Abstract 47604

Multicomponent T2 relaxation complements diffusion MRI in the characterization of T2 hyperintensities related with Neurofibromatosis type 1

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Purpose/Introduction

In Neurofibromatosis type 1 (NF1), so-called “unidentified bright objects“(UBOs), have been shown to correlate with learning difficulties[1]. Although the exact nature of UBOs is not known, one hypothesis is vacuolization of the myelin sheath and astroglial cell proliferation. The present in vivo study assesses the microstructure of UBOs using diffusion kurtosis imaging (DKI) and myelin water imaging (MWI).

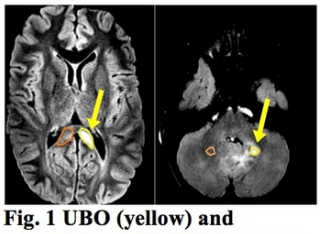


Fig. 1 UBO (yellow) and contralateral NAWM (orange) on T2-weighted image

Subjects and Methods

10 NF1 patients were scanned (3T Philips Achieva).

DKI scan: 700, 1000 and 2800 s/mm2 along 25, 40 and 75 directions, respectively. Using ExploreDTI[2], fractional anisotropy (FA), mean, axial and radial diffusivity (MD, AD, RD) were estimated, as well as kurtosis anisotropy (KA), mean, axial and radial kurtosis (MK, AK, RK), axonal water fraction (AWF) and extra-axonal tortuosity (TORT).

MWI scan: 3D GraSE 32-echo [3][4]. Myelin water fraction (MWF), intra-and extracellular water fraction (IEWF), geometric mean T2 (gmT2) and peak width of resulting T2 distribution peaks [5] were calculated.

ROIs around 20 UBO sites and contralateral NAWM were drawn on T2w-FLAIR (Fig. 1) and registered to the b0-image for DKI and mean echo image for MWI. A Wilcoxon signed ranks test was applied.

Results

Significant increases in UBOs compared to NAWM were found for MD, RD, IEW-gmT2 and IEW-PW (Fig.2). FA, MK, RK and KA were lower in UBOs than in cNAWM. No significant changes were found for AD, AK, MWF, IEWF, AWF or TORT

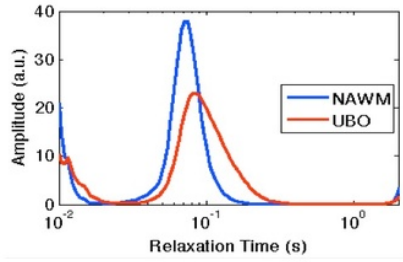


Fig.2 UBO sites show an increased peak width and gmT2 in the T2-distribution

FA	MD	AD	RD		
UBO<NAWM	UBO > NAWM	/	UBO>NAWM		
0.001	0.005	0.058	0.002		
KA	MK	AK	RK	AWF	TORT
UBO<NAWM	UBO<NAWM	/	UBO<NAWM	/	/
0.001	0.005	0.305	0.004	0.859	0.213
G-gmT2	MW-gmT2	IEW-gmT2	IEW-PW	MWF	IEWF
UBO>NAWM	/	UBO>NAWM	UBO>NAWM	/	/
0.012	0.508	0.005	0.047	0.646	0.799

Table 1. P-values of paired comparison between 20 UBOs and contralateral NAWM.

Discussion/Conclusion

RD and RK were found altered in UBOs compared to NAWM, indicating a variety of diffusional compartments[6], possibly intramyelinic edema. This hypothesis is strengthened by a broadened intra- and extracellular water peak (IEW-PW) and geometric mean T2 time (IEW-gmT2), which may indicate edema formation[7].

Although RD and RK can relate to myelin breakdown [8], MWF was not lower in UBOs compared to NAWM. This suggests that no demyelination is involved in NF1-related T2 hyperintensities.

References

[1]Piscitelli, O., M. C. Digilio, et al. *Dev. med. ch. neur*. 54(1): 49-51 (2012) [2] Leemans, A. *Proc. Intl. Soc. Mag. Reson. Med*. (2009) [3] Madler, B., S. A. Drabycz, et al. *Magnetic resonance imaging 26(7): 874-888* (2008) [4] Prasloski, T., A. Rauscher, et al. *Neuroimage 63(1): 533-539* (2012) [5] MacKay, A., C. Laule, et al. *Magnetic resonance imaging 24(4): 515-525* (2006) [6] Jensen, J. H. and J. A. Helpern, *NMR in biomedicine 23(7): 698-710* (2010) [7] Vavasour, I. M., C. Laule, et al. *J. M.R.M. 33(3): 713-718* (2011) [8] Hui, E. S., M. M. Cheung, et al. *Neuroimage 42(1): 122-134* (2008)

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