Journal of Medical Sciences

ISSN 1682-4474

science alert

ANSInet
an open access publisher
http://ansinet.com

Research Paper

JMS (ISSN 1682-4474) is an International, peer-reviewed scientific journal that publishes original article in experimental & clinical medicine and related disciplines such as molecular biology, biochemistry, genetics, biophysics, bio-and medical technology. JMS is issued four times per year on paper and in electronic format.

For further information about this article or if you need reprints, please contact:

Ozdincler Razak Arzu
Istanbul University
School of Physical Therapy and Rehabilitation
34390 Çapa, Istanbul
Turkey

Tel: 90 212 531 83 19
Fax: +90 216 417 12 38

J. Med. Sci., 5 (3): 189-194
July-September, 2005

What is the Relation Between Motor Function Assessment Outcome and Activities of Daily Living after Stroke?

Ozdincler Razak Arzu and Ersoz Burcu

The purpose of this study was to determine the relationship between motor function assessment outcomes and ability to perform Activities of Daily Living (ADL) among the stroke patients. Another aim was to identify this relationship from the other factors which affects the prognosis in subacute phase. Modified Rankin Scale (MRS), Motor Assessment Scale (MAS), Motricity Index (MI) and Functional Independence Measure-motor (FIM-motor) were applied to fifty-five stroke inpatients at our stroke unit. Significantly high correlation rate was found between MAS, MI, and FIM-motor. Dependency in ADL after stroke is primarily determined by degree of motor function impairment. When the motor function level was well known in the subacute phase, the dependency level of ADL in stroke patients can be estimated.

Key words: Stroke, activities of daily living, motricity index, motor assessment scale, functional independence measurement, motor function

ANSInet
Asian Network for Scientific Information

Istanbul University, School of Physical Therapy and Rehabilitation, 34390 Çapa, Istanbul, Turkey

INTRODUCTION

In its broadest sense, World Health Organization (WHO) has defined stroke as: Rapidly developing clinical signs of focal disturbance of cerebral function, lasting more than 24 h or leading to death with no apparent cause other than that of vascular origin[1].

Stroke was the primarily cause of death and it remains the third leading cause of death in the world, it is exceeded only by cardiovascular disease and cancer[2]. Data from the Turkish Statistical Institute indicate that the incidence of stroke in Turkey is approximately 88.000 per year, resulting in significant morbidity, mortality and disability.

Loss of motor control, loss of sensation and balance, disorders of cognitive function and speech or coma after stroke may vary according to the localization and size of brain lesions[3]. Third percent of all stroke patients live dependent in their Activities of Daily Living (ADL).

Aims of stroke rehabilitation are; to minimize the impact of the disability resulting from stroke, to optimize the independency in activities of daily living and to increase the quality of life.

Motor function assessment in subacute phase is very important. The severity of the motor impairment is reflected in the overall improvement and most of the researchers have reported that the initial motor function assessment score is a good predictor of ultimate advanced outcomes. Patients admitted for rehabilitation with lower motor function assessment scores do not have as good as functional outcome as patients who initially had higher admission scores. Muscle strength, movement patterns, balance and gait are four basic assessment subgroups of motor function. These subgroups can be evaluated separately but the capacity of stroke patients to perform these subgroup activities is usually scored on specific rating scales.

Motor function after stroke correlates with independency in ADL such as transfers, gait and stair climbing[4]. Accurate and precise assessment of activities of daily living in post-stroke patients are important for quality care and for measuring the outcomes of stroke treatment. Performance in ADL requires visual, cognitive, perceptual and coordination skills in addition to range of motion, motor strength and sensation. The Agency for Health Care Policy and Research Post-Stroke Rehabilitation Panel[5] suggests that well-validated and standardized instruments for reliable documentation of post-stroke disabilities should be used and it is recommended to use the 2 following instruments: Barthel Index (BI) and the motor component of the Functional Independence Measure.

The aim of the present study was to inquire the relationship between motor functional assessment outcomes and ADL and to identify this relationship also by help of the other factors which are determined at the prognosis such as age, gender, lesion type, lesion size, lesion localization, sensory and sphincter impairment, aphasia, neglect or dysphasia, frequency of stroke.

MATERIALS AND METHODS

This study was performed during October 2003- June 2004. Subjects were 55 stroke inpatients in stroke unit of Neurology Department at Istanbul Medical Faculty. Patients were excluded (1) if they had a one or a zero score from Modified Rankin Scale, (2) had cortical blindness, (3) had no cooperation, (4) had an additional disease resulting in movement disorders.

All the assessment procedures were applied by a physiotherapist to the patients in the stroke unit. The average period of assessment was 19±12 days (range 5-60 day) before the patient discharged from the stroke unit. Several data was gathered by a stroke assessment form, such as; name, surname, age, gender, education, dominant extremity, type of the stroke, lateralisation and localization of the brain lesions, OSCP (Oxfordshire Community Stroke Project) classification, loss of sensory and sphincter impairment, aphasia, dysphasia, denial and neglect, frequency of stroke. In this study, we have applied MI, MAS for the motor function assessment, FIM-motor for ADL assessment and Modified Rankin Scale for global disability.

The Modified Rankin Scale (MRS) which has been used to define clinically discrete patient disability categories, was used as reference. The scale has six grades (0-5): 0=no symptoms and 5=severe disability[6-9].

Motricity Index had been developed in order to evaluate limb strength by Demeunisse and has been used in several studies applied for patients with stroke[10,11].Weighted scores are given for levels of ability for a thumb and forefinger pinch grip, for power at the elbow flexors, shoulder abductors, hip and ankle flexors and knee extensors. All the parameters are scored in the scale from 0 to 5; this scale is the model of Medical Research Council Muscle Strength Assessment. Total score was set as 100 for one side of the body.

Motor Assessment Scale (MAS) is a measure of motor impairment and mobility in stroke patients[12]. MAS uses a seven-point ordinal scale to measure five-mobility-related activities; rolling from supine to side-lying, rising from supine to a sitting position, balanced sitting, standing up from a sitting position and walking. The additional items measure upper limb impairment and function. The MAS has documented validity and reliability[12-14].

The Functional Independence Scale (FIM) is one of the most widely used methods of assessing basic quality of life activities in persons with stroke. In this study FIM-motor subscale rates, which contain 13 items related to self-care, sphincter control, mobility and locomotion, was used. Each item is scored according to a scale from 1 to 7 points corresponding to complete dependence-total independence. FIM content validity has been established and has been reported[15,16].

The values are divided into two categories: one of them is qualitative variables which effect ADL such as; gender, dominant extremity, type of the lesion, lateralization, location, OCSP classification, loss of sensation, sphincter impairment, dysphasia, aphasia, neglect, frequency of stroke; and the second group includes continuous variables such as age, MAS, MI and timing of assessment.

Qualitative variables were analyzed with Mann Whitney U and Kruskall-Wallis methods. Continuous variables were analyzed with Spearmann Correlation Analysis Methods. Logistic regression analysis were used to test the independency of the relation between motor impairment scales and ADL scale from other variables.

RESULTS

Fifty-five patients with stroke were assessed in this study. The demographic and clinical characteristics of the patients are shown in Table 1 and 2, respectively.

Thirty-two (58.2%) participants were men, mean age of whole patients were 65±14.3. The average timing of assessment since on set was 19±12 days (Table 1).

The most prevalent type of stroke was ischemic (94.5%). Seventeen (30.9%) participants have sphincter impairment and twenty-one (38.2%) participants have aphasia. Neglect, dysphasia and sensation loss affect five (9.1%) patients (Table 2).

The majority of strokes occurred on the left hemisphere (40%) and the most prevalent location of lesion was at deep hemisphere/brain stem (54.5%). The most prevalent type of OCSP classification was PACS (36.4%).

Table 1: The demographic characteristics of the patients

	Mean±SD*		Range
Age	65±14.3		23-83
Timing of assessment	19±12 (days)		5-60 (days)
	Variables	Frequency	Percent (%)
Sex	Female	32	58.2±41.8
	Male	23	
Dominant hemisphere	Left	52	94.5±5.5
	Right	3	

Table 2: The clinical characteristics of the patients

Variable		Frequency	Percent (%)
Sensation loss	Existent	5	9.1
	Absent	50	90.9
Disphagia	Existent	5	9.1
	Absent	50	90.9
Sphincter impairment	Existent	17	30.9
	Absent	38	69.1
Aphasia	Existent	21	38.2
	Absent	34	61.8
Neglect	Existent	5	9.1
	Absent	50	90.9
Lesion type	Ischemic	52	94.5
	Hemoragic	3	5.5
Lesion location	Cortical	25	45.5
	Deep/Brain Stem	30	54.5
Lesion lateralisation	Right hemisphere	17	30.9
	Left hemisphere	22	40
Lesion lateralization-b	Hemisphere	39	70.9
	Brain stem	6	29.1
OCSP classification	TACS	9	16.4
	PACS	20	36.4
	LACS	6	10.9
	POCS	18	32.7

Participants who had their first stroke attack was 70.9% of all the patients. The score ranges and mean score±SD which the participants had at the end of the assessment is indicated in Table 3.

We have analyzed the relationship between motor function outcome scores and independence in activities of daily living. Significant correlation was observed between FIM-motor and MAS. Correlation between FIM-motor and Motricity Index was also significant (Table 4). It was clear that motor function status affects the independence level in subacute phase of stroke.

We have also analyzed the relationship between independence level in activities of daily living and the other factors that can affect this level. Table 5 indicates all these factors and relations. There was significant difference between FIM-motor scores of participants who had aphasia, sphincter impairment and sensation loss and participants who didn't have those impairments. Also FIM- motor score difference between participants with ischemic stroke and hemoragic stroke was significant ($p=0.0043$). Participants in TACS group have less FIM-motor score than the other groups and this difference was statistically significant ($p=0.005$).

Using a stepwise logistic regression, we have analyzed the factors that affect the FIM-motor score and we found that changes in MAS score effects FIM-motor

Table 3: Motor and ADL Scales assessment results

	Mean±SD	Range
MAS*	31.30±13	3-48
Motricity index	70.56±25.8	14-100
FIM-motor**	56.9±22.7	10-90

*Motor Assessment Scale **Functional Independence Measure-motor

Table 4: Relation between FIM-motor and continuous variables

	(Spearman correlation)		
	r	R^2	p
FIM-motor*-age	-0.136	-0.016	0.32
FIM-motor*-timing of assessment	-0.419	-0.16	0.001
FIM motor*-MAS**	0.83	0.68	0.0005
FIM motor*-Motricity Index	0.921	0.84	0.0005

* Functional Independence Measure-motor, **Motor Assessment Scale

Table 5: Relation between FIM-motor and qualitative variables

		FIM motor	
Variables		Mean score	z; p (Mann-Whitney U)
Dominant hemisphere	Left	27.99	-0.19;0.985
	Right	28.17	
Sensation loss	Existent	8.90	-2.79;0.005
	Absent	29.91	
Disphagia	Existent	18.90	-1.3;0.18
	Absent	28.91	
Sphincter impairment	Existent	14.21	-4.273;0.0005
	Absent	34.17	
Aphasia	Existent	20.76	-2.63;0.008
	Absent	32.47	
Neglect	Existent	15.10	-1.88;0.059
	Absent	29.29	
Lesion type	Ischemic	29.05	-2.02;0.043
	Hemotagic	9.83	
Lesion location	Cortical	31.38	-1.429;0.153
	Deep/Bain stem	25.18	
lesion lateralisation	Right hemisphere	20.03	-0.704;0.481
	Left hemisphere	19.98	
Lesion lateralization-b	Hemisphere	27.03	-0.14;0.989
	Brain stem	30.08	
First stroke attack	Yes	28.83	-0.603;0.547
	No	25.97	

		Mean score	X^2; p(Kruskal-Wallis)
OCSP	TACS	13.89	7.914;0.048
	PACS	28.92	
	LACS	30.75	
	POCS	30.17	

score independently from other factors. With other words, there is a predictive power of MAS for independence level in activities of daily living. Also it is found that when Motricity Index is used for motor evaluation, there is an independent effect of MI score and timing of assessment on FIM-motor score (Table 6).

Table 6: Logistic regression analysis results of motor assessment scales

	FIM motor*			
	B	P	OR**	95% Confidence interval
MAS***	0.51	0.002	1.66	1.214-2.27

	FIM motor*			
	B	P	OR**	95% Confidence interval
Motricity index	0.51	0.002	1.66	1.214-2.27
Timing of assessment	-0.99	0.041	0.906	0.824-0.996

*Functional independence measure-motor, ***Odds ratio, ***Motor Assessment scale

DISCUSSION

The purpose of this study was to determine the relationship between motor function assessment outcomes and ability to perform ADL and to identify this relationship from the other factors which affect the prognosis. Motor function impairment is the major factor for dependency in ADL in stroke patients at the later stage. Little documentation exists concerning the relationship between motor impairment and ADL in the subacute phase. Nevertheless this relation is important for planning rehabilitation programs.

Bernspang *et al.*[17] research outcomes show that motor function is by far the most important determinant of self-care ability during the first two weeks after stroke. There was a significant covariance between motor function and self-care ability. We found the same kind of relationship in this study.

Williams *et al.*[18] studied 153 subjects with stroke for upper limb MAS subscores and the FIM subscales for upper body dressing. No relationship was found between the FIM score for upper body dressing and the scores for each of the upper limb subtests of the MAS. Having full upper limb function, as measured by the MAS, was not necessary to be able to dress the upper body independently. Their results were opposite of ours. Nevertheless, their patients' timing of assessment was longer than our patients, 50 days versus 16 days respectively. Besides they have only used upper limb subscales. We couldn't find any other research related to the relationship between MAS and FIM.

MI evaluates the muscle strength. Strength of post stroke was shown in order to predict the future status of motor function, functional status of discharge from inpatient rehabilitation, length of stay in inpatient rehabilitation, discharge destination after inpatient rehabilitation and mortality. Wade and co-workers have demonstrated that muscle weakness is the major motor deficit in stroke patients in subacute phase. Muscle weakness is related with the independent level of ADL such as transfer activities, walking, stair climbing directly[19,20].

Chae *et al.*[21] have evaluated 48 stroke inpatients with Fugl-Meyer and FIM assessments. They reported that the level of motor impairment in the subacute phase is a predictor of physical disability at the later stage on stroke patient. Patel *et al.*[22] study showed

that severity of motor impairments make a difference in the likelihood of reaching a particular functional level. Motor function is the variable with highest predictive power for self-care ability.

FIM-motor score was affected from Motricity Index and timing of assessment independently. When timing of assessment decreased and MI score increased, also FIM-motor scores have increased. This was an expected outcome if it is considered that evaluations were done when our inpatients were being released and strength of stoke was directly related with the period of their stay.

Although stroke results in some degree of long-term impairment and disability, most patients experience some natural recovery of neurological functioning and impairment in ability to perform activities of daily living. Critics of rehabilitation have argued that the reduction of impairment caused of spontaneous natural recovery of neurological function is the primary factor contributing to the reduction in their impairment levels achieve reduced disability during rehabilitation. Many of these improvements may be attributed to the learning and practice effects of rehabilitation. Well- oriented and planned rehabilitation programs have been recognized as being important in having successful results with stroke patients. Therefore the determination of predictors of outcomes of stroke rehabilitation is very valuable. The various studies suggest that dependency in ADL after stroke is primarily determined by degree of motor function impairment.

This study concludes that when motor function impairment level is well known in the subacute phase, the ability to perform in ADL could be estimated with minimum error. Another conclusion is that the relationship between motor function impairment assessment outcomes and ADL is high correlated. Therefore we can declare that MAS can give us a high chance of estimation about ADL without being affected by any independent variable.

ACKNOWLEDGMENTS

We are grateful to Yakup Krespi, Assoc. Prof. MD. and to the staff of the Edip Aktin Stroke Unit for their kind support during this work.

REFERENCES

1. Rowland, L.P., 2000. Merritt's Neurology. 10th Edn. Lippincott Williams and Wilkins.
2. Roth, E.J. and R.L. Harvey, 1990. Rehabilitation of Stroke Syndromes. In: Physical Medicine and Rehabilitation (Ed. Braddom, R.L.,)W.B Saunders Company, pp.1053-1085
3. Chen, C.L., F.T. Tang, H.C. Chen, C.Y. Chung and M.Y. Wong, 2000. Brain lesion size and location: Effects on motor recovery and functional outcome in stroke patients. Arch. Phys. Med. Rehabil., 81: 447-452.
4. Andrews, A.W. and R.W. Bohannon, 2001. Discharged function and length of stay patients with stroke are predicted by lower extremity strength on admisssion to rehabilitation. Neurorehabil Neural Repair., 15: 93-7.
5. Hayes, M.K., J.T. Robertson, J.P. Broderick, P.W. Duncan, L.A. Hershey, E.J. Roth, W.H. Thies and C.A.Trombly, 1998. The American Heart Association stroke outcome classification. Stroke, 29: 1274-1280.
6. Kwon, S., A.G. Hartzema, P.W. Duncan and S.M. Lai, 2004. Disability measures in stroke. Relationship among the Barthel Index, the functional independence measure and the modified Rankin scale. Stroke, 35: 918-923.
7. Boigousslavsky, J., 2002. Long-term Effects of Stroke. Marcel Dekker Inc.
8. Wade D.T., 1992. Measurement in Neurological Rehabilitation. Oxford University Press.
9. Rde Haan, R.N., M. Limburg, P. Bossuyt, J. Meulen and N. Aaronson, 1995. The clinical meaning of Rankin 'Handicap' grades after stroke. Stroke, 26: 2027-2030.
10. Collin, C. and D. Wade, 1990. Assessing motor impairment after stroke: A pilot reliability study. J. Neurol Neurosurg Psychiatry., 53: 576-579.
11. Demeurisse, G., O. Demol and E. Robaye, 1980. Motor evaluation in vasküler hemiplegia. Eur. Neurol, 19: 382-389.
12. Carr, J.H., R.B. Shepherd, L. Nordholm and D. Lynne, 1985. Investigation of a new Motor Assessment Scale for stroke patients. Phys. Ther., 65: 175-179.
13. Poole, J.L. and S.L. Whitney, 1988. Motor Assessment Scale for stroke patients:Concurrent validity and interrater reliability. Arch. Phys. Med. Rehabil., 69: 195-197.
14. Maloin, F., L. Pichare, C. Bonneau, A. Durand and D. Corriveau, 1994. Evaluating motor recovery early after stroke: comparasion of the Fugl-Meyer Assessment and Motor Assessment Scale. Arch. Phys. Med. Rehabil., 75: 1206-1212.
15. Dodd, T.A., D.P. Martin, W.C. Stolov and R.A. Deyo, 1993. A validation of the functional independence measurement and its performance among rehabilitation inpatients. Arch. Phys. Med. Rehabil., 74: 531-5.

16. Ottenbacher, K.J., Y. Hsu, C.V. Granger and R.C. Fiedler, 1996. The reliability of the functional independence measure: A quantitative review. Arch. Phys. Med. Rehabil.,77: 1226-32.
17. Bernspang, B., K. Asplund, S. Eriksson and A.R. Fugl-Meyer, 1987. Motor and perceptual impairments in acute stroke patients: Effects on self-care ability. Stroke,18: 1081-1086.
18. Williams, B.K., M.P. Galea and A.T. Winter, 2001. What is the functional outcome for the upper limb after stroke. Australian J. Physiother., 47: 19-27.
19. Wade, D.T., R.L. Hewer, V.A. Wood, C.E. Skilbeck and H.M. Ismail, 1983. The hemiplegic arm after stroke: measurement and recovery. J. Neurol. Neurosurg. Psychiatry, 46: 521-524.
20. Andrews, A.W. and R.W. Bohannon, 2003. Short-term recovery of limb muscle strength after acute stroke. Arch. Phys. Med. Rehabil., 84: 125-130.
21. Chae, J., M. Johnston, H. Kim and R. Zorowitz, 1995. Admission motor impairment as a predictor of physical disability after stroke rehabilitation. Am. J. Phys. Med. Rehabil., 74: 218-223.
22. Patel, A.T., P.W. Duncan,S.M. Lai and S. Studenski, 2000. Relation between impairment and functional outcome poststroke. Arch. Phys. Med Rehabil., 81: 1357-1363.