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FUNCTIONAL MOTOR RECOVERY IN STROKE SURVIVORS-DETERMINANTS IN A SUB-SAHARAN AFRICAN STROKE UNIT

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ABSTRACT

Objective: To find out the determinants of functional motor recovery in stroke survivors.

Design: A prospective cross-sectional study

Setting: Stroke outpatient clinic tertiary care hospital

Subjects: One hundred and two stroke survivors had their basic data captured as well as the modified Rankin score (both at the time of discharge after admission and at the time of evaluation in the clinic).

Results: Twenty nine (28.4%) had functional recovery versus 73(71.6%) that did not. Younger age (OR = 0.95{CI 0.90-0.99} P=0.048), higher Rankin score at discharge (OR = 2.35{CI 1.40-3.95} P = 0.001), fewer informal caregivers at home (OR = 0.68{0.48-0.97} P = 0.034) and higher frequency of visits to the physical therapist (OR = 1.30{0.99-1.71} P = 0.05) predicted functional recovery. Age, modified Rankin score at discharge, duration between discharge from in-patient care and evaluation in clinic and frequency of visits to the physical therapist predicted group membership between functional recovery and others.

Conclusion: In spite of the lean neurorehabilitation facilities in the setting of this study, increased frequency of visits to the physical therapist predicted functional recovery in stroke survivors as in more resource robust climates. It should therefore be prescribed until functional recovery is achieved.

INTRODUCTION

Stroke is the leading cause of chronic disability in adults and it is estimated that there are 60 million stroke survivors, 16 million new cases of stroke and on average six million (37.5%) deaths occur per year from stroke the world over (1,2). Case fatality figures across the regions of the world are more staggering in sub-Saharan Africa, where mortality figures may be higher than 50% (3). Years lost to disease (YLD) in stroke impacts more negatively on Disability Adjusted Life Year (DALY) and Quality Adjusted Life Year (QALY) figures in stroke survivors in sub-Saharan Africa where life expectancy is comparably shorter than in the developed world (4-6). Acute stroke outcome is influenced largely by the quality of care received, age of the patient, presence of co-morbidities

and the severity of the stroke (7).

Stroke survivors enter a chronic recovery phase that is guided among other things by the quality of rehabilitation received (2, 8, 9). Rehabilitation in stroke survivors is instituted at different levels depending on the disability, which may be psychologic (mood and affect) cognitive (executive function, speech and language) physical (swallowing, bowel function, limb function and gait) or vocational (2,8-10). Functional recovery in stroke survivors is directly influenced by early commencement of physical therapy activity, the available rehabilitation expertise and facility, the frequency of contacts between the expert and the disabled patient, all of which are hinged on how well the patient can afford the services in a sub-region where social services like health insurance scarcely exist (2,11-14).

This study investigated the determinants of good physical function recovery (limb function and gait) in a stroke unit in sub-Saharan Africa.

MATERIALS AND METHODS

One hundred and two stroke survivors, from a discharged patient population of one hundred and forty, who were on follow-up in the outpatient clinic arm of a stroke unit had their basic demographic data of age, sex, marital status and level of education captured on a study pro forma as well as the modified Rankin score (both at the time of discharge after admission and at the time of evaluation in the clinic), the duration in months since discharged from in-patient care, number of physical therapy sessions per week, number of informal care givers at home, source of financial support for medicare and rehabilitation since discharged from hospital, presence or absence of aphasia, number of manifest strokes suffered in the past and type of stroke as determined by cranial Computed tomography (CT) or Magnetic Resonance Imaging (MRI) at the time of admission. All patients had neuroimaging as part of the stroke unit protocol. Thirty two patients dropped out from the enrollees, giving a drop-out rate of one in four (1:4) and all enrollees were only admitted and discharged patients in the stroke unit. Stroke type was categorised as cerebral infarct and intracerebral haemorrhage.

Operationally functional motor recovery was defined by at least a two point reduction in modified Rankin score after discharge from in-patient care plus a modified Rankin score of TWO and below at the time of evaluation. Rankin score gain was the difference between modified Rankin score at discharge from in-patient care and at evaluation in clinic for this study. Modified Rankin score was assessed by the

unit Consultant Neurologists and senior registrars at intervals of at least seven days and multiples of seven days from the time of discharge from in-hospital care.

Neurorehabilitation commenced for all admitted patients within forty eight hours of admission as per the unit protocol and throughout the duration of admission. Maximum length of in-hospital stay was 30 days.

Basic data were compared between participants with functional motor recovery and the others. Categorical, discrete and skewed continuous variables were tested with chi square and Mann-Whitney U-test as appropriate.

Predictor(s) of functional motor recovery was tested on a binary logistic regression and group membership between participants with functional motor recovery and others was predicted on a stepwise discriminant function analysis and a discriminant function equation was obtained with function co-efficients and mean group centroids. Inter-rater and intra-rater reliability between a Consultant and a senior registrar in the evaluation of Rankin score was tested on Pearson's correlation. Data analysis was done with SPSS version 20 and P-value of less than or equal to 0.05 was taken as significant for all tests.

RESULT

A total of 102 patients were studied comprising 70(68.6%) males and 32(31.4%) females. Mean age was 61.64± 11.82, (range 26-92 years, median 62 years). Mean duration in months between discharge from hospital and time of evaluation in clinic for this study was 14.18(19.08) months and 29(28.4%) had functional recovery and 73(71.6%) did not (Table 1).

Table 1
Comparing characteristics of participants with functional motor recovery and others

Parameter	Functional motor recovery	Others	Mann-Whitney U value	Chi-square	P-value
Age in years (mean ±sd)	59.82±12.91	62.36±11.37	947.50	-	0.410
Sex (f/m)	8/21	24/49	-	0.167	0.683
Marital status (s/m/w)	3/23/3	3/56/14	-	2.361	0.307
Educational attainment (none/primary/secondary/tertiary)	1/8/7/13	6/21/15/29	-	1.592	0.661
Stroke type (ischaemic/haemorrhagic)	22/6	55/18	-	2.622	0.270
Presence of aphasia (yes/no)	4/25	8/65	-	1.415	0.493

Source of financial support (0/1/2/3/4)	6/8/11/2/2	7/33/19/6/8	-	4.117	0.249
Modified Rankin score at discharge (mean±sd)	3.79±0.86	2.93±1.29	583.50	-	0.001
Modified Rankin score now (mean±sd)	1.48±0.63	2.22±1.14	607.50	-	0.002
Number of informal caregivers at home (mean±sd)	2.11±1.86	2.71±1.70	709.00	-	0.064
Number of visits per week to the Physiotherapist (mean±sd)	2.00±2.58	0.94±1.47	706.00	-	0.019
Number of stroke suffered (mean±sd)	1.17±0.38	1.15±0.36	1011.50	-	0.830
Duration in months (mean±sd)	18.04±25.70				
	12.64±15.69	608.50	-	0.269	
Rankin score gain (mean±sd)	2.31±0.47	0.75±0.59	50.00	-	<0.001
N = 102(100%)	29(28.4)	73(71.6)			

No significant differences were found between the mean ages ($P=0.410$), gender distribution ($P=0.683$), marital status ($P=0.307$), educational attainment ($P=0.661$), stroke types ($P=0.688$), presence or absence of aphasia ($P=0.493$), source of financial support for medicare and rehabilitation ($P=0.249$) of the two sub-groups of functional recovery and others (Table 1). The mean duration in months from time of discharge to evaluation in clinic for this study ($P=0.269$) and the mean number of manifest strokes suffered in the past ($P=0.830$) as well as the mean number of informal care givers at home ($P=0.064$) were not also significantly different between the participants with functional motor recovery and others (Table 1).

Mean Rankin score at discharge and at evaluation in clinic and the Rankin score gain as well as the mean number of visits to the physical therapist were however significantly different between the study groups ($P=0.001, 0.002$ and $<0.0001, 0.019$ respectively) Table 1.

Age (OR= 0.95{CI 0.90-0.99} $P=0.048$), modified Rankin score at discharge (OR= 2.35{CI 1.40-3.95} $P=0.001$), number of visits per week to the physical therapist (OR=1.30{0.99-1.71} $P=0.05$) and number of caregivers at home (OR= 0.68{0.48-0.97} $P=0.034$) significantly predicted functional motor recovery Table 2.

Table 2
Showing the predictors of good and functional motor recovery

Parameter	O.R	95% CI	P-value
Age	0.950	0.903-0.999	0.048
Modified Rankin score at discharge	2.352	1.400-3.952	0.001
Number of visits to Physical therapist	1.309	0.488-0.972	0.050
Number of informal caregivers at home	0.689	0.999-1.715	0.034
N = 102			

Also a discriminant function equation (DF) was obtained to predict group membership between participants with functional motor recovery and others using mean function at group centroids.

Table 3
Showing the predictors of group membership between good and functional motor recovery and others

Parameter	DF co-efficient	Wilk's Lambda (P-value)
Age	-0.748	<0.0001
Number of visits to Physiotherapist	0.302	
Duration	0.281	
Modified Rankin score discharge	0.708	
N	102	

DF = discriminant function

DF = $-0.748(\text{age}) + 0.302(\text{number of visits per week to the physiotherapist}) + 0.281(\text{duration}) + 0.708(\text{modified Rankin score at discharge})$

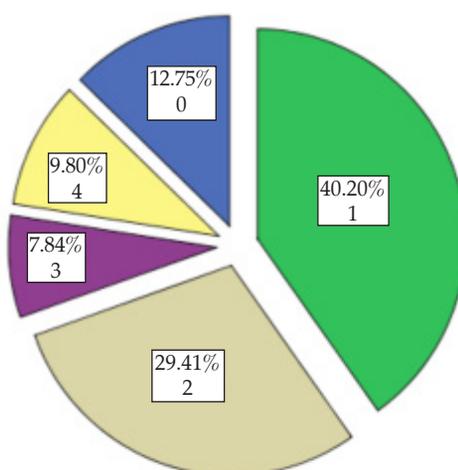
Discriminant function at group centroids were 0.926 for the group with functional motor recovery and -0.387 for the other group. Mean function at group centroids was $0.926 + (-0.387)/2 = 0.269$

DF score above 0.269 was predictive of functional motor recovery and below 0.269 was predictive of poor functional motor recovery.

Inter-rater reliability and intra-rater reliability was $r = 0.98, 0.98$ and 0.95 respectively ($P \leq 0.001, \leq 0.001, \leq 0.001$)

Figure 1

Pie chart showing the distribution of the sources of financial support for medicare and neuro-rehabilitation



Key 0 = Unknown (source of financial support not declared) 1 = Children of stroke survivors
2 = Self (stroke survivor) 3 = Spouse of stroke survivor 4 = National health insurance

DISCUSSION

Mean age was comparatively higher in the group with poor functional recovery though the effect was not significant. Older age has been associated with poor functional motor recovery in stroke survivors (15, 16). Gender, marital status and educational attainment did not also differ significantly between the sub-groups, but the influence of gender and marital status on motor recovery has however been shown to be more favourable in males compared to females and among married subjects in similar studies (17-

20). The number of manifest stroke suffered in the past and the pathologic types of stroke as well as the presence of aphasia were also not significantly different between the sub-groups, findings which might be due to the level and frequency of organised rehabilitation care received. Stroke survivors with intra-cerebral haemorrhage have been shown to fare better than those with cerebral infarct in overall functional gain during rehabilitation with the same level of stroke severity and the presence of aphasia is also known to influence overall functional recovery negatively (21-23).

Though significant differences were not found between the sub-groups in the mean duration between when stroke occurred and the time of evaluation in the clinic, duration however predicted a discrimination in part between membership of the study sub-groups. Longer duration in months after stroke has been associated with better outcomes in functional abilities in stroke survivors (22). The association between an increased number of informal caregivers and functional outcomes in stroke survivors have largely tilted towards a positive influence on functional recovery but there are studies that have also linked increased number of caregivers with reduced functional improvement over time, apparently due to caregivers' burden (24-26). In this study, a higher number of caregiver predicted poor functional outcome. The financial burden of care was largely borne by the patients and immediate family members for both subgroups, which might have affected how well rehabilitation services were procured. Less than 10% of study subjects had financial support for medicare and neuro-rehabilitation services from the national health insurance.

It is worthy of note that the modified Rankin scores at discharge from in-patient care and at evaluation in clinic were significantly different between the sub-groups as well as the frequency of visits per week to the physical therapist. Rankin scores and the frequency of visits to the physical therapist were comparatively higher in the group with functional motor recovery. The Rankin score gain was also significantly different and comparatively higher in the group with functional recovery.

Remarkably, younger age, higher modified Rankin score at discharge and marginally, higher frequency of visits to the physical therapist and a fewer number of informal care givers at home significantly predicted functional motor recovery. This is consistent with earlier related studies (15,22,24).

We also noted that age, modified Rankin, frequency of visits to the physical therapist and duration in months between discharge from in-patient care and evaluation in clinic predicted group membership between functional motor recovery and others. The significant reliability in the evaluation of modified Rankin score within and between the assessors is noteworthy as it precludes any inconsistencies.

We conclude that younger age, higher modified Rankin score at discharge and Rankin score gain, longer duration in months since discharge from in-hospital care, and importantly, higher frequency of visits to the physical therapists which is dependent on accessibility and affordability particularly in resource constrained climes, are determinants of functional motor recovery in stroke survivors. It therefore bears reiteration that in spite of the lean neurorehabilitation facilities in most parts of the region where this study

was carried out, higher frequency of visits to the physical therapist determines amongst other variables the extent of functional recovery in stroke survivors and it should therefore be prescribed and encouraged until functional independence is achieved.

The small sample size is an obvious limitation of this study.

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