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Research Article

Association of Rehabilitation Care Duration and Functional Status of People with Chronic Stroke

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ABSTRACT

Introduction: There is limited information on the status of international classification of functioning, disability, and health (ICF) framework in subjects with chronic stroke with varying duration of rehabilitation care. Accordingly, this study investigates whether the duration of rehabilitation care affects the status of ICF in subjects with chronic stroke.

Materials and Methods: This was an observational cross-section study on 58 individuals with chronic stroke. The number of subjects who received rehabilitation care for less than 3 months and more than 3 months were 22 (group A) and 36 (group B), respectively. The ICF components of impairment of body functions and structure were assessed using the clock drawing test, the Beck depression inventory, and the Fugl-Meyer assessment of motor recovery after stroke. The activity limitation and participation using timed up and go test, the community integration questionnaire, and environmental factors were assessed by the Craig Hospital inventory of environmental factors.

Results: The Fugl-Meyer assessment and the policy components of the Craig hospital inventory of environmental factors showed a significant difference between the groups. Longer duration of rehabilitation care only showed a positive effect on the Fugl-Meyer assessment scores. No other components of ICF showed any difference between the groups.

Conclusion: The duration of rehabilitation impacts the impairments of body functions and body structures of ICF components. The study findings are limited and further studies are required before generalizing the results.

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1. Introduction

Stroke is the second leading cause of preventable death and its resultant disability is a major concern for public health [1]. Survivors can have cognitive impairment, sensory-motor deficits, functional impairments, and restricted activities of daily living [2]. The majority of survivors of stroke continue to live with different disabilities and rehabilitation is necessary to enable the person to live their life, independently.

Functional independence is the starting point of any goal-oriented, evidence-based rehabilitation process [3]. The World Health Organization's (WHO) international classification of functioning disability and health (ICF) aims to give a universal language for functioning and disability [4]. Assessing the function of an individual includes the interaction of positive aspects among 3 main ICF components, namely body functions and structures, activity and participation, and environmental and personal factors [5]. WHO's ICF model has been adopted as a framework to assess and formulate rehabilitation programs for people with stroke [6]. WHO has identified and developed specific ICF core sets for different disease conditions. The brief and comprehensive core sets have been developed for stroke [7]. Some studies have explored functionality using ICF as a framework in people with stroke [8, 9]. The categories of ICF can be assessed directly using the core sets for the specific conditions or assessment tools that can measure the ICF components.

There is no consensus on the ideal duration of rehabilitation interventions for people with stroke for managing various impairments. The findings showed varying results because of heterogeneous study settings along with other factors. Early initiation and intensity of rehabilitation may be factors affecting rehabilitation outcomes [10, 11]. The duration of intervention employed strategies can vary from a minimum of 4 weeks to a much longer duration. Varying duration of rehabilitation care is recommended for different impairments associated with stroke [12]. In this study, we used a minimum duration of rehabilitation of 3 months as the time frame, since this is the early phase of rehabilitation and is the time when maximum relative recovery is also noted.

In this study, we compared the status of people with chronic stroke between subjects who received up to 3 and more than 3 months of rehabilitation care on ICF components. The association of various components of ICF with duration of rehabilitation was also determined. There are validated tools to assess the impairment of body function and structure, activity limitation and participation, and environmental factors domains of ICF. The clock drawing test (CDT) and the Beck depression inventory (BDI), were used to evaluate the cognitive and depression symptoms. The Fugl-Meyer assessment (FMA) of motor recovery after stroke was employed for motor function as a part of the ICF components of impairment of body functions and structure. The activity limitation and participation domain were evaluated using the timed up-and-go test (TUG) and the community integration questionnaire (CIQ). And, the environmental factors were assessed by the Craig hospital inventory of environmental factors (CHIEF). The findings of this study may help us in identifying the needs of patients and rehabilitation professionals to structure rehabilitation programs, according to the health status of the individuals and their current functioning status.

2. Materials and Methods

Study participants

A total of 75 patients diagnosed with stroke were evaluated for participation in this study, from which 17 subjects were excluded as they did not meet the inclusion criteria. Meanwhile, 58 subjects (>6 months since stroke) in the age range of 30 to 75 years were included in the study. The subjects were recruited from a physiotherapy outpatient department of a teaching institute in India. The convenient sampling method was used. The inclusion criteria were clinical diagnosis of primary stroke with weakness and or spasticity in the affected half of the body. The subjects were excluded if there was a recurrent stroke, any musculoskeletal deformity, or neurological abnormality besides hemiparesis stemming from stroke, aphasia, or cognitive impairment (screened using mini-mental status examination [MMSE]).

Sample size

The sample size was determined using G*Power software, version 3.1.7, with a significance level of 0.05 at a power of 0.80 with an effect size of r=0.7. The value of 0.7 was considered significant as it indicates a strong linear relationship between the variables. A total of 58 subjects had to be recruited for this study.

Study design and protocol

In this cross-sectional observational study, the participants were classified into 2 groups, namely subjects who had received rehabilitation less than 3 months (group A)

and subjects who had received rehabilitation more than 3 months (group B). Subjects with symptoms of stroke more than 6 months were screened and eligible individuals were recruited and were then informed about the study. The Subjects were informed about the purpose, methodology, and possible risks of the study. Each subject received a written informed consent form explaining their rights as research subjects. If they agreed to participate in the study, they signed the consent form. All identifying information on the consent form and demographic/injury history questionnaire was kept confidential by assigning a number to each subject. The participants were interviewed for demographic information, date of attack, side effects, along with outcome measures. To reduce the measurement bias, the assessor was blinded from the objectives of the study, and to minimize measurement error, the assessor was given specific training in administering each test and measure. The stroke diagnosis was done by a neurologist and referred to the physiotherapist for further assessment as a part of the study. The person who conducted the assessment based on ICF had an experience of more than 3 years in handling people with stroke.

Familiarization sessions were given concerning various tests and tools and how they were to be administered, answered, and performed. Two testing sessions were conducted with each participant. The first session included grip strength measurement, CDT, CHIEF, and TUG. The second session included the administration of BDI, CIQ, and FMA recovery after stroke scale for both upper and lower limbs. The assessment for both sessions was completed in 30 to 40 min. The scale and methods used for the assessment were validated tools for measuring specific domains in people with stroke and established methods of using these scales and tests were followed. Each category was based on the ICF core set for stroke [7].

Study measures

Clock drawing test

The participants were asked to mark a particular time on the drawn clock by the examiner. This test was done to assess the cognitive functions [13]. Scoring was done by the method described by Sunderland [14]. A score of 6 or more was considered normal on a scoring scale of 1 to 10 [15].

Beck depression inventory

The participants were given the Beck depression inventory questionnaire and received an explanation of the scoring method of the questionnaire (0=no problem and 3=severe problem). Then, the participants were asked to read the questions one by one and tick the option that was appropriate to them. This test was used to assess the emotional functions of the individual and depression, if present. Scoring was done out of 60 as one question that dealt with sexual activity was excluded from the study [16-18].

Grip strength

The Lafayette instrument JAMAR hydraulic hand dynamometer was used to measure the grip strength of the patients. The patients were given a demonstration on how to hold the dynamometer in their hand and how to perform with it to have the desired readings. The subjects were required to hold the dynamometer in one hand with fingers anteriorly and the thumb posteriorly while pressing the device as strongly as possible. Before taking the readings, it was ensured that the pointers are on zero so that no error existed and the standard position was maintained. Three readings were taken and the average was derived from them [19]. In case the patient found any difficulty, assistance was given to the patient to hold the dynamometer.

Fugl-Meyer assessment scale of motor recovery after stroke

The Fugl-Meyer assessment scale of motor recovery after stroke–upper extremity and lower extremity (FMA-UE/LE) has a function-based scoring. As more functions are performed by the patient correctly, more scores are given to the participant. The patients were required to be in sitting, standing, and lying positions. The assessment was fully assessed by the therapist. The main areas that were assessed were reflexes, synergy patterns, voluntary movements, hyperactivity, coordination, sensations (superficial and deep), passive movements, and pain during each movement in every plane for both upper and lower extremities [20, 21]. The scoring was done for different domains of recovery on an ordinal scale ranging from 0 to 2. A higher score indicated better function. The maximum total score was 126 and 86 for the upper and lower extremity, respectively.

Timed up and go test

The patients were asked to get up from their chairs independently or with their walking aid, depending upon the patient, and walk for 3 m, turn around, walk another 3 m, and then sit back on their chairs. The therapist measured the time taken for the whole activity using a stopwatch. Each participant had one trial session and then performed the required test. The test was done to assess the functional mobility in individuals with chronic stroke and the best score out of the 3 measurements was taken [22, 23].

Community integration questionnaire

The CIQ was used to assess the community participation and social role fulfillment of an individual having a chronic stroke. The scoring was done for each component and then, the total score was calculated out of 29 points adding all the scores of the sub scales [24, 25].

Craig hospital inventory of environmental factors

The questions on the CHIEF tool were asked by the therapist similar to an interview. On this scale, each question has 2 components, that is, how severe is the problem and what is the frequency of the problem's occurrence in various situations and environmental conditions. The response was marked by the therapist and the scoring was done by multiplying the frequency and magnitude for each question. Each question with a greater range indicated the particular situation as a barrier, while lower scores indicated the situation as a facilitator. The short form of this questionnaire was used in this study. It was used to assess the various facilitators and barriers present in the environment for participation in the home and society by the individual with chronic stroke [26, 27].

Data analysis

Descriptive statistics (Mean±SD) were calculated for age (years), weight (kg), height (m), body mass index (kg/m^2), duration of rehabilitation (months), duration of hospitalization (days), duration since the attack (months), impairments of body functions and body structures, activity limitation and participation restriction and environmental factors, and environmental factors. The frequency distribution (n) for other relevant participant characteristics was also calculated. The independent t test was used to compare the parameters based on the duration of rehabilitation between both groups for the impairments of body functions and body structures, activity limitation and participation restriction, and environmental factors. The data was logarithmically transformed (logarithm to base of 10) before analysis for the duration of hospitalization and the duration of stroke. Then, the analysis was done to find out the association between different measures and the duration of rehabilitation using binary logistic regression for each variable with the group as the dependent variable. The reference was taken by subjects toward more than 3 months of rehabilitation and analyzing predictability of each independent variable falling into the reference category. The level of significance was set at $P \leq 0.05$. The statistical analysis was done using the SPSS software, version 21.

3. Results

The demographic characteristics were compared between individuals who had taken rehabilitation for less than 3 months and more than 3 months. The subjects' demographic characteristics were similar, except for the duration of rehabilitation care. The descriptive statistics (Mean±SD) for age, weight, height, body mass index, duration of rehabilitation care, duration of hospitalization, and frequency distribution (n) of other relevant characteristics are provided in Table 1.

There was no significant difference in the impairments of body functions and body structures between the study groups. The outcome scores of clock drawing, BDI, and grip strength did not show any difference, while the FMA of motor recovery after stroke for both upper extremity and lower extremity showed a significant difference for the duration of rehabilitation (Table 2). There was no significant difference between the groups in the scores of TUG, the total score of the community integration questionnaire, and its components (Table 3). There was also no significant difference between the groups in the total score and its components, except for the policies component of CHIEF (Table 4). The FMA-UE and FMA-LE were the only variables that showed significant association with the duration of rehabilitation. The odds ratio with its confidence interval for the impairment of body structure and function, activity limitation, and participation restriction are shown in Figure 1.

4. Discussion

This study aimed to investigate whether there was any difference between subjects on various components of ICF based on the duration of rehabilitation care in subjects with chronic stroke. There is a shortage of information regarding the association between the duration of rehabilitation and the functional outcomes in people with stroke.

Table 1. Demographic characteristics of the participants

Variables	Mean±SD		Mean Difference 95% CI	P
	Group 1: <3 Months Care n=22 (M=17, F=5)	Group 2: >3 Months Care n=36 (M=29, F=7)		
Age (y)	55.5±10.63	50.44±10.43	10.75–0.64	0.08
Weight (kg)	68.5±9.33	69.33±9.65	4.33 –6.00	0.74
Height (m)	1.66±0.086	1.66±. 087	0.03–0.056	0.71
BMI (kg/m^2)	24.88±3.16	25.02±4.07	1.89–2.17	0.89
Duration of rehabilitation care (months)	1.258±.744	4.37±1.10	0.86–5.43	0.008
Hospitalization (d)	9.95±11.25	15.361±18.44	3.3–14.14	0.22
Duration since stroke (m)	26.04±26.51	38.17±59.93	15.01–39.28	0.37
Type of stroke (I/H)#	20/2	30/6	---------	---------
Dominant side#	22	36	---------	---------
Affected side (R/L)#	9/13	17/19	---------	---------
Seizure history#	1	3	---------	---------
Walking aid (Y/N)#	4/18	13/23	---------	---------
Hypertension#	21	33	---------	---------
Diabetes mellitus#	11	12	---------	---------
CVD#	6	11	---------	---------
Pain#	12	5	---------	---------
Any medication (Y/N)#	20/2	33/3	---------	---------
Smoking history#	5	7	---------	---------
H/o alcohol intake#	2	2	---------	---------

JMR

Abbreviations: kg: Kilogram; m: Meter; BMI: Body mass index; CI: Confidence interval; M: Male; F: Female; R: Right; L: Left; I: ischemic; H: Hemorrhagic; Y: Yes; N: No; CVD: Cardiovascular disease; H/o: History of.

#Frequency distribution (n).

As earlier the rehabilitation care starts with more duration the functioning in chronic stroke individuals would improve [10, 28, 29]. A recent Cochrane review reported the potential benefits of rehabilitation therapy compared to no treatment since the stroke [30]. With more delay in rehabilitation the functioning, mobility, and participation decrease while the depression scores increase [31]. This study found a difference in motor functions of the upper and lower extremities which is similar to the results of the earlier studies [10, 28]. The policy components of CHIEF showed a difference between the groups. There is no information available on the effect of duration of rehabilitation on environmental factors.

In this study, the CDT score was more in subjects with less than 3 months of rehabilitation care and the BDI score was less in subjects who had rehabilitation care more than 3 months. The grip strength and FMA-UE/LE were more in subjects who had rehabilitation care for more than 3 months. There can be an association between cognitive impairment and depression [32]; however, according to this study, the group with bet-

Table 2. Impairments of body functions and body structures difference between the study groups

Variables	Mean±SD		Mean Difference 95% CI	P
	Group 1: <3 Months Care	Group 2: >3 Months Care		
Grip strength (kg)	13.97±6.43	15.63±5.37	1.48–4.79	0.296
Clock drawing test	5.4±3.55	4.00±3.26	0.41–3.22	0.128
Beck depression inventory	16.40±7.34	14.86±6.83	2.62–5.33	0.419
FMA-upper extremity	95.59±18.04	107.47±13.18	3.62–20.11	0.005
FMA-lower extremity	69.63±8.47	75.72±7.23	1.89–10.29	0.005

Abbreviations: kg: Kilogram; FMA: Fugl-Meyer assessment of motor recovery after stroke; CI: Confidence interval. JMR

Table 3. Activity limitation and participation restriction difference between the study groups

Variables	Mean±SD		Mean Difference 95% CI	P
	Group 1: <3 Months Care	Group 2: >3 Months Care		
TUG (s)	18.47±15.99	20.83±13.65	5.54–10.28	0.553
Home integration-CIQ	2.00±1.02	1.94±1.62	0.71–0.82	0.886
Social interaction-CIQ	3.59±2.21	4.05±2.12	0.70–1.63	0.430
Productive action-CIQ	3.13±2.45	2.72±2.19	0.83–1.666	0.508
Total-CIQ	8.72±4.73	8.75±4.77	2.55–2.66	0.986

Abbreviations: TUG: Timed up and go test; CIQ: Community integration questionnaire; CI: Confidence interval. JMR

Table 4. Environmental factors difference between the groups

Variables	Mean±SD		Mean Difference 95% CI	P
	Group 1: <3 Months Care	Group 2: >3 Months Care		
Attitudes and support–CHIEF	4.59±4.61	3.75±3.06	1.77–2.88	0.407
Services and assistance–CHIEF	6.27±4.34	4.75±4.24	0.79–3.33	0.194
Physical and structural–CHIEF	3.04±2.33	3.19±2.35	1.12–1.42	0.815
Policies–CHIEF	0.955±2.10	3.02±3.47	0.42–3.72	0.014
Work and school–CHIEF	0.864±2.18	0.667±1.97	0.91–1.31	0.725
Total–CHIEF	15.72±6.74	15.38±8.01	3.76–4.44	0.869

CHIEF: Craig hospital inventory of environmental factors; CI: Confidence interval. JMR

ter cognitive function had more depression. Individuals with stroke may develop mental regression, discouragement, anxiety, and depression if they do not receive proper physical, social, and psychological support [33]. Post-stroke depression increases neurological and psychological damage, negatively affecting performance in activities of daily living [34]. Upper limb rehabilitation may require more intense practice [35-37]. The grip strength improves proportionately with the upper limb motor tasks. Hand strength is a critical indicator of functional recovery in stroke [35, 38]. The effect of the duration of rehabilitation on cognitive, and emotional

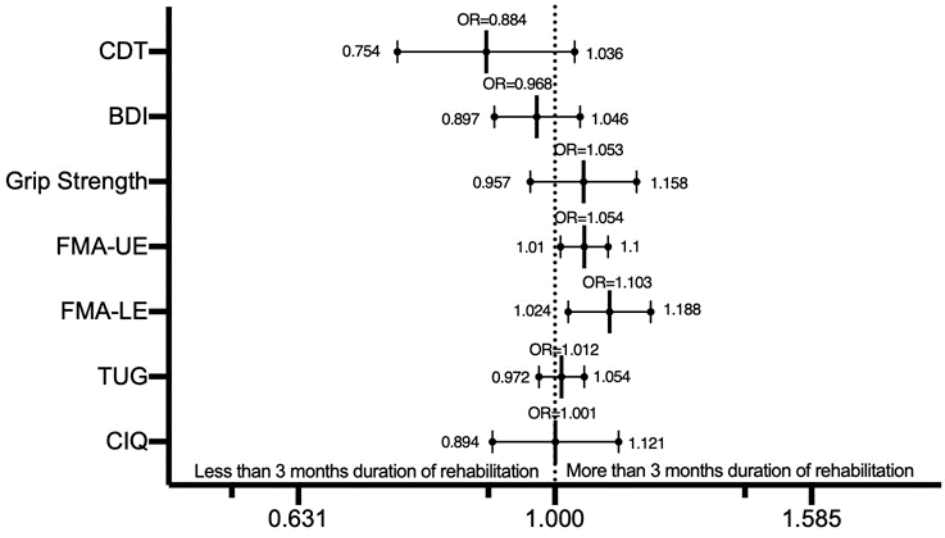

Figure 1. The binary logistics regression analysis results with odds ratio and 95% confidence interval

Abbreviations: OR: Odds ratio; CDT: Clock drawing test; BDI: Beck depression inventory; FMA: Fugl-Meyer assessment of motor recovery after stroke; UE: Upper extremity; LE: Lower extremity; TUG: Timed up and got test; CIQ: Community integration questionnaire.

The Fugl-Meyer assessment of motor recovery after stroke–upper extremity and lower extremity showed a significant association ($P<0.05$).

functions, and grip strength might also have contributed to better improvement in FMA UE/LE score in subjects with longer duration of rehabilitation care. The results of our study showed that the FMA-UE and FMA-LE were the only variables that had significant odds toward extended rehabilitation. Similar results were documented with prolonged robot-assisted training on upper limb motor recovery in sub-acute stroke [39].

The increased scores of the TUG test in individuals with rehabilitation care for more than 3 months may be due to the longer duration since stroke leading to mobility decline. The reduced scores in CDT scores might also have an impact on mobility function since the common neurological pathways are involved in cognitive and mobility functions. The non-significant differences in impairment of body functions and structure along with the TUG test may also contribute to the insignificance differences in CIQ. The changes in the FMA score alone are insufficient to bring changes in community integration. The upper limbs, including the hands, play an important role in motor functions [40]. Accordingly, upper limb function is closely related to performing ADLs and social participation [41]. The people with chronic stroke reported many barriers which restricted their participation in the family, community, society, and in doing exercises which were assessed using the CHIEF scale. The main barrier which was reported by the patient was the policy component in CHIEF. People with stroke were found to have difficulty accessing transport and communication facilities, services in government hospitals, and access to assistive devices [42, 43].

In lower- and middle-income countries, little work is done on ICF as a framework. This study helped find how the duration of rehabilitation is helping in gaining functional outcomes in people with chronic stroke. With the increase in the rehabilitation phase, more patients will be functionally independent at least in the motor function. The strengths of the study include using ICF as a framework for finding the status of the functionality of chronic stroke individuals and assessing all the dimensions of health. The weakness of the study was concerning that the study did not consider the area of the brain affected, size of the infarct, type, dosage of rehabilitation, intensity, and frequency of exercise sessions, which where given under guidance and by any specialized therapists. The study also did not consider the upper limit of the chronicity of the stroke which would have been a confounder in the study. Future studies are recommended on people with stroke on structured exercise programs for various durations and their effect on ICF domains.

5. Conclusion

The duration of rehabilitation was found to impact the motor functions of the upper and lower extremities. Though the study findings are limited in nature, further studies are warranted before the generalization of the results.

Ethical Considerations

Compliance with ethical guidelines

This study was approved by the Institutional Ethics Committee of Jamia Millia Islmia (Code: 04-10-86-IEC-2016). The study was done as per the declaration of Helsinki.

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Authors' contributions

Conceptualization and supervision: Majumi Mohamad Noohu and Muhammad Azharuddin; Methodology: Rashmi Gupta and Majumi Mohamad Noohu; Investigation, writing the original draft, review & editing: All authors; Data collection: Rashmi Gupta and Muhammad Azharuddin; Data analysis: Majumi Mohamad Noohu and Fayaz Rahman Khan; Funding acquisition and Resources: Rashmi Gupta and Majumi Mohamad Noohu.

Conflict of interest

The authors declared no conflict of interest.

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