High-Resolution Vessel Wall MRI in Ruptured Cranial Dural Arteriovenous Fistulas

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Background

High-resolution magnetic resonance vessel wall (black blood) imaging (MR-VWI) is increasingly being used to characterize intracranial vascular disease. Recent work has shown promise in using this to identify the site-of-rupture in patients with multiple aneurysms and subarachnoid hemorrhage. Here we report our preliminary experience using MR-VWI in the evaluation of ruptured cranial dural arteriovenous fistulas (dAVFs).

Methods

We performed a retrospective review of patients with ruptured cranial dAVFs who underwent MR-VWI. All patients underwent standard imaging including non-contrast CT, CT angiography, and digital subtraction angiography (DSA). High-risk angioarchitectural features, e.g., venous-side aneurysms and varices, were identified and then evaluated with MR-VWI for (1) vessel wall enhancement, and (2) contiguity to the hemorrhage.

Results

High-risk angioarchitectural features were identified in 4/7 patients with ruptured cranial dAVFs (two patients with a single high-risk structure and two patients with multiple high-risk structures). In each of these cases, a single high-risk feature was demonstrated to have (1) selective, robust vessel wall enhancement, and was also (2) contiguous with the hemorrhage. In each of these patients, the identified structure is consistent with the site-of-rupture as defined by classical criteria. In the remaining three patients, no high-risk angioarchitectural features were identified.

Case Example With Vessel Wall Enhancement

Fig 1. An 87-year-old female presents with a ruptured cranial dAVF. Non-contrast head CT (A) demonstrates a midline cerebellar intraparenchymal hematoma. Diagnostic cerebral angiography (B) reveals a Borden Type III cranial dAVF arising from multiple posterior meningeal artery branches arising from the extracranial left vertebral artery, and draining directly into a midline cerebellar vein with a prominent bilobed venous varix (arrowhead and asterisk). High resolution black blood T1 weighted sagittal MRI (C) clearly resolves the bilobed venous varix (arrowhead and asterisk), demonstrating contiguity with the hematoma. Post contrast images demonstrate circumferential enhancement of the anterior pointing bleb, but NOT the posterior pointing bleb of the venous varix. (D-F are post contrast, serial sagittal slices of the delineated area in C, arrowhead indicates the enhancing anterior bleb, the asterisk indicates the non-enhancing posterior bleb).

Conclusions

Similar to its utility in ruptured aneurysms, MR-VWI may be useful in the evaluation of ruptured cranial dAVFs. Specifically, this work demonstrates that ruptured, arterialized venous structures also have robust vessel wall enhancement. MR-VWI may assist in identifying the site of rupture in cranial dAVFs.