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Original Research Article

A Study on Functional Measures in Patients with Stroke

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ABSTRACT

Background and Objective: Stroke is the leading cause of functional disability. This study has been taken as an insight to capture functional measures using Functional Independence Measure and Functional Assessment Measure scale on both motor and cognitive function which shows the dependence of the patient performing activities of daily living. This measurement is useful for assessing patient's progress and functional outcome.
Methodology: The functional disability of the patient was assessed using the Functional Independence Measure and Functional Assessment Measure scale at admission, in the middle and on discharge in 124 patients. Functional gain was recorded as the difference between the score on admission and at discharge. Data were collected by direct observation of the patient and by interview with the help of a questionnaire.
Study Setting: Narayana Hrudayalaya Hospitals.
Results: The score ranges between 30-210. A score of 30 indicates impairment of functioning and 210 indicates complete regain of normal functioning. The patients showed a mean admission score of 64.74 which indicates a low functionality and a mean discharge score of 174.86 indicates functionality is sufficiently regained to discharge the patient. The functional gain was calculated as the difference between the score at admission and at discharge. The mean functional gain was 110.12 which was statistically significant (p=0.009). The mean score when measured during the course of treatment was 109.66.
Conclusion: The scale is significantly useful to measure patient's progress and assess functional outcomes. The admission score was the most powerful predictor of functional outcome.

Key words: Stroke, Functional Independence Measure, Functional Assessment Measure, Functional gain.

INTRODUCTION

Stroke is an acute focal neurologic deficit that lasts for 24 hours and is presumed to be of vascular origin. There are two types of stroke. Strokes can either be ischemic (88%) and hemorrhagic (12%). [1]

Stroke is the leading cause of morbidity and mortality worldwide. [2] Stroke is a major public health challenge not only for neuropharmacology but the society in general. [3] It is also a leading cause of functional impairments. [4] According to WHO, 15 million people suffer stroke worldwide each year. [5]

The ability to measure the functional ability of post stroke patients may assist in

the prediction of their functional outcome. [6] Stroke related functional limitations diminish a person's quality of life and place economic and social burdens on families and society.

The Functional Independence Measure (FIM) and Functional Assessment Measure (FAM) scale is widely used and accepted as a functional level assessment tool that evaluates the functional status of the patients. [7] Higher FIM and FAM scores mean a higher level of independence. The functional status is measured by documenting admission, middle, discharge and functional gain (subtracting the admission score from the discharge score) scores. This gain in function is attributed to a number of risk factors, therapeutic intervention and time. [8]

Global measures of disability such as the Functional Independence Measure (FIM) and Functional Assessment Measure (FIM+FAM) at individual clinical level provide valid and reliable information about a person's requirements for assistance with essential tasks of daily living, and on a group level, they can be used to measure and compare outcomes across different patients.

The FIM is an 18 item ordinal measure of disability which includes 13 motor items and 5 cognitive items. It was developed in the 1980s by a national task force in the United States and is now one of the most commonly used measures. The FAM does not stand alone but adds a further 12 items to the FIM primarily addressing cognitive and psychosocial function.

The original US version of the FAM was developed in the early 1990s, for evaluating outcomes like traumatic brain injury. The UK version of the FAM was developed in the mid 1990s by the United Kingdom FIM+FAM in collaboration with the US originators to address the known subjectivity and inconsistency of some items. [9]

The present version used in this study is a 30 FIM+FAM items which scores different groups of patients, according to impairment and localization of neurological injury.

Based on the impression that the stroke has a significant burden of care, this study has been taken as an insight to capture functional measures using FIM and FAM on both motor and cognitive dysfunction among post-stroke patients.

MATERIALS AND METHODS

The study was carried out for a period of seven months (Feb-Aug 2013) in the Department of Neurology, Narayana Hrudayalaya Hospitals, a 600 bedded multispecialty hospital situated in Hyderabad. The study was conducted after approval by Institutional Human Ethical Committee, Malla Reddy College of Pharmacy with the approval IRB code IEC/MRGI/PROT/13/0008.

A total of 124 patients from the in-patient department of Neurology in Narayana Hrudayalaya Hospitals, who were diagnosed with stroke, were included after obtaining the Permission for collection of data and to accompany physician in Neurology ward from Head of the Neurology department.

All patients and caregivers were informed about the study objectives and data confidentiality, and were asked to indicate their understanding about study conditions and agreement by signing an informed consent form. A patient pro forma was designed, this provides information about patient demographic details (age, gender, date of admission and discharge, type of stroke, previous medical history, social and family history), functional measure (FIM+FAM) scores, risk factors and pharmacotherapy.

Patients were enrolled based on inclusion and exclusion criteria.

Inclusion criteria:

- Male and female patients of age 20 years and above were included in the study.
- Patients diagnosed with Ischemic and Hemorrhagic stroke were included in the study.
- Those patients who had radiological confirmed diagnosis of Stroke using CT/MRI scan were included.
- Patients with identified and unidentified risk factors were included.

Exclusion criteria:

- Patient with intracranial abnormalities like subdural hematoma, brain tumor and dementia were excluded.
- Patients in whom CT/MRI could not be obtained were excluded from the study

The functional disability of the patient was assessed using the Functional Independence Measure and Functional Assessment Measure (FIM+FAM) scale at admission, during the course of treatment and on discharge.

Motor items:

The motor FIM is an assessment instrument of motor functional status. It is a 16 item measurement that evaluates the parameters like self-care, sphincter control and mobility, locomotion. Each item on the motor FIM is scored on a 7 point ordinal scale that ranges between 1 and 7. FIM scale is used extensively in Stroke to measure the patient's progress and assess rehabilitation outcomes.

Cognitive items:

Cognitive function refers to a person's ability to process thoughts, memory and ability to learn new information, speech, and reading comprehension. Cognitive FIM is a 14 item measurement that evaluates the parameters like communication, psychosocial and cognition. The items on the FIM are scored on a 7 point ordinal scale that ranges between 1 and 7. FIM scale focuses on the burden of care that is, the level of disability indicating burden of caring for the patients.

The minimum range of scores on FIM is 30 which indicate a low level of functioning; the maximum range of scores is 210 which indicate a very high level of functioning. Functional gain was recorded as the difference between the FIM score on admission and the FIM score at discharge. Data were collected by direct observation of the patient and by interview with the help of a questionnaire.

The mean, median FIM+FAM scores at admission, mid value, discharge and functional gain were recorded and analyzed using Anderson- Darling Normality test in MINI TAB SOFTWARE version 15.0.

FIM+FAM Scale

Motor items	Cognitive items
1. Eating	1.Expression
2. Grooming	2. Comprehension
3. Bathing/showering	3. Reading
4. Dressing upper body	4. Writing
5. Dressing lower body	5. Speech intelligibility
6. Toileting	6. Social interaction
7. Swallowing	7. Emotional status
8. Bladder management	8.Adjustment to limitations
9. Bowel management	9. Use of leisure time
10.Transfers: bed/chair/wheelchair	10. Problem solving
11. Transfers: toilet	11. Memory
12. Transfers: bathtub/shower	12. Orientation
13. Transfers: car	13. Concentration
14.Locomotion:walking/wheelchair	14. Safety awareness
15. Locomotion: stairs	
16. Community mobility	

Scoring:

Independent. Another person is not required for the activity (NO HELPER)

7- Complete Independence. All of the tasks described as making up the activity are typically performed safely without modification, assistive devices, or aids, and within a reasonable amount of time

6- Modified Independence. Activity requires any one or more than one of the

following: an assistive device, more than a reasonable amount of time, safety (risk) considerations

Dependent. Another person is required for either supervision or physical or other assistance in order for the activity to be performed, or it is not performed (REQUIRES HELPER)

Modified dependence. The subject expends half (50%) or more of the effort. The levels of assistance required are:

5- Supervision or setup. Subject requires no more help than standby, cuing, or coaxing, without contact if motor activity or without significant prompting/direction if cognitive activity or helper sets up needed items or applies orthoses.

4- Minimal assistance. Subject, with only touching contact if motor activity or some prompting/direction if cognitive activity, expends 75% or more of the effort

3- Moderate assistance. Subject requires more help and expends half (50%) or more (up to 75%) of the effort

Complete dependence. Subject expends less than half (less than 50%) of the effort; maximal or total assistance is required, or the activity is not performed; the levels of assistance required are:

2- Maximal assistance. Subject expends less than 50% of the effort, but at least 25%

1-Total assistance. Subject expends less than 25% of the effort

RESULTS

Table 1: Demographic data of stroke patients

	Number (%)
Subjects	124
Male	65 (52.4%)
Female	59 (47.6%)
Age (years)	
Mean ± SD	56.36 ± 12.6
Range	22-80
Type of Stroke	
Ischemic	102 (82.3%)
Haemorrhagic	22 (17.7%)

The demographic data of 124 patients who were admitted and diagnosed with stroke are shown in Table 1. Out of 124 patients 65 (52.4%) were males and 59 (47.6%) were females. The age range was from 22-80 years with mean age of 56.36 years (SD=12.6). Out of the total study population 102 (82.3%) patients experienced Ischemic Stroke and 22 (17.7%) patients experienced Hemorrhagic stroke.

The functional level of the patients was measured by Functional Independence Measure (FIM) and Functional Assessment Measure (FAM) scale and the data was analyzed using One Way ANOVA test shown in Table 2. Patients were divided into groups based on their admission FIM+FAM scores and their progress is recorded during the hospital stay. Highest number of patients, 68 (58.84%) had admission scores in the range of 30-59 with their mean admission score of 37.37 (SD=9.65 & 95% CI=35.03-39.70) followed by 28 (22.58%) patients in the admission score range of 60-89 with their mean admission score of 73.64 (SD=8.525 & 95% CI= 70.34-76.95). Four patients showed high admission score above 150 as they came with less significant disabilities.

All patients were followed during the hospital stay. Scores were recorded for all patients when they were shifted from general ward to rehabilitation unit as mid value. Patients with admission score in range 30-59 showed a mid score of 92.88 (SD=9.835 & 95% CI=90.50-95.26) and the patients with admission score 60-89 showed a mid score of 113.71 (SD=8.36 & 95% CI=110.47-116.96).

At the time of discharge patients with admission score in the range of 30-59 had a mean discharge score of 169.49 (SD=15.51 & 95% CI=165.73-173.24) and patients with admission score in the range of 60-89 had a mean discharge score of 174.79 (SD=10.74 & 95% CI=170.62-178.95). The

four patients who had high admission score showed highest discharge score.

Table 2: Patients Progress Based on FIM+FAM Admission Scores by ONE WAY ANOVA Test

	FIM+FAM admission scores	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound	Lower Bound	Upper Bound
On admission	30-59	68	37.37	9.652	1.170	35.03	39.70	30	59
	60-89	28	73.64	8.525	1.611	70.34	76.95	60	85
	90-119	15	103.47	6.093	1.573	100.09	106.84	92	113
	120-149	9	134.67	7.890	2.630	128.60	140.73	124	147
	150-179	4	165.25	12.121	6.060	145.96	184.54	150	175
	Total	124	64.74	37.149	3.336	58.14	71.35	30	175
Mid value	30-59	68	92.88	9.835	1.193	90.50	95.26	69	111
	60-89	28	113.71	8.366	1.581	110.47	116.96	99	125
	90-119	15	133.20	7.408	1.913	129.10	137.30	122	144
	120-149	9	154.44	6.984	2.328	149.08	159.81	144	166
	150-179	4	177.50	8.888	4.444	163.36	191.64	168	189
	Total	124	109.66	24.551	2.205	105.30	114.03	69	189
At discharge	30-59	68	169.49	15.517	1.882	165.73	173.24	128	193
	60-89	28	174.79	10.744	2.030	170.62	178.95	156	194
	90-119	15	184.20	12.084	3.120	177.51	190.89	163	210
	120-149	9	189.44	5.223	1.741	185.43	193.46	182	198
	150-179	4	199.00	4.899	2.449	191.20	206.80	193	203
	Total	124	174.86	15.382	1.381	172.13	177.60	128	210
Functional gain	30-59	68	132.11	17.49757	2.12189	127.88	136.3530	98.00	159.00
	60-89	28	101.14	12.67460	2.39527	96.22	106.0576	81.00	123.00
	90-119	15	80.733	13.37090	3.45235	73.32	88.1379	54.00	118.00
	120-149	9	54.777	7.93375	2.64458	48.67	60.8762	42.00	67.00
	150-179	4	33.750	7.22842	3.61421	22.24	45.2520	28.00	43.00
	Total	124	110.12	32.13579	2.88588	104.40	115.8334	28.00	159.00

Highest functional gain was found in patients with admission score in the range of 30-59 whose mean functional gain was 132.11 (SD=17.49 & 95% CI=127.88-136.35) followed by patients with admission score in the range of 60-89 whose mean functional gain was 101.14 (SD=12.67 & 95% CI=96.22-106.05).

The patients were counseled at the time of discharge and 30 stroke patients were followed for a period of three months. Patients were contacted for follow up by telephone or in person when they came for review to hospital. The mean follow up FIM+FAM score was 204.53 (SD=3.88). Follow up data and functional gain summary was shown in table 3.

The mean scores at admission, mid value and discharge were 64.74±37.15 (p = < 0.005), 109.66±24.55 (p = < 0.005) and 174.86 ±15.38 (p=0.010) respectively. The functional gain was recorded as the difference in FIM+FAM scores between discharge and admission. The mean functional gain was 110.12±32.14 (p=0.009) respectively. The mean score of 30 patients after following for 3 months was 204.53±3.88 (p=<0.05) with a mean functional gain (difference between discharge score to follow-up score) 28.73±11.75 (p=<0.05).

Table 3: Summary of total average scores

FIM +FAM scores	Mean	Median	SD	p value
Admission	64.74	54	37.15	< 0.005
Discharge	174.86	176	15.38	0.010
Functional gain	110.12	112.5	32.14	0.009
On follow-up (after 3 months, for 30 patients)	204.53	205	3.88	<0.05
Functional gain	28.73	28	11.75	<0.05

The summaries of the patient's progress based on FIM+FAM scores at admission, mid value, discharge and

functional gain was analyzed using Anderson Normality test in MINI TAB software version 15.0.(Figures 1, 2, 3 and 4).

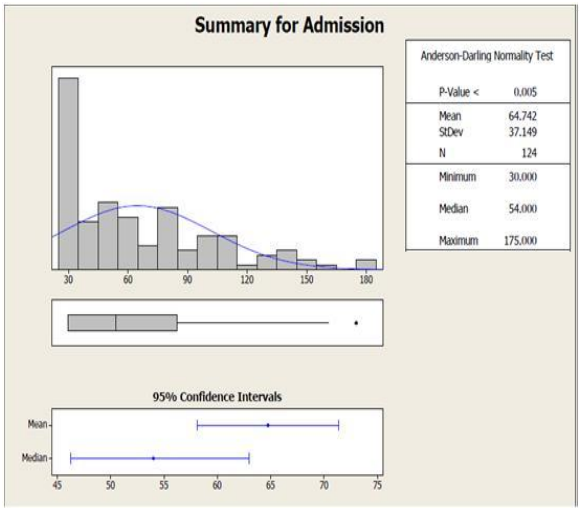

Figure 1: Summary for Admission FIM+FAM Scores

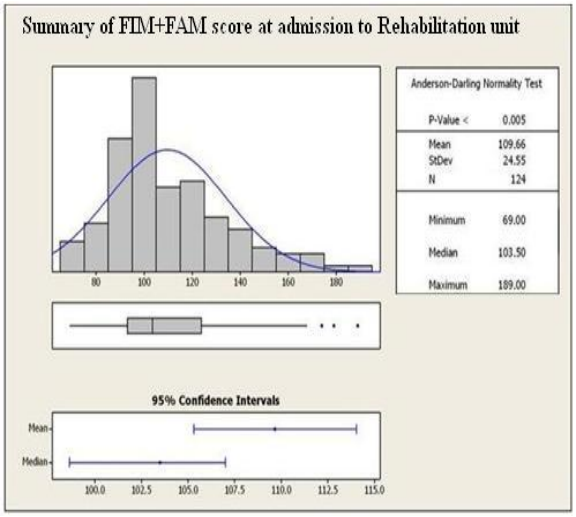

Figure 2: Summary for FIM+FAM scores during course of treatment

DISCUSSION

The present study is limited by small number of sample size and lack of individual item scoring which could explore the importance of FIM+FAM scale, however the purpose of this study is to establish uniformity in assessment of patient level's of disability and functional outcome which strengthens the scientific basis for medical rehabilitation practice. Uniformity promotes reliability of measurement and likely reflects consensus and common understanding among practitioners in the field. This descriptive study examined the functional measurements of stroke patients admitted to a multi specialty hospital.

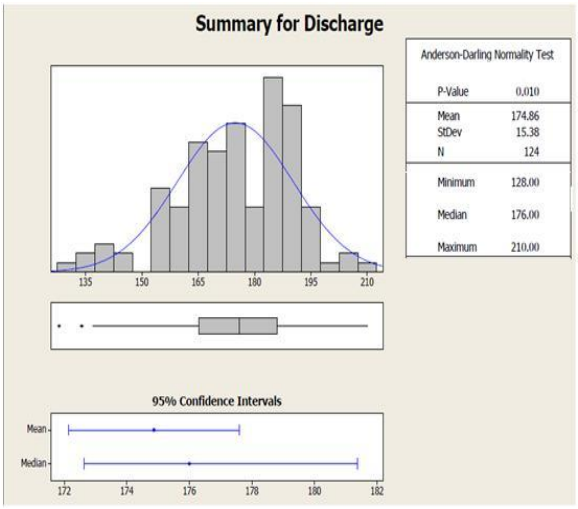

Figure 3: Summary for Discharge FIM+FAM Scores

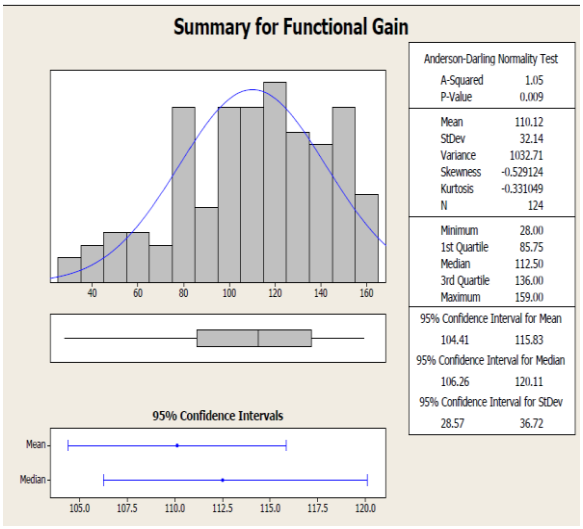

Figure 4: Summary for Functional Gain FIM+FAM Scores

In the present study all the patients were admitted to the hospital within the 4-6 hours of occurrence of symptoms of stroke. Majority of the patients were admitted in non ambulatory condition while few had some specific symptoms. Patients were diagnosed by neurophysicians after thorough

examination and FIM+FAM score was taken to assess the condition of patient.

Patients were admitted with different degree of disabilities. Majority of patients who were admitted with a very low FIM+FAM score were non ambulatory, unable to speak, unable to perform their daily activities or have altered cognitive functions. Patient's activities like grooming, eating, toileting etc were taken care by nurses or caregivers. The FIM+FAM score of such patients at the time of admission were found to be in range of 30-59 (mean 37.37). Patients with moderate disabilities showed better FIM+FAM score at the time of admission. Patients were kept in special care unit until they were fit to send for rehabilitation unit. Four of the patients had specific complaints such as slurred speech, inability to move arms etc but the rest of the body functions were normal. These patients showed a high FIM+FAM score at the time of admission above 150. The average admission score of all the patients was 64.74±37.15. (P=<0.005) which is consistent with *Tur et al., 2003* [10] who found the mean FIM+FAM total scores as 69.2 ± 27.4 at the time of admission. Similar score was also reported by Denti et al., 2008 [11] which were 55.8 ± 24.0.

Patients were shifted to rehabilitation ward when conditions were improved. All patients were included in rehabilitation program. The aim of rehabilitation program is to help patient become as independent as possible and to attain the best possible quality of life. FIM+FAM score was taken when patient was shifted for rehabilitation units to establish a baseline score at which patient can be shifted to rehabilitation units and to assess patient's improvement. Patients were shifted to rehabilitation units at an average score of 109.66±24.55 which is 3.6 per item (109.6/30=3.6). Similar result was reported by Hamilton BB et al., [8] where patients were admitted to rehabilitation units at score of 3.4 per item.

Patients were kept under rehabilitation program until they attained a satisfactory recovery to be sent home. Total average discharge score was found as 174.86±15.38 (P=0.01) which is similar to the average discharge score reported by Rehabilitation measures database (165.1±34.3). [12]

Patients who were admitted to the hospital with low score had a low average discharge score i.e. 169.49 as they had multiple disabilities at the time of admission and a full recovery will take a long time hence these patients were discharged at a best possible quality of life. Highest average discharge score i.e. 199 was seen in four patients who were admitted with few disabilities which is way more than the total average discharge score, hence individual item score is important to assess the patient condition. Average FIM+FAM score provides benchmark functional values to establish a baseline from which to estimate therapy effectiveness and efficiency and to compare innovative therapy interventions in the future. Robert W. Teasell et al [13] also described the outcomes of patients using median admission and discharge scores.

Looking at the functional gain, functional gain was found to be inversely proportional to the average admission score. Highest functional gain was found in patients who were admitted to the hospital at low score i.e. 132 and least in patients with high average admission score. As evidenced by the comparison of admission and discharge FIM+FAM scores (as functional gain) all patients included in the study achieved the best possible quality of life, all patients, regardless of their degree of disability, showed nearly the same magnitude of improvement in physical and functional abilities after their rehabilitation stay. Therefore, results showed admission

FIM+FAM score to most strongly predict discharge. A study done by Ferriero et al [14] also reported that admission FIM score was the most powerful predictor of functional outcome.

CONCLUSION

Observations from FIM scores showed that most of the patients had FIM scores in range of 30-59 which comprised of 68 patients. The average FIM scores on admission were found to be 64.74.

The mean middle score was 109.66 and mean discharge score was found to be 174.86.

The mean functional gain was 110.12. It was found that high FIM+FAM scores were associated with high functional levels in the patients.

FIM+FAM scale is a significantly useful scale to measure patient's progress and assess functional outcomes. The admission FIM+FAM score was the most powerful predictor of functional outcome.

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