



Impact of movement disorders during sleep on patients with Parkinson's disease

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INTRODUCTION, PURPOSE

Difficulty turning over in bed is one of the motor symptoms of Parkinson's disease (PD), with a prevalence of 45-82% for this subjective complaint [1-4]. In recent years, the accuracy of three-axis accelerometers has improved together with advances in miniaturization, and wearable accelerometers are now available to analyze kinetic data of overnight movements in PD patients [5]. This study set out to objectively assess nocturnal turnover movements in PD patients with overnight monitoring using a wearable three-axis accelerometer to test the hypothesis that inability to turn in bed would negatively impact on daytime sleepiness, sleep quality, and depressive mood in PD patients.

METHODS

Study Design: A prospective observation study

Subjects: PD patients (n=64)

Data Collection:

- 1) Activity of daily living in PD patients
 - Unified Parkinson's disease rating scale (UPDRS)
 - Barthel index (B-I)
 - modified Hoehn-Yahr stage (mH-Y)
- 2) Sleep evaluation
 - Epworth Sleepiness Scale (ESS)
 - Beck Depression Inventory (BDI)
 - Parkinson's Disease Sleep Scale-2 (PDSS-2)

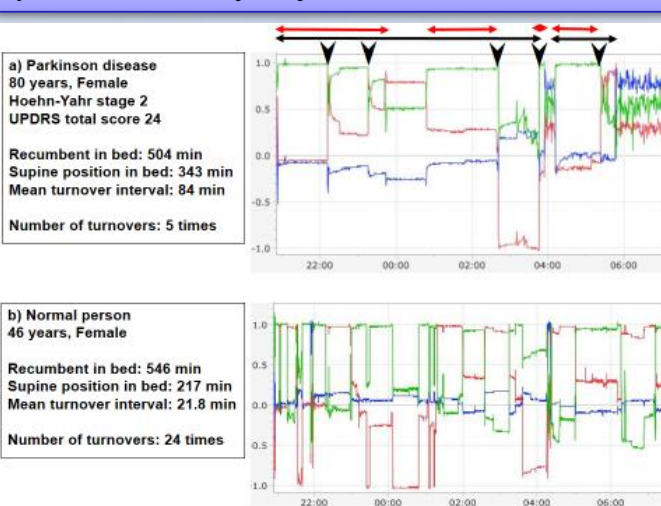
Overnight monitoring of turnover movements:

- A wearable motion recorder (75 mm × 50 mm × 20 mm, 120 g) equipped with three-axis acceleration sensors (Mimamori-Gait system, MG-M1110-HW; LSI Medience)
- Fixation on the center of the abdomen at the novel
- Monitoring for 10h from 21:00 to 7:00 the next day

Definition of turnover movement:

Turnover movements are defined as movements simultaneously registering acceleration along three axes (Y axis value $\leq 0.32G$, X axis value $\geq 0.58G$, Z axis value $\geq 0.20G$) [5].

Fig 1. Number of turnover movements in bed in PD patients and healthy subjects.



- a) PD patient: Arrowhead indicates turnover movement, black lines indicate time recumbent, and red lines indicate time supine.
- b) Healthy subject. Variations in acceleration along the X, Y, and Z axes are represented by red, blue, and green lines, respectively.

RESULTS

Fig 2): Number of turnover movements in bed correlated significantly with disease duration, modified H-Y stage, B-I, and total UPDRS score.

Table 2): Multivariate logistic regression analyses revealed no correlations between number of nocturnal turnover movements in bed and BDI, ESS, or PDSS-2. Use of anti-psychotic drugs was associated with ESS ($p=0.045$). UPDRS was associated with PDSS-2 ($p=0.016$).

Table 1. Patient characteristics

	Patients with PD n=64
Age, mean (SD)	73.3 (8.21)
Male sex, n (%)	35 (54.7)
BMI, kg/m ² (SD)	21.2 (3.65)
Age at onset, years (SD)	66.1 (10.1)
Disease duration, years (SD)	7.22 (6.28)
Modified Hoehn-Yahr staging (SD)	3.0 (1.0)
Barthel index (SD)	76.6 (27.4)
Beck Depression Inventory	15.5 (12.4)
Epworth Sleepiness Scale	7.03 (4.55)
Parkinson's Disease Sleep Scale-2	19.3 (10.0)
LED, mg (SD) †	540 (317)
Dopamine agonist, n (%)	35 (54.7)
Amantadine, n (%)	9 (14.1)
Sleeping drug, n (%)	15 (23.4)
Antipsychotic drug, n (%)	11 (17.2)
Antidepressant, n (%)	8 (12.5)

† LED, L-dopa-equivalent dose; SD, standard deviation.

Fig 2. Correlations between number of turnover movements in bed and background.

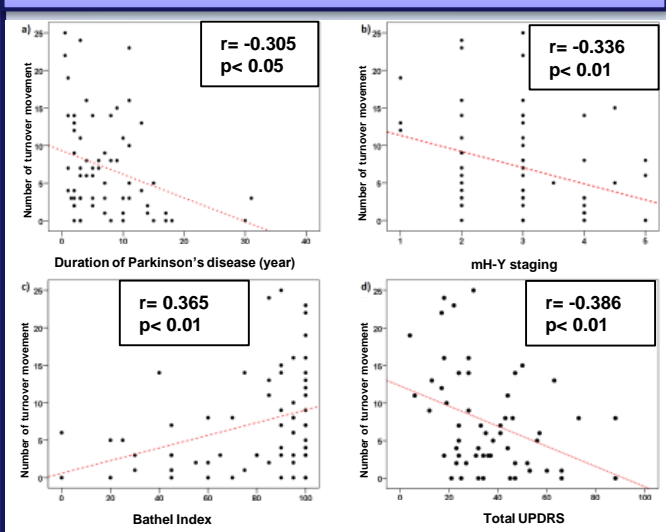


Table 2. Multivariate logistic regression analyses.

	ESS			PDSS-2			BDI		
	OR	(95%CI)	p	OR	(95%CI)	p	OR	(95%CI)	p
Age	0.951	(0.829-1.090)	0.471	0.785	(0.596-1.035)	0.087	1.004	(0.892-1.131)	0.941
LED	1.003	(0.999-1.007)	0.193	0.999	(0.995-1.003)	0.554	1.003	(0.999-1.007)	0.211
UPDRS	1.002	(0.943-1.064)	0.948	1.152	(1.027-1.291)	0.016	1.019	(0.967-1.075)	0.476
Sleeping drugs	0.103	(0.005-2.244)	0.148	1.293	(0.140-11.97)	0.821	3.156	(0.475-20.95)	0.232
Antipsychotics	46.18	(1.099-1942)	0.045	1.941	(0.091-41.36)	0.671	1.920	(0.209-17.65)	0.564
Dopamine agonist	2.442	(0.229-26.00)	0.459	0.599	(0.067-5.384)	0.647	0.833	(0.090-7.728)	0.872
Number of turnovers	1.174	(0.972-1.353)	0.105	1.062	(0.907-1.245)	0.454	0.924	(0.794-1.075)	0.331

For logistic regression analysis, ESS score ≥ 10 , PDSS-2 score ≥ 15 , and BDI score > 20 were taken to indicate excessive daytime sleepiness, sleep disturbance, and moderate to severe depressive features, respectively.

CONCLUSIONS

Decreased number of turnover movements may not be a direct determinant of daytime sleepiness, sleep disorders, or depressive mood in PD patients. Use of anti-psychotic drugs and higher UPDRS score are factors significantly associated with daytime sleepiness and uncomfortable sleep, respectively.

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