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Parkinson’s disease patients with hallucinations exhibit dopaminergic degeneration and cortical thinning

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Introduction

Parkinson’s disease (PD) is the fastest growing neurological condition (Aarsland & Kurz, 2010; Dorsey & Bloem, 2018). The development of visual hallucinations in PD is a significant predictor of dementia and earlier nursing home placement (Pfeiffer et al., 2016; Schapira et al., 2017; Weintraub et al., 2004). A reduction in striatal dopamine transporter (DAT) has been linked to posterior cortical atrophy and associated with the development of psychosis (Sampedro et al., 2019). Therefore, dopaminergic degeneration may be one mechanism of cortical atrophy associated with the development of hallucinations (Dave et al., 2020; Jaakkola et al., 2019). Identified 41 patients with hallucinations (p ≤ 0.01 on Movement Disorder Society-Society- Unified Parkinson’s Rating Disease Scale (MDS_UPDRS) 1.2 at any visit)

Participants

- PPMS cohort
- De novo at enrollment
- 423 participants with PD and 196 HCs in PPMS study

Methods

Statistical Analysis

- Extracted longitudinal cortical thickness [figure 1] values from T1-weighted structural MRI and striatal binding ratios (SBRs) in the putamen and caudate from 123I-oiluprene SPECT data [figure 2] for 34 HC, 34 PD-ctrl, and 34 PD-hall.
- Pear 3 × 4 (group × hall vs PD-ctrl) × Time (baseline, year 1, 2, 4) repeated measures analyses of variance were conducted with SBR values as the dependent variables to examine whether SBRs exhibited a greater decline over time in the PD-hall relative to PD-ctrl groups.
- General linear models were used to examine the relationship between SBRs and cortical thickness across time.

Results

- PD-hall showed greater reduction in SBR in the left and right caudate over time relative to PD-ctrl [figure 3].
- A greater reduction in caudate SBR values was associated with reduced cortical thickness over time in the left lateral occipital (p = 0.01), right superior parietal (p = 0.001), and precentral gyr (p = 0.01) in the PD-hall group only [figures 4 and 5].
- Reduced right putamen SBR was associated with cortical thinning in the PD-hall group in the right precentral gyrus (p = 0.04). (Figure 3 PD-hall showed greater reduction in SBR in the left and right caudate over time relative to PD-ctrl [figure 3].)

Discussion

- People with Parkinson’s disease who experience hallucinations exhibit a greater decline in striatal dopamine binding. Striatal dopamine binding is associated with posterior cortical thinning in the left lateral occipital, right superior parietal, and precentral gyr in these patients.
- This suggests dopaminergic degeneration may play a role in posterior cortical thinning and the development of hallucinations in Parkinson’s disease.
- Understanding these relationships can inform treatment practices as well as identify novel avenues for interventions.