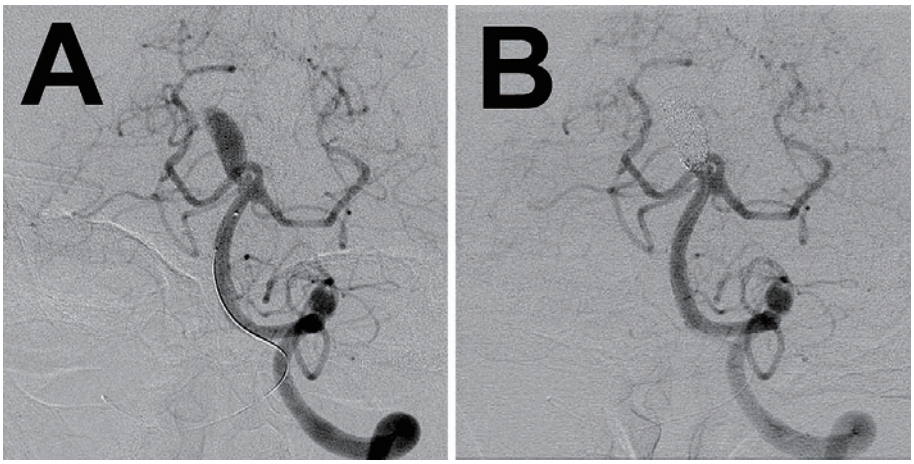

Fig. 4 Pre- (A) and post-embolization (B) of the aneurysm.

however, device development and increased experience of operators have led to its application in neuroendovascular procedures in recent years.[5,16] Moreover, in the last few years, dTRA, a less invasive variant of TRA, has been introduced in PCI.[6] In dTRA, the distal radial artery lies under the anatomical snuffbox, a triangular depression surrounded by the tendon of the extensor pollicis longus, extensor pollicis brevis, and the abductor pollicis longus, which is punctured.[6,9] dTRA may have some potential advantages over conventional TRA, such as a lower risk of forearm radial artery occlusion and shorter hemostasis time;[17] however, the greatest advantage is the better intraoperative comfort for the patient and operator, especially in the left dTRA.[6] The conventional left-hand approach requires the operator to perform the procedure in an unfamiliar and uncomfortable posture, such as standing on the left side of the patient to perform the puncture, or striding over the patient's body from the right side of the patient to manipulate the catheter. However, we had previously reported the usefulness of left dTRA for left vertebral artery aneurysms,[12] and the patient's left hand was placed naturally on the abdomen in the left dTRA. This is close to the familiar puncture position in TFA and enables the operator to stand on the right side of the patient and perform the procedure in an ergonomically better posture similarly to TFA. The left dTRA can provide great benefit to neuroendovascular operators, particularly when access to the left vertebral artery via the left hand is required.

Shorter compression time is another advantage of dTRA.[6] As the punctured artery is small in diameter and close to the skin surface, compression is easier than with conventional TRA. Manual compression is the most convenient method, and hemostatic devices for conventional TRA are also useful for this. A new hemostatic device designed specifically for dTRA was recently released.[18] Two to three hours of compression are usually sufficient for achieving good hemostasis.[9] However, inadequate compression can lead to bleeding complications, and excessive compression can lead to radial artery occlusion. Therefore, establishment of an appropriate hemostatic protocol is essential.

Good visualization of a vessel using digital subtraction angiography is essential for safe and good results in neuroendovascular procedures. However, in the treatment of the posterior circulation system, neurointerventionalists often struggle with poor visualization of the basilar artery during unilateral vertebral artery catheterization. This is because of the laminar flow or dilution of the contrast medium by the strong flow from the contralateral vertebral artery, and is particularly likely to occur when a large catheter is inserted into a tortuous vertebral artery. In addition, when a therapeutic microcatheter is coaxially guided into the lesion through a small guiding catheter, such as an intermediate catheter, sufficient injection of the contrast medium may not be possible. In such situations, contralateral vertebral angiography via another puncture is a solution. Although bilateral TFA or combined unilateral TFA and another TRA or transbrachial approach are usually selected, they may increase the risk of access site-related complications and decrease postoperative comfort for the patient. Meanwhile, because the angle of origin of the vertebral artery from the subclavian artery may often be more direct, it may be easier to access the vertebral artery from the upper arm, especially in older patients or in those with severe access route tortuosity.[19,20] Therefore, TRA may be preferable to TFA for catheterization of the vertebral artery. Hanaoka et al. reported the feasibility and safety of the bilateral transradial approach for coil embolization of basilar artery aneurysms associated with an unfavorable vertebral artery anatomy, including the role-sharing technique.[21] The authors emphasized that the use of two 3.2F intermediate catheters for bilateral vertebral arteries via the bilateral TRA is safe and provides good visualization during the procedures. Luther et al. also reported bilateral TRAs in complex posterior circulation interventions.[22] These two cases were performed using a

combined right conventional TRA and left dTRA, which was ergonomically favorable for the neurointerventionalist. Bilateral distal transradial access for the vertebral arteries is the minimally invasive version of these techniques. Bilateral dTRA has been documented as a case report or personal communication in social networking services for complex PCI; however, this is the first report of bilateral dTRA for neuroendovascular treatment. We observed no perioperative complications or access-related issues. This approach can be a less invasive and safe method for cases that require simultaneous catheterization of both vertebral arteries.

dTRA has some disadvantages compared with conventional TRA. There are difficulties in arterial puncture and sheath insertion due to the small caliber of the vessel. The diameter of the distal radial artery is approximately 80%-90% smaller than that of the forearm radial artery, and that of females is smaller than that of males.[23,24] Therefore, a smaller puncture needle (20-22 G) and guidewire (0.018-0.025") are useful in increasing the success rate. Ultrasound-guided puncture, although requiring a learning curve, will also increase the success rate compared with palpation-guided puncture.[25] The most important aspect of this method is selecting a patient with good distal radial artery pulsation in the snuffbox. Second, the size of the sheath and catheter that can be used is limited. The insertion of a large sheath or catheter may lead to radial artery spasm or occlusion; therefore, the use of a thin-walled or slippery guiding sheath is recommended.[9] It is necessary to check the size of the artery beforehand using ultrasound or CT angiography; however, the size of the sheath or guiding catheter must be selected based on the lesion to be treated. Third, a longer guiding catheter may be needed because the puncture site of dTRA is approximately 5 cm distal to that of conventional TRA. Care should be taken when treating patients with tortuous access routes and high stature.

Several studies have reported high success rates of dTRAs;[9] however, access failures can occur. If catheterization via the distal radial artery is impossible, we should not hesitate to crossover to a conventional TRA, transbrachial approach, or TFA. We should always keep in mind that the puncture and approach consist only of a method of treatment, not of the goal of the treatment.

dTRA is a novel approach to neuroendovascular procedures. This method has some advantages (e.g., shorter hemostasis time and better operator ergonomics, especially in the left-hand approach) and disadvantages (e.g., smaller puncture vessels); however, it can be a useful option if selected appropriately. To the best of our knowledge, this is the first report on bilateral dTRA for neuroendovascular procedures. Bilateral dTRA can be safely performed for coiling of the basilar artery aneurysm, which requires simultaneous catheterization of the bilateral vertebral arteries.

Acknowledgments

We would like to thank Editage (www.editage.jp) for English language editing.

Conflicts of Interest Disclosure

All authors declare no conflicts of interest regarding the materials or methods used in this report.

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