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Distal Stump of an Occluded Intracranial Vertebral Artery at the Vertebrobasilar Junction Mimicking a Basilar Artery Aneurysm

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Summary

The distal stump of an occluded intracranial vertebral artery (VA) can mimic a basilar artery aneurysm of the vertebrobasilar junction. Their differentiation is crucial to establishing the appropriate treatment. We report two cases with occlusion of the distal stump of the VA due to atherosclerosis and arterial dissection. Magnetic resonance images with three-dimensional constructive interference in steady state sequences are useful in revealing the occluded segment as a continuous anatomical structure from the proximal VA to the basilar artery. This information may prevent unnecessary exploratory surgery for a suspected basilar artery aneurysm.

Keywords: CISS imaging; magnetic resonance imaging; vertebral artery occlusion; vertebrobasilar junction.

Introduction

The distal stump of an occluded intracranial vertebral artery (VA) can mimic a basilar artery aneurysm of the vertebrobasilar junction. To our knowledge, such a situation has not been previously reported. Differentiation of an occluded VA stump from a saccular aneurysm is critical because a saccular aneurysm can cause subarachnoid haemorrhage whereas an arterial stump requires no surgical treatment.

Magnetic resonance imaging with three-dimensional constructive interference in steady state (3D-CISS) sequences is useful in diagnosing pathological processes involving the cerebellopontine angle and internal auditory canal because of its high spatial resolution of structures within the cerebrospinal fluid spaces [3, 4, 9]. We report two cases in which the distal stump of an occluded VA resembled a saccular aneurysm at the vertebrobasilar junction, and discuss their differential diagnosis using 3D-CISS images and underlying aetiologies.

Case Presentation

Case 1

This 58-year-old man developed transient ischaemic attacks causing right hemiparesis several times within 12 hours. Each ischaemic episode disappeared within three minutes and the patient recovered completely without any residual deficits. Past history was otherwise unremarkable. MR imaging on day 4 disclosed a small lacunar infarct in the left basal ganglia. MR angiography showed a suspected basilar artery aneurysm. The left VA distal to the left posterior inferior cerebellar artery (PICA) was not visualised.

The patient was neurologically normal when he was admitted three months after these transient ischaemic attacks for further evaluation of a possible basilar artery aneurysm. Digital subtraction catheter angiography showed atherosclerotic changes of the right intracranial VA and an aneurysmal dilatation just proximal to the anterior inferior cerebellar arteries. Fig. 1a, b. The left VA terminated at the origin of the left PICA. Fig. 1c. The VA segment between the left PICA and the basilar artery was not visualised.

Our diagnosis at that time was that a basilar artery aneurysm could not be ruled out, but that the process could involve the distal VA itself. Lacunar infarction was not related to VA occlusion. After discussion with the patient regarding treatment options, consent was obtained for exploratory surgery. We performed the operation with the patient in the park-bench position using a far-lateral approach. Surgical exposure showed that the left VA distal to the left PICA was present but occluded. The occluded segment appeared of a yellowish colour due to atherosclerosis and lacked blood flow. No basilar artery aneurysm was found. What we had suspected to be an aneurysmal dilatation of the basilar artery by pre-operative imaging was, in fact, the distal stump of an occluded left VA. No surgical intervention was performed. The patient experienced transient hoarseness and vertigo postoperatively. After the exploratory surgery, the patient was followed with CISS imaging. MR parameters for CISS imaging included a repetition time of 17 msec, echo time of 8.1 msec, flip angle of 70 degrees, voxel size of $0.70 \times 0.70 \times 0.86$ mm, and number averaging of 1. CISS images clearly demonstrated structural continuity of the occluded left VA with the proximal patent VA and the basilar artery Fig. 1d, e.

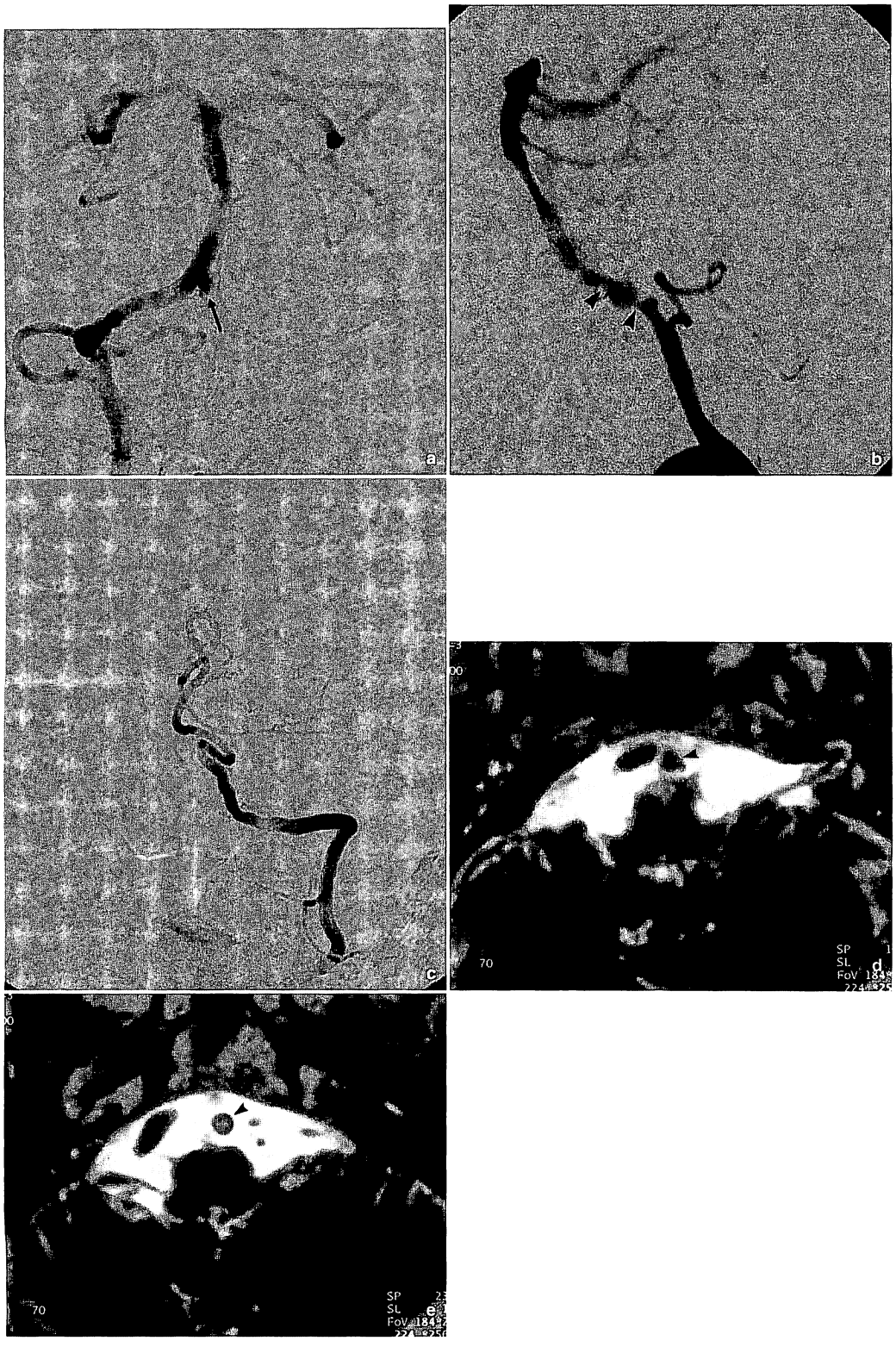

Fig. 1. Case 1: Right vertebral angiograms (a: frontal view, b: lateral view) show stenotic changes in the right intracranial vertebral artery (arrowheads) and an aneurysmal dilatation (arrow) proximal to the anterior inferior cerebellar arteries. Left vertebral angiogram (c: frontal view) shows the left vertebral artery terminating at the origin of the left posterior inferior cerebellar artery. The segment of the left vertebral artery distal to the posterior inferior cerebellar artery is not demonstrated. CISS images show the patent segment (d) and occluded segment (e) of the intracranial left vertebral artery (arrowheads) continuing from the proximal vertebral artery to the basilar artery

Case 2

This 40-year-old man developed severe left occipitalgia suddenly and was transferred immediately to the hospital by ambulance. At admission, the patient was alert, had a left Horner's sign, a right hemicorporeal hypalgesia including the face, and was dysarthric, but motor weakness and neck stiffness were not observed. His past history was unremarkable. The initial CT of the head was normal. To diagnose a suspected left VA dissection, digital subtraction angiography was performed 3 hours after the ictus. Left vertebral angiograms revealed a string sign of the left intracranial VA Fig. 2a, b. There was no atherosclerosis evident on either of the bilateral vertebral angiograms. MR imaging performed 12 hours after the onset of symptoms revealed an intramural haematoma of the left intracranial VA confirming the diagnosis of a VA dissection.

This patient was treated conservatively. Follow-up angiography at 1.5 months from the ictus disclosed an occlusion of the intracranial portion of the left VA and the arterial stump at the vertebrobasilar junction Fig. 2c. This arterial stump resembled the aneurysmal dilatation in Case 1, but was obviously differentiated from basilar artery aneurysm by findings on the previous angiograms. MR images showed a small infarction in the left dorso-lateral medulla. CISS images (scanning parameters were the same as those in Case 1) showed the occluded left intracranial VA clearly. Fig. 2d, e. This patient was discharged 1.5 months after the ictus with moderate dysphagia and right hemicorporeal sensory disturbance, both of which gradually improved over the ensuing 3 months.

Discussion

Cerebral aneurysms in the posterior fossa are relatively rare, but the vertebrobasilar junction is one of the most common places for aneurysmal formation [1, 2, 13, 15]. Saccular aneurysms at this location are frequently associated with fenestrations of the basilar artery [2, 5, 7, 13]. Surgical approaches to this region are usually challenging and require special skull base approaches [1, 5, 6, 10, 12, 14, 16]. Endovascular treatment provides a less invasive therapeutic alternative [5, 7, 8, 13]. When one VA is occluded, a saccular aneurysm at the vertebrobasilar junction may resemble the arterial stump of a proximally occluded VA. Differentiating between a vertebrobasilar junction aneurysm and a distal stump of an occluded VA is difficult using only angiography, however, this distinction is critical because their natural history and treatment are completely different.

Kalia *et al.* [11] similarly reported a vascular pouch mimicking a saccular aneurysm which was composed mainly of a thrombosed limb of the basilar artery fenestration. Occlusion of one VA distal to the PICA accompanied these findings as well. Their exploration of the vertebrobasilar junction surgically identified no aneurysm, similar to our Case 1. In their report, they did not propose any means of avoiding exploratory surgery. The two cases reported here imply that a distal VA stump may mimic a cerebral aneurysm without the existence of the rare anomaly known as a basilar artery fenestration.

3D-CISS imaging provides excellent spatial resolution of the brain anatomy and high contrast between the cerebrospinal fluid and extramedullary structures. CISS imaging is useful in demonstrating the fine anatomical structures in the cerebellopontine angle and internal auditory canal [3, 4, 9]. We observed that CISS images are also valuable in delineating an occluded intracranial VA and its continuity with the vascular structures from the proximal VA to the basilar artery. When the source images of MR angiography are interpreted in tandem with CISS images, it is possible to distinguish whether the vascular structure has blood flow within or not. CISS images also differentiate a congenitally hypoplastic VA from an acquired VA occlusion by the absence of a VA segment between the PICA and the basilar artery.

In Case 2, VA dissection caused an intracranial VA occlusion resulting in the stump formation at the vertebrobasilar junction. In Case 1, however, no such ischaemic episode was apparent. Intra-operative observation of a yellowish colour to the occluded segment of the left VA and atherosclerotic changes in the right VA on angiograms suggested that the aetiology of the left VA occlusion was atherosclerosis. Thus, we believe that the underlying aetiologies for distal stump formations may include VA dissection and atherosclerosis. Although it is impossible to differentiate between aetiologies in the chronic stage of VA occlusion, MR images may disclose an intramural haematoma which would imply a recent arterial dissection in its acute stage.

In conclusion, the arterial stump of an occluded intracranial VA may mimic a basilar artery aneurysm of the vertebrobasilar junction. Its differentiation is crucial because their natural history and treatment are radically different. CISS imaging can be a useful adjunct for establishing the differential diagnosis and avoiding unnecessary exploratory surgery.

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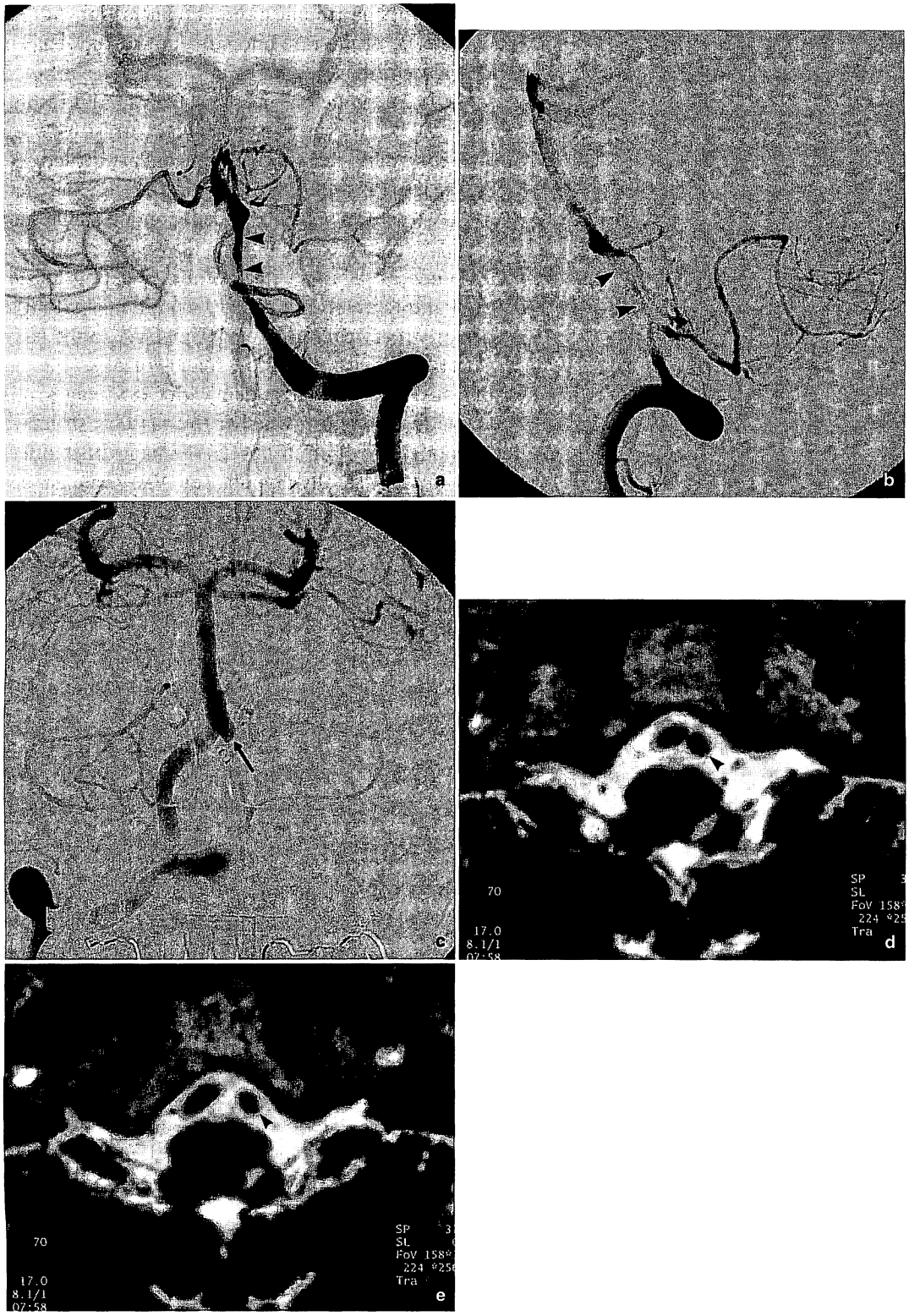

Fig. 2. Case 2: Left vertebral angiograms three hours after the ictus (a: frontal view, b: lateral view) show the string sign at the intracranial portion of the left vertebral artery (arrowheads), suggesting an arterial dissection. Right vertebral angiogram (c: frontal view) 1.5 months after the ictus shows an aneurysmal pouch protruding from the basilar artery (arrow). Left vertebral angiogram (not shown) fails to show an intracranial portion of the left vertebral artery. CISS images show the patent segment (d) and occluded segment (e) of the intracranial left vertebral artery (arrowheads) continuing from the proximal vertebral artery to the basilar artery

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Comments

Komiyama *et al.* report two rare cases of a distal stump of an occluded intracranial vertebral artery at the vertebrobasilar junction mimicking a basilar artery aneurysm. One case with ischaemic symptoms and the other with acute vertebral artery dissection symptoms. The first case was surgically explored and the dissection was treated conservatively. The conventional transfemoral digital substraction angiography (DSA) only gives a "luminal" image and a stump can be misdiagnosed as an aneurysm. As mentioned by the authors, the complementation with magnetic resonance imaging (MRI) is very useful to make the differential diagnosis avoiding an unnecessary surgical exploration of the vertebrobasilar junction. The MRI gives intraluminal image, eventual mural thrombus on acute dissections, neural related structures, etc. The eventual use of helical scanning CT angiography was not commented on by the authors another non invasive technique that shows extraluminal structures as MRI. The differentiation between stump and an aneurysm is very important because only the latter needs surgical or endovascular obliteration. As pointed by the authors, the approach to this region is complex, and most of the times a far lateral transcondylar approach is needed. The endovascular techniques to aneurysms of this region are not always feasible, and the coils or stent assisted coiling technique are not a worldwide accepted procedure, with unknown long term results. This report emphasizes the important association of different imaging techniques to make a correct diagnosis and to avoid unnecessary exploration in non-aneurysmal non-surgical vertebro-basilar pathology.

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