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Iron deposition within thalamic subregions is related to cognitive dysfunctions in early drug-naïve Parkinson's disease patients with mild cognitive impairment

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Introduction: Iron deposition using Quantitative Susceptibility Mapping (QSM) has been reported in several cortical and subcortical areas within the dopaminergic pathways in patients with Parkinson's disease (PD), and a relationship with cognitive decline has been proposed. Mild cognitive impairment (MCI) is a common nonmotor symptom in PD and it is considered a risk factor for future development of dementia.

Objectives: In this study, we aimed at o exploring the QSM signature underling MCI in early drug-naïve PD patients, focusing on several subcortical areas, and particularly on the thalamic subregions.

Methods: 3T MRI images of 59 drug-naïve PD patients (20 PD-MCI and 39 PD-noMCI), were analyzed and compared. MDS Task Force Level II diagnostic criteria were applied to determine the presence of MCI. QSM values were extracted from several subcortical deep gray matter nuclei and 16 thalamic subregions. A partial correlation analyses were run between MRI metrics and clinical data. Finally, a ROC curve was performed to test the ability of QSM values in distinguishing PD-MCI from PD-noMCI.

Results: Compared PD-noMCI, PD-MCI patients showed higher susceptibility values in right subthalamic nucleus, in bilateral inferior pulvinar and in bilateral ventral posterolateral nuclei of thalamus Moreover, higher susceptibility values in the thalamus correlated with worse motor/cognitive severity and quality of life in patients. The ROC curve analysis showed that QSM values extracted from left inferior pulvinar and right ventral posterolateral nuclei of thalamus could significantly and accurately identify the presence of MCI in drug-naïve PD.

Conclusions: This study provides evidences of higher iron deposition within lateral and posterior regions of thalamic nuclei in drug-naïve PD patients with MCI patients compared to those without. We hypothesize that these findings may reflect the presence of more diffuse neuropathological changes occurring at the disease onset, potentially leading to altered cognitive processing and sensorial perception/integration in PD patients