

Focus on the locus: In vivo assessment of the brainstem noradrenergic system in Parkinson Disease with ultra-high field MRI

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Abstract

Objective: We aim to assess the degeneration of the brainstem nucleus locus coeruleus (LC) in patients with Parkinson Disease (PD) and establish the significance of noradrenergic dysfunction to the PD clinical phenotype.

Background: PD is a neurodegenerative disease affecting several brainstem nuclei including the LC, the main source of noradrenaline (NA) in the brain. In contrast with dopaminergic dysfunction the contribution of noradrenergic neuronal loss to the PD phenotype is poorly understood[1]. The LC-NA system is involved in modulating sleep, level of arousal, cognition and emotional processing, and NA loss from LC degeneration might contribute to the development of non-motor symptoms associated with PD. Recently, a MRI modality for visualizing dopaminergic and noradrenergic nuclei, so-called “neuromelanin sensitive MRI”, has been optimized for use at ultra-high field strength[2].

Methods: We quantify PD related brainstem changes by obtaining 7 tesla structural MRI in a group of PD patients (N=60) and healthy control participants (N=30). As a marker of LC structural integrity, we measure the signal intensity of the LC on a neuromelanin sensitive, magnetization transfer weighted (MTw) sequence at sub-millimetre resolution (voxel size 0.4x0.4x1.0mm). Motor- and non-motor symptoms are assessed using validated clinical and neuropsychological scales. Additionally, in order to explore the relationship between LC structural integrity and NA dysfunction, we examine a subgroup of participants with functional MRI.

Results: We have developed a multimodal 7T MRI pipeline for structural and functional MRI assessment of the LC-NA system in healthy participants. Data acquisition is ongoing with 46 participants currently being enrolled.

References:

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