Follow-up after endovascular therapy of cerebral aneurysms: a comparative study of angiographic CT versus time-of-flight MR-Angiography at 1.5 and 3 Tesla

J-H. Buhk[1], S. Leise[2], K. Kallenberg[2], A. Mohr[2], P. Dechent[1], and M. Knauth[2]

[1]MR-Research in Neurology and Psychiatry, University of Göttingen, Göttingen, Germany, [2]Dept. of Neuroradiology, University of Göttingen, Göttingen, Germany

Introduction: Angiographic computed tomography (ACT) is a further development of three-dimensional (3D) rotational angiography providing an even higher spatial resolution and the possibility of CT-like postprocessing including multiplanar reconstruction (MPR). In this study we applied ACT in follow-up examinations of patients after endovascular treatment of a cerebral aneurysm and compared the diagnostic results with time-of-flight (TOF) magnetic resonance angiography (MRA) at 1.5 and 3 Tesla.

Patients and methods: Eleven patients admitted for control angiography after endovascular therapy of a cerebral aneurysm participated in this study. Digital subtracted angiography (DSA) with ACT as well as TOF-MRA at 1.5 Tesla (Intera, Philips Medical Systems, Best, Netherlands) and 3 Tesla (Magnetom Trio, Siemens Medical Solutions, Erlangen, Germany) were conducted within 36 hours. DSA was performed on an angiographic system equipped with flat-panel-detectors (AxiomArtis dBA, Siemens Medical Solutions, Erlangen, Germany). The protocol for the rotational acquisitions was the following: 10 seconds rotation over 220°, 546 single acquisitions (InSpace3D and DynaCT, Siemens Medical Solutions, Erlangen). Subtracted and unsubtracted isotropic datasets in highest resolution (average slice thickness: 0.12 mm) were processed on a Leonardo workstation (Siemens Medical Solutions, Erlangen, Germany). The diagnostic analysis was performed by two neuroradiologists experienced in neurointerventions (A.M., M.K.) using MPR, three-dimensional maximum intensity projections (3D-MIP) and anatomically co-registrated MPR (3D-Fusion, Siemens Medical Solutions, Erlangen, Germany).

Results: The analysis of the TOF-MRA showed a complete consistence in between 1.5 and 3 Tesla. Neck remnants or recurrent fillings of the aneurysms could reliably be detected in all cases. No advantage was seen in the application of a high-resolution matrix at 3 Tesla. In contrast, the implant-induced artifacts were more pronounced at 3 Tesla, so that artificial vessel stenoses closely to the implants occurred more frequently (at 3 Tesla: 4 patients; at 1.5 Tesla: 2 patients). The assessment of stent lumina was rated as impossible in all TOF-MRA-datasets. Concerning the definite visualization of stent lumina, stent grids, single coil loops and smaller coil packages, ACT was the better technique. However, no valid insight into central parts of larger coil packages was possible by ACT. This finding occurred in three patients of our series, in all of them the aneurysm diameter was larger than 1 cm. The central fractions of these large coil packages showed a similar radiopacity as the parent vessel after intraarterial injection of contrast media. In one of the cases a residual filling of the aneurysm could only be detected in TOF-MRA (**Figure**). Neither DSA nor subtracted or unsubtracted ACT showed that finding.

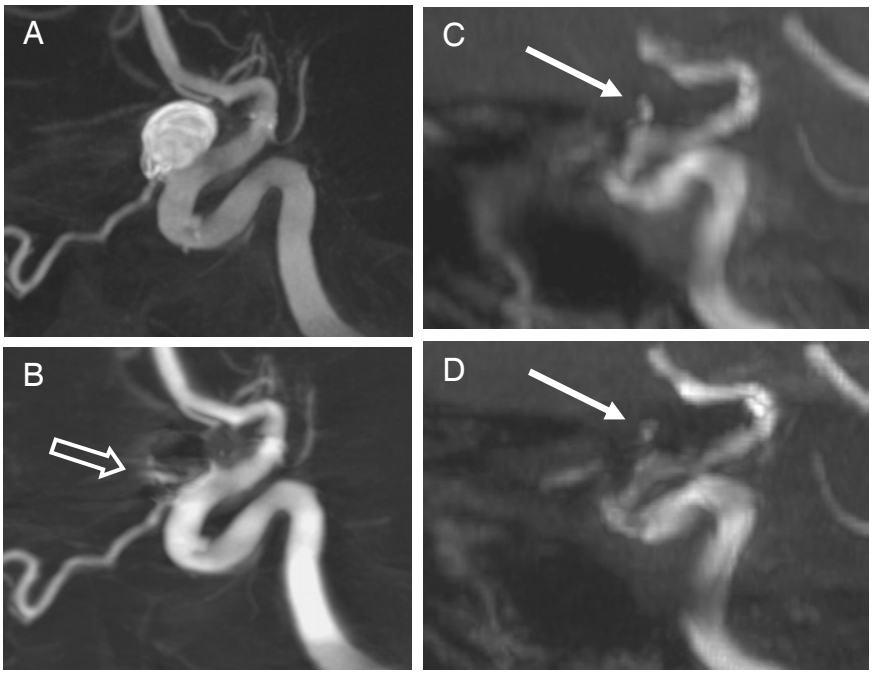

Figure: 10 mm MIP slices from the same patient following stent-protected coiling of an internal carotid aneurysm. The unsubtracted (**A**) and the subtracted (**B**) ACT-images provide excellent information about the parent vessel and – in this case – the ophthalmic artery, but they fail to reveal the small central filling as shown by TOF-MRA at 1.5 T (**C**, closed arrow) and 3T (**D**, closed arrow).

Note: the subtracted ACT-image shows a small movement artifact (**B**, open arrow)

Conclusion: We found an almost complete equivalence between TOF-MRA and ACT (DSA) concerning diagnostic imaging of cerebral aneurysms in follow-up after endovascular therapy. The only exception was a small residual filling that was not depicted in ACT. In our small series, performing an MRA at 3 Tesla did not lead to any further diagnostic benefit when compared to 1.5 Tesla. Our data confirm the most common follow-up protocols that recommend DSA (ACT) and MRA at 6 months following the intervention and mere MRA for further follow-up if there is a good correlation.