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Virtual Arterial Endoscopy as a Diagnostic Aid in a Patient with Basilar Artery Fenestration and Thromboembolic Pontine Infarct

Axel Scherer, Mario Siebler, and Albrecht Aulich

Summary: Focal signal intensity loss of the basilar artery on MR angiograms obtained in a 69-year-old man was considered to be caused by an embolus, and thrombolytic therapy was initiated. On the follow-up MR angiograms, the same oval signal intensity loss of the basilar artery was observed. On the basis of a virtual endoscopic look into the basilar artery, the diagnosis of a rare vascular anomaly—a fenestration of the basilar artery—was confirmed and the presence of a thrombus at the site of the signal intensity loss was excluded.

Basilar artery fenestrations are the most frequently observed fenestrations of the cerebral arteries, with vertebral and middle cerebral artery fenestrations being the next most frequent. Although their clinical significance is controversial, a basilar artery fenestration might be misinterpreted as an arterial dissection or thrombosis, especially in patients with stroke, thereby leading to a wrong decision regarding further diagnostic approaches or therapies. Virtual endoscopy may facilitate the qualitative analysis and enhance the diagnostic capabilities in the presence of basilar artery fenestrations.

Case Report

A 69-year-old man suddenly developed several episodes of dysarthria, dysphagia, and right-sided paresis 3 days before admission. At admission, he had severe dysarthria and paresis of the right side but without disturbances of gaze. The vascular risk profile included hypertension, diabetes, and hypercholesterolemia. Diffusion- and T2-weighted MR imaging performed the same day revealed high signal intensity in the left pontine area, compatible with an ischemic lesion (Fig 1A). MR angiography, using time-of-flight technique, displayed a focal signal intensity loss within the basilar artery (Fig 1B). According to these findings, diagnosis of an acute thromboembolic brain stem infarction was made that was treated with anticoagulation (heparin and thrombocyte aggregation inhibitors) (1). On the follow-up MR angiograms, the same oval signal intensity loss of the basilar artery was observed. On the basis of a virtual

endoscopic look into the basilar artery (Fig 2), reconstructed from the MR angiographic data sets, the diagnosis of a small slitlike fenestration was confirmed and a thrombus was deemed unlikely. The precise illustration of the intraluminal symmetric appearance of a tiny membranous pathologic finding of the fly-through technique was especially helpful in indicating this vascular anomaly. According to the literature, two types of fenestrations of cerebral arteries exist: true duplications and arterial slits (2). Because of the incomplete central fusion shown by the virtual endoscopy, we speculated that this was not a true duplication-type fenestration but an incomplete abortive slitlike fenestration.

Discussion

Basilar artery fenestrations are the most frequently observed fenestrations of the cerebral arteries, with vertebral and middle cerebral artery fenestrations being the next most frequent. The angiographically determined incidence of basilar artery fenestrations is reported to be 0.3–0.6% (2). The clinical significance is controversial, but a basilar artery fenestration might be misinterpreted as an arterial dissection or thrombosis, especially in patients with stroke, thereby leading to a wrong decision regarding further diagnostic approaches or therapies. Fenestrations of the cerebral arteries can be multiple, and associated with cerebral aneurysm, cerebral arteriovenous malformation, or persistent trigeminal artery (3). None of these additional findings were observed in our patient. It is unlikely that the fenestration had played a role as an embolic source in our case. To date, we know of only one case report that speculates about an association between brain stem infarction and vertebral artery fenestration (4).

Virtual endoscopy combines perspective volume rendering and interactive visualization to a new approach featuring the motion of postprocessing procedures in MR imaging (5). Comparing maximum intensity projection and virtual endoscopy, we found relevant additional information regarding virtual endoscopy, such as depth information, intraluminal perspective, lighting, and color. The ability to obtain an internal view would facilitate the qualitative analyses and would thus enhance diagnostic capabilities and could improve the pretherapeutic visualization of intracranial vascular malformations. Despite these improvements, this technique is time-consuming and pitfalls exist (eg, suitable threshold values). It also does not provide more data than do available

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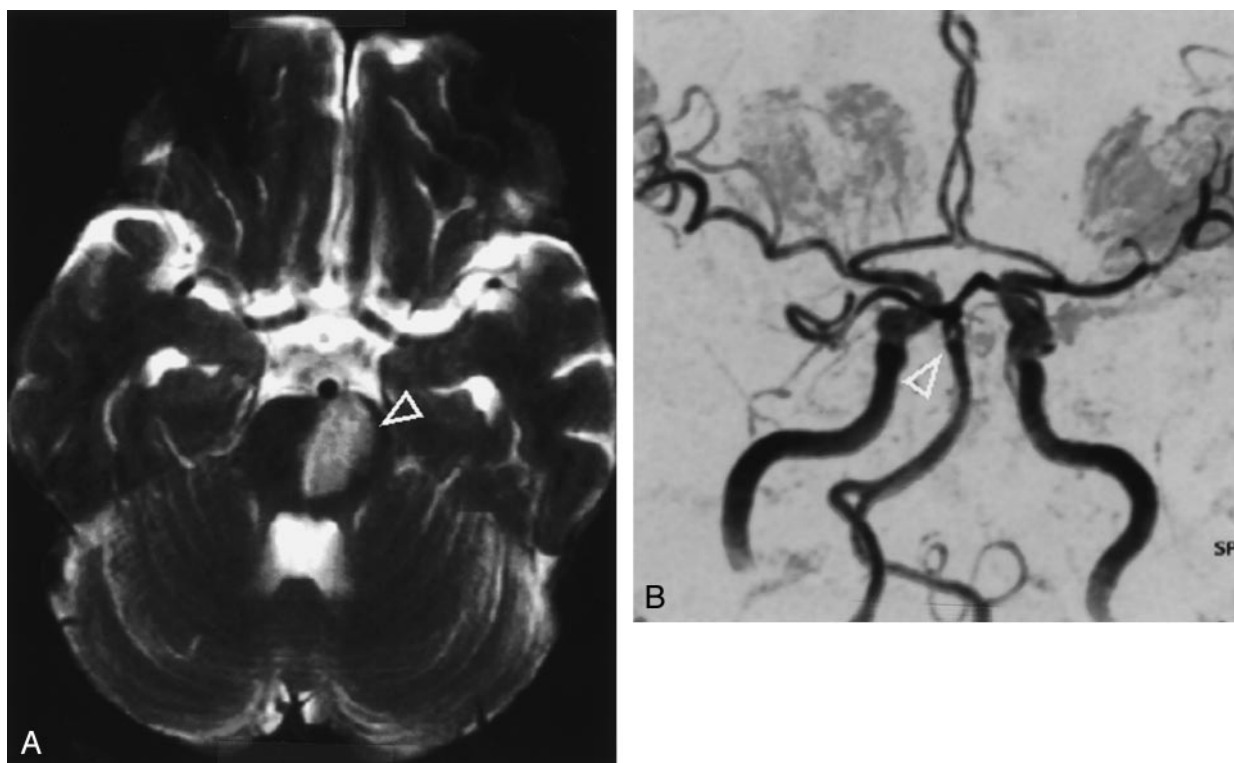
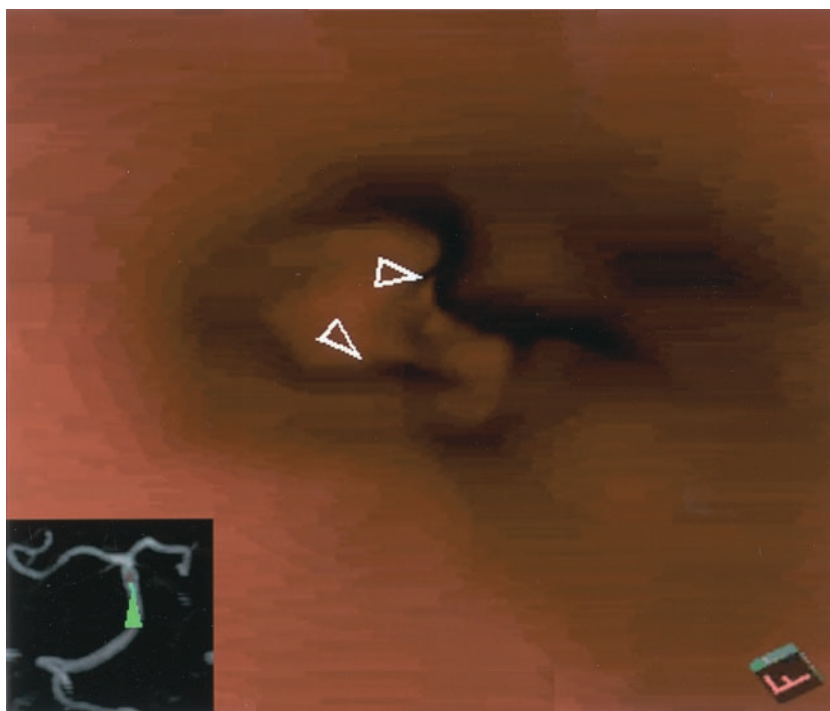


FIG 1. Images from the case of a 69-year-old man with acute pons infarction.

A, Axial T2-weighted MR image reveals hyperintense signals in the left pontine area (*arrowhead*). Note the normal flow void in the middle cerebral and basilar arteries.

B, Maximum intensity projection of the 3D time-of-flight MR angiogram shows a circumscribed, small signal intensity loss of the basilar artery at its terminal segment (*arrowhead*).

FIG 2. Virtual endoscopy (point of view is marked by *green arrowhead* in *small black window*) of the basilar artery shows an eight-shaped lumen due to incomplete fenestration (*white arrowheads*). Complete virtual endoscopic fly is available at www.ajnr.org.



single sections, but it does allow a practicable evaluation of the complex morphology of intracranial vessels. Therefore, in our opinion, virtual endoscopy has to be applied in select cases and must be evaluated combined with the conventional data sets.

Conclusion

Basilar artery fenestrations are rare findings that should not be misinterpreted as thrombosis, even if a brain stem infarction is noted. Virtual arterial endoscopic measures may be helpful in these cases, but online reconstruction requires a high power of computation.

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