Original Article

# Comparison of Cognitive Profile in Young- and Late-onset Parkinson's Disease Patients

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## Abstract

**Background:** Cognitive impairment is increasingly being recognized as a major cause of morbidity and increased dependence over the caregivers in Parkinson's disease (PD) patients. **Objective:** The present study aimed to compare the cognition testing in young- and late-onset PD patient. **Methods:** Sixty PD patients (20 young onset and 40 late onset) fulfilling UKPDS Brain Bank diagnostic criteria were enrolled in the study. Patients were assessed clinically and using scales for cognition testing such as Scales for Outcomes in PDCognition (SCOPA-COG), Unified Parkinson's Disease Rating scale (motor part), and Hoehn and Yahr staging. **Results:** Young-onset group comprised 20 (33.3%) and late-onset group comprised 40 (66.7%) patients. Most of the young- and late-onset patients, 15 (75%) and 21 (52.5%), had SCOPA-COG score in the range of 30–39, respectively. On comparison between young- and late-onset groups, SCOPA-COG score's mean ± standard deviation (SD) for young and late onset was 32.60 ± 2.52 and 30.30 ± 3.65, respectively, with statistical significance ($P = 0.01$). SCOPA-COG score's mean ± SD for mild, moderate, and severely impaired PD patients was 31.48 ± 3.19, 30.60 ± 3.24, and 23.50 ± 3.53, respectively, which on group comparisons (ANOVA) were statistically significant ($P = 0.004$). However, the SCOPA-COG score was statistically insignificant with respect to disease duration. **Conclusion**: There was statistically significant difference in SCOPA-COG score between young- and late-onset PD patients and in patients with more severe motor impairment.

**Keywords:** Late-onset Parkinson's disease, outcome scales in Parkinson's disease-cognition, Parkinson's disease, young-onset Parkinson's disease

## Introduction

Parkinson's disease (PD) is a progressive, disabling neurodegenerative disorder, characterized by bradykinesia and at least 1 of the following: resting tremor, muscle rigidity, and postural instability.[1,2] PD is the primary and most common form of Parkinsonism. The most common sporadic form of Parkinson's disease manifests around age 60; however, young-onset and even juvenile presentations are seen. Early-onset Parkinsonism refers to patients presenting with a parkinsonian syndrome with onset before age 40 years[3] although some authors include onset up to age 50 years.[4] PD is the second most common neurodegenerative disorder, after Alzheimer's disease.[5] Cognitive impairment in PD ranges from subtle deficits in specific cognitive domains to frank dementia.[6-8] Some studies indicated that the cognitive dysfunctions are dependent on age of the patient and stage of the disease. Green *et al*. found poorer performance and increased bradykinesia with older age and longer disease duration.[9] Executive dysfunction also influences the instrumental activities of daily living in PD.[10] Few studies on cognitive impairments in PD patients from India are available, with studies on comparative assessment of cognitive impairment in young- and late-onset PD being sparse. Early recognition of cognitive impairment is of paramount importance since it is a disabling nonmotor symptom. Furthermore, the potential for exploring novel therapeutic options to delay or prevent cognitive impairment would be best in the early phase or preclinical disease.

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### Aims and objectives

The present study aimed to evaluate and compare the cognitive impairment in young- and late-onset PD patients in a tertiary care referral hospital.

## Methods

### Study design and patient assessment

This was an observational, cross-sectional study carried out in a tertiary neurology center in North India from October 2014 to March 2016. Sixty PD patients (20 young onset and 40 late onset) fulfilling the UKPDS[11] Brain Bank criteria were included after obtaining a valid informed consent. One of the inclusion criteria was that the patients were able to read English as well as Hindi. Cases were defined as "young-onset" PD (YOPD) when the disease started between 21–40 years of age and "late onset" when the disease started above 40 years of age. The patients were assessed clinically and subjected to detailed neurological examination for motor as well as nonmotor features. The severity of motor symptoms of PD was assessed using Unified Parkinson Disease Rating Scale III (UPDRS III).[12] To assess the stage of motor impairment, the modified Hoehn and Yahr[13] staging was applied. Stages 4 and 5 are referred to as "severe impairment," Stage 3 as "moderate impairment," and others were labeled as having "mild impairment." Cognitive assessment was done by Scales for Outcomes in PDCognition (SCOPA-COG).[14] There are various components in SCOPA-COG scale, each having a maximum possible score. The lower the score, more is the impairment. The various components include memory (total score 22), attention (total score 4), executive functions (total score 12), and visuospatial functions (total score 5). The maximum possible total score in SCOPA-COG is 43.

### Statistical analysis

The data were entered into Microsoft Excel and analyzed using SPSS version 16.0 (IBM). Continuous variables were expressed as mean ± standard deviation (SD) and categorical variables as frequency and percentage. The independent sample *t*-test was used to analyze if there was a significant difference between the groups of "young-onset" and "late-onset" patients. One way ANOVA was used to analyze if there was a significant difference between PD patients with mild, moderate, and severe impairment as well as between PD patients with disease duration 1–5 years, 6–10 years, and >10 years. In the *post hoc* test, comparison between different groups was done. $P < 0.05$ was taken as statistically significant.

## Results

Young-onset group comprised 33.3% and late-onset group comprised 66.7% of patients. Forty-one patients (68.3%) were male and 19 patients (31.7%) were female. Majority of the patients in both groups, i.e., 65% for young onset and 70% for late onset, had total duration of illness between 1 and 5 years. Most patients of YOPD and late onset PD were in Hoehn and Yahr stage I, followed by stage III in YOPD and stage 1.5 in the older onset group. Most of the young- and late-onset patients, 15 (75%) and 21 (52.5%), had SCOPA-COG score in the range of 30–39, respectively. Six patients (15%) of late-onset PD had SCOPA-COG score below 20. On comparison between young- and late-onset groups, SCOPA-COG score's mean ± SD for young and late onset was 32.60 ± 2.52 and 30.30 ± 3.65, respectively, which was statistically significant ($P < 0.05$).

SCOPA-COG score's mean ± SD for mild, moderate, and severe PD patients was 31.48 ± 3.19, 30.60 ± 3.24, and 23.50 ± 3.53, respectively, which on group comparisons (ANOVA) came out to be statistically significant ($P = 0.004$).

SCOPA-COG score's mean ± SD for 1–5 years, 6–10 years, and >10 years' duration PD patients was 31.41 ± 3.17, 30.20 ± 3.91, and 28.33 ± 5.71, respectively, which on group comparisons (ANOVA) were not significant.

## Discussion

A decline in executive functions and speed processing occurring years before the onset of PD was shown in an observational study by Darweesh *et al*.[15] Mild cognitive impairment is now considered as a prelude to the development of dementia in PD with a variable clinical course; thus, early recognition of cognitive impairment is necessary. In addition to the widespread Lewy body pathology, recent studies have demonstrated an association of *APOE**ε4 allele, *GBA* mutations and *SCNA* mutations, and triplications with cognitive decline in PD.[16] In a review of studies on cognitive training in PD from 2004 to 2014, Glizer and MacDonald reported short-term moderate improvement in some cognitive functions in PD. However, because of the inconsistencies in the training interventions and outcome measures, the authors emphasized on conducting large, well-designed studies in future.[17]

**Comparison of Scales for Outcomes in Parkinson's disease-Cognition score in mild, moderate, and severely impaired Parkinson's disease and according to duration of disease**

| | SCOPA-COG score mean±SD |
|---|---|
| Stage of disease | |
| Mild impairment (modified Hoehn and Yahr stage <3) (*n*=48) | 31.48±3.19 |
| Moderate impairment (modified Hoehn and Yahr stage=3) (*n*=10) | 30.60±3.24 |
| Severe impairment (modified Hoehn and Yahr Stage 4 and 5) (*n*=2) | 23.50±3.53 |
| Between-group comparison ANOVA | *F*=6.08, *P*=0.004 |
| Duration of disease (years) | |
| <1-5 (*n*=47) | 31.41±3.17 |
| 6-10 (*n*=9) | 30.20±3.91 |
| >10 (*n*=4) | 28.33±5.71 |
| Between-group comparison ANOVA | *F*=2.21, *P*=0.119 |

Data are expressed as mean±SD. Statistical analysis of data was done using one-way ANOVA. *P*<0.05 was considered statistically significant. SD=Standard deviation, SCOPA-COG=Scales for Outcomes in Parkinson's disease-Cognition

The present study revealed a significant cognitive impairment with respect to age of onset and staging of disease but not with disease duration. This could be attributed to very small patient numbers in those with disease duration more than 5 years ($n = 13$) as compared to ($n = 47$) patients in <5 years' duration. The various studies in literature report variable performances on cognitive scales in young- and old-onset patients.

Das *et al*.[18] compared the two groups according to the age of onset, disease phenotype, and stage of disease. There were no statistically reliable differences between the mean cognitive scores of "early-onset" and "late-onset" patients. Similarly, they did not find any difference between the mean cognitive scores of "mild" and "moderate" patients (no patient with severe impairment). In our study, there was statistically significant difference between SCOPA-COG score between young- and late-onset PD patients, and also, there was statistically significant difference between SCOPA-COG scores between mild, moderate, and severe PD patients. In a study by Tang *et al*., they found the cognitive dysfunction to progress more slowly in the early-onset PD. The late-onset group even with shorter disease duration had more impairment in their cognitive abilities, including executive function, visuospatial function, and attention.[19]

Adhikari *et al*. also reported that with increasing age, greater impairment in delayed memory and recognition task was noted, and with advancement of disease, greater impairment in MMSE, delayed recall, and fund of information was noted.[20] Ray *et al*. found that the everyday abilities deteriorate with severity of Parkinsonism but not with advanced age.[21]

### Limitations of the study

The major limitation was a small sample size and lack of a follow-up clinical and neurological assessment. The small sample size resulted in an unequal distribution of patients, with more patients in those with a disease duration <5 years and those with milder disease. Neuropsychological testing with validated scales was not done, which would have resulted in better understanding of the pattern of cognitive involvement. A larger cohort of patients and a longer follow-up would have provided us with a better understanding of the complex interaction between the nonmotor and motor symptoms of PD.

## Conclusion

The present study revealed a worst performance on the SCOPA-COG scores in the late-onset PD patients and those with more disease severity. However, a small sample size and short duration of study was our major shortcoming. Mild cognitive impairment is regarded as a forerunner to the development of dementia in PD which is a disabling nonmotor symptom. Further, large population-based cohort studies must be conducted to identify preclinical memory involvement in PD and to develop therapeutic options which may delay prevent development of dementia in Parkinson's disease.

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### Conflicts of interest

There are no conflicts of interest.

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