7 Tesla MRA enables differentiation between intracranial aneurysms and infundibula

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Target audience: Clinicians and MR physicists

Purpose: To investigate the added value of 7 Tesla high resolution angiography (MRA) in differentiating between aneurysms and infundibula compared to images acquired at 1.5T and 3T.

Introduction: Intracranial aneurysms occur in approximately 3% of the general population (1).With the improvement of imaging techniques incidental aneurysms are increasingly detected. Since growth is a risk factor for rupture, small unruptured aneurysms are usually followed over time with repeated imaging (2). In small lesions it is sometimes difficult with the spatial resolution of 1.5 or 3T MRA to discriminate a true aneurysm from an infundibulum. Infundibula are considered to be small physiological symmetrical funnel-shaped enlargements at the origin of cerebral arteries that do not require further follow-up. Because of the consequences for management, it is important to be able to reliably differentiate between aneurysms and infundibula preferably with a non-invasive technique. High resolution 7T MRA has been shown to be a promising technique to visualize small perforating arteries (3,4). This abstract investigates the added value of 7T MRA in differentiating true aneurysms from infundibula.

Methods: 5 patients in whom a small vascular lesion was detected at 1.5T or 3T, suspect for an aneurysm or infundibulum underwent an additional 7T MRI (Philips Healthcare, The Netherlands). A high resolution time-of-flight (TOF) sequence was employed using a quadrature volume transmit and 32 channel receive headcoil (InVivo, USA). Scan parameters were: 3D gradient echo, TR/TE/FA = 16ms/ 4.2ms/ 30°, 0.23mm isotropic resolution, 161 slices, with a SENSE factor of 3, resulting in a scan duration of 11 minutes. Because of the limited coverage of the 7T acquisition, the imaging volume was planned based on the previously acquired images at lower field strength.

age	sex	indication screening	location of suspected lesion	size	7T conclusion
59	M	family history of IA	focal bulging of left A2 segment	2.0 mm	infundibulum
41	F	migraine	focal bulging of left A2 segment	1.2 mm	infundibulum
36	F	cluster headache	out pouching of lateral part of left cavernous ICA	1.9 mm	infundibulum
35	F	family history of IA	focal bulging at the top of left carotid artery	1.0 mm	infundibulum
65	F	family history of IA	focal bulging of left A2 segment	1.3 mm	infundibulum

Table 1. Subject characteristics and diagnosis.
IA=intracranial aneurysms

Results and Discussion: Figure 1 shows maximum intensity projections of 3 sections from a 65 year old female with a family history of increased risk of aneurysms. The left column shows the images acquired at 3T, which showed a focal bulging of the vessel (either aneurysm, or infundibulum) between the anterior communicating artery and the A1 segment (full arrow). The images acquired at 7T (right column) confirms the presence of an infundibulum of an artery (dashed arrows). Another example is given in figure 2 showing a focal bulging at the location of the top of the left carotid artery in a 35 year old female. The left column shows the images acquired at 1.5T and the right column the 7T images. The 7T images confirm the presence of an infundibulum. The arrows point to the focal bulging. The data from all 5 patients is summarized in table 1. In all patients we were able to confirm the presence of an infundibulum and exclude an aneurysm based on the 7T images. Conventional angiography was needed in none of the patients and in all patients further follow-up could be omitted.

Conclusion: Our data suggest that high resolution of 7T TOF MRI is a useful new non-invasive tool that can help in discriminating true intracranial aneurysms from infundibula and can prevent repeated imaging and invasive techniques and exposure to radiation in patients with small vascular lesions of unknown origin.

References: 1. Vlak et al. Lancet Neurol. 2011(107); **2.** Juvela et al. Stroke 2001(32); **3.** Hendrikse et al. Cerebrovasc Dis 2008(26); **4.** Liem et al. Stroke 2010(41).

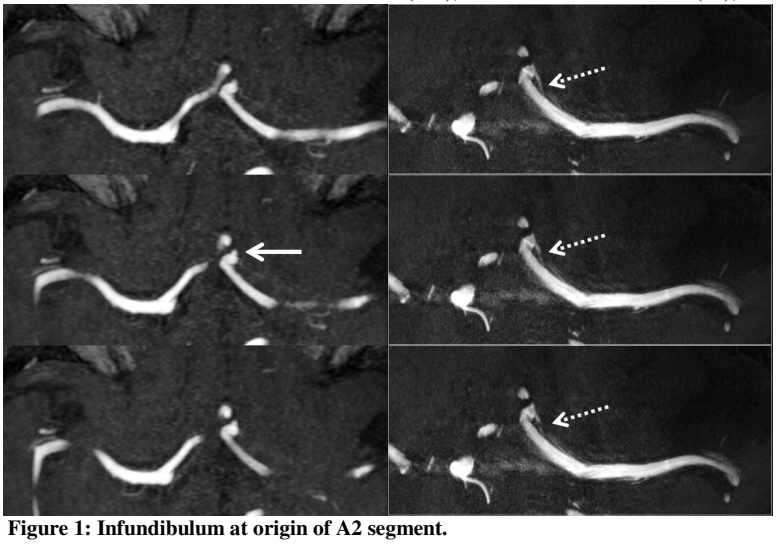

Figure 1: Infundibulum at origin of A2 segment.
MRA from a 65yo female, at 3T (left column) and 7T (right column). Full arrow points towards focal bulging of the vessel, dashed arrow shows origin of small vessel.

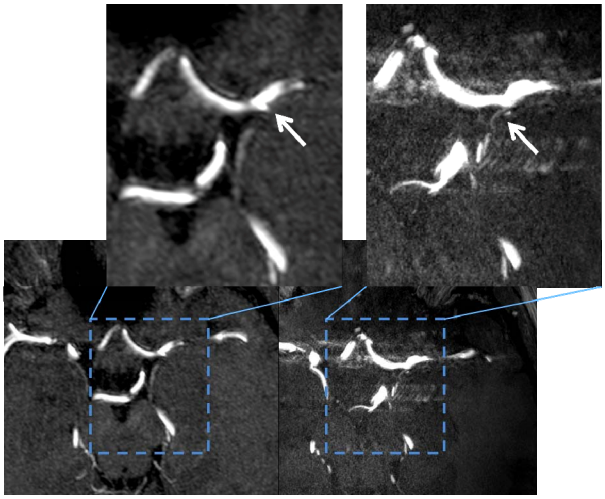

Figure 2: Infundibulum at left carotid artery
MRA from a 35yo female, at 1.5T (left column) and 7T (right column). Arrow points towards focal bulging. Top row shows zoomed sections