Magnetic resonance angiography for intracranial arteriovenous malformation

A report demonstrates that Time-of-flight magnetic resonance angiography is a useful adjunct for planning stereotactic radiosurgery (SRS) of large arteriovenous malformations (AVMs) after staged embolization with Onyx.

Limiting SRS to regions of persistent arteriovenous shunting and excluding regions eliminated by embolization may reduce unnecessary radiation doses to eloquent brain structures. However, SRS dosimetry planning presents unique challenges after Onyx embolization because it creates extensive artifacts on CT scans, and it cannot be delineated from untreated nidus on standard MR sequences. During the radiosurgery procedure, MR images were obtained using a GE Signa 1.5-T unit. Standard axial T2 fast spin echo high-resolution images (TR 3000 msec, TE 108 msec, slice thickness 2.5 mm) were generated for optimal visualization of brain tissue and AVM flow voids. The 3D TOF MR angiography images of the circle of Willis and vertebral arteries were subsequently obtained to visualize AVM regions embolized with Onyx (TR 37 msec, TE 6.9 msec, flip angle 20 degrees). Adjunct TOF MR angiography images demonstrated excellent contrast between nidus embolized with Onyx and regions of persistent arteriovenous shunting within a large AVM prior to SRS. Additional information derived from these sequences resulted in substantial adjustments to the treatment plan and an overall reduction in the treated tissue volume [1)].

Case series

1995

Magnetic resonance (MR) angiography as a method for the long-term follow-up of cerebral arteriovenous malformations (AVMs) was assessed in 14 patients with cerebral AVMs. These patients were either untreated or treated with transarterial embolization and/or stereotactic radiosurgery (gamma knife). Two-dimensional- and three-dimensional (3D)Time-of-flight magnetic resonance angiography were useful for following AVMs with a small nidus and few feeders and drainers which were either untreated or had been treated only a few months previously. 3D Time-of-flight magnetic resonance angiography with a contrast agent was more useful for visualizing the vascular structure, including the residual nidus, during long-term follow-up of treated AVMs [2)].

1994

Over an 18-month period 4 patients with such malformations were examined by Magnetic resonance angiography (MRA). There was an arteriovenous malformation of the corpus callosum, a left parieto-rolandic arteriovenous malformation, a posterior thalamic arteriovenous malformation and a cerebellar arteriovenous malformation. All examinations were performed with a Magneton-Impact 1 Tesla machine (Siemens, Erlangen, Germany), using a head coil, Time-of-flight magnetic resonance angiography and differential arterial and venous saturations. Each patient was examined by MR-Angiography first at the beginning of treatment, then when ambulatory after embolization. The morphological study applied to the afferent vessels, the nidus and the efferent veins. MR-Angiography proved to be very good in identifying the arteries feeding the malformation, and this made it easier to evaluate the reduction of their input after treatment, without having recourse to any arteriography.

Beside, analysis of the nidus was facilitated by the judicious arrangement of arterial and venous saturations. In fact, the systematic use of MR-Angiography in the follow-up of intracranial arteriovenous malformations makes it possible to measure, with full reliability, the efficacy of the endovascular treatment under conditions of comfort unequalled in these out-patients, and selective angiography sequences need to be performed only during therapeutic phases [3].

1)

Loy DN, Rich KM, Simpson J, Dorward I, Santanam L, Derdeyn CP. Time-of-flight magnetic resonance angiography imaging of a residual arteriovenous malformation nidus after Onyx embolization for stereotactic radiosurgery planning. Technical note. Neurosurg Focus. 2009 May;26(5):E13. doi: 10.3171/2009.1.FOCUS08246. PubMed PMID: 19408991.

2)

Abe T, Matsumoto K, Horichi Y, Hayashi T, Ikeda H, Iwata T. Magnetic resonance angiography of cerebral arteriovenous malformations. Neurol Med Chir (Tokyo). 1995 Aug;35(8):580-3. PubMed PMID: 7566388.

3)

Tournade A, Krupa P, Tajahmady T, Oesterle H, Sengel C, Courthéoux P, Cerfon JF, Stilhart B, Coscia S, Srour R. [The role of magnetic resonance angiography in the follow-up of intracranial arteriovenous malformations treated by an intravascular approach]. J Neuroradiol. 1994 Dec;21(4):255-61. French. PubMed PMID: 7884487.