**Advanced MRI studies of the vascular burden in dementia**

**GJ Biessels on behalf of the UMC Utrecht VCI study group**

Department of Neurology, Brain Center Rudolf Magnus, University Medical Center Utrecht, NL

**Background:** Autopsy studies report vascular pathology in the majority of patients with dementia, also when the clinical diagnosis is Alzheimer’s disease. Conventional MRI scans do not fully capture this vascular burden in dementia. Our research program, using both 7T and 3T MRI, aims to establish new markers of microvascular pathology in the brain, addressing parenchymal lesions as well as blood vessel abnormalities.

**Methods:** Our projects involve different study populations, including 1) patients with Alzheimer’s disease or MCI, 2) patients with clinically manifest cardiovascular disease, including stroke, 3) patients with type 2 diabetes (a risk factor for dementia and cerebrovascular disease), and 4) healthy controls. Participants undergo both 3T and 7T MRI scans. The 7T scan is used for detection of microvascular lesions and high resolution non-contrast enhanced time-of-flight MR angiography. The 3T scan is used for automated analyses of brain, CSF and WMH volumes, DTI analyses of white matter integrity, and assessment of cerebral perfusion. Patients also undergo neuropsychological assessment. We perform validation studies in brain autopsy material combining post mortem imaging and histology.

**Results:** With 7T MRI we are now able to depict small intracranial arteries and veins in detail, including the arterial wall and surrounding perivascular spaces. We can assess atrophy of individual hippocampal subfields and compare those between subjects with and without dementia. Microbleed counts at 7T MRI are much higher than at regular field strength. Interestingly, we have shown that it is possible to depict cortical microinfarcts in vivo with 7T MRI, in a study that included verification in post-mortem material. We are currently linking these markers to specific disease conditions, etiological processes and cognition.

**Conclusion:** Advanced MR techniques allow us to depict novel and existing markers of small vessel disease in high detail. This provides new perspectives on the vascular burden in dementia across different clinical dementia subtypes.

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