Magnetic Resonance Imaging and Optical Coherence Tomography obtained in patients with acute Optic Neuritis

H.J. SIMONSEN1,2, K. KALLENBACH4, D. FUGLO1,2, M. LINDBARDT1,3, B.S. MØLLER1,3, B. SANDER5, M. LARSEN5, H.B.W. LARSSON1,2

1 FUNCTIONAL IMAGING UNIT, 2 DEPARTMENT OF CLINICAL PHYSIOLOGY AND NUCLEAR MEDICINE, 3 DEPARTMENT OF RADIOLOGY, 4 DEPARTMENT OF NEUROLOGY, 5 DEPARTMENT OF OPHTHALMOLOGY, GLOSTRUP HOSPITAL, UNIVERSITY OF COPENHAGEN, DENMARK

Background
Optic neuritis (ON) is a demyelinating disease in the optic nerve. It usually affects younger people, age 20-40 years and is often the initial symptom of Multiple Sclerosis (MS). Symptoms include pain on eye movement, progressive visual loss and later a spontaneous improvement in vision. The typical signs are decreased visual acuity, decreased color vision and contrast sensitivity and visual field defects. In the acute phase of optic neuritis around 1/3 of the patients present with a swollen optic disc (papillitis) on ophthalmoscopy where 2/3 have a normal appearing optic disc (retrobulbar neuritis). The demyelinating lesion on the optic nerve can be shown by Magnetic Resonance Imaging (MRI) and Optical Coherence Tomography (OCT) can quantify the thickness of the Retinal Nerve Fibre Layer (RNFL) surrounding the optic disc.

Aim
- To identify the lesion on the affected eye shown on MRI.
- To investigate if the location of the lesion on the optic nerve is related to the thickness of the RNFL.
- To investigate if the length of the optic nerve lesion is related to the RNFL.

Methods
Patients with acute monosymptomatic unilateral optic neuritis was included in the study (symptoms <28 days prior to examination). OCT measurements, included Fast RNFL thickness and Fast Macular Thickness, were performed at the Optic Neuritis Clinic at Glostrup Hospital. All MRI experiments were performed on a 3 T system (Philips Achieva, The Netherlands) with an eight-element SENSE head coil. To visualize the location and the length of the optic nerve lesion a T2 weighted SPAIR sequence (TR 3000, TE 80, slice thickness 2x2 mm, gap 0, slice number 30) with coronal-oblique images was obtained of the orbito frontal part of the brain. A trained MR technologist blinded to the clinical status of the patient evaluated each optic nerve and reported presence of a demyelinating optic nerve lesion, number of slices affected (length), and which slice number after the eyeball where affected (location). Images of low quality due to movement artefacts were omitted from the analysis.

Results and discussion
In 61.0 % of the cases (25/41), we identified the optic nerve lesion on the affected side, in 34.1 % of the cases (14/41), we did not identify a lesion on the optic nerve on either side, and in 4.9 % of the cases (2/41), we identified a lesion on the non-affected side. The length of the optic nerve lesion was calculated as the number of affected slices on the coronal images. We calculated the median number of affected slices and found it to be 3 (range: 0-15). The median starting point of the optic nerve lesion was 4 slices after the eyeball (range: 0-13). The geometric mean of the RNFL thickness in the affected eye was 123.07µm and 93.38µm in the non-affected eye. Regression analysis showed that the average of the RNFL thickness was significantly correlated with the lesion length (number of slices affected), but no relation between the beginning of the lesion on the optic nerve and the RNFL thickness. Identification of optic nerve lesions might improve if more scan planes were obtained or additional T1-weighted sequences were obtained following Gadolinium in normal or triple dose, but this was not possible here due to time constraints.

E-mail: hejusi01@glo.regionh.dk

Acknowledgement
Supported by the Lundbeck Foundation via the Lundbeck Foundation Center for Neurovascular Signaling (LUCENS)