

Does cognitive impairment in Parkinson's disease correlate with striatal dopamine transporter scan (DaTscan) uptake?

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OBJECTIVE:

Using striatal dopamine transporter scans (DaTscans), we investigate if dopaminergic pathways are responsible for the pathophysiology in cognitive impairment in Parkinson's disease (PD) patients.

BACKGROUND:

In PD, cognitive impairment can present at early or, more commonly, at late-stages. The pathophysiology has been thought to involve cholinergic dysfunction while the role of dopaminergic dysfunction is unclear. In this study we have explored the dopaminergic basis of cognitive impairment pathophysiology using dopamine transporter scan (DaTscan) imaging in a cohort of PD patients undergoing non-motor assessments.

METHODS:

Patients were enrolled from the Non-motor symptoms International Longitudinal study (NILS). These patients underwent baseline assessments including the Non-motor symptoms (NMS) Scale (NMSS), NMS Questionnaire, as well as other non-motor assessments. A subgroup of these patients also had DaTscan imaging performed. Patient were scanned at optimal 'ON' state. Spearman rank correlation coefficient was used to explore the relationship between NMSS scores and the striatal dopaminergic uptake.

Table 1: Patient demographics

	Mean	SD
Age (yrs)	62.04	11.80
Age of Onset (yrs)	58.86	11.76
Duration of disease (yrs)	3.0	3.22
NMSS total*	50.35	40.62
NMS Quest total	9.65	5.85
*NMS Burden (cohort mean)	Moderate	

NMS Burden grading (based on NMSS): 0 no burden; 1-20 Mild burden; 21-40 Moderate burden, 41-70 Severe burden, >71 Very severe burden (Chaudhuri et al., 2013)

Table 2: Mean DaTscan uptake

	Mean	SD
Right striatum	1.21	0.52
Left striatum	1.26	0.48
Right caudate	1.51	0.60
Left caudate	1.52	0.56
Right putamen	0.90	0.46
Left putamen	0.99	0.42

King's dopamine transporter scan uptake grading system: Normal (>2.0); Mild (1.5 to 2.0); Moderate (1.0 to 1.5); Severe (<1.0)

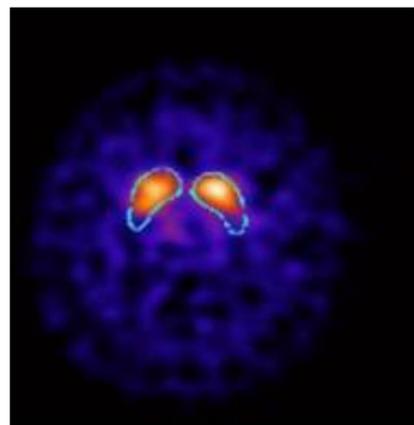


Figure 1: Normal DaTscan

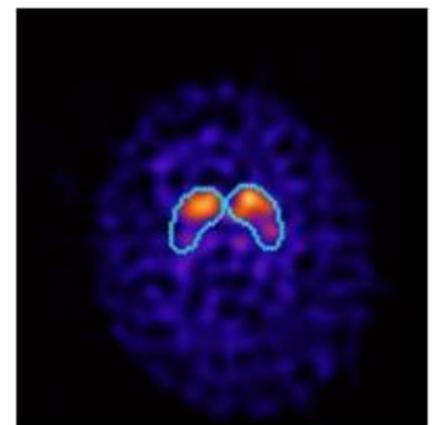


Figure 2: Reduced DaT uptake

Figure 1 shows the characteristic 'comma' shape and circular 'full stop' in a PD patient with normal DaTscan; Figure 2 shows the loss of uptake in the putamen with preserved caudate uptake in a PD patient

Table 3: NMSS Cognitive Domain (DaT uptake values)

	RC	LC	RP	LP	RS	LS
Concentration	-0.123	-0.193	-0.119	-0.165	-0.130	-0.179
Short term memory	-0.026	-0.145	-0.021	-0.138	-0.038	-0.134
Forgetfulness	-0.065	-0.099	-0.052	-0.085	-0.069	-0.091
Domain total	-0.080	-0.163	-0.073	-0.158	-0.095	-0.155

Spearman's *r* system: Very weak (0.00-0.19); Weak (0.20-0.39); Moderate (0.40-0.59); Strong (0.60-0.79); Very strong (0.80-1.00)

Table 4: NMSS Cognitive Domain

	Mean DaTscan uptake
Concentration	2.15
Short term memory	2.15
Forgetfulness	1.65
Domain total	5.96

King's dopamine transporter scan uptake grading system: Normal (>2.0); Mild (1.5 to 2.0); Moderate (1.0 to 1.5); Severe (<1.0)

Yrs years; NMS non-motor symptoms; NMSS NMS Scale; NMSQuest NMS Questionnaire; SD standard deviation; RC right caudate; LC left caudate; RP right putamen; LP Left putamen; RS right striatum; LS Left striatum; DaTscan dopamine transporter scan; PD Parkinson's disease

RESULTS:

86 patients underwent DaTscan imaging (70.9% male, mean age 62.04 years, mean disease duration 3.0 years, mean age of disease onset 58.86 years). There was no significant correlation between cognitive impairment as measured by attention, concentration, memory and forgetfulness in the NMSS cognitive domain or other measures, with DaTscan uptake in the caudate, putamen or the whole striatum. This is also shown by the mean DaTscan uptake being generally in the normal range

CONCLUSIONS

Our data suggests there to be no significant correlation between striatal dopaminergic uptake in patients with cognitive impairment. This suggests dopaminergic pathway is unlikely to be a major pathway involved in cognitive impairment pathophysiology.

REFERENCE: Chaudhuri, K. R, Rojo, J. M., Schapira, A. H., Brooks, D. J., Stocchi, F., Odin, P., Antonini, A., Brown, R. G., and Martinez-Martin, P. (2013) A proposal for a comprehensive grading of Parkinson's disease severity combining motor and non-motor assessments: meeting an unmet need. *PLoS One*, 8, e57221

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