Motor Function in Relation to Activities of Daily Living Measurements in Stroke Patients

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ABSTRACT

The purpose of this study was to investigate the relationship between upper extremity motor function and independence in basic activities of daily living in hemiplegia following a first cerbrovascular accident (CVA). Twenty-seven subjects (16 men and 11 women) with a mean age of 67±14.9 years and a mean post-stroke duration of 4.7±1.4 months parcipitated in the study. Barthel Index and Fugl-Meyer test were used as a standard and reliable measurements to evaluate activities of daily living and upper extremity motor function respectively. For evaluation of upper extremity function the Functional Test for the hemiplegic-paretic upper extremity was used. Results showed that the scores on the Barthel Index are poorly correlated with both the Fugl-Meyer Test and the Functional Test for the hemiplegic-paretic upper extremity scores. It was inferred that variables other than motor function, such as the learning of compensatory techniques and perceptual-cognitive status, are responsible for this discrepancy as they can influence the level of activities of daily living performance in hemiplegic patients. A high correlation between the scores on the Fugl-Meyer Test and the Functional Test for the Hemiplegic-Paretic Upper Extremity was found. It indicated that either test may be used for the assessment of motor function or activities of daily living.

INTRODUCTION

Cerebrovascular accident is the commonest cause of severe disability.[11,15] In Egypt a considerable number of CVA patients are treated by physical therapists. From the human, economic and therapeutic points of view the main goal of treatment would be to enhance motor function of the upper and lower extremities in the hemiplegic side, and promotion of the independence of basic activities of daily living in stroke patients. Both goals are of paramount importance.

Motor function status and level of activities of daily living measurements are used to assess physical therapy outcome and to develop treatment strategies. Reviewing the literature produced little information concerning the relationship between motor function and the activities of daily living measurements. So, physical therapists recognize the need to explore this relationship.

It was mentioned that there is some evidences that support the positive relationship between activities of daily living and motor function of the upper extemeity[14]. This relationship could be explained by that the upper extremities are important and involved

in bilateral manner in most activities of daily living. From this point of view, a patient who presents a good motor function status of the impaired upper extremity is expected to have a high level of independence in activities of daily living and the physical therapist would need to assess only one of these two parameters to predict the other one.

On the other hand, it was suggested that the two parameters are not closely related because learning of compensatory techniques is an important factor affecting the level of independence in activities of daily living gained in stroke patients[13].

Therapists are in agreement with this view, because teaching of compensatory techniques as well as encouragement of motor recovery is included as an important part of their treatment programme especially when motor recovery has no longer developed. Consequently, hemiplegic person who has poor upper extremity motor function could be completely independent in basic activities of daily living because of the compensation of the learning process.

Independence in basic activities of daily living was evaluated with the Barthel Index[16] because many studies have shown the validity and reliability of this test and its appropriateness[19] for stroke patients has been stated[9,10]. The global score on the Barthel Index ranges from completely dependent (0) to completely independent (100). The upper extremity motor function section of Faugl-Mayer Test[8] was chosen for the assessment of upper extremity motor function because it is a valid[4,12] and reliable[6] measurement. It has also been used as the standard measurement in validation studies[2,4]. The Functional Test for the hemiplegic-paretic upper extremity[18] was also used as an assessment tool for upper extremity function.

The Fugl-Meyer Test and the Functional Test for the hemiplegic-paretic upper Extremity are designed on the base of the motor recovery model developed by Twitchell[17] and Brunnstrom s[5] statement that motor recovery follows specific sequence of organized stages. These tests, however, reflect two different assessment approaches. The Functional Test for the hemiplegic-paretic upper extreme involves the use of functional tasks, but the Fugl-Meyer Test involves a more systematic evaluation of motor function through movements involved in or deviated from the stereotypical synergyies as defined by Brunnstrom[5].

The purposes of this study was to find (1) the relationship between the upper extremity motor function and independence in activities of daily living in stroke patients. (2) the validity of the Functional Test for the hemiplegic-paretic upper extremity relative to the Fugl-Mayer test. (3) sensitivity of the three studied tests across time.

It was hypothesized that: (1) there would be no correlation between the scores on Barthel Index and on both the Fugl-Meyer Test and the Functional Test for the hemiplegic-paretic upper extremity. (2) There would be no correlation between the scores on the Fugle-Meyer Test and on the Functional Test for the hemiplegic-paretic upper extremity. (3) The scores on each test would not be sensitively changed across time.

MATERIALS AND METHODS

Subjects:

Twenty-seven subjects suffering from hemiplegia were recruited on a volunteer basis (16 men, 11 women) following a first episode of CVA at least four months post-stroke participated in this study during their

rehabilitation program. The post-stroke period ranged from 4.4 to 5.5 with a mean of 4.7±1.4. They ranged in age from 43 to 79 years ($\bar{X}$= 67±14.9 years), in weight from 55 to 76 Kg ($\bar{X}$= 63±11.5 Kg), and in height from 137 to 174 cm ($\bar{X}$= 153±9.3 cm). Fifteen subjects were right-sided hemiplegia (55.6%) and 12 were left-sided hemiplegia (44.4%). Stroke subjects meeting the following criteria were included in the present study (1) following a first CVA (2) normal upper extremity function prior to the current stroke, (3) at least four months post-stroke, (4) unimpaired cognition and understanding of the instruction to accomplish tests procedures, (5) absence of contracture of the muscle of the upper extremity. Exclusion criteria were: (1) impaired upper limb function prior to stroke, (2) previous upper limb amputation, (3) history of upper extremity of orthopedic problems of neurological conditions other than stroke (4) mental impairment sever expression and receptive dysplasia, (6) unable to attend for the physiotherapy program and/or assessment sessions.

Measurments:

Measurements were administered while conventional physical therapy was conducted for all subjects through the study period (two months). The Barthl Index, the upper extremity motor function section of the Fugl-Meyer Test and the Functional Test for the hemiplegic-paretic upper extremity were utilized on three separate occasions: (a) at the beginning of the study (at least four months post-stroke) (b) one month later (c) at the end of the study (two months after the beginning of the study). The Barthel Index was the test used to measure the level of activities of daily living. The global score on the Barthel Index ranges from completely dependent (0) to completely independent (100)[16]. The upper extremity motor function section of the Fugl-Meyer Test was administered to measure the status of motor function. In this test a three grade ordinal scale that ranges from 0 to 2 for each item. A score of 0 indicates the details of an item cannot be performed; a score 2 indicates the details are performed correctly. This test also uses a global score for the upper extremity motor function that ranges from absence of voluntary movement (0) to complete upper extremity motor function (66). The Functional Test for the hemiplegic-paretic upper extremity involves different tasks associated with daily living, but rather, assesses the person s motor ability to use the upper extremity for purposeful tasks. This test is a seven-level scale, ranging from absence of voluntary movement (1) to the level of selective and coordinated movement at the upper extremity (7). Each level has a different task that is graded on a pass-or-fail basis. A patient earns a plus for successfully completing the task or a minus for failing at the task. After the assessment, the patient gets to the highest level at the successful achievement of all the tasks included.

Statistical Analysis:

To estimate the level of association between the different pairs of variables, interrelation matrix was computed using Spearman Rho coefficients. i.e. coefficients were used to study the relationship between the upper extremity motor function and independence in basic activities of daily living. The scores of the three evaluation sessions were compared for each test with the use of Friedman s analysis of variance for repeated measure (ANOVA) to test the sensitivity of each of the three tests i.e. to determine if there is a systemic change on scores obtained on

measurements for each test across time. Through out the analysis the P<0.1 level of significance was used. Kendall s coefficient of concordance was used to depict the presence of changes over time on scores and the similarity of these changes across subjects.

RESULTS

The three sets of evaluations were treated statistically (P<0.1). Each set of evaluations using Barthel Index, the Fugle-Meyer Test or the Functional Test for the hemiparetic-upper extremity involved three measurements separately: (a) at the beginning of the study, (b) one month later (c) two months after beginning of the study.

Spearman Rho coefficients were used to study the relationship between the upper extremity motor function and independence in basic activities of daily living. These coefficients indicated that the scores on the Barthel Index were poorly correlated with the scores obtained on the Fugl-Meyer Test and Functional Test for the Hemiplegic-Paretic Upper Extremity (at the end of study Rho = 0.66 and 0.69 respectively) (Table 1). Similar results were obtained at the beginning (Rho = 0.62 and 0.67), and at one month after the beginning of the study (Rho = 0.61 and 0.68), (Table 1).

On the other hand the scores on the Fugle-Meyer Test were highly correlated with the scores on Functional Test for the hemiplegic-paretic upper extremity at the end of the study (Rho = 0.96). At the beginning of the study (Rho = 0.92) and at one month later (Rho = 0.95), (Table 1).

Table (1): Rho coefficients on each pair of scores gained at the beginning of the study, one month later and at the end of the study.

	Rho coeffecient (Barth* & F.MT**)	Rho coefficient (Barth & FTHPUE***)	Rho coefficient (F.MT & FTHPUE***)	P
At the beginning of study	0.62	0.67	0.92	<0.1
One month later	0.61	0.68	0.95	<0.1
At the end of study	0.66	0.69	0.96	<0.1

* Barthel Index.
** Fugl-Meyer Test
*** Functional Test for the hemiplegic-paretic upper extremity.

Each of the three tests were studied to determined the sensitivity to changes over time. The sensitivity of the two upper extremity motor function tests were compared. The mean scores and standard deviations obtained on each test over the three evaluation sessions are shown in (Table 2). The Barthel Index, Fugl-Meyer Test, and Functional Test for the hemiplegic-paretic upper extremity are sensitive to changes over time, because their scores increase across the three assessments (Fig. 1). For each test, the significance of for repeated measures. The results indicated that these changes were all significant (Barthel Index, Fugl-Meyer Test and the Functional Test for the hemiplegic-paretic upper extremity, (X^2 = 14.66, 13.61, and 8.71 respectively), (Table 2). The changes across subjects were studied using Kendall s coefficient of concordance (W). The W values were low: 0.41, 0.51 and 0.33 for the Barthel Index, Fugl-Meyer Test and the Functional Test for the hemiplegic paretic upper Extremity respectively, (Table 2).

Table (2): Mean test scores, SD and X^2, W values for each of the three tests; Barthel Index Fugl Test and the Function Test for the Hemiplegic

Test	At the beginning of the study	One month after beginning	At the end of the study	X^2	W
Barthel Index	72.5±20.1	83.3±16.1	86.3±14.3	14.66	0.41
Fugl-Meyer Test	15.9±19.2	23.3±21.1	22.1±21.2	13.61	0.51
Functional Test for the hemiplegic-paretic upper extremity	1.9±1.0	2.9±1.1	4.1±1.2	8.71	0.33

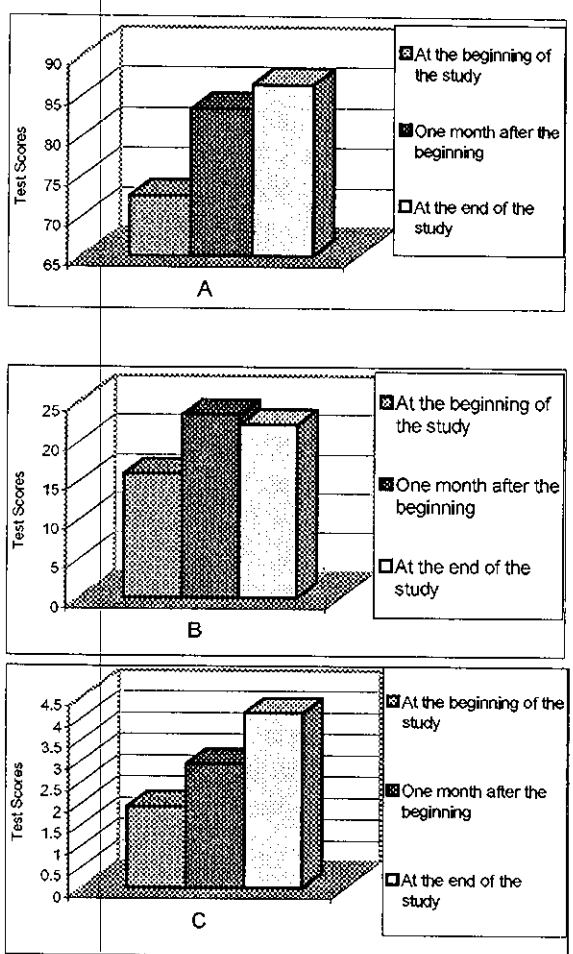

Fig. (1): (A) Mean test score on Barthel Index, (B) Mean Test Score on Fugl-Meyer test and (C) Mean test score on Functional Test for the hemiplegic-paretic upper extremity.

DISCUSSION

It is of a paramount importance to measure the level of functional abilities of stroke patients on which the physical therapy program is greatly based. Nevertheless motor function status is used to be evaluated. Little evidence, however, has been presented in the literature on the relation between the functional ability and motor function.

This present study investigates the relationship between activities of daily living and motor function tests in stroke patients. The results support the hypothesis that there would be no correlation between the scores gained on Barthel Index Test and both the Fugle-Meyer Test and the Functional Test for the Hemiplegic-Paretic Upper Extremity. The results implies poor correlation between the Barthel Index and these two tests. This means a weak relationship between independence in activities of daily living and upper extremity motor function. These findings are similar to those of Auger and his colleagues[3], who suggested that independence in activities of daily living is influenced by variables other than motor function. The learning of compensatory techniques through physical therapy, such as the use of an adapted spoon or wearing a shirt with unilateral technique, may be potential source of variations that might explain the discrepancy between the scores on the Barthel Index and the other two tests. A patient may demonstrate poor level of upper

extremity motor function but relatively independent in basic activities of daily living because he/she had learned compensated activities for his/her impairment with the unimpaired upper extremity. Up till now no test that evaluates the efficacy of the learning of compensatory techniques on the level of activities of daily living has been developed. Thus, activities of daily living test could not be used to evaluate the level of performance resulting from adaptation. Associated deficits present in a hemiplegic subjects, as perceptual or cognitive disorder, may affect the level of performance in activities of daily living as well[1,7]. These variables would not affect performance in test evaluating motor function alone e.g. patient with unilateral neglect may demonstrate poorly in combing even if he/she has a satisfactory level of upper extremity motor function. It could be inferred that assessment of upper extremity motor function cannot
functional level. At the same time an activities of daily living test should not be used as a pridector of the status of motor function.

A high correlation coefficient was found between the scores on the Fugl-Meyer Test and those on the Functional Test of hemiplegic-paretic upper extremity. This does not support the second hypothesis stated that there would be no correlation between the scores on the Fugle-Meyer Test and those on Functional Test of the hemiplegic-paretic upper extremity. These results indicate that either test can be used to measure the status of motor function or the level of activities of daily living of the upper extremity. This strong relationship also shows the validity of Functional Test for the hemiplegic-paretic upper extremity. The Functional Test for the hemiplegic-paretic upper extremity measures the motor function through functional tasks, thus allowing the observation of other aspects of performance, whereas, the Fugle-Meyer Test measures motor function in a more systematic manner through measuring each movement involved in or deviated from the stereotypical synergies.

The third hypothesis, that the scores on each of the three tests would not be sensitively changed across time, is not supported by the results of this study which indicate that the three tests are sensitive to changes over time. However the Barthel Index and the Fugl-Meyer Test, which have larger scale show more sensitivity than the Functional Test for the hemiplegic-paretic upper extremity. This is demonstrated by their higher-chi-square (X^2) values. Therefore, the Functional Test for the hemiplegic-paretic upper extremity may benefit from a numerical scale and from an elarged global score which would increase its sensitivity over time. Kendall s coefficien of concordance is used to provide more information concerning changes of subjects scores across time. The maximum value of W (Kendall s coefficient) is 1, such a value indicates that there is an agreement among subjects. Low W value obtained for each test, even those with large scale, suggests that the lapse of time between sessions in the present study may have been too short to detect comparable progress in upper extremity motor function and dependence in basic activities of daily living.

CONCLUSION

In stroke patients, the upper extremity motor function is poorly related with the independence in basic activities of daily living. It is suggested that this poor correlation is due to the learning of compensatory techniques and perceptual deficits. Thus, the level of independence in basic activities of daily living can not be predicted through the assessment of

the motor function of the upper extremity and vice versa. It was found that the Functional Test of the hemiparetic upper extremity is a valid test for the upper extremity motor function as it is highly correlated with the Fugl-Meyer Test. Therefore, either test could be used to measure the status of the upper extremity motor function and the level of basic activities of daily living.

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الملخص العربي

علاقة مقاييس الوظيفة الحركية بالنشاطات اليومية لمرض الشلل النصفي الطولي

أجريت هذه الدراسة لبحث العلاقة بين مقاييس الوظيفة الحركية والنشاطات اليومية للذراع لمرضى الشلل النصفي الطولي، فقد تطوع ٢٧ مريضا ومريضة بعد أول إصابة بالشلل النصفي الطولي، وبعد فترة من الإصابة لا تقل عن أربعة أشهر كان متوسط أعمار المرضى ٦٧ ± ١٤,٩ عاماً. وأجريت القياسات بثلاث مقاييس – ثلاثة مرات لكل مريض (في بداية الدراسة وبعد شهر ثم شهرين من الدراسة) باستخدام كل من: ١– دليل بارثل Barthel Index ٢– مختبر فاجل ماير (Fugl-Meyer test) ٣– المختبر الوظيفي للطرف العلوي لحالات الشلل النصفي الطولي. وقد أسفرت النتائج عما يلي: ١– هناك ارتباط ضعيف بين دليل بارثل وكل من مختبر فاجل ماير والمختبر الوظيفي للطرف العلوي لحالات الشلل النصفي الطولي. ٢– هناك ارتباط قوي بين مختبر فاجل ماير والمختبر الوظيفي للطرف العلوي لحالات، الشلل النصفي الطولي. ٣– الثلاث قياسات المستخدمة ذات حساسية عند استخدامها عبر الزمن. ٤– يمكن استخدام مختبر فاجل ماير والممختبر الوظيفي للطرف العلوي لحالات الشلل النصفي الطولي لتقييم وقياس الوظيفة الحركية والنشاطات اليومية في مرضى الشلل النصفي الطولي.