Magnetic resonance perfusion predicts disease severity in early multiple sclerosis.

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Aims and objectives

Perfusion weighted imaging (PWI) is a well established advanced MRI technique in neuroradiology [ref. 1, 2]. However, the utility of PWI in multiple sclerosis (MS) is not well explored. The aim of this study was to compare normalized perfusion measures in subgroups of newly diagnosed MS patients defined according to disease severity and disease activity at one-year follow-up. Figure 1. shows principles of PWI: the DSC MRI perfusion sequence is acquired after intravenous gadolinium-based bolus contrast injection. The perfusion data are processed using arterial input function, resulting in parametric perfusion maps of CBF, CBV and MTT. In our study the perfusion analysis was performed with the nordicICE software.

Images for this section:

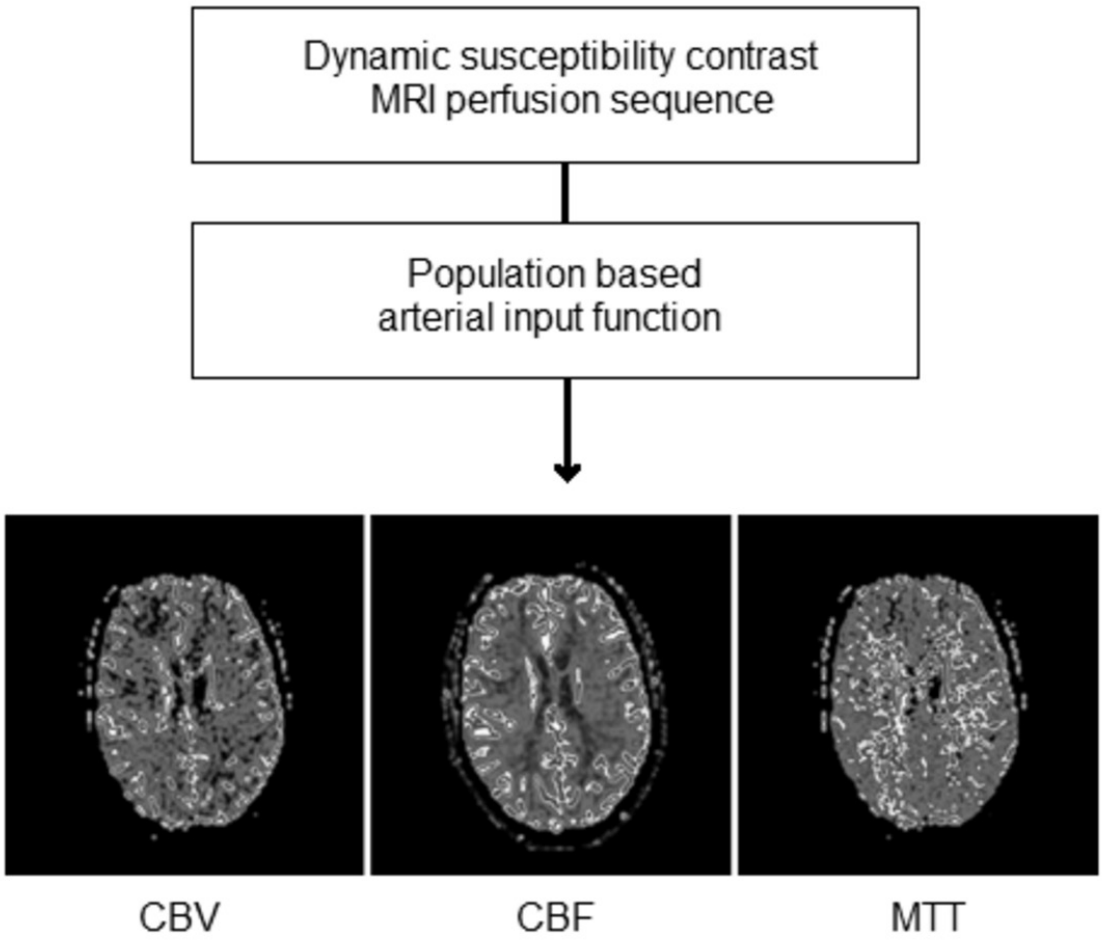

Fig. 1: Fig. 1 Principles of PWI. CBF: cerebral blood flow; CBV: cerebral blood volume; MTT: mean transit time; PWI: perfusion weighted imaging.

Methods and materials

Baseline MRI including a dynamic susceptibility contrast perfusion sequence was performed on a 1.5 Tesla scanner in 66 patients newly diagnosed with relapsing-remitting MS (on average 14 months after diagnosis). Cerebral blood flow (CBF), cerebral blood volume (CBV) and mean transit time (MTT) maps were generated from the baseline MRI and their values in white matter lesions (WML) were normalized (n) to normal appearing white matter (NAWM). Neurological examination was performed at baseline and at follow-up approximately one year later to assess the multiple sclerosis severity score (MSSS) and evidence of disease activity (EDA). Figure 2. shows co-registered FLAIR series, white matter (WM) and WML masks, and MTT map in a sample patient. Normalized perfusion measures were calculated by dividing each perfusion parameter obtained in WML (red) by the same parameter obtained in NAWM (blue), using WM and WML masks.

Images for this section:

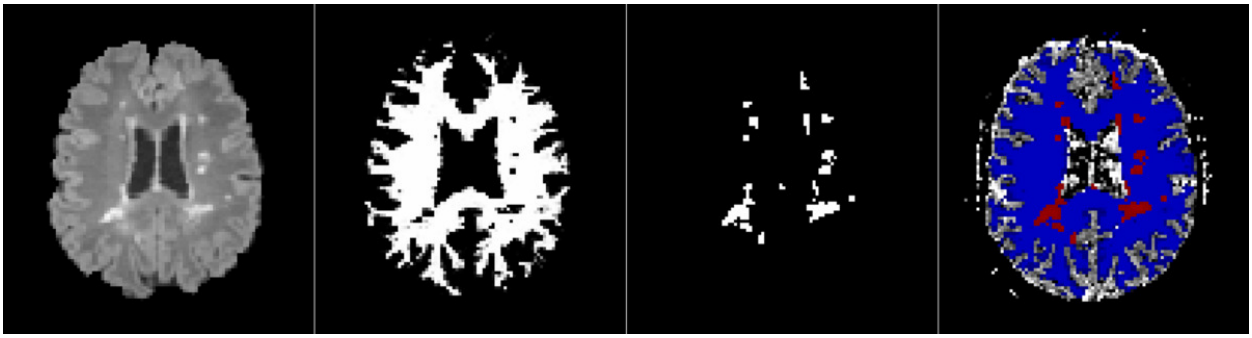

Fig. 2: Fig. 2 Co-registered FLAIR series, WM and WML masks, and MTT map in a sample patient. FLAIR: fluid-attenuated inversion recovery; MTT: mean transit time; WM: white matter; WML: white matter lesions.

Results

Baseline nMTT was significantly lower in patients with higher severity as defined by MSSS>3.79 (p=0.016), in patients with EDA (p=0.041) and in patients with both higher severity and EDA (p=0.032) at one-year follow-up. The nCBF and nCBV were similar in these groups. Figure 3. shows baseline nMTT in groups defined according to disease severity by MSSS (A), disease activity by EDA/NEDA status (B) and both disease severity and disease activity (C), n=65.

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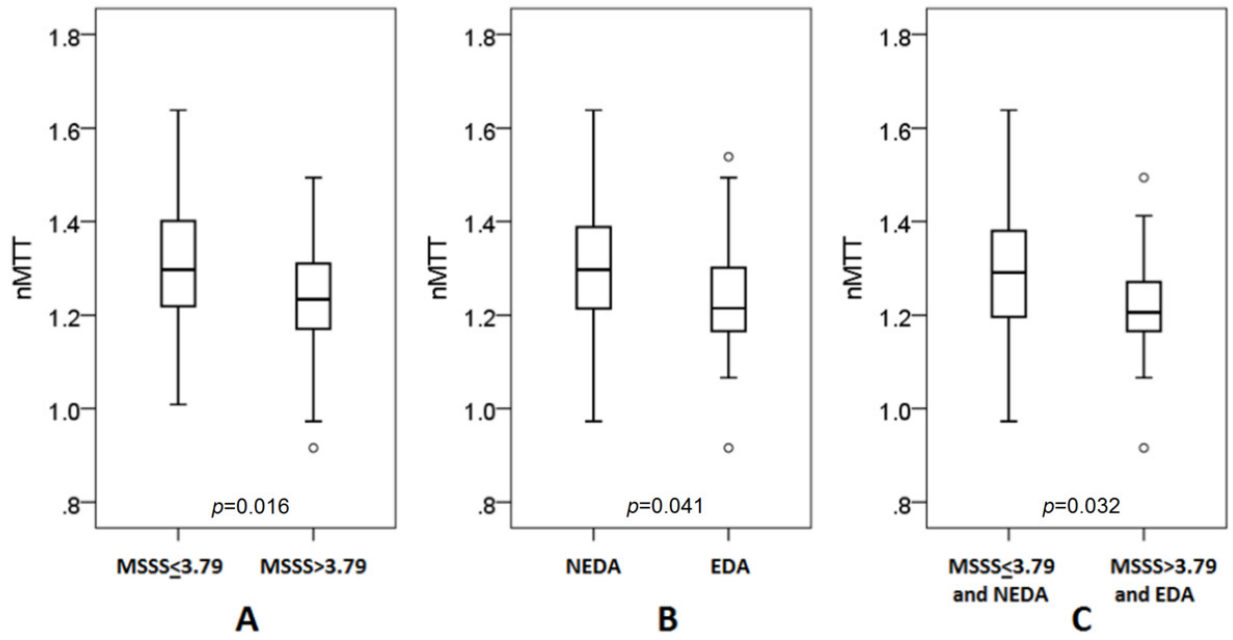

Fig. 3: Fig. 3 Baseline nMTT in groups defined according to disease severity by MSSS (A), disease activity by EDA/NEDA status (B) and both disease severity and activity (C), n=65. EDA: evidence of disease activity; MSSS: multiple sclerosis severity score; NEDA: no evidence of disease activity; nMTT: normalized mean transit time

Conclusion

Lower baseline nMTT was associated with higher disease severity and with presence of disease activity one year later in newly diagnosed MS patients. Further longitudinal studies are needed to confirm whether baseline normalized perfusion measures can differentiate between disease severity and disease activity groups over time.

Personal information

References

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2. Petrella J.L. et al., MR perfusion imaging of the brain: techniques and applications. AJR Am J Roentgenol. 2000 Jul;175(1):207-19.