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Endovascular Therapeutic Approach to Peripheral Aneurysms of the Superior Cerebellar Artery

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Summary: Peripheral aneurysms of the superior cerebellar artery may be difficult to treat surgically owing to their inaccessibility and to the frequent inability to preserve the involved parent artery. In fact, for most cases, surgical treatment consists of proximal parent artery occlusion and/or trapping with surgical clips. An equivalent endovascular therapeutic approach to these lesions may be an attractive alternative method of management. We describe two cases of peripheral superior cerebellar artery aneurysms that were treated successfully with endovascular embolization.

Index terms: Aneurysm, embolization; Arteries, cerebellar, superior

Peripheral aneurysms involving the superior cerebellar artery that are nonmycotic in origin are rare. Findings in two large case series suggest a rate of occurrence of 0.25% to 0.66% of all aneurysms of the posterior circulation (1–3). Although direct clipping of such aneurysms with preservation of the parent artery occasionally has been reported (4–8), more commonly, proximal parent artery occlusion and/or trapping with surgical clips has been the primary method of treatment (2, 9–11).

Because simple parent artery occlusion is often required for treatment of these types of aneurysms, an endovascular therapeutic approach may be an attractive alternative, sparing the patient some of the hazards associated with craniotomy and open surgical clipping. We describe two cases of peripheral aneurysms of the superior cerebellar artery that were treated successfully by endovascular transarterial embolization, resulting in good technical and clinical outcomes.

Case Reports

Case 1

A 40-year-old right-handed man was found collapsed at his site of employment shortly after complaining of a severe headache. At that time, the patient was somnolent. On arrival at the hospital, he was moving all extremities spontaneously, although he was difficult to arouse and was not following simple commands. A computed tomographic (CT) scan showed subarachnoid hemorrhage mostly within the posterior fossa basal cisterns. There was also significant intraventricular hemorrhage within the occipital horns of the lateral ventricles and the fourth ventricle. A diagnosis of a ruptured berry aneurysm with Hunt-Hess grade IV was suggested, prompting emergency cerebral angiography.

Cerebral angiography showed a 10-mm saccular aneurysm arising from the proximal lateromesencephalic segment of the right superior cerebellar artery (Fig 1A). The aneurysmal neck was broad and appeared to incorporate the parent vessel. There was moderate to severe vasospasm in the right superior cerebellar artery just proximal to the aneurysm and poor filling distally into the hemispheric (lateral division) and vermian (medial division) territories.

Owing to the patient's poor clinical grade, it was decided to treat the aneurysm via an endovascular approach. A microcatheter (Tracker-18 HiFlow Unibody, Target Therapeutics, Fremont, Calif) was successfully navigated into the lateromesencephalic segment of the right superior cerebellar artery at the transition between the parent artery and the aneurysm (Fig 1B). Several 2 × 10-mm and 2 × 20-mm fibered platinum microcoils (Target Therapeutics) were carefully delivered into the aneurysm. Repeat superselective angiography showed incomplete occlusion of the aneurysm and parent vessel. The microcatheter was then withdrawn proximally several millimeters and an additional 2 × 10-mm fibered platinum microcoil was delivered into the parent artery. Repeat cerebral angiography

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Fig 1. Forty-year-old man with subarachnoid hemorrhage on CT scans.

A, Right anterior oblique view from a digital subtraction angiogram shows a 10-mm aneurysm of the proximal lateromesencephalic segment of the right superior cerebellar artery (SCA) (*straight arrow*). Moderate to severe vasospasm in the right SCA (*curved arrow*) just proximal to the aneurysm is associated with poor filling distally of the hemispheric and vermian territories.

B, A microcatheter positioned in the proximal right SCA (*arrow*) occludes antegrade filling of the distal territory.

C, Left vertebral injection confirms occlusion of the right SCA proximally with occlusion of the aneurysms. Several microcoils are seen within the aneurysmal lumen (*arrow*).

showed complete occlusion of the aneurysm and the right superior cerebellar artery (Fig 1C). The patient tolerated the therapeutic embolization well, with no change noted in his neurologic status.

The patient's clinical course was complicated by the development of noncommunicating hydrocephalus, which initially required placement of a ventriculostomy catheter and subsequently a ventriculoperitoneal shunt. The patient's mental status gradually returned to normal, although he had a moderate short-term memory deficit and minor right-sided cerebellar dysfunction. Serial CT scans obtained after endovascular therapy showed a small infarction in the right superior cerebellar hemisphere.

Case 2

A 68-year-old right-handed man was seen at another hospital because of severe headache and mild ataxia due to subarachnoid hemorrhage and right-sided cerebellar hemorrhage from a presumed ruptured aneurysm of the posterior fossa. The patient was eventually transferred to our institution, at which time he was more somnolent yet able to be aroused and to follow simple commands. Neurologic examination was also notable for moderate right-sided upper and lower extremity ataxia and dysdiadochokinesia. The patient's clinical grade was Hunt-Hess III.

A CT scan showed a right-sided cerebellar hematoma and subarachnoid hemorrhage within the basal cisterns (Fig 2A). Cerebral angiography showed a peripheral aneurysm of the distal right superior cerebellar artery involving the hemispheric segment (lateral division) just past the origin of the vermian branch (medial division) (Fig 2B). The aneurysm measured approximately 4 mm in its greatest dimension with complete incorporation of the hemispheric segment.

Owing to the patient's worsening clinical grade and the location of the aneurysm, it was decided to treat the ruptured aneurysm by using an endovascular technique. A 2.5F microcatheter (Transit, Cordis Endovascular Systems, Miami, Fla) was quickly navigated into the distal right superior cerebellar artery and the tip was positioned at the transition between the parent artery and the aneurysm. A few 2 × 10-mm and 2-mm straight fiber platinum microcoils (Target Therapeutics) were initially deposited into the aneurysm and then subsequently into the parent artery just proximal to the aneurysm (Fig 2C). A control angiogram from a superselective right superior cerebellar artery injection and a selective right vertebral injection showed complete occlusion of both the aneurysm and the hemispheric segment with preservation of the vermian branch and proximal first two segments of the right superior cerebellar artery (Fig 2D). The patient tolerated the therapeutic embolization well without change in his neurologic status.

The patient's hospital course was uneventful. He quickly returned to a normal level of consciousness and had only mild ataxia of the right upper and lower extremities as a result of the cerebellar hemorrhage. Serial CT scans of the brain showed no evidence of cerebellar infarction.

Discussion

Symptomatic aneurysms arising from the peripheral segments of both supratentorial and infratentorial cerebral arteries are rare and have frequently been noted to stem from either traumatic or mycotic origins (10–13). Peripheral aneurysms involving the superior cerebellar ar-

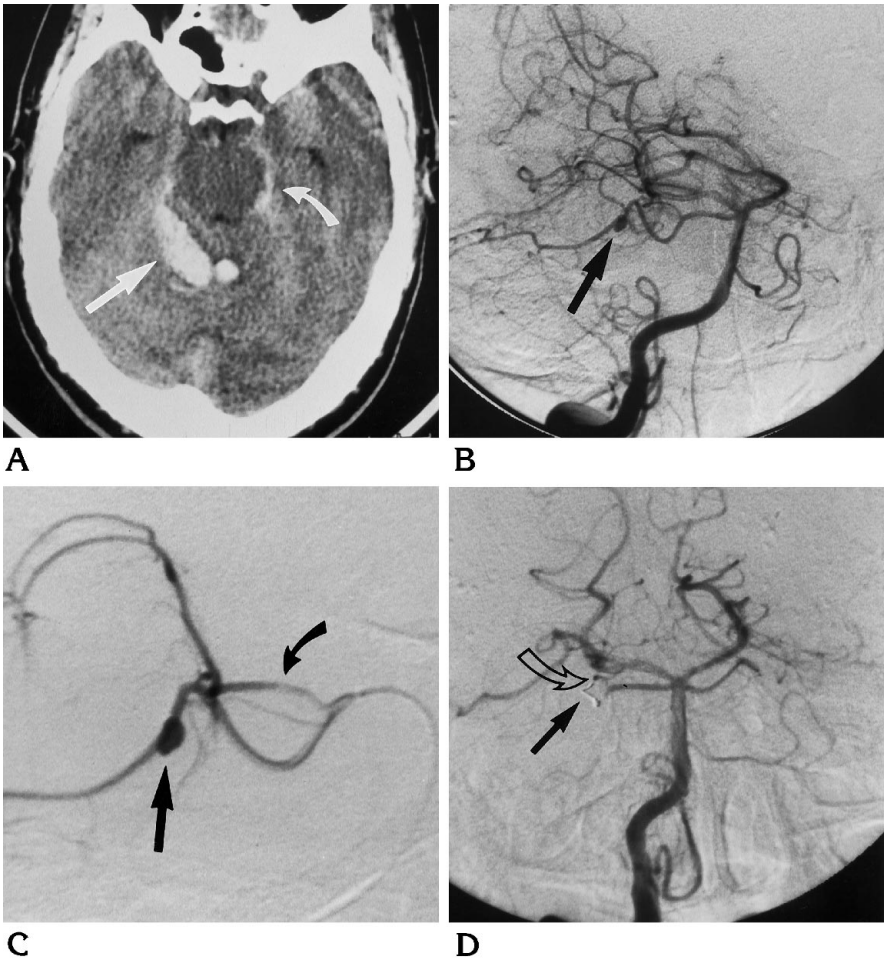

Fig 2. Sixty-eight-year-old man with headache, ataxia, and dysdiadochokinesia.

A, Noncontrast CT scan shows subarachnoid hemorrhage in the perimesencephalic cisterns (*curved arrow*) and a right cerebellar hemorrhage (*straight arrow*).

B, Right anterior oblique projection from a right vertebral injection shows a 4-mm peripheral aneurysm of the distal right superior cerebellar artery (*arrow*) involving the hemispheric segment just past the origin of the vermian branch. The hemispheric segment is completely incorporated.

C, The initial position of the microcatheter after superselective catheterization shows filling of the vermian branch (*curved arrow*). The catheter was advanced past the origin of the vermian branch to isolate the hemispheric branch before embolization (*straight arrow*).

D, Right vertebral injection after embolization shows occlusion of the aneurysm and hemispheric branch (*straight arrow*) with preservation of the vermian branch (*curved arrow*).

tery are particularly uncommon; findings in two large case series suggest a rate of occurrence of 0.25% to 0.66% of all aneurysms of the posterior circulation (1–3). Furthermore, peripheral aneurysms involving the cerebellar arteries are associated more frequently than expected with cerebral arteriovenous malformations (4).

Superior cerebellar artery aneurysms typically manifest with subarachnoid hemorrhage, although an isolated fourth nerve palsy occasionally has been reported (8, 14). Interestingly, many previously reported peripheral aneurysms of the superior cerebellar artery that manifested with subarachnoid hemorrhage were less than 5 mm in diameter (as in case 2 of our series), which has arguably been considered the minimum size at which intracranial aneurysms are statistically likely to bleed (15, 16). Gacs et al (4) theorized that these peripheral aneurysms tended to rupture at a smaller size because of a thinner aneurysm wall.

The diagnosis of ruptured peripheral aneurysm of the superior cerebellar artery should be considered when subarachnoid hemorrhage predominates in the perimesencephalic and superior cerebellar cisterns. Careful angiographic evaluation is essential to distinguish peripheral aneurysms of the superior cerebellar artery from aneurysms of the posterior cerebral artery, because the former's infratentorial location requires a modification of the surgical approach. The need to demonstrate the presence or absence of a surgical neck and to ascertain the proximity of the aneurysm to major branches are also relevant concerns for surgical planning, as often these features can only be observed with the use of magnification views in various planes. We favor high-resolution digital subtraction angiography (1024 $\times$ 1024 matrix) over conventional film-screen angiography, because the former is ideally suited for obtaining multiple projections with high magnification.

Open surgical treatment of peripheral aneurysms of the superior cerebellar artery often requires parent artery occlusion with trapping, especially in the case of traumatic and mycotic aneurysms. According to several surgical reports, occlusion of the superior cerebellar artery appears to be well tolerated, (4, 9, 10), most likely because of a combination of factors. First, there is generally good collateral circulation between the superior cerebellar artery and both posterior inferior cerebellar and anterior inferior cerebellar arteries through the vermian arcade (17), which often permits reconstitution of the distal branches of the superior cerebellar artery if more proximal occlusion of that artery occurs. Second, there is generally a paucity of perforating branches arising from the anterior pontine and lateromesencephalic portions of the superior cerebellar artery, which are well collateralized with the paramedian and short circumferential perforators from the basilar artery (18, 19). This anatomic arrangement probably diminishes the likelihood of perforator ischemia to the ventral brain stem if these proximal segments are occluded. Finally, potential ischemic injuries to the superior cerebellar artery territory from this approach are more likely to affect only the cerebellar cortex. Such insults are generally better tolerated over the long term, often with good recovery of neurologic function, as compared with other posterior fossa ischemic insults (20).

When parent artery occlusion is anticipated on the basis of angiographic findings (eg, no surgical neck, incorporation of parent artery) or because an open surgical approach is unfavorable owing to the patient's poor clinical grade, concurrent medical conditions, or age, an endovascular therapeutic technique may provide an attractive alternative. Parent artery occlusion by transarterial embolization can provide an equivalent therapeutic result without subjecting the patient to the hazards of craniotomy and anesthesia.

Superselective catheterization of the distal superior cerebellar artery with a microcatheter usually can be accomplished readily and it enables detailed examination of the vascular anatomy of the proximal and distal superior cerebellar artery via superselective angiography, thus making it possible to obtain a more precise definition of the relationship between the aneurysm, the parent artery, and other branches of the superior cerebellar artery. This information permits optimal assessment of endovascular therapeutic options. As is the case for open surgical clipping, a reconstructive endovascular technique that preserves the parent artery, such as endosaccular coiling, is conceptually attractive and should be considered if the anatomy of the targeted aneurysm is favorable for such an approach.

Our experience, however, is similar to that of others in that these peripheral aneurysms of the superior cerebellar artery often have either relatively wide or undefinable necks that are not amenable to such a technique. Therefore, endovascular occlusion of the proximal parent artery near the site of the aneurysm is required. The detailed anatomic information provided by superselective angiography also can be critical in optimizing management, as illustrated in our second case, in which precise parent artery occlusion near the aneurysm was possible without sacrificing uninvolved arteries that are important sources of collateralization, such as the vermian (medial) branch.

As with all instances of parent artery occlusion, there is concern about proximal or distal thromboembolic propagation that may threaten collateral vessels or nearby perforators. Because of this concern, we are particularly careful to limit the length of the occluded segment of the artery during coiling and to avoid coil deposition near visible branches or in more proximal, perforator-bearing segments of the superior cerebellar artery. We also consider periprocedural anticoagulation to prevent thromboembolic propagation, although we are less likely to use this in patients who have cerebellar hematomas. These strategies may further decrease the likelihood of ischemic sequelae of this endovascular treatment.

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