Simultaneous ASL/FDG-PET Imaging of Frontotemporal Dementia

Jing Zhang[1,2], Elizabeth Finger[1,2], Udunna Anazodo[2,3], Julia MacKinley[2], John Butler[2], Frank Prato[2,3], and Keith St Lawrence[2,3]
[1]*Department of Clinical Neurological Sciences, University of Western Ontario, London, Ontario, Canada,* [2]*Lawson Health Research Institute, London, Ontario, Canada,* [3]*Department of Medical Biophysics, University of Western Ontario, London, Ontario, Canada*

Purpose: Clinically feasible and sensitive means of detecting early neural dysfunction are needed for FTD patients who do not demonstrate significant brain atrophy. FDG-PET increases the diagnostic accuracy of FTD, but it is expensive and has limited access. Using ASL to image cerebral blood flow (CBF) may be a promising alternative due to the tight coupling of CBF to neural activity [1, 2]. For this study, ASL and FDG-PET images were acquired simultaneously. The goal was to compare the ability of each technique to distinguish FTD patients from age-matched controls.

Methods: This study involved 11 FTD patients (5 females, mean age: 66.1 ± 8.3 years) and 10 age- and gender-matched controls (6 females, mean age: 67.0 ± 6.6 years). Anatomical MRIs, pseudo-continuous ASL (3D GRASE [3], post-labeling delay=1.5s, labelling duration =1.5 s, voxel size=3.8x3.8x6mm^3) and FDG-PET images were acquired on a Siemens Biograph PET-MR scanner. MR images were segmented and the functional images were registered to the MNI brain with FSL. WFU PickAtlas was used to generate regions of interest (ROIs) for the frontal, temporal, parietal and occipital lobes. Correlation analysis of normalized CBF and FDG standard uptake values was performed using SPSS.

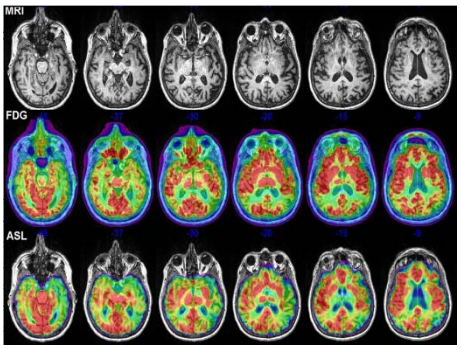

Figure 1. Representative MRI, FDG-PET, and ASL images from one patient.

Results: ASL and FDG-PET images from one patient are shown in Fig. 1. CBF and FDG values were positively correlated in whole-brain gray and white matter as well as in frontal and temporal lobes (Table 1). Correlation was not found in the parietal and occipital lobes, which may be due to watershed artifacts in the parietal-occipital junction on ASL in old subjects [4, 5]. Significant group differences in both CBF and FDG uptake were found in the GM and the frontal lobe (Figure 2).

Region	GM	WM	FL	TL	PL	OL
R	**0.74**	**0.48**	**0.61**	**0.57**	0.36	0.16

Table 1. Correlations of rCBF and rCMRGlc in grey matter (GM), white matter (WM), frontal lobe (FL), temporal lobe (TL), parietal lobe (PL) and occipital lobe (OL). R: correlation coefficient. Bold font: signifies significant ($p<0.05$)

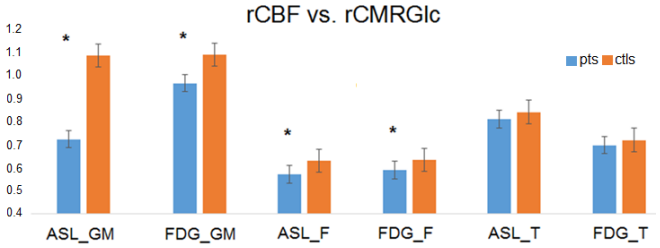

Figure 2. rCBF and rCMRGlc in GM and frontal lobe (F). *p<0.05.

Conclusions: The regional agreement between ASL and FDG-PET results suggests that the former may be a promising alternative for detecting regional functional dysfunction associated with FTD.

References

1. Cha et al., J Cereb Blood Flow Metab. 2013, 33(12): 1909-14.
2. Chen et al., Neurology. 2011, 77:1977-1985.
3. Günther, et al. Magn Reson Med. 2005;54(2):491-8.
4. Zaharchuk et al., Radiology. 2009;252(3):797-807.
5. Musiek et al., Alzheimers Dement. 2012. 8(1):51-9.