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# Endovascular Treatment of Basilar Tip Aneurysms after Direct Puncture of the Vertebral Artery

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**Summary: Basilar aneurysms that are not amenable to standard endovascular treatment via the femoral approach because catheterization is difficult pose a rare but serious problem. We present two cases of basilar tip aneurysms successfully treated by the endovascular route after direct puncture of the right vertebral artery. In both patients, the left vertebral artery was tortuous, small, and irregular, and the ostium of the right vertebral artery was not accessible by the femoral approach.**

Percutaneous angiography of the vertebral artery was described in 1950 by Lindgren (1). Because of discomfort to the patient and the relative difficulty of performing this procedure, direct vertebral artery puncture was rapidly replaced by catheter techniques or indirect noncatheter methods, like retrograde brachial angiography (2). Currently, catheterization of the vertebral artery is the main route of access for endovascular treatment of a vertebrobasilar aneurysm (3).

Since the advent of hydrophilic-coated catheters and hydrophilic guidewires, cases in which the vertebral artery cannot be reached by the femoral approach are rare. Previously published reports of direct puncture of the carotid artery for treatment of inaccessible lesions of the anterior vascular circulation (4) led us to consider direct puncture of the vertebral artery for the treatment of inaccessible lesions of the posterior vascular circulation.

We present two cases of basilar tip aneurysms successfully treated by the endovascular route after direct puncture of the right vertebral artery. In both cases, the left vertebral artery was tortuous, small, and irregular, and the ostium of the right vertebral artery was not accessible by the femoral approach.

## Case Reports

### *Case 1*

In April 1996, a 54-year-old woman was hospitalized after acute onset of headache and vomiting. A CT study showed subarachnoid hemorrhage predominantly in the interpeduncular cistern. The Hunt and Hess score was grade 1. Angiography showed aneurysms of the basilar tip and of the right middle cerebral artery (MCA). The right MCA aneurysm was clipped, but the basilar tip aneurysm was not surgically accessible. Endovascular treatment of the basilar tip aneurysm was then attempted but failed owing to difficulty in catheterizing the vertebral arteries. Less than 4 weeks later, the patient suffered a new episode of subarachnoid hemorrhage, and 4 weeks after that she was transferred to our institution for a further attempt to treat the basilar tip aneurysm.

On admission, the patient was conscious, mute, with apraxia, but without motor or sensory deficit. An angiogram showed a small aneurysm of the basilar tip, pointing backward (Fig 1A). The left vertebral artery was small, tortuous, and irregular, with a small dissection at the V2–V3 junction (Fig 1B), probably related to a previous embolization attempt. The ostium of the right vertebral artery could not be reached via the femoral approach, although the artery could be opacified by subclavian injection. During catheterization of the left vertebral artery with a microcatheter (Tracker 10, Target Therapeutics, Fremont, CA), clotting appeared at the level of the dissection. Subsequent emboli occluded the distal third of the basilar trunk. Intraarterial thrombolysis was immediately performed (with 1.2 million U of urokinase) using the Tracker 10, resulting in complete opening of the basilar artery. The aneurysm did not rehemorrhage and no additional neurologic deficits were noticed in the postoperative course. The next day, a new approach to the aneurysm was attempted. Under general anesthesia, the right vertebral artery was directly punctured (Fig 1C) with a catheter needle (Nycomed EV 19G, 90-mm length, Nycomed, Paris, France). Using the catheter of the catheter needle as an introducer and guiding catheter, we reached the aneurysm by using a microcatheter (Tracker 10). A 5F catheter was additionally placed by the femoral route at the origin of the left vertebral artery for control angiography during the procedure. After the procedure, the patient received our normal heparin regime for aneurysmal embolization (5000-IU bolus, 3000 IU per hour). The aneurysm was treated with two soft Guglielmi detachable coils (GDCs; Target Therapeutics) (2 mm × 8 cm; 2 mm × 4 cm) (Fig 1D). Before retrieving the catheter from the right vertebral artery, we fully reversed the heparin with protamine, and started subcutaneous heparin 2 hours later, which continued for 7 days (Fraxiparine 0,3 mL X2, Sanofi Winthrop, Gentilly, France). The postoperative course was unremarkable.

### *Case 2*

In August 1996, a 69-year-old woman was hospitalized for acute onset of headache with brief impairment of consciousness. A CT study showed subarachnoid hemorrhage. The Hunt and Hess score was grade 1. Angiography revealed a basilar tip

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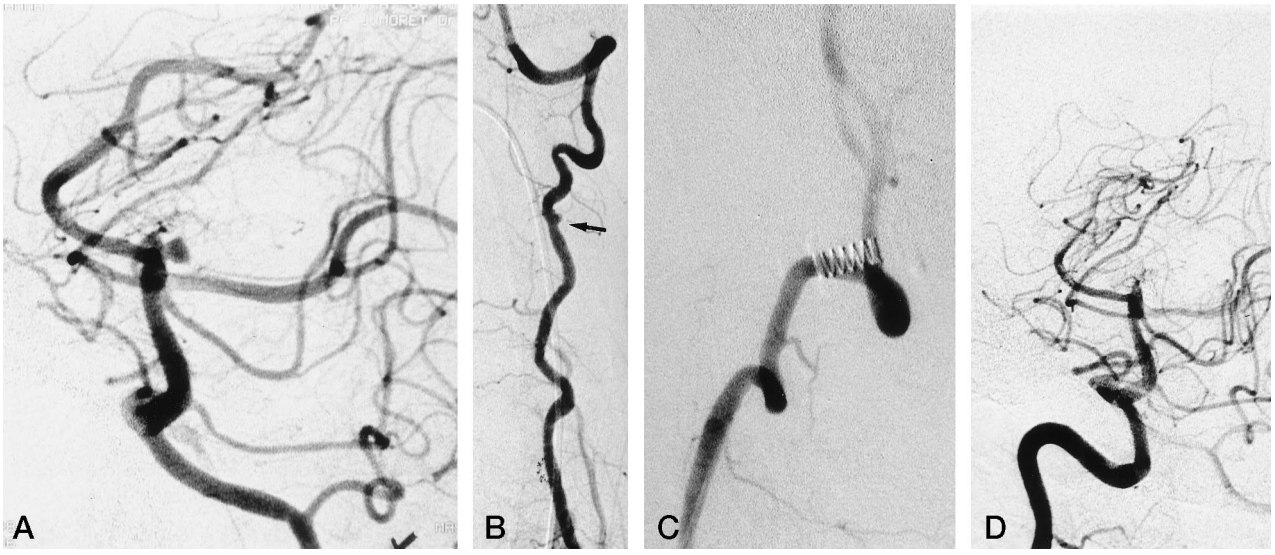


FIG 1. Case 1.
*A*, Left vertebral artery angiogram by the femoral approach shows the basilar tip aneurysm pointing backward (left anterior oblique view).
*B*, Left vertebral artery angiogram by the femoral approach shows a small left vertebral artery with a small dissection (*arrow*) at the V2–V3 junction (anteroposterior view).
*C*, Right vertebral artery angiogram after direct puncture shows a patent right vertebral artery (lateral view).
*D*, Right vertebral artery angiogram (after direct puncture) at the end of the treatment shows occlusion of the basilar tip aneurysm by coils (same view as *A*).

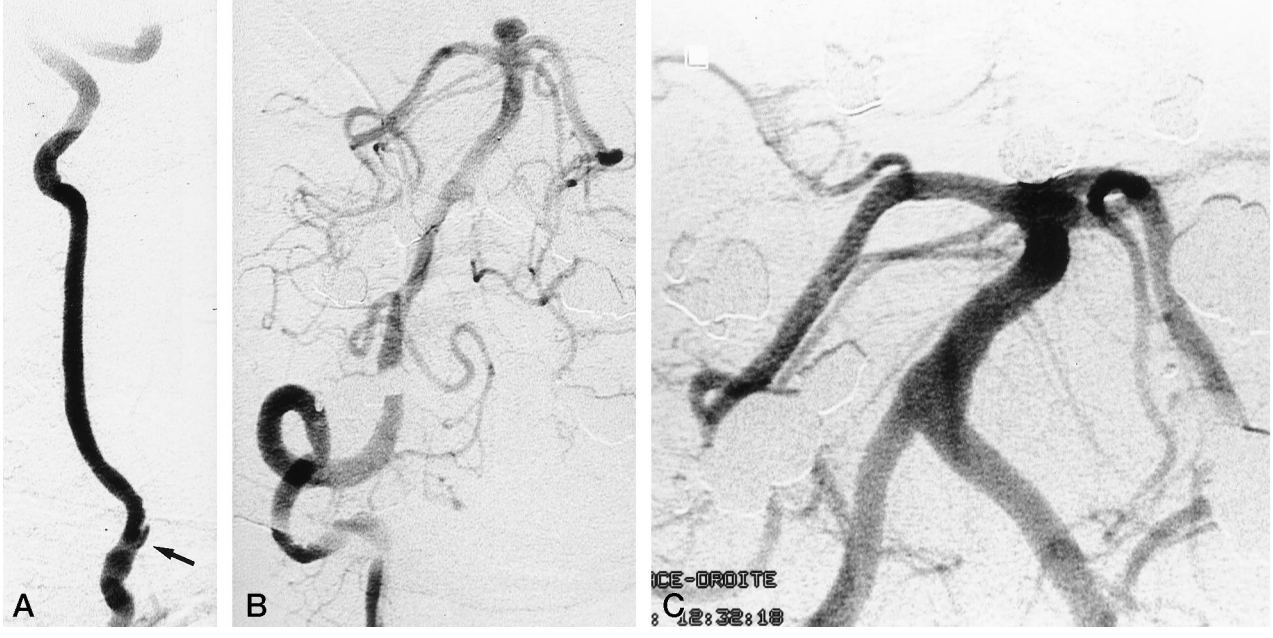


FIG 2. Case 2.
*A*, Left vertebral artery angiogram by the femoral approach shows a small dissection (*arrow*) on V1 segment (anteroposterior view).
*B*, Right vertebral artery angiogram after direct puncture shows the basilar tip aneurysm pointing upward (anteroposterior view; petrous bone is above the maxillary sinuses).
*C*, Right vertebral artery angiogram (after direct puncture) at the end of the treatment shows occlusion of the aneurysm by coils (same view as *B*, focused on the aneurysm).

aneurysm. Two days later, the patient underwent surgery, but the aneurysm proved to be inaccessible. Twenty-four hours later, endovascular treatment of the aneurysm was attempted, but this also failed owing to difficulty in catheterizing the vertebral arteries. Six weeks later, the patient was transferred to our institution.

Results of a neurologic examination performed on admission were normal. Angiography, performed by the femoral route, showed a dissection of the V1 segment of the left vertebral artery (Fig 2A), probably related to the previous embolization attempt. An aneurysm of the basilar tip pointed upward. Because of difficulty in catheterization due to tortuosity, we were not able to reach the ostium of the right vertebral artery, but an injection in the right subclavian artery showed that the right vertebral artery was patent. Using the same technique as for the previous case, we treated the aneurysm with GDCs (4 mm $\times$ 10 cm; 3 mm $\times$ 12 cm; 2 mm $\times$ 8 cm; 2 mm $\times$ 6 cm) via direct puncture of the right vertebral artery (Fig 2B and C). The postoperative course was unremarkable.

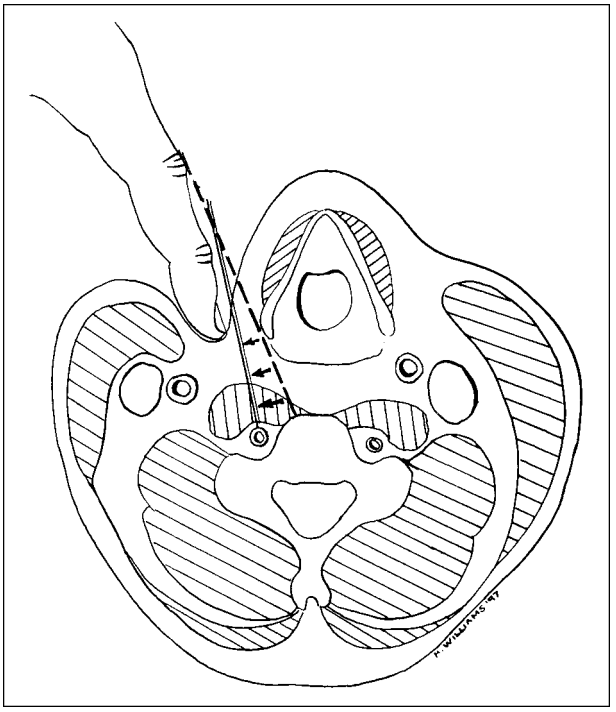

FIG 3. Diagram shows the trajectory of the needle for direct vertebral artery puncture.

*Puncture Technique*

The puncture reported here is similar in principle to the ones described by Lindgren (1) and Sjögren (5). The examiner presses two fingers of the left hand in between the brachiocephalic vessels and the aerodigestive lumen. At approximately the level of C4, the catheter needle is introduced through the skin toward the midline until it touches the vertebral body. The catheter needle is then directed upward and outward until it glides between adjacent transverse processes (Fig 3). The vertebral artery is finally catheterized with the plastic catheter of the catheter needle using the Seldinger technique. Even though in our cases we did not use a road map, such a technique, when possible, might be helpful.

## Discussion

In 1953, Sjögren (5), in a study of 200 direct vertebral artery punctures, reported only one complication—an infarct of the posterior inferior cerebellar artery (PICA)—with the use of needles and contrast media much less sophisticated than those now at our disposal. Furthermore, we are now able to avoid puncturing a nonpatent vertebral artery or a vertebral artery ending in the PICA, because it is possible to have an image of the vertebral artery (subclavian artery injection, aortic injection, angiographic MR study, angiographic CT study) prior to puncture. We believe, therefore, that the risks of this procedure are limited, although today we perform fewer direct punctures.

Since the vertebral artery cannot be compressed at the level of the neck, we used a small-caliber (19-gauge) catheter needle for puncture and catheterization of the vessel and we reversed the heparin before withdrawing the catheter. A micropuncture technique, with 21-gauge needles and serial dilatation of these to a 4F system, is also possible, but does not avoid the necessity of injecting protamine before withdrawing the catheter.

Retrograde catheterization of the vertebral artery from the brachial or the axillary artery is another theoretical solution, but retrograde catheterization may also be problematic in patients with tortuous and atheromatous vessels.

## Conclusion

Basilar aneurysms not amenable to customary endovascular treatment by the femoral approach because of difficulty in catheterization pose a rare but serious problem. As shown in our two cases, direct puncture of the vertebral artery may be a solution.

## Acknowledgments

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