Teaching NeuroImage: Primitive Drainage Pattern of Basal Vein of Rosenthal

An Underrecognized Cause of Perimesencephalic Subarachnoid Hemorrhage

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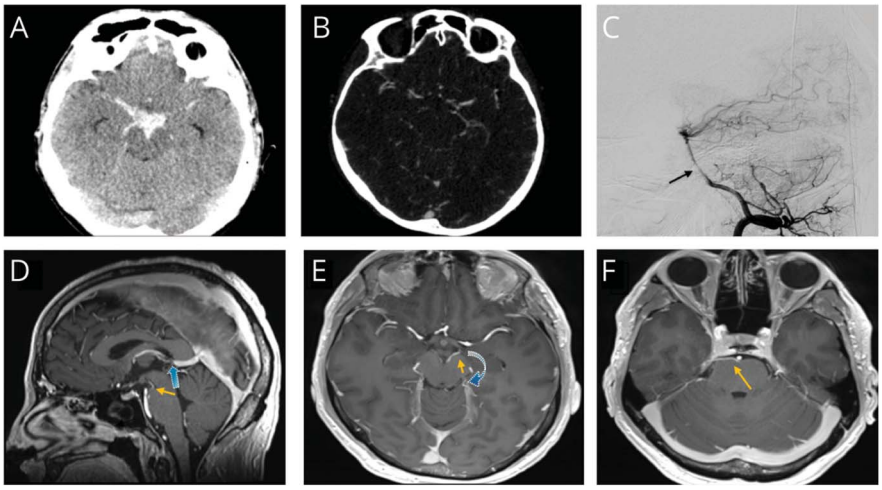
Figure 1 Imaging Findings of a Patient With Perimesencephalic Subarachnoid Hemorrhage Due to Primitive Drainage of BVR



Noncontrast axial brain CT scan on admission shows hyperdense signal in the basal cistern corresponding to perimesencephalic subarachnoid hemorrhage (A). No evidence of aneurysm is depicted on axial CT angiography (B). Sagittal DSA shows a severe basilar artery vasospasm (black arrow) (C), but no evidence of aneurysm or venous anomalies (venous phase of DSA not shown). At the 1-month follow-up, HR-MRI in sagittal plane of 3D T1 MP RAGE sequence shows a discontinuous drainage of BVR (yellow arrow) to the vein of Galen (blue arrow) (D). In the axial plane of the same sequence, veins of the interpeduncular cistern drain to the left BVR (yellow arrow). Note that the BVR does not follow its typical course to drain to the vein of Galen (blue arrow indicates the normal course of BVR), and this finding corresponds to a primitive BVR variant (E). Following the course of BVR at the pontine level (yellow arrow), we note drainage to the right tentorial sinus (F). Of note, that following the resolution of basilar artery vasospasm at the 1-month follow-up, no evidence of underlying aneurysm was detected on magnetic resonance angiography (images not shown). BVR = basal vein of Rosenthal; DSA = digital subtraction angiography; HR-MRI = high-resolution MRI.

A previously healthy 43-year-old man presented with coital thunderclap headache. A brain CT scan revealed a perimesencephalic subarachnoid hemorrhage (PMSAH). Digital subtraction angiography (DSA) showed a severe basilar artery vasospasm without underlying aneurysm (Figure 1). Under nimodipine treatment, the vasospasm resolved gradually. At a 1-month follow-up, a high-resolution (3T) MRI (HR-MRI) uncovered a primitive left basal vein of Rosenthal (BVR) draining to the lateral mesencephalic veins instead of the Galenic system.[1]

Approximately one-half of nonaneurysmal PMSAH are associated with primitive venous drainage variants (Figure 2).[2] These variants have been linked to hemodynamic perturbations, inducing retrograde flow, abrupt pressure changes and venous rupture, resulting in PMSAH.[2] Patients with BVR harbor a 4-fold increased risk of nonaneurysmal PMSAH compared with aneurysmal SAH.[1]

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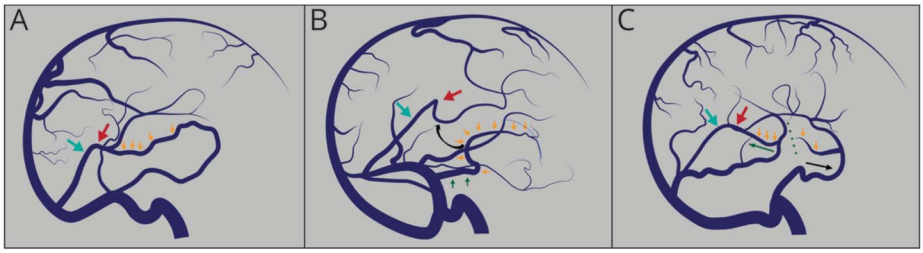
Figure 2 Different Variants of BVR Drainage



Sagittal view of brain venogram: BVR (orange arrow), vein of Galen (red arrow), and straight sinus (light green). In Panel A, there is continuous drainage of BVR into the vein of Galen (typical continuous type). Panel B illustrates a primitive drainage of BVR, such as in our case, which is associated with perimesencephalic subarachnoid hemorrhage. BVR does not follow its typical course to the vein of Galen (black curved arrow). The anterior part (orange arrow) drains to the petrosal sinus (dark green arrows), whereas the middle and posterior parts are missing. Disturbed venous drainage results in increased retrograde venous pressure, which eventually results in subarachnoid hemorrhage. Panel C illustrates another BVR anatomical variant (not observed in our patient) associated with subarachnoid hemorrhage. Discontinuous drainage of BVR is noted (dotted line), with the anterior part (black arrow) draining to the cavernous sinus, while the posterior part (dark green) drains to the vein of Galen. BVR = basal vein of Rosenthal.

Given the frequent unavailability of venous phase DSA, HR-MRI should be considered for the evaluation of primitive BVR and underlying venous anomalies in PMSAH. In patients with typical PMSAH, identification of primitive BVR by HR-MRI provides an underlying etiopathogenetic mechanism that may render a repeat DSA redundant.[1]

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