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The Feasibility of the Adaptation of Ability for Basic Movement Scale II for Patients with Parkinson Disease

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HIGHLIGHTS

- The Ability for Basic Movement Scale (ABMS) II has not been used in patients with Parkinson's disease (PD).
- Forty-nine patients with PD underwent assessments with ABMS II and Unified Parkinson's Disease Rating Scale (UPDRS) Part 3.
- ABMS II correlated significantly with UPDRS Part 3.
- We recommend evaluation of basic movement by ABMS II before application of rehabilitation therapy in patients with PD.

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The Feasibility of the Adaptation of Ability for Basic Movement Scale II for Patients with Parkinson Disease

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Conflict of Interest
The authors have no potential conflicts of
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ABSTRACT

The Ability for Basic Movement Scale (ABMS) II has been introduced recently in some institutions for assessment of motor function in hemiparesis patients. This scale can estimate 5 important basic movements (turn over from supine position, sit up, remain sitting, stand up and remain standing). However, this scale has not been used in patients with Parkinson's disease (PD). The purpose of this study was to determine the association among ABMS II, lower leg muscle strength, activity of daily living (ADL) and neurological deterioration in PD patients. Forty-nine patients with PD were studied (mean age at evaluation: 73.8 ± 15.9 years; time between onset and evaluation: 33.8 ± 44.2 months, ± standard deviation). All patients underwent assessments with ABMS II, Barthel index (BI), lower limb muscle strength and Unified Parkinson's Disease Rating Scale (UPDRS) Part 3. ABMS II correlated significantly with UPDRS Part 3 and BI, and moderately with lower leg muscle strength. There was no correlation between UPDRS Part 3 and lower leg muscle strength. The study demonstrated that ABMS II score was associated significantly with neurological deterioration, ADL and lower leg muscle strength in patients with PD. We advocate the use of ABMS II by physical therapist for the assessment of PD patients.

Keywords: Parkinson Disease; Muscle Strength; Scale; Activities of Daily Living; Disability Evaluation

INTRODUCTION

The Ability for Basic Movement Scale (ABMS) was developed to evaluate basic movements in hemiplegic patients [1]. Later, the final version was published in 2010 with some modification [2]. The latter version estimates 5 important basic movements; it quantifies the activity of basic movements by classifying such movements into 6 levels (levels 1 to 6). In addition to hemiplegic patients, ABMS II was also recently used for the evaluation of motor function in stroke patients [3]. In this regard, there is concern in the field of physical therapy about the lack of sufficient items in the Unified Parkinson's Disease Rating Scale (UPDRS) on basic movements when evaluating patients with Parkinson's disease (PD).

PD is a progressive neurological disorder characterized by loss of nigrostriatal dopaminergic neurons. The prevalence of PD increases with advancing age [4]. The clinical hallmarks of

neurological symptoms of PD include bradykinesia, rigidity, tremor and postural instability. Physical inactivity associated with these neurological symptoms is definitely one of the factors predisposing to muscle weakness [5,6]. To our knowledge, the ABMS II has not been used to assess basic movements in PD patients. The purpose of this study was to investigate the relation between the score of ABMS II, neurological deterioration, activity of daily living (ADL), and strength of lower leg muscle in PD patients and also was to confirm the feasibility of ABMS II in patients with PD patients.

MATERIALS AND METHODS

Subjects

The human ethics committee of our university approved the study protocol. Forty-nine consecutive patients with PD were recruited for the study (Table 1). All were hospitalized at our facility for clinical evaluation, medical management (initiation or modification of pharmacological intervention) and short-term rehabilitative training. The following inclusion criteria were selected: 1) clinical diagnosis of PD by an in-hospital neurologist with criteria of Clinical Practice Guideline for Parkinson's disease 2017 of the Japanese Society of Neurology, 2) no other pathological conditions associated with motor dysfunction, such as symptomatic stroke, 3) no medical or psychological condition requiring aggressive management, 4) no use of muscle relaxants. In addition, subjects were required to provide signed informed consent before enrolment in the study.

The mean age on admission was 73.8 ± 15.9 years (± standard deviation). The disease duration ranged from 1 to 127 months (mean: 33.8 ± 44.2 months). The majority of the enrolled patients (80.4%) were taking at least one anti-Parkinson agent on admission. Apparent on-and-off phenomenon was identified in 20 patients. Clinical assessment of basic movements and neurological stage was performed on the day of admission to our hospital. For patients with the on-and-off phenomenon, they were assessed when the drug effect was "on."

On the first day of rehabilitation, each patient underwent assessment using the ABMS II, lower limb muscle strength and neurological stage of PD. These measurements were performed by a physical therapist at our department.

Table 1. Characteristics of all studied patients (n = 49)

Characteristics	Value
Age (yr)	73.7 (15.8)
Gender (male, female)	22, 27
Time between disease onset and the evaluation (mon)	33.8 (44.2)
Hoehn and Yahr stage	
Stage 1	15 (30.6)
Stage 2	9 (18.3)
Stage 3	15 (30.6)
Stage 4	6 (12.2)
Stage 5	3 (6.1)
UPDRS Part 3	13.3 (15.5)
BI	80.4 (18.2)
Knee extension muscle strength (Nm/kg)	1.5 (2.7)
ABMS	25.2 (7.1)

Values are presented as mean (standard deviation) or number (%).
UPDRS, Unified Parkinson's Disease Rating Scale; BI, Barthel index; ABMS, Ability for Basic Movement Scale.

Table 2. Revised version of the Ability for Basic Movement Scale II

Instructions	Grade of ability	Total score
Turn over from supine position	1 = prohibited from moving	30
Sit up	2 = totally dependent	
Remain sitting	3 = partially dependent	
Stand up	4 = supervision	
Remain sitting	5 = independent in special environment	
	6 = completely independent	

Instructions: 1) "Turn over from supine position": patient is asked to roll over from the supine position to a lying position on their most favoured side. 2) "Sit up": patient is requested to change from the supine position to a sitting position on the edge of the bed. 3) "Remain sitting": patient is instructed to retain the sitting position on the edge of the bed for more than 30 seconds. 4) "Stand up": patient is asked to move from the sitting position on the edge of the bed to a standing position at the bedside with feet flat on the floor. 5) "Remain standing": patient is asked to remain standing at the bedside with feet flat on the floor for more than 30 seconds.
Grade of ability: 1 = prohibited from moving: patient prohibited from moving because of a medical problem such as unstable vital signs and complications. 2 = totally dependent: movement with more than 75% support by another person. 3 = partially dependent: movement with 75% or less support by another person. 4 = supervision: movement requiring someone present to provide verbal cues or gestures without physical contact. 5 = independent in special environment: movement by holding a handrail or edge of the bed. 6 = completely independent: movement without holding a handrail or edge of the bed.

Evaluation of ABMS II
The 5-item ABMS II requires the patient to "turn over from the supine position," "sit up," "remain sitting," "stand up," and "remain standing." Details of instructions given to patients during the evaluations and the scoring system of the ABMS II are shown in Table 2 [2].

Evaluation of lower limbs muscle strength
The strength of the knee extensor muscle was measured isometrically using a hand-held dynamometer (Mutas F1; ANIMA Corp., Tokyo, Japan) in this study. The patients were asked to be seated with the knee being flexed at 90 degrees and extend their knee as much as possible. The strength of the knee extensor muscle was measured with the dynamometer and the values of strength (Nm/kg) were adjusted with being divided by body weight and being multiplied by the length of the lower leg.

Evaluation of severity of neurological deficit
The UPDRS consists of 4 parts that measure: 1) mental function, 2) ADL, 3) motor skills, and 4) complications of treatment. This scale has excellent test-retest reliability and comprehensively covers motor symptoms of PD, especially in Part 3 of the scale [7,8]. In this study, the neurological stage was evaluated in patients using Part 3 of the UPDRS.

Evaluation of ADL
All patients were evaluated for ADL with the Barthel index (BI).

Statistical analysis
Association between parameters was tested by the Spearman rank correlation test. A p value less than 0.01 was considered statistically significant. All analyses were conducted using the SPSS software version J5.0 (SPSS Inc., Chicago, IL, USA).

RESULTS

The calculated correlation coefficients between UPDRS Part 3 and BI, UPDRS Part 3 and knee extension, UPDRS Part 3 and ABMS II, BI and lower limb muscle strength, BI and ABMS II,

Table 3. Spearman rank correlation coefficients between the parameters

Parameters	UPDRS	BI	Knee extension	ABMS
UPDRS Part 3	-	−0.49*	−0.14	−0.61*
BI		-	0.47*	0.70*
Knee extension			-	0.43*
ABMS				-

UPDRS, Unified Parkinson's Disease Rating Scale; BI, Barthel index; ABMS, Ability for Basic Movement Scale.
*$p < 0.01$.

and between knee extension and ABMS II, were −0.49 ($p < 0.001$), −0.14 ($p = 0.32$), −0.61 ($p < 0.001$), −0.47 ($p < 0.005$), 0.70 ($p < 0.001$), and 0.43 ($p < 0.005$), respectively (Table 3). Spearman rank correlation analysis showed no significant correlation between UPDRS Part 3 score and lower leg muscle strength. ABMS II correlated significantly with UPDRS Part 3 and BI.

DISCUSSION

We calculated previously the predictive value of ABMS II associated with functional ability in stroke patients [1]. In addition, we have also confirmed that the ABMS II score was significantly associated with neurological deterioration in patients with PD [9]. In the case of PD, it is important to know the severity of motor impairment through basic motion evaluation from the viewpoint of physical therapy rather than prognostic prediction. It is rather interesting that the performance of PD patients correlates with the severity of motor impairment. In this study, there was no correlation between UPDRS Part 3 score and lower leg muscle strength. This finding is different from that of Koller et al. [10], who found decreased muscle strength, as measured using an isokinetic device, even in the early stage of PD, compared to normal subjects. It is possible that the different findings are due to differences in the study design, where patients with late-stage PD were included in this study. Another study reported decreased muscle strength in PD patients, and that muscle weakness was not related to tremor or rigidity [11]. We believe that evaluation of muscle strength in our study was limited due to the severity of PD symptoms.

There is little or no information on clinical evaluation of muscle weakness and basic movement, using ABMS II, in patients with PD. Evaluation of patients with ABMS II in this study showed that UPDRS Part 3 score, strength of knee extensor muscle, and ADL score were associated with basic movement in PD patients. Among these variables, ABMS II showed high correlation with UPDRS Part 3 and BI. ABMS II does not require any special tools. Moreover, this scale comprises basic actions necessary for physical therapy. We believe that it is important to evaluate basic movement to help provide efficient physical therapy for PD patients. This is important since both the Hoehn and Yahr stages and UPDRS do not assess basic movement. Based on the results of the present study, we believe the ABMS II is appropriate for evaluation of the functional ability to establish basic movements in PD patients. Therefore, we recommend measurement of basic movement in patients with PD with ABMS II.

However, we the present study has certain limitations that the inter-rater reliability of ABMS II by 2 measurers is not performed.

CONCLUSION

In UPDRS Part 3, I can evaluate each neurological deficit, but the evaluation of turn over, sitting and standing is insufficient. Effective rehabilitation mainly on the kinesitherapy for PD patients include many basic actions. Thus, we need judgment of the effect of curing in basic actions to evaluate. This is because it leads to improvement of UPDRS Part 3 and ADL score and strength of knee extensor muscle. We recommend evaluation of basic movement by ABMS II before application of rehabilitation therapy in patients with PD.

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