SHORT COMMUNICATION

REVISED VERSION OF THE ABILITY FOR BASIC MOVEMENT SCALE (ABMS II) AS AN EARLY PREDICTOR OF FUNCTIONING RELATED TO ACTIVITIES OF DAILY LIVING IN PATIENTS AFTER STROKE

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Background: **The objective of this study was to test the predictive validity of a new scale, the Revised Version of the Ability for Basic Movement Scale (ABMS II).**
Methods: **A total of 71 patients after stroke participated in this prospective study. In addition to the ABMS II score, age, limb paresis as measured by the Brunnström stage, and functional ability as measured by the Barthel Index were also selected as predictor variables.**
Results: **Pearson's correlation coefficient analysis showed that the state of functional ability according to the 4-week Barthel Index had significant positive correlations with total scores of ABMS II and Brunnström stage at all data collection time-points. The results of linear stepwise regression analysis indicated that the "turn over from supine position" at the start of rehabilitation and "remain sitting" items of ABMS II at 2 weeks after onset of the stroke, in addition to the 2-week Barthel Index and 2-week Brunnström stage, were significant predictors (88.9%) of functional ability at 4 weeks after onset of stroke.**
Conclusion: **This study provides evidence for the predictive value of the ABMS II with regard to functional ability in patients after stroke.**

Key words: cerebrovascular disorders; ABMS; functional ability; rehabilitation; basic movement.

INTRODUCTION

We have previously reported evidence of the predictive value of the Ability for Basic Movement Scale (ABMS) with regard to functional ability in patients after stroke (1). Results showed that the degree of ability to perform basic movements at the bedside in the early stage after stroke is a valuable predictor of functional ability at discharge from hospital. However, functional evaluation of some acute-stage patients after stroke can be limited by various symptoms and complications that were not accounted for in the administration of the ABMS. Therefore, we revised the ABMS by adding another grade that can be used to evaluate the patient who requires cues, either verbal or by gesture. Verbal instruction can be extremely helpful in performing basic motions in the patients with cognitive problems. With these issues in mind, the revised instrument, the ABMS II, consists of 6 grades for the ability to perform basic movements. The objective of this study was to test the predictive validity of the ABMS II by assessing the relationship between the ABMS II score, level of limb paresis, and functioning in activities of daily living (ADL) at the start of rehabilitation (baseline) and 2 and 4 weeks after onset of the stroke.

STUDY POPULATION AND METHODS

From August 2007 to December 2008, 286 patients after stroke were admitted to Tokyo Metropolitan Ohtsuka Hospital for rehabilitation. For this study, we excluded patients with subarachnoid haemorrhage, because its course, which includes vasospasm, differs from that of thrombotic and other haemorrhagic strokes. A total of 71 patients were included in the study, all of whom were admitted to our hospital with motor impairment within 2 weeks after the onset of a clinically diagnosed stroke, received rehabilitation, remained in the hospital for more than 2 weeks after admission without undergoing surgery, and were successful in all of the data collection. There were 38 men and 33 women, mean age 71.2 (standard deviation (SD) 13.5) years. Of the 71 patients, 38 had cerebral infarction (17 right hemiparesis, 18 left hemiparesis, 3 ataxia), and 33 had cerebral haemorrhage (14 right hemiparesis, 19 left hemiparesis). Sites of lesions for cerebral infarctions were as follows: 17 middle cerebral artery, 7 internal capsule, 6 brainstem, 2 putamen, 4 anterior cerebral artery, and 2 cerebellum. Sites of cerebral haemorrhages were as follows: 7 middle cerebral artery, 1 internal capsule, 1 brainstem, 13 putamen, 2 anterior cerebral artery, and 9 thalamus. Mean time after onset until the first rehabilitation contact was 4.03 (SD 3.30) days, and the mean hospital stay was 58.5 (SD 36.7) days.

Tests

Following admission, all study patients received rehabilitation by rehabilitation therapists. We assessed their ability to perform

basic movements at the bedside using the ABMS II, the Barthel Index (BI) and the Brunnström stage (BS) (2, 3) on the first day of rehabilitation (baseline), 2 weeks after onset (2-week), and 4 weeks after onset (4-week). 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 Appendix I. The BS is a well-known clinical measure of motor impairment in the upper limb, hand, and lower limb for patients after stroke (2, 3).

Data analysis

Using Pearson's correlation coefficients, we examined the strength of the association between the 4-week BI and the baseline, 2-week, and 4-week ABMS II grade; baseline and 2-week BI; and baseline, 2-week, and 4-week BS. Additional variables included age and length of stay, which were correlated with the BI at 4 weeks. We also used stepwise regression analysis to identify factors predicting functional independence at 4 weeks. Data were analysed using SPSS 12.0 J software (SPSS Japan, Inc., Tokyo).

RESULTS

Age at the onset of stroke and length of stay were negatively correlated with functional ability at 4 weeks. Functional ability status determined by the BI at 4 weeks had significant positive correlations with total scores of the ABMS II and BS at all stages of data collection (Table I). Linear stepwise regression analysis was used to determine the variables that predicted functional ability at 4 weeks. The variables entered into the equation were baseline and 2-week functional ability, scores of each item on baseline and 2-week ABMS II, total scores at baseline and 2-week BS, and age. Results of the 2-week BS, 2-week BI, and the baseline and 2-week ABMS-II accounted for 88.9% of the variance in functional ability at 4 weeks (see Table II). With regard to findings of the ABMS II, scores for

Table I. *Correlation between functional ability at 4 weeks, basic mobility, limb paresis, age, and length of hospital stay (n = 72)*

Variable	Pearson's correlation with BI at 4 weeks after onset of the stroke discharge			
	Mean	SD	*r*	*p*
Functional ability (BI)				
4 weeks	49.92	36.94	–	–
2 weeks	40.70	35.16	0.887	0.0001
Baseline	26.34	30.87	0.706	0.0001
Basic mobility (ABMS II)				
4 weeks	20.29	7.77	0.876	0.0001
2 weeks	18.96	7.91	0.853	0.0001
Baseline	15.97	8.47	0.682	0.0001
Limb paresis (BS)				
4 weeks	10.74	4.48	0.877	0.0001
2 weeks	10.51	4.51	0.878	0.0001
Baseline	9.97	4.66	0.861	0.0001
Age, years	71.2	13.50	–0.371	0.0075
Length of stay, days	58.5	36.74	–0.122	0.3993

ABMS II: Ability for Basic Movement Scale version II; BI: Barthel Index; BS: Brunnström stage; SD: standard deviation.

Table II. *Predictors of functional ability at 4 weeks*

	Predictors of BI at 4 weeks				
	df	β	*p*	R^2	F
	49			0.889	89.70
2-week BS		0.323	0.0001		
2-week BI		0.494	0.0001		
Baseline "turn over from supine position"		–0.187	0.0001		
2-week "remain standing"		0.341	0.0001		

β: standardized partial regression coefficient; BI: Barthel Index; BS: Brunnström stage.

baseline "turn over from supine position" and 2-week "remain sitting" after onset were stronger predictors of functional ability at 4 weeks than the other items on the ABMS II.

DISCUSSION

We previously reported evidence for the predictive value of ABMS with regard to functional ability in stroke patients (1). In that study, the scale did not include a grade for a function that could not be performed unless someone was available to stand by and either verbally or by gesture cue the patient without physical contact (4–6). Therefore, in the revised version we added another grade to solve this problem. There were high correlations with the 4-week BI and all stages of the BI, BS and ABMS II (Table I). Also, the 2-week BI, BS and ABMS II were consistently significant predictors of ADL function at 4 weeks (Table II). Based on this result, we believe that the ABMS II is appropriate to evaluate the functional ability to make basic movements in acute-stage stroke patients. The present results on predictors of ADL function are similar to those of other studies. For example, Tyson et al. (7) reported that, in the acute stage, balance ability was the strongest predictor of function in terms of ADL and recovery of mobility. Ahmed et al. (8) found that evaluations of voluntary movement and basic mobility during the first week after stroke, at 4 weeks post-stroke and 3 months post-stroke were predictors of the patient's condition at discharge from the acute care hospital. Benaim et al. (9) confirmed that the Postural Assessment Scale for Stroke patients (PASS) is one of the most valid and reliable clinical assessments of postural control in stroke patients during the first 3 months after stroke. Lai et al. (10) reported that, in a sample of subjects with mostly mild and moderate strokes, use of the Orpington Prognostic Scale was similar to that of the National Institutes of Health Stroke Scale and was a slightly better predictor of ADL and higher levels of physical function. Kollen et al. (11) reported that improvement in standing balance control is more important than improvement in leg strength or synergism to achieve improvement in walking ability, whereas reduction in visuospatial inattention is independently related to improvement of gait. Thus, there are many established scales to evaluate basic movement. However, a scale is required that is easier for physicians to use than those formerly used and that can predict functional outcome at the bedside. Although the ABMS that we developed met these

requirements, we felt that we could extend its usefulness by adding another grade in order to evaluate patients who needed verbal cues or gestures without physical contact in performing the tasks within the evaluation. The revised instrument, the ABMS II, consists of 6 grades of ability to perform basic movements. In assessing factors that would predict future function, doctors and rehabilitation therapists require measures that are simple and require no special resources or intensive training.

Several limitations of this study should be mentioned. There is a difference in the bed rest level in the acute stage recommended by the doctor, treatment department, and the hospital, which would prohibit the patient from moving, which is the first grade of ability in the assessment. Moreover, we cannot perform measurements in patients with higher brain dysfunction, such as aphasia, apraxia, and agnosia. In future research that uses the ABMS II, it is necessary to consider means to utilize the instrument in evaluating patients with higher brain dysfunction. In future research, it will be necessary to accumulate further cases and to consider further revision of this assessment tool.

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APPENDIX I. Revised version of the Ability for Basic Movement Scale ABMS (ABMS II)

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

[1]**Instructions**
"Turn over from supine position": patient is asked to roll over from the supine position to a lying position on their most favoured side.
"Sit up": patient is requested to change from the supine position to a sitting position on the edge of the bed.
"Remain sitting": patient is instructed to retain the sitting position on the edge of the bed for more than 30 seconds.
"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.
"Remain standing": patient is asked to remain standing at the bedside with feet flat on the floor for more than 30 seconds.

[2]**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.