

Can optic nerve MTR and OCT distinguish between multiple sclerosis and neuromyelitis optica?

Lise Magnollay, Floriana De Angelis, Viktor Wottschel, Ahmed Toosy, Carmen Tur, Marios Yiannakas, Rosa Cortese, David Miller, Olga Ciccarelli

Introduction: Optic neuritis (ON) occurs in both multiple sclerosis (MS) and neuromyelitis optica (NMO), but is usually more severe in NMO. This study compared optic nerve magnetic transfer ratio (MTR) and retinal nerve fibre layer (RNFL) thickness, obtained with optic coherence tomography (OCT), of the affected and fellow eye between NMO and relapsing-remitting (RR) MS patients. In the patient groups, the relationships between MTR and OCT biomarkers and visual acuity (VA) were explored.

Methods: 14 NMO and 3 NMOSD (spectrum disorder) patients (13F, mean age 49yrs \pm 12, median EDSS 4 (range 2-6), 7 with unilateral and 5 bilateral ON), 12 RRMS patients (8F, mean age 40yrs \pm 10, median EDSS 3.5 (range 1-7.5), 5 with unilateral and 1 bilateral ON) and 21 healthy controls (HC) (10F, mean age 33yrs \pm 10) were scanned at 3T and RNFL was measured on a Spectralis OCT. The MTR of the optic nerves were calculated and analysed using automated ROIs. VA was assessed in patients with letter charts and 100-hue test. Multiple linear regressions adjusted for age, gender and disease duration were used to compare MTR and OCT biomarkers between the different groups.

Results: NMO patients showed lower MTR in the affected optic nerves than HC (regression coefficient (RC) -5.23, 95%CI -7.6, -2.87, $p < 0.001$) and borderline evidence for lower MTR in the affected optic nerves than RRMS (RC -4.23, 95%CI -9.17, 0.7, $p = 0.09$). Similarly, NMO patients showed lower MTR in the fellow eye than HC (RC -2.18, 95%CI 4.56, -0.52, $p = 0.02$) and RRMS (-2.67, 95%CI -4.78, -0.58, $p = 0.013$). RRMS did not have a lower MTR in the affected and fellow eyes than HC. RNFL thickness in the affected eye was lower in RRMS than HC (RC -22.2, 95%CI -39.1, -5.31, $p = 0.012$) and in NMO than HC (RC -29.4, 95%CI -50.9, -7.9, $p = 0.009$), but did not differ between NMO and RRMS. The RNFL thickness in the fellow eye did not differ between groups.

In patients, the VA of the affected eye was associated with the corresponding optic nerve MTR (NMO: RC -0.12, $p < 0.001$, MS: RC -0.04, $p < 0.001$). This association was stronger in NMO patients ($p < 0.001$). VA in the unaffected eye was associated with optic nerve MTR but only in MS (RC -0.04, $p < 0.001$).

Conclusion: Optic nerve MTR seems to distinguish between MS and NMO more effectively than OCT, though the use of OCT in NMO was limited by the low visual acuity of some patients. Optic nerve MTR is associated with visual acuity and could become a useful outcome measure for clinical trials in NMO.

L. Magnollay, V. Wottschel, F. De Angelis, M. Yiannakas and Rosa Cortese have nothing to disclose. O. Ciccarelli receives research grant support from the Multiple Sclerosis Society of Great Britain and Northern Ireland, the Department of Health Comprehensive Biomedical Centre, the International Spinal Cord Research Trust (ISRT) and the Engineering and Physical Sciences Research Council (EPSRC); she serves as a consultant for Novartis, Biogen and GE and payments are made to UCL Institute of Neurology. A. Toosy has received speaker honoraria from Biomedica, Sereno Symposia International Foundation and Bayer. C. Tur received a McDonald Fellowship (from the Multiple Sclerosis International Federation) in 2007, and has received anECTRIMS post-doctoral research fellowship in 2015. She has also received honoraria and support for travelling from Bayer-Schering, Teva, Merck-Serono and Serono Foundation, Biogen, Sanofi-Aventis, Novartis, and Ismar Healthcare. D.H. Miller has received honoraria, through payments to UCL Institute of Neurology, for Advisory Committee and/or Consultancy advice in multiple sclerosis studies from Biogen Idec, GlaxoSmithKline, Novartis, Merck, Chugai, Mitsubishi Pharma Europe and Bayer Schering Pharma and has received compensation through payments to UCL Institute of Neurology for performing central MRI analysis of multiple sclerosis trials from GlaxoSmithKline, Biogen Idec, Novartis and Merck.