

Regional quantifying normal-appearing white matter perfusion in mild to moderate hypertension using 3D pseudo-continuous arterial spin labeling

Ting Wang¹, Yanhua Li², Xinhong Guo², Diandian Huang¹, Lin Ma¹, and Xin Lou¹

¹Department of Radiology, Chinese PLA General Hospital, Beijing, Beijing, China, ²Department of Cardiology, Chinese PLA General Hospital, Beijing, Beijing, China

PURPOSE

White matter (WM) is the predilection area of lacunar infarction¹ in hypertensive patients. It was hypothesized that abnormal CBF in WM appeared at early stage of hypertension, hence, our objective was to explore the hemodynamic changes of the normal-appearing WM in hypertension using 3D pcASL technique².

METHODS

Sixty subjects, including a hypertensive group (n,30; male,23; age,47.9±8.5years; test-time SBP,155±23mmHg) and a control group(n,30; male,14; age,45.7±8.6years; test-time SBP,117±8mmHg), were recruited and scanned on a 3.0T MR system using the 3D pcASL sequence. The CBF data were calculated from eight regional WMs, including right and left centrum semiovale, right and left anterior and posterior periventricular WM, and genu and splenium of corpus callosum (CC)(Fig.1) for two times by a single observer. The intraobserver CBF values were mainly evaluated with the intraclass correlation coefficient(ICC), and independent sample t test was performed to compare the significance of the inter-group difference in CBF modifications.

RESULTS

Compare to healthy volunteers, CBF values in various normal-appearing WM regions were observed to be lower in hypertensive patients, with statistical difference at the centrum semiovale (R:25.45±3.45 vs 21.11±4.13, $P=0.000$; L:25.87±3.69 vs 21.58±3.12, $P=0.000$), anterior periventricular WM (R:23.09±3.99 vs 19.92±3.75, $P=0.002$; L:23.97±4.34 vs 20.3±3.77, $P=0.001$), posterior periventricular WM (R:27.9±4.46 vs 21.8±4.02, $P=0.000$; L:26.84±5.1 vs 21.76±3.43, $P=0.000$) and splenium of CC (34±4.86 vs 30.4±4.28, $P=0.003$). Nevertheless, the CBF values in the genu of CC demonstrated no statistically significant (28.64±4.35 vs 26.85±4.31, $P>0.05$) inter-group differences. Furthermore, the intra-observer variability was relatively insignificant, with ICC ranging from 0.708 to 0.911(Fig.2).

CONCLUSION

3D pcASL has ability to detect the subtle hemodynamic abnormalities even at the early stage of hypertension. Furthermore, the focal decrease of CBF in several particular WM regions may suggest an increased potential of cerebral small vascular complications.

REFERENCES

1. Jones DK, et al. Characterization of white matter damage in ischemic leukoaraiosis with diffusion tensor MRI. Stroke 1999;30:393-7
2. Wen-Chau Wu, et al. Measurement of Cerebral White Matter Perfusion Using Pseudo-continuous Arterial Spin Labeling 3T Magnetic Resonance Imaging - an Experimental and Theoretical Investigation of Feasibility. PLoS One 2013;8:e82679

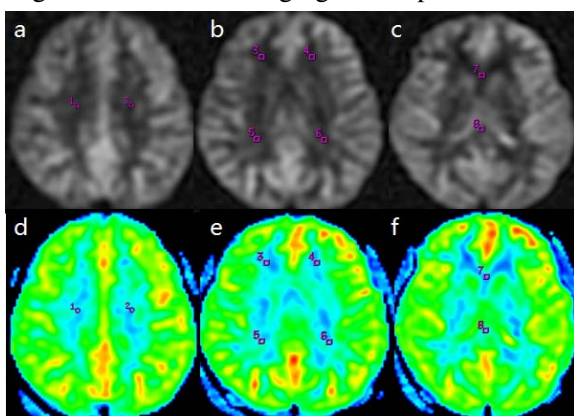


Fig. 1 ROIs (circular, 18mm²) were placed in 8 regions of normal-appearing WM in a symmetric fashion on 3D ASL raw data images (a,b, c) and CBF images (d, e, f).

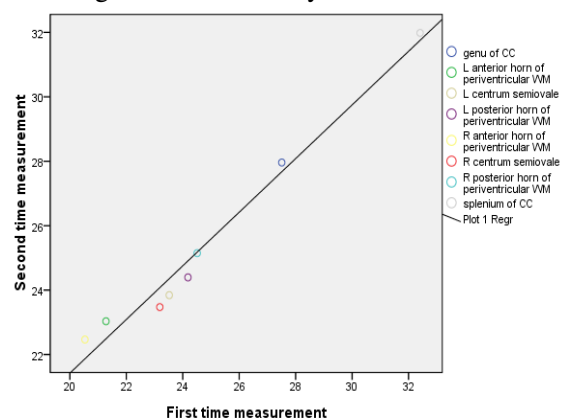


Fig. 2 Correlation plots between two sets of measurements of the 8 regional ROIs. The plots demonstrated high relationship between two sets. Perfusion was measured in units of mL/100 cc gray matter/min.