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Purpose

Hemodynamic changes in MS have long been acknowledged and advances in perfusion MR imaging have allowed for examinations of these changes. Recent studies have shown decreased perfusion in lesions as well as normal appearing white matter in patients with RR-MS. However, perfusion in PP-MS has yet to be explored. PP-MS is often neglected in clinical trials of disease-modifying agents due to a relative lower rate of new T2 lesions formation and lower amount of inflammatory lesions compared to RR-MS. As a consequence, no treatments are currently available for PP-MS patients. Perfusion imaging might provide in-vivo surrogate markers for a more effective monitoring of PP-MS progression. The aim of this study was to assess the extent of perfusion abnormalities in the deep gray matter of PP-MS patients in comparison to RR-MS patients and healthy controls.

Materials and Methods

Eleven patients with PP-MS, eleven patients with RR-MS, and nine healthy controls underwent the following MRI protocol on a 3.0 Tesla imaging unit: axial pre- and post-contrast T1-weighted, T2-weighted images and dynamic susceptibility contrast (DSC) enhanced T2*-weighted sequences. In each subject, cerebral blood flow (CBF), cerebral blood volume (CBV), and mean transit time (MTT) were measured using regions of interest (ROI) analysis. Measurements were taken bilaterally in corresponding areas of normal appearing thalamus and lenticular nuclei in all subjects (Fig 1). Least-squares regression analysis was used to compare perfusion measures in each region after adjusting for age, gender, and disease duration.

Results

CBF in the thalamus and lenticular nuclei were found to have significant differences among the three subject groups ($p < 0.0029$) when adjusted for age, gender, and region, with or without adjustment for disease duration. CBF was reduced in both PP-MS and RR-MS patients compared to controls and CBF was significantly reduced in PP-MS compared to RR-MS. Similarly, CBV in the thalamus and lenticular nuclei were found to be significantly different in the three patient groups ($p < 0.0046$). CBV was reduced in PP-MS and RR-MS compared to controls and CBV was significantly reduced in PP-MS compared to RR-MS. No significant differences were found in MTT in the thalamus or lenticular nuclei when comparing the three patient groups.

Conclusion

Perfusion measurements showed significant differences in CBF and CBV between PP-MS and RR-MS patients, suggesting a more severe vascular involvement in the pathogenesis of the former. DSC perfusion imaging might provide a useful in-vivo marker for monitoring disease progression in PP-MS.

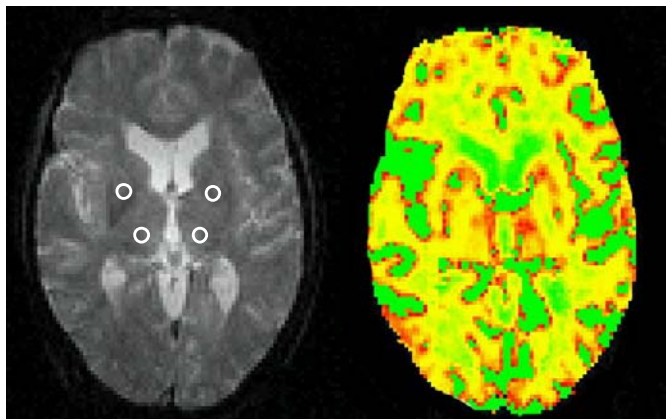


Fig 1. Left: Axial gradient-echo echo-planar MR image from a patient with PP-MS. Circular regions of interests are placed in the thalamus and lenticular nucleus bilaterally. Each ROI has an in-plane resolution of 2 pixels and was placed after visual co-registration with the transverse T2-weighted image to ensure that lesions were not included in the ROI. **Right:** Axial color-coded CBF map from the same patient.