

Correlations between Cognitive Function and Functional Ability in Strokes using MMSE and FIM

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ABSTRACT

The Purpose of this study was to investigate correlations between the Mini-Mental State Examination (MMSE) and the Functional Independence Measure (FIM) in strokes. The data collected retrospectively from fifty-five stroke rehabilitation patients. The MMSE and FIM at the time of admission and discharge were obtained from patients' medical records. Firstly, Pearson correlation coefficients of the MMSE score at the time of admission revealed 0.286~0.747 with FIM at the time of discharge ($p < 0.05$). Also, the change of MMSE score significantly correlated with the change of total FIM scores in strokes ($r = 0.409$, $p < 0.05$). Because the MMSE scores at the time of admission and FIM at the time of discharge are correlated, the MMSE scores can be used to predict the FIM at the time of discharge and establish a rehabilitation program.

Keywords: MMSE, FIM, cognitive function, functional ability, stroke

1. INTRODUCTION

Stroke is a circulatory disease with its prevalence continuously increasing despite the multiple approaches and rapid development in medicine, and as a consequence it is the second most prevalent cause of death in our country [1]. Also, the incidence of death due to stroke is 70-80 people for every 100,000, and for the last ten years this rate has remained constant for this disease [2].

The goal of therapy on stroke is for the patient to regain his functional independence as much as possible, for the patient and his family to regain their roles, and to enhance quality of life by helping him to return to his family and work [3]. After the occurrence of stroke, it is known that approximately 60-70% of the survivors lead an independent and normal life, and 70-80% of them can transfer independently [2]. There are two ways of recovering from the stroke: neurological and functional recovery. Although functional recovery cannot be explained as a simple factor, it is related to the type, size and location of the damaged area in the brain with the disease. Also, poor prognosis is related to severe damage in motor function, dependence on basic normal daily motions, history of stroke, continuous urinary or fecal incontinence, severe impairment in visual perception, and severe cognitive impairment [4]. The single most important factor in predicting the functional recovery of a patient in discharge is the functional level at the time of admission as well as cognition, speech ability, and the

type and the quality of rehabilitation therapy [3]. If in the case where the patient cannot follow an instructed speech or a motion or where there is severe impairment in memory there will be a low possibility of functional recovery (citation)[5]. There is also a significant correlation between visual perception, cognition damage and functional ability [6]. Numerous studies show that there is a significant relevance between cognitive function at early onset of stroke and functional recovery [5], [7]-[14].

It has been reported that there is a high connection between cognitive function and activities of daily living (ADL) of rehabilitation process. However, most of the studies are about the relationships between cognitive function and the enhancement in general function with insufficient studies of its relevance to the domain of ADL [5], [10]-[14]. In this study, a domestic therapist used Mini Mental State Examination (MMSE), Functional Independence Measure (FIM) which is an evaluation tool commonly used in clinical trials to observe the relation between cognitive function in admission and FIM score in discharge as well as degree of the relationship between cognitive function and the enhancement in ADL.

2. MATERIALS AND METHODS

2.1 Participants of the study

The 72 patients hospitalized in the department of rehabilitation medicine of 'A' university hospital from November 2004 to May 2007 due to stroke were assessed by measuring MMSE and FIM scores at admission and at discharge. However, due to the lack of information from some patients, only 55 patients' information were analyzed at the end.

This is an excellent paper selected from the papers presented at ICCO 2008.

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The age of patients ranged from 33 to 79, with average age of 60.4 ± 11.0 , and the total number of patients in the study were 55 with 34 male and 21 female. There were 26 patients who had stroke due to cerebral hemorrhage and 29 patients due to cerebral infarction. The length of admission varied from shortest 3 days to longest 105 days with average of 35.9 ± 19.0 days (Table 1).

Table1. General qualities of study participants

General qualities	Classification	Number of participants	Percentage (%)
Sex	Male	34	61.8
	Female	21	38.2
Age	39 and below	2	3.6
	40 – 49	9	16.4
	50 – 59	14	25.5
	60 – 69	20	36.4
	70 and above	10	18.2
Cause of stroke	Cerebral hemorrhage	26	47.3
	Cerebral infarction	29	52.7
Length of hospitalization	29days or less	21	38.2
	30 – 59 days	27	49.1
	60 days or more	7	12.7
Total		55	100.0

2.2 Method of study

This was a follow up study done by examining the medical records of the patients of their MMSE score in admission and detailed FIM sub-items at discharge as well as the correlations between the total scores and the correlations between the variations of MMSE and FIM scores at admission and at discharge.

The MMSE consists of 12 items measuring different abilities of orientation, recall, attention, communication, calculation and composition. It is an easy way to assess the mental abilities of the patients in a short period of time of five to ten minutes [16].

The FIM uses a 7-point scale and assesses 18 items measuring areas such as self-care, sphincter-control, transfer, locomotion, communication and social-cognition. It is a tool to evaluate and record the state of disability of the patient and the result of recovery therapy [4]. Other than the basic ADL, sub-items such as communication and social-cognition are included in the FIM which enables a comprehensive observation of the patient's functional state [17]. It is largely divided into motor and cognitive function categories of which the motor function category is again divided into 13 items (eating, grooming, bathing, dressing upper body, dressing lower body, toileting, bladder and bowel management, transfers to bed/chair, toilet and tub/shower, walking/wheelchair and stair climbing) emphasizing self-care, and the cognitive function category into 5 items (comprehension, expression, social interaction, problem solving and memory) related to communication and social-cognition [18].

2.3 Method of analysis

We used Pearson correlation to determine the lower head of FIM sub-items at discharge following determination of initial MMSE score in addition to its correlation with the total FIM score and also to determine the lower head of FIM sub-items and total score following changes in MMSE. We set the statistically significant standard as 0.05 and analyzed the collected data using Windows SPSS version 12.0.

3. RESULTS

3.1 Descriptive statistics of MMSE and FIM scores

Mean and standard deviation suggest of the scores of admission and discharge of the MMSE and FIM (Table 2).

Table2. Descriptive statistics of MMSE and FIM scores

		Admission (Mean±SD)	Discharge (Mean±SD)
MMSE score		17.5±9.2	22.0±9.4.
FIM	self-care	19.3±6.6	23.5±6.6
	sphincter-control	8.8±3.5	10.4±2.8
	transfer	9.6±4.0	11.8±3.8
	locomotion	4.3±2.3	6.3±2.9
	communication	7.1±2.9	8.2±2.8
	social-cognition	10.0±4.3	11.9±4.1
	total	59.0±19.4	72.2±18.4

3.2 Correlation of FIM sub-items and total scores at discharge and MMSE scores at admission

From the MMSE at admission and sub-items of each FIM at discharge in correlation with the total score, the coefficient of correlation of self-care, sphincter-control, transfer, communication and social-cognition was 0.350, 0.286, 0.327, 0.697, and 0.747 ($p < 0.05$) showing a statistically significant correlation. There was no significant correlation with locomotion item. There was a significant correlation with the total FIM score with the coefficient of correlation being 0.549 ($p < 0.05$) (Table 3).

Table3. MMSE at admission, FIM sub-items score at discharge and correlation to the total score

		MMSE score at admission
FIM subcategory score and total score at discharge	self-care	0.350*
	sphincter-control	0.286*
	Transfer	0.327*
	locomotion	0.245
	communication	0.697*
	social-cognition	0.747*
	total	0.549*

*. $p < 0.05$

3.3 The correlation between MMSE variation and FIM variation

The coefficient correlation of MMSE variation and the total FIM variation was 0.409 ($p < 0.05$) with significant correlation. From the correlation between the MMSE and the FIM sub-items such as self-care, transfer, communication and social-cognition, the coefficient of correlation was 0.347, 0.286, 0.470, and 0.570 ($p < 0.05$), showing statistically significant relationship. There was no significant correlation between sphincter-control and locomotion (Table 4).

Table 4. MMSE variation, FIM sub-items and correlation to the total score variation

		MMSE variation
FIM variation	self-care	0.347*
	sphincter-control	0.160
	transfer	0.286*
	locomotion	0.104
	communication	0.470*
	social-cognition	0.570*
	total	0.409*

*. $p < 0.05$

4. DISCUSSION

Improvement of ADL is a simple but an important task to fulfil the goal of helping the patients recover. However, it is not easy to predict the degree of recovery and the time it takes to recover from the stroke. Additionally, it is hard to distinguish the factors between intrinsic or neurological recovery, adaptive or functional recovery [4]. It is the FIM score at admission [20] that allows predicting the degree of functional recovery of patients at discharge, as well as the existence of aphasia, the difference due to the location of lesion [21], the dexterity of non-affected hand at admission and discharge, and the length of treatment [22]. Among these, cognitive function shows a great correlation with the ability to carry out ADL and is a factor affecting the functional ability after the stroke [8]. Cognitive function examination score of a patient with brain damage is related not only to cognitive function but also to the ability to carry out ADL [23]. Orientation and cognitive function of an elderly affect the ability to carry out instrumental ADL (IADL) [9] and ability of construction, memory, similarity category had a significant correlation with functional improvement [24]. The functional results were better for the group without cognition damage compared to group with cognition damage, indicating that cognition damage has negative effects upon functional improvement [12], [13], [25]. The cognitive function measured at admission allows us to predict the ability to carry out ADL at discharge [7], [14]. Also in this study, the MMSE score at admission and the FIM score at discharge showed significant correlation, indicating that cognitive ability at admission affects ADL accomplishment at discharge.

There is a significant correlation among cognitive ability, IADL and self-care [26]. Patients with cognition damage had a worse IADL achievement after 6 months of recovery compared to those without damage [27]. From a study determining which item of FIM at discharge is most affected by cognitive ability at

admission, there was no correlation with transfer or locomotion but showed significant correlation with social-cognition, communication, self-care and sphincter-control [28]. This was in accordance with our study where there was no significant correlation between the MMSE at admission and locomotion FIM at discharge, but there was significant correlation with social-cognition, communication, self-care and sphincter-control, showing disagreement of these items. These results can be interpreted as most of ADL are affected by cognitive ability except for locomotion where motor ability plays the most important role.

From the results observing the change in ADL following change in cognitive ability, there was a significant correlation between MMSE variation and FIM variation. This was in agreement with another study done by Kim et al [28] which shows that there was a statistically significant correlation between MMSE increase in the start of recovery treatment and at discharge with FIM increase. In the correlation between the MMSE and the FIM variations, the biggest correlation occurred with social-cognition, and communication item variation of FIM, and this is considered due to the FIM examination sub-items being related to the cognitive ability. The next biggest correlation occurred with self-care item of the FIM variation. This is in accordance with report showing an enhancement in cognitive function after cognitive therapy using computer as well as self-care of Modified Barthel Index (MBI) such as clothing, eating and using the toilet [29]. It is also in accordance with the result showing a significant enhancement in personal hygiene, bathing and using the toilet [30]. There is a significant correlation between cognitive ability enhancement and the ADL execution enhancement and it shows that the functional level increases as cognitive ability enhances. It is regarded that if therapy for improving cognitive functions were accompanied during recovery therapy in order to enhance the ADL, there would be a greater functional enhancement for the patients. This is elucidated from the high correlation between the MMSE variation and the FIM sub-items such as variations of communication, social-cognition and self-care. This demonstrates the correlation between changes in cognitive function, self-care and ADL is related to cognition.

Some of the limitations of this study were that the number of participants was small and the analysis was made without correction of the variables such as the age of the patients, sex, the area and the size of the affected cerebrum, and the level of education. Also, the MMSE is not a tool that can determine whether or not there is a disability in the details of cognitive function and requires further research to figure out which domain of cognition is related to the ADL.

5. CONCLUSION

The following shows the conclusion we have reached after analyzing the MMSE and the FIM scores of 55 stroke patients of 'A' university hospital upon admission and discharge from November 2004 to May 2007. First of all, from the correlation between the MMSE at admission and each sub items of the FIM at discharge, there was significant correlation in items of self-care, communication, social cognition, sphincter-control

and transfer ($p < 0.05$). There was no significant correlation with locomotion. Another point to note is that, from the correlation between the MMSE and the FIM variations, there was a statistically significant correlation with the FIM total score, self-care, communication, social-cognition and transfer ($p < 0.05$). There was no significant correlation between the sphincter-control and the locomotion.

From the above results, we can conclude that there is a correlation between the cognitive ability and the accomplishment of ADL, showing that the cognitive ability is an important factor in functional recovery after the stroke. Moreover, as the enhancement in the cognitive ability increases the enhancement in function also increases. It, especially, affects communication, social cognition and self-care significantly. From this we can expect that if treatment to enhance cognitive ability is carried out simultaneously during recovery treatment, there would be a greater enhancement in function.

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