Original Research Article

Functional recovery and its predictors after sub-acute stroke rehabilitation in a Nigerian tertiary health facility: A preliminary finding

Abstract

Background: Neurorehabilitation remains one of the main methods of treatment in the management of stroke survivors and its early commencement reduces morbidity and improves function. This study assessed motor function recovery after sub-acute stroke rehabilitation and determines factors that predict the recovery.

Methods: The cohort prospective study includes 30 consecutive in-patients of a tertiary health facility in Nigeria with primary diagnosis of stroke. Their motor function was assessed at admission and discharge using Functional Independence Measure (FIM) and Modified Motor Assessment Scale (MMAS). Descriptive and inferential statistics were used to analyse the data.

Results: Length of rehabilitation/hospital stay ranges between 3 and 60 days (median=16.5 days) and stroke onset interval before admission/rehabilitation ranges between 2 and 28 days (median=8 days). There were significant differences between admission and discharge FIM and MMAS (p=0.001). Only 53.3% achieved Minimal Clinically Important Difference (MCID) in functional recovery as measured by FIM at discharge. Type of stroke (haemorrhagic), motor impairment body side (right) and admission FIM (68.5±30.4) were the predictors of achieving MCID after stroke. Right body side motor impairment are 8 times (OR=7.72; CI=1.08 – 54.97; p<0.05) more likely to achieve MCID in functional recovery compared with left side. The multiple regressions also revealed that stroke type (haemorrhagic) and motor impairment body side were the only significant factors in predicting improved functional recovery after stroke measured by FIM.

Conclusion: More than half of stroke survivors achieved MCID in motor function recovery after sub-acute stroke rehabilitation and side of impairment is the major predictor.

Key word: stroke rehabilitation; functional recovery; outcomes; sub-acute stroke

Introduction

Stroke has become major health issue worldwide. It is the leading cause of disability among adults and is the most common cause of dependence in activities of daily living among the elderly [1,2]. It causes not only physical impairment, but also leads to activity restriction, social non-participation and depression [3]. Regaining functional independence is an important goal for people who have experienced stroke [4]. Improved motor function is one of the most often expressed recovery goals by patients with stroke [4].

Previous studies have shown that stroke severity [4], reduced functional status at admission [5,6], increasing age [7,8], sex being female [9,10], and delay in seeking medical treatment [11] are factors that have been associated with a lower rate and extent of functional recovery after stroke. Studies have suggested that patients with intracerebral hemorrhage and ischemic stroke have different recovery patterns though; they share similar prognostic factors with recovery favoured the former [12,13]. These studies observed that despite a greater level of disability on admission to rehabilitation among patients with intracerebral hemorrhage, they achieved significantly greater gains in function than patients with cerebral infarction after rehabilitation [11,12].

One of the goals of rehabilitation is to help stroke survivors achieve optimal level of motor function and independence. Several studies have assessed, monitor the progress of rehabilitation and predict end point outcome among stroke survivors [6,8,11,12]. It is crucial to define changes in functional scores that correspond to a relevant clinical improvement [14]. There is paucity of study that defines functional recovery based on minimal clinically important difference from Nigeria. Therefore, the aim of present prospective study is to assess motor function recovery (based on MCID) after sub-acute stroke rehabilitation and determine factors that predict the recovery.

Materials and Methods

Patients

The prospective study includes 30 consecutive patients admitted to medical ward of a University Teaching Hospital in Nigeria with primary diagnosis of stroke. Other inclusion criteria included: first onset of stroke without other major disease (like diabetes) and the absence of apparent pre-existing disability, stroke onset within 28 days before admission or commencement of rehabilitation, ability to follow instructions and willingness to participate in the study. Their motor function was assessed on admission and after 10 treatment sessions of physiotherapy or at discharge (whichever comes first).

Procedure

Physical characteristics of the participants (sex and age), type of stroke (based on clinical classification) and duration since onset of stroke to admission or commencement of rehabilitation were obtained from patient's record. The Outcome Measures (FIM and MMAS) were then applied at admission/point of referral to physiotherapy and after 10 treatment sessions of physiotherapy or at discharge (from in-patient care) with either of the outcome measure administered first. Their Length of Rehabilitation (LOR) was noted. Scientific and ethical review committee of Olabisi Onabanjo University Teaching Hospital, Nigeria approved the study. Informed consent was given by the participants after the nature, purpose and procedure had been explained. More than half of the data were collected between 2008 and 2010 with few data collected earlier than 2008 and beyond 2010.

Measurements

Functional recovery: this was measured with FIM. FIM is an 18-item, 7-level ordinal scale instrument that measures consistent performance in essential daily functional skills. Two main domains with six subscales are assessed by interviewing or by observing a performance of a task to criterion standards. FIM is categorized into 2 main functional streams: "Dependent" (i.e., requires helper: scores 1–5) and "Independent" (i.e., requires no helper: scores 6–7). Scores 1 (total assistance) and 2 (maximal assistance) belonged to the "Complete Dependence" category. Scores 3 (moderate assistance), 4 (minimal contact assistance), and 5 (supervision) belonged to the "Modified Dependence" category. Scores 6 (modified independence) and 7 (complete independence) belonged to the "Independent" category. Functional independence measure has been shown to be reliable and valid [15,16].

Motor recovery: this was assessed by MMAS. MMAS has 8 dimensions of motor function: Supine to side lying, Supine to sitting over side of bed, Balanced sitting. Sitting to standing, Walking, Upper-arm function, Hand movements and Advanced hand activities. Each dimension is on 7 point scale 0 to 6. Point 6 indicates optimal motor behavior. MMAS is a valid instrument [17,18].

Rehabilitation program

All patients received physiotherapy treatment (motor rehabilitation) in addition to medical treatment and nursing care. The need and type of motor rehabilitation needed was determined by the attending physiotherapists. All patients underwent an average of 3 days/week of physiotherapy (120 min/week). The motor rehabilitation was based on proprioceptive neuromuscular facilitation and neurodevelopmetal concept. In order to ensure standardization of treatment procedure the lead author supervised the treatment and other physiotherapists involved in the management.

Definition of end-points

All patients showing an improvement from baseline to discharge in FIM (motor, cognition and total) scores higher than the Minimal clinically important difference (MCID) were defined as true MCID and those who were not as none MCID. Minimal clinically important difference FIM change scores cut-off of ≥22, ≥17, and ≥3 for the total FIM, motor FIM, and cognitive FIM, respectively were used to categorize patients to achieve functional recovery or not [14]. Sub-acute stroke was defined as stroke onset within 28 days before admission or commencement of rehabilitation.

Analysis

Data were summarised with descriptive statistics of mean, standard deviation and percentages. Wilcoxin was used to compare mean of admission and discharge FIM and MMAS. The MMAS and FIM (total, motor and cognitive) changes were determined through differences in the values at admission and discharge. Rate of recovery was determined by dividing the change by LOR. Mann-Whitney U was used to assess differences between characteristics of those who achieved MCID and those who did not. Binomial and multiple regressions were performed to assess association of factors that predict motor function recovery. *P* level was set at 0.05.

Results

Thirty consecutive stroke survivors were followed up in this study. Twenty (67%) were male and majority (90%) had ischemic stroke (table 1). More than half achieved minimal clinically important difference (MCID) in their functional recovery measured by FIM at discharge. There was significant difference in the admission and discharge FIM and MMAS with mean length of rehabilitation and stroke onset interval before admission/rehabilitation of 19.5±14.2 and 9.8±6.7 days respectively (table 2). Only admission FIM (motor, cognitive and total) showed significant difference between those who achieved MCID and those who did not (table 3). There were also significant differences in change of MMAS, FIM (motor, cognition and total), and rate of recovery for MMAS and FIM (in favour of those who achieved MCID) when stratified MCID by motor and total FIM. The result of logistic regression indicates that type of stroke (haemorrhagic); side of body motor impairment (right side), stroke onset interval, age and admission FIM score were the predictors of achieving MCID in functional recovery after stroke measured by FIM (table 4). Right body side motor impairment are 8 times (OR=7.72; CI=1.08-54.97) more likely to achieve MCID in their functional recovery compared with left body side motor impairment. The generalized linear models also revealed that type of stroke (haemorrhagic) and motor impairment body side (right) were the only significant factors in predicting change in functional recovery measured by FIM when factors such as age, sex, stroke onset interval, type of stroke and motor impairment body side were entered in the models.

Discussion

The present study reported motor function recovery defined by minimal clinically important difference (MCID) after sub-acute stroke rehabilitation. The advantage and clinical relevance of MCID have been earlier stated being the smallest change that is important to patient and minimum threshold of improvement [19]. Thus, it helps to focus on patient-perceived outcomes. The results showed that discharge FIM (total, motor and cognition) and MMAS were significantly greater than admission values. The clinical implication of this finding is that post stroke motor rehabilitation may benefit stroke survivors. This observation was consistent with previous studies which assessed motor functional recovery after stroke [5,6,19]. Analyses of statistical difference of admission and discharge outcomes may not provide sufficient information to identify and quantify those who reach successful recovery and those who did not but MCID does [19]. In particular, around 53% of our subjects reached a clinically relevant improvement which was similar to a previous study who reported 65% [19]. Again this buttress the gain of post stroke motor rehabilitation and this rule out any misleading effect of taking statistics by itself. The slight difference in the value of those that reached a clinically relevant improvement in the two studies may be due to the fact that the present study's subject received only physiotherapy as a form of rehabilitation while the other study's subject received occupation therapy and speech therapy in addition. Occupation therapy and speech therapy were not available at the centre where the present study was conducted for those patients that might benefit from such services. It could also be that the present study setting is under-resourced. It has been reported that there is differential recovery patterns for stroke survivors in developed and developing countries due to differences in resource availability [20].

Admission FIM (motor and cognition) predicted minimal clinically important difference of functional recovery in the present study. This may suggest that the better the functional independence at admission the better the motor function recovery after post stroke rehabilitation. This observation was consistent with previous studies who reported the role admission FIM in the prediction of discharge or change FIM in stroke survivors [6,19,21]. However, the magnitude of effect found in the present study using MCID analysis was lower than what is found by studies using traditional approach based on exit/discharge FIM scores gained by stroke survivor after rehabilitation [6,21]. As revealed by our data those subjects achieving MCID have higher scores of admission FIM than those who did not achieve clinically relevant improvement. The reason for this is not fully understood but it may be that the cognition of those who achieved MCID are less affected or are more independent than those who did not achieve MCID.

Body side of paresis predicted MCID in the present study. Right body side motor impairment is 8 times more likely to achieve MCID in their functional recovery compared with left body side motor impairment. The reason for this is not clear but it may be that the patients with right body paresis have greater gain in FIM than left body side paresis as suggested by our data or better still, it could be that many were right hand dominant. Though, hand dominance was not assessed. Type of stroke, age and onset of stroke to rehabilitation has been shown to predict functional recovery after stroke [22-24]. Our results confirm these findings though not significant in sub-acute stroke rehabilitation. Gender does not predict functional recovery in the present study which was in agreement with a study which reported that gender did not emerge as an independent predictor for higher FIM at discharge, suggesting that gender should not be held as adversely affecting rehabilitation [21]. Our study differ from study that reported that length of rehabilitation predict functional recovery [22]. The difference could be due to the fact that our study follows up the patient for a short period of time than the previous study.

This study has some limitations, which must be considered when interpreting these results. Our findings may not be generalized to all stroke survivors but are representative of functional recovery only in survivors who undergo inpatient rehabilitation therapy. We did not include all possible predictors (such as stroke severity, depression etc) in regression analysis. A future line of research could be the influence of mild cognitive impairment on functional recovery of acute stroke. This would be important because mild cognitive impairment is an essential clinical feature of acute stroke, mainly in small vessel subcortical infarcts [25].

Despite these limitations, the present study has several strengths. We define functional recovery based on a new and powerful method of assessing rehabilitation outcomes using minimal clinically important difference. The prospective nature of the study allows us to follow up the survivors through the sub-acute stage.

Conclusion

More than half of the stroke survivors achieved minimal clinically important difference in their functional recovery after sub-acute rehabilitation. Side of paresis predicted MCID in the present study.

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Table 1: Descriptive Characteristics of the Participants (N=30)

Variables	n	%
Sex		
Male	20	66.7
Female	10	33.3
Type of stroke		
Ischemic	27	90
Haemorrhagic	3	10
Stroke motor impairment		
Right body	13	43.3
Left body	17	56.7
Minimal clinically important difference		
True difference (total FIM)	16	53.3
Motor FIM	17	56.7
Cognitive FIM	15	50.0

FIM=Functional Independence Measure

Table 2: Quantitative Characteristics of the Participants

Variables	admission Mean±SD	discharge Mean±SD	p	change/gain Mean±SD	Mean±SD
MMAS	24.70±13.86	35.23±11.26	0.001	10.53±8.34	
Motor FIM	43.97±24.00	64.83±20.24	0.001	20.87±16.23	
Cognitive FIM	24.57±10.25	29.00±7.46	0.001	4.43±5.29	
Total FIM	68.53±30.39	93.83±25.16	0.001	25.3±19.6	
Age (years)					62.3±13.1
Length of rehabilitation (days)					19.5±14.2
Stroke onset interval (days)					9.8±6.7
MMAS rate of recovery [median(range)]					0.5(0.1-2.6)
Motor FIM rate of recovery [median(range)]					1.2(0-9.3)
Cognitive FIM rate of recovery [median(range)]					0.1(0-6)
Total FIM rate of recovery [median(range)]					1.4(0-15.3)

MMAS=Modified motor assessment scale FIM= Functional Independence Measure

Table 3: Differences between true MCID and none MCID characteristics

Variable	MCID stratified by motor FIM		cognitive FIM		total FIM	
	U	*P*	U	*P*	U	*P*
Age	98.0	0.60	88.5	0.32	88.0	0.32
Stroke onset interval	69.0	0.08	110.5	0.93	78.0	0.16
Length of rehabilitation	72.5	0.11	105.0	0.76	75.5	0.13
Admission MMAS	91.5	0.43	95.5	0.48	99.0	0.59
Admission Motor FIM	60.0	0.03	82.5	0.21	58.0	0.02
Admission Cognitive FIM	89.5	0.38	44.0	0.01	84.0	0.24
Admission Total FIM	67.5	0.07	66.5	0.06	66.0	0.06
Change in MMAS	45.0	0.01	106.0	0.79	42.0	0.01
Change in Motor FIM	0.0	0.001	69.5	0.07	0.5	0.001
Change in Cognitive FIM	51.5	0.01	0.0	0.001	48.0	0.01

Change in Total FIM	0.0	0.001	57.0	0.02	0.0	0.001
MMAS rate of recovery	24.0	0.001	98.5	0.56	22.0	0.001
Motor FIM rate of recovery	4.0	0.001	84.0	0.24	8.0	0.001
Cognitive FIM rate of recovery	51.0	0.01	13.0	0.001	48.0	0.01
Total FIM rate of recovery	3.0	0.001	72.0	0.09	6.0	0.001

Table 4: Association of Predicting Factors and Minimal Clinical Important Difference

Independent variables		true MCID		
		OR	SE(OR)	95%CI
Total FIM				
Stroke type	haemorrhagic	1		
	Ischemic	0.02	2.35	0 – 1.77
Stroke motor impairment				
	Left side	1		
	Right side	7.72*	1.00	1.08-54.97
Age		1.07	0.04	0.99-1.16
Stroke onset interval		0.87	0.08	0.74-1.01
Motor FIM				
Admission motor FIM		0.96*	0.02	0.92-1.00
Cognitive FIM				
Admission cognitive FIM		0.88*	0.05	0.80-0.98

MCID=Minimal Clinical Important Difference *significant at $P<0.05$

Factors enter in the model (binary regression): type of stroke, motor impairment body side, stroke onset interval, age, admission FIM, sex and length of rehabilitation.