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Case Report

Noninvasive Detection of a Ruptured Aneurysm at a Basilar Artery Fenestration with Submillimeter Multisection CT Angiography

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Summary: The criterion standard for the detection of intracranial aneurysms is digital subtraction angiography. MR imaging and CT provide good accuracy in the evaluation of brain arteries and aneurysms. We herein report a case of a ruptured aneurysm at a basilar artery fenestration. The diagnosis was assessed with 16-row multisection CT angiography and was confirmed by using digital subtraction angiography. The patient was successfully treated with coil placement.

A fenestration or a segmental duplication of the basilar artery, previously reported exclusively as an anatomic variation, owes its clinical interest to the possible association with aneurysms localized at the junctions of the fenestrated segments (1). The fenestration is frequently located in the proximal basilar trunk, close to the vertebrobasilar junction (2). Saccular aneurysms associated with fenestration, especially in the middle or distal portion of the basilar artery, are infrequent (3). An aneurysm at the fenestrated basilar artery usually arises at the proximal end of the fenestration, with few exceptions (4).

Basilar artery fenestration, with or without cerebral aneurysm, has been diagnosed by using digital subtraction angiography and MR angiography (5). The capability of CT angiography to diagnose this malformation has not been reported. We herein describe the first case of saccular aneurysm at the proximal end of the fenestration located in the middle portion of the basilar artery diagnosed with the new generation of 16-row multisection CT scanners.

Case Report

A 37-year-old woman was admitted to the hospital with the following symptoms: coma, meningeal syndrome, and stiff neck. Unenhanced CT was performed and showed signs of subarachnoid hemorrhage.

Subsequently, multisection CT angiography (Sensation 16; Siemens, Forchheim, Germany) was performed and depicted an intracranial aneurysm. Scanning was performed with the following parameters: detector rows, 16; collimation, 0.75 mm; feed/rotation, 12.0 mm; and gantry rotation time, 500 ms. A volume of 80 mL of contrast medium was injected at 4.0 mL/s through an antecubital vein with an automatic power injector. The scanning time was 3.1 s. The effective reconstructed section width was 0.75 mm, with a reconstruction index of 0.5 mm. The reconstructed data sets were sent to a workstation for postprocessing to create multiplanar reconstructions, maximum intensity projections, and 3D volume renderings (Fig 1A–C; Videos 1–3 [To view, see supplemental data at www.ajnr.org]).

Multisection CT angiography showed both the saccular aneurysm and the fenestration with their reciprocal relationships. The proximal junction, lumen duplication, and distal junction were visualized. The neck of the aneurysm was depicted at the proximal end of the basilar fenestration (Fig 1B; Video 2). The direction of the dome of the aneurysm was posterior (orthogonal to the axis of the basilar artery).

Subsequently, digital subtraction angiography (Angiostar; Siemens, Erlangen, Germany) was performed for confirmation and treatment planning and revealed a fenestration of the middle segment of the basilar artery with a saccular aneurysm. Because of the surgical difficulties anticipated in approaching the aneurysm, the patient was successfully treated with endovascular embolization using GDCs (Boston Scientific, Target Therapeutics, Natick, MA).

Discussion

The basilar artery is formed by fusion of the plexiform primitive longitudinal neural arteries in a craniocaudal direction by approximately the 5th fetal week (6). If these embryonic precursors fail to fuse completely, duplication or fenestration of the basilar artery results.

The word *fenestration* refers to localized duplication of a vessel. Fenestrated basilar arteries are found in 1.33% to 6% of anatomic dissections (7). Their angiographic prevalence has been described as ranging from 0.04% to 0.6% (7, 8). In one study, basilar artery fenestration was detected in 1.7% of cases by using MR angiography.

An association of the fenestration with an aneurysm is not different from the typical association of the bifurcation in the circle of Willis with saccular aneurysms. The incidence of aneurysms in association with basilar fenestration is 7% (5). Medial defects, a common feature in both brain arteries and fenestrations, may predispose the arterial fenestration to aneurysm formation (9).

No reports in the literature describe the CT angiographic detection of a saccular aneurysm associated with basilar artery fenestration. In this case report, an association between a ruptured saccular aneurysm

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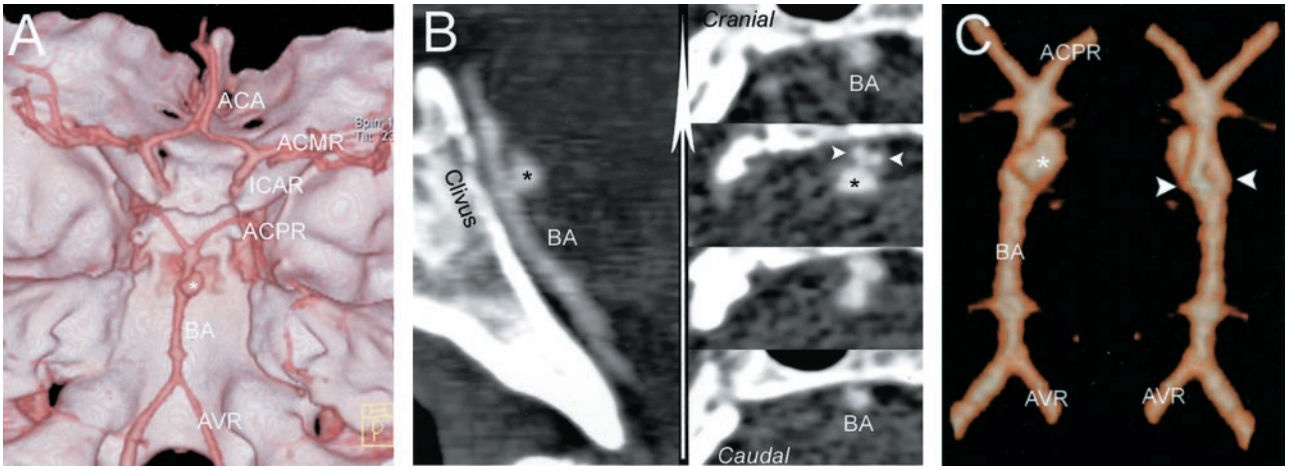

FIG 1. Scans from 16-row multisection CT and digital subtraction angiograms obtained before and after coiling.

A, 3D volume rendering of the multisection acquisition shows a panoramic view of the skull base with the position of the aneurysm (*asterisk*) at the middle segment of basilar artery.

B, Multiplanar reconstructions, obtained at the level of the clivus, show the position and configuration of the aneurysm and of the underlying basilar fenestration in the sagittal plane (*left*) and on sequential planes orthogonal to the clivus (*right*) through the basilar artery.

C, Segmented 3D volume rendering at the level of the basilar artery shows the aneurysm (craniocaudal view on *left*) and the fenestration (caudocranial view on *right*).

and a fenestration of the middle portion of the basilar artery is reported. An aneurysm was suspected after the clinical presentation of the patient and the detection of subarachnoid hemorrhage by unenhanced CT. Multisection CT angiography allowed us to make the diagnosis and showed the ruptured aneurysm and the congenital anatomic variant of the fenestration of the basilar artery. Digital subtraction angiography confirmed the findings of 16-row multisection CT.

One of the disadvantages reported with previous generations of CT scanners was the low scanning speed that resulted in visualization of cerebral veins together with cerebral arteries. This is because of the fast arteriovenous circulation time in the brain. Another reported disadvantage of CT angiography of cerebral arteries is the lack of spatial resolution needed to resolve small structures (eg, small aneurysms), especially those located at bone edges.

The new generation of spiral multisection CT scanners with 16 rows of detectors and 500-ms gantry rotation time allows fast data acquisition with high spatial resolution, reducing those pitfalls. Proper reconstructions and postprocessing allow better visualization of the vessels and their normal and abnormal morphologic features.

A limitation of this technique is blurring of the scan related to patient motion during scanning, even though the scanning time is very fast (3.1 s). Nevertheless, the limited amount of contrast material needed and the real-time display of the scans allows prompt scanning repetition. The advantages of multisection CT over digital subtraction angiography are related to its feasibility in any condition, its lower cost, its reduced invasiveness, and its high diagnostic accuracy.

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