

Improvement of magnetic resonance angiography at 3 Tesla and clinical capability in patients with cerebral aneurysms after endovascular coiling: correlation with standard digital subtraction angiography

U. Wiesspeiner¹, R. Vollmann², H. Deutschmann², K. Leber³, and F. Ebner⁴

¹Department of Radiology, Medical University of Graz, Graz, Austria, ²Medical University of Graz, ³Neurosurgery, Medical University of Graz, ⁴Neuroradiology, Medical University of Graz

Background: The rate of recanalisation of cerebral aneurysms after incomplete endovascular coiling is up to 20% and implies a higher risk for rebleeding. Therefore long term follow-up imaging is required to detect neck-remnants and reperfusion. In addition follow-up has to screen for de-novo aneurysms and, if present, to monitor changes in aneurysm size. Two and three dimensional digital subtraction angiography (DSA) is up to now considered as gold standard technique for this purpose but it is an invasive procedure, needs to be performed repeatedly for years and is attended by higher radiation dose.

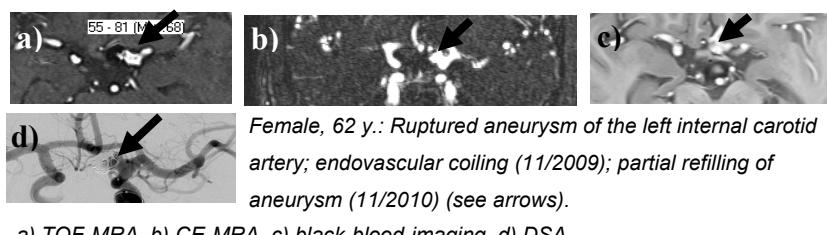
Objectives: The aim of the present study was to examine the diagnostic accuracy of 3.0 T MRA versus conventional (2D or 3) DSA in the assessment of complete occlusion, the presence of a neck remnant or partial refilling of the aneurysm in the presence of coil materials, which can produce field inhomogeneities and corrupt image geometry.

Methods and Materials: Eighty-seven patients (58 female, 29 male) with previously coiled intracranial aneurysms underwent 3.0T MRA and DSA within a time period of 3 to 12 months. The MR imaging protocol included time-of-flight (TOF)-MRA (TR/TE/α: 22/ 3.68/ 18°, TA: 04:19 min) and contrast enhanced (CE)-MRA (FLASH 3D TR/TE/α: 3.74/ 1.49/ 20°;GRAPPA, Accel.Factor:2; TA: 00:22 min). Patients with additional intravascular stents were excluded from analysis.

Consecutively complete occlusion, remnant or reperfusion and newly developed aneurysms were evaluated. Findings were assigned to five categories: exact match between MRA and DSA (1), minor discrepancy (2), considerable discrepancy (3) no match (4) and not diagnostic image quality (5). All images were analyzed retrospectively by three diagnostic and one interventional neuroradiologists and decision was achieved by consensus between them.

Results: DSA assessed complete occlusion in 44, neck remnant or reperfusion in 39 and de-novo aneurysms in 16 patients. 3.0T MRA found occlusion in 44, remnant/ reperfusion in 43 and de novo aneurysms in 22 patients. TOF and CE-MRA at 3.0 T depicted the Circle of Willis and its major branches (segments A1 to 2, P1 to 2, M1 to 3). In 87% of recurrent aneurysms there was an exact match or only minor discrepancies of MR findings compared with size and geometry on DSA.

	MRA	DSA	%
remnant or recurrence	43	39	91
complete occlusion	44	44	100
new aneurysm	22	16	73



Discussion: Even in the presence of coil material 3T-MRA has shown the capability to proof complete occlusion or reperfusion of cerebral aneurysms after endovascular coiling in the vast majority of patients and had a higher detection rate of small de-novo aneurysms at the Circle of Willis and its major branches compared with DSA. The diameter of newly developed aneurysms not verified on (2D)-DSA was less than 3mm.