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Correlation between gait analysis and subregional uptake of striatal dopamine transporter on 18F-CIT positron emission tomography in patients with idiopathic Parkinson disease

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Objective

To investigate subregional uptake of striatal dopamine transporter in patients with idiopathic Parkinson disease (IPD) in correlation with three-dimensional gait analysis (3DGA).

Methods

This retrospective study included 88 patients with IPD who underwent 18F-CIT Positron Emission Tomography (CIT-PET) and 3DGA between January 1, 2014 and December 31, 2016. The CIT-PET images were analyzed with 12 striatal subregional (bilateral, ventral striatum, anterior caudate, posterior caudate, anterior putamen, posterior putamen and ventral putamen) and 1 occipital volume of interest templates (Fig 1). Rt striatum of CIT-PET for all patients were set to more affected side according to clinical feature. The level of activity in each voxel of interest (VOI) was calculated. The specific to nonspecific binding ration (SNBR) was defined as follows: (mean standardized uptake value of the striatal subregional VOI – mean standardized uptake value of the occipital VOI)/mean standardized uptake value of the occipital VOI, considering occipital uptake to be nonspecific binding. The correlation between SNBR of 12 striatal subregional area and 3DGA was analyzed after controlling age effect using Pearson's correlation coefficient.

Results

The mean SNBR of anterior putamen in all patients were positively correlated with contralateral maximal hip extension angle in stance phase and hip maximal flexion angle in swing phase. The mean SNBR of anterior caudate, ventral striatum, ventral putamen in the 46 patients with HY scale 1 were correlated with hypokinetic sign of contralateral limb such as decrease of hip/knee/ankle joint angle during gait cycle. The mean SNBR of posterior putamen and ventral putamen in the 23 patients with HY scale 2 were positively correlate with ipsilateral knee maximal extension moment. There is no correlation between the 19 patients with HY scale 3 and SNBR of entire striatum (Fig 2 & 3).

Conclusion

Hip control during gait cycle was mainly associated with the activity of anterior putamen which including in skeletomotor loop of basal ganglia. Hypokinetic sign was mainly associated with ventral striatum in mild IPD. Kinetics of knee was associated with ipsilateral ventral and posterior putamen in mild to moderate IPD.

Subregions of Striatum

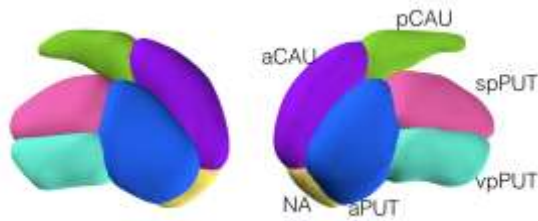
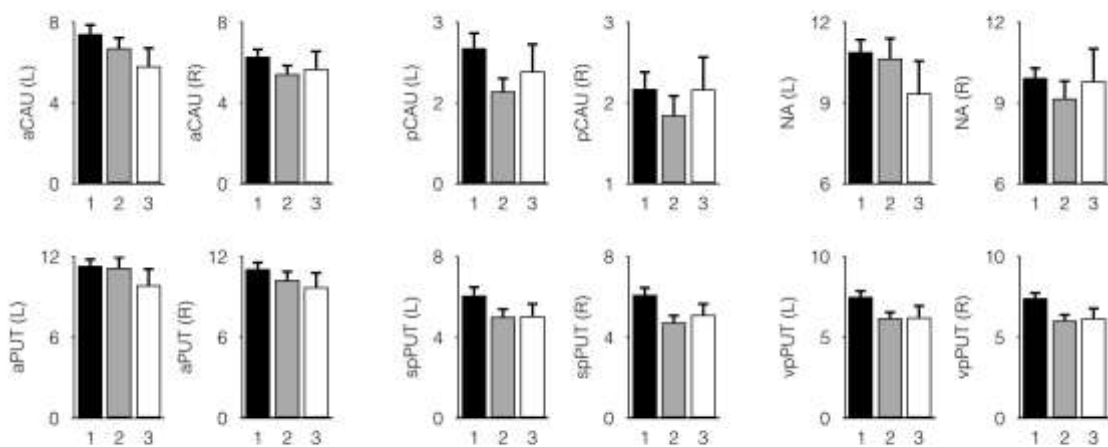


Fig 1. 12 striatal subregional area of CIT-PET

HY Stage vs. SNBR (specific to nonspecific binding ratio)



Mean \pm SE values were plotted.

No significant results in ANOVA

Fig 2. The specific to nonspecific binding ratio of 12 striatal subregional area according to HY scale

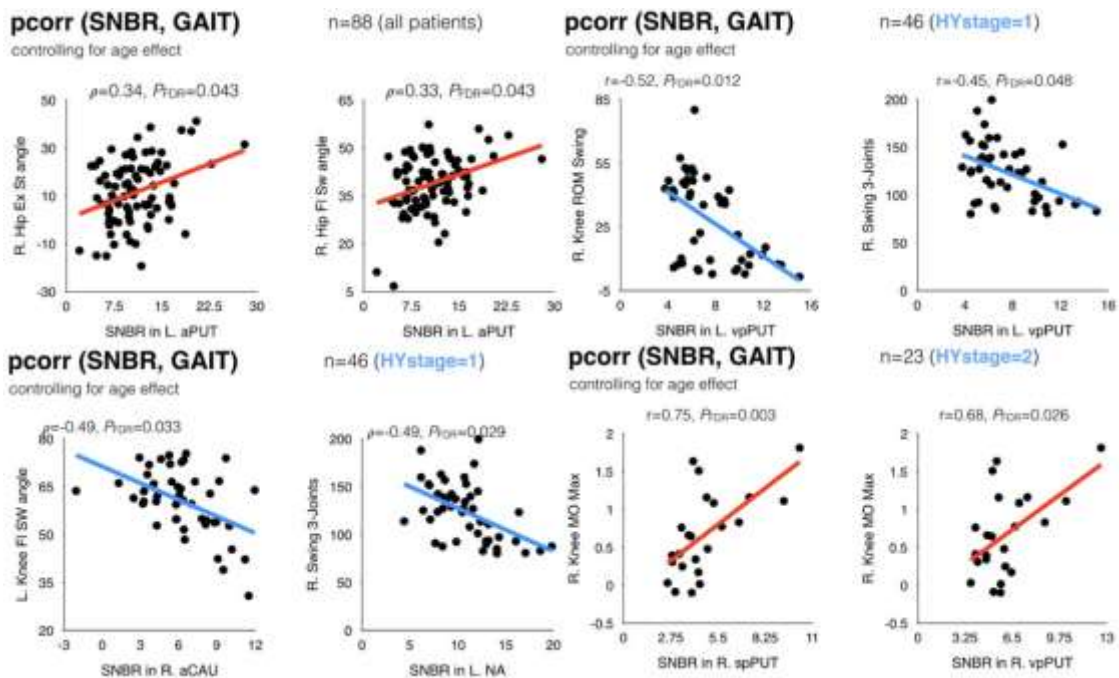


Fig 3. Correlation between SNBR and 3DGA