Longitudinal changes of R2 star and diffusion parameters in substantia nigra of Parkinson's disease patients.

G.Arribarat, O. Pasternak, O. Rascol, P. Péran.

Purpose/Introduction

Previous studies showed changes of several MR parameters in the substantia nigra (SN) of Parkinson's disease (PD) patients. An increase of iron-related MR parameter (e.g. R2*) in the SN have been showed in PD patients compared to healthy controls [1]. Similarly, several diffusion markers in the same region also showed a significant modification in PD [2] [3].

The aim of this study was to determine which marker is most sensitive to PD diagnosis and disease progression, with patients followed for 3 years.

Subjects and Methods

Using 3T-MR, we measured T2* relaxometry and diffusion tensor imaging (DTI) in 19 PD patients and 22 controls. We calculated the different parametric maps for each patient: R2*, Fractional anisotropy (FA), Mean diffusivity (MD), Free-Water (FW), Free-water-corrected fractional anisotropy (FAc), Free-water-corrected mean diffusivity (MDc).

After normalization of the images in MNI space, bilateral SN was manually segmented [1][4]. The averages values of each parameters have been computed for each individual. For each parameters, we conducted (i) comparison between PD patients and controls (ii) evaluation of longitudinal changes.

Results

The result of the comparison between PD and control showed significant differences for the diffusion parameters and R2*, with different regions of interests in the substantia nigra.

Over the three years, we find differences between the parametric maps of the diffusion. Typically, these results relate to the imaging of FA corrected for free water, corrected and uncorrected mean diffusivity, and free water itself. In addition, R2* maps showed also significant modifications.

Discussion/Conclusion

R2*star, FA and Free water in SN are promising biomarkers not only for diagnosis, but also for disease progression to follow PD pathophysiology. Indeed, these biomarkers were able to measure longitudinal changes in moderate PD patients that could be associated with the dopaminergic neuron loss located in SN.

References

[1] Péran and al. Brain 2010
[2] Planetta and al. Brain. 2016
[3] Ofori E and al. Neurobiology of aging.2015
[4] Barbagallo and al. Movement Disorders 2016