Training of Caregivers of Ischemic Stroke Patients in Neurology ward: An Assessor Blind Randomized Controlled Trial

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Abstract:

Background: *Management of stroke patients in low resource settings like Bangladesh largely depends upon their caregivers who are mostly unskilled family members. The effect of a structured caregiver-training program on stroke patients has not been studied adequately in Bangladesh. This study was conducted to evaluate the effect of caregivers' training in improving outcome of stroke patients.* ***Methods and Materials:*** *This assessor blind randomized controlled trial was performed in the Department of Neurology, Chittagong Medical College Hospital, Chattogram for a period of two years. One hundred and forty-nine stroke patients and their care givers were randomly divided into two groups: the intervention arm and the control arm. Caregivers in the intervention arm received actively two sessions of training according to modified London Stroke Carers Training Course manual before their patients are discharged from the hospital. The functional status of patients from both groups was evaluated by the Barthel Index score (BI) and Modified Rankin scale (MRS) score at base line and at two, four and six months.* ***Results:*** *Baseline characteristics and functional status of patients and caregivers of both arms were similar (p=>0.05). Median value of interval from stroke onset to hospitalization was 1 and 0 days in the intervention and control arm, respectively (p=0.897) and median length of stay in hospital was 5 days in both arms (p=0.360). Patients in the intervention arm had significant improvement in their median BI from baseline to 6 months (10 and 100; p=<0.001). Similarly, patients in the control arm also had significant improvement in their BI in the same period (15 and 70; p=<0.001). However, the intervention arm had better median BI at two, four and six months follow-up periods (p = <0.001, p = 0.001 and p = <0.001 respectively) than the control arm. Moreover, significantly more patients achieved BI e"60 (representing functional independence) after 6 months in the intervention arm than the control arm (90.4% versus 74.4% respectively; p=0.038). Better improvement was also observed in MRS score in intervention arm (p = 0.001, p = 0.002 and p = 0.037 at 2, 4 and 6 months respectively) than the control arm. Six-month mortality rate was higher in the control arm (27%) than intervention arm (18.7%) but difference was not statistically significant (p=0.224).* ***Conclusions:*** *Training of caregivers of post-stroke inpatients resulted improved functional independency of stroke patients and it might be helpful for the home management of such patients. It is important to explore different methods of caregiver training program to find out the best one suitable in our settings.*

Key words: *Ischemic stroke; Caregiver Training; Barthel Index; Bangladesh.*

Background:

Stroke is a well-documented public health problem in low, middle and high-income countries and is a leading cause of mortality and disability[1]. World Health Rankings ranked Stroke as the leading cause of death in Bangladesh[2]. It indicates that

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stroke will have a great economic burden in Bangladesh in the future. Data from Bangladesh suggested that the prevalence of stroke is around 0.3%[3]. In developed countries like USA, approximately 2% to 3% of the total population assumed to be disabled because of stroke[4].

More than 60% stroke survivors need help with activities of daily living when at home following stroke[5]. Although facilities for acute stroke care have been developing in Bangladesh, rehabilitation services are lagging far behind primary care services[6]. The stroke patients do not have the supported early discharge programs found in developed countries that are described in the literature[7]. In our settings, early discharge with home based rehabilitation continued by the caregiver is an usual practice. Home based rehabilitation and support is mostly provided by informal caregivers like, family members such as spouses or their offspring or close relatives[8]. Though informal caregivers are responsible for caring disabled patients with stroke at home, they receive little or no training for their care-giving role[9]. Caregiver involvement helps to reduce the risk of another stroke, reduce post-stroke complications, help achieve the highest possible functional recovery and in this process improve community integration[9,10].

Out of different non-pharmacological interventions to reduce the burden of informal caregivers and facilitate patients' recovery after stroke, the most promising one is the London Stroke Carers Training Course[9,11]. Training of caregivers in essential skills is believed to reduce the burden of care and contribute to improve patient outcomes. Nonetheless, the impact of a structured and focused caregiver training on stroke survivors and their caregivers remains under-studied in Bangladesh. Moreover, studies conducted till now provided controversial results[9,12-14]. In light of the above, this study was planned to find out the impact of caregiver training on the functional recovery and mortality of stroke survivors.

Materials and methods:
Subjects:

This randomized controlled trial was performed in Neurology department of Chittagong Medical College Hospital, Chattogram, Bangladesh. Admitted stroke patients were included if they had a confirmed diagnosis of acute ischemic stroke within last 15 days, e"18 years, were independent in activities of daily living before stroke, medically and neurologically stable at the time of baseline assessment, expected to be discharged from hospital with some form of residual disability and had someone willing to look after them post discharge (a caregiver) who fulfilled the required inclusion and exclusion criteria. A caregiver of an eligible stroke patient was enrolled if aged e" 18 years, was willing to provide support to the stroke patient after discharge, did not have a remarkable disability (MRS score = 0 or 1) and were staying with the stroke patient in same house. Stroke Patients with a diagnosis of hemorrhagic stroke, transient ischemic attack or having other organ failure were excluded. Caregivers were excluded if they refused to participate or if they had prior exposure to formal training regarding stroke patient's care.

Sample size calculation:
The primary outcome measure for the study was the functional independence of the patients assessed by Barthel index (BI). Sample size calculation was based on data of Mudzi[12]. The inclusion of 196 subjects would give the study 80% power to detect differences of 1 point in the BI (standard deviation of 2.5) at the 5% significance level for unpaired comparisons. However, finally within the scheduled time it was possible to enroll a total of 149 patients (75 in intervention group and 74 in control group) in the study.

Baseline assessments and randomization procedures:

Prior to the allocation in two groups, researchers undertook baseline assessments of the patients which included demographics, stroke subtype, BI, Modified Rankin scale (MRS) score. Caregiver assessments was also done, which included details of demographics, accommodation and functional status (by MRS).

In this study, randomization applied not to the individual level but to clusters of individuals to prevent contamination. Here, a cluster of

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individuals was the stroke patients admitted in a definite week in the Neurology ward of CMCH. We collected data in 16 consecutive weeks. All the selected admitted patients from a single week were included either in the intervention or in the control arm. The arm allocation for the individual week was done by block randomization with a block size of two. The randomization was done by an associate professor of Neurology ward not related to the study with the help of computer software Research Randomizer. From the total eligible admitted patients of each day, sample patients for the purpose of study were selected by simple lottery method. The lottery was also done by the associate professor of Neurology ward.

Interventions:

All patients were managed in Neurology ward with usual practice and received conventional care in accordance with existing hospital protocol. In addition to conventional care, care givers of the intervention group were trained on structured caregiver training for 2 sessions (60 minutes and 30 minutes on consecutive days) by the researchers based on modified London Stroke Carers Training Course Module comprising[9]:

• Instruction on common stroke related problems and their prevention, management of pressure areas and prevention of bed sores, continence, nutrition, positioning, gait facilitation.

• Hands-on training (tailored to individual patients) regarding lifting and handling techniques, facilitation of mobility and transfers, continence, assistance with personal activities of daily living and communication.

Training started after stabilization of patients' neurological condition. Caregivers' competencies were assessed by the researchers with question and answer session at the end of training.

Assessment of outcome:

Outcome was measured at 02, 04 and 06 months and assessed with MRS and BI scores to see functional activity.

Blinding of assessor:

Assessment was done by a physician who had experience in data collection in other studies.

However, he was neither related with allocation, training or patient management in this study nor informed about in which group the patient was allocated during assessment period. Assessor was trained by the researcher to use the MRS and BI tool. Before involving the assessor in the study, reliability of the assessor was tested in 20 patients not involved in the study.

Data analysis and statistical methods:

Continuous data were expressed as mean ± standard deviation (SD) for normally distributed data or median and 25%–75% IQR (Interquartile range) for non-normally distributed data. Categorical variables were presented as frequency (percentages). Student's t-test was used to analyze normally distributed continuous variables, while Mann–Whitney U-test was used for non-normally distributed continuous variables between two groups and Friedman test for comparison of more than two medians. Categorical variables were compared by means of Chi-square test or Fisher's exact test. $p < 0.05$ was considered statistically significant. Statistical analysis was performed using SPSS version 23.0.

Ethical implications:

Informed consent was obtained from the participants before enrollment. The study protocol was approved by the Ethical Review Committee of Chittagong Medical College.

Results:

Out of 149 patients randomized, 34 patients died before completing the study. Deaths were distributed equally between allocations. Mortality data were available for all patients. Data on the functional assessments were missing or incomplete in some cases. Patients with completed assessments at each time point were included in the analyses.

Baseline demographic and clinical characteristics of the patients are shown in Table I. It depicts that, mean age of the patients in both arms was around 60 years with a male predominance. In both arms, most frequent stroke type was Partial anterior circulation syndrome. The median (IQR) BI values were 10 (5-30) and 15 (10-40) in intervention and

Table-I

Distribution of baseline demographic characteristics of the patients stratified by study groups

Characteristics	Intervention (n=75)	Control (n=74)	p value
Age (years)	60.7±11.3	58.9±11.7	0.367‡
Sex			
Male	45 (60.0)	45 (60.8)	0.919*
Female	30 (40.0)	29 (39.2)	
Stroke type			
Lacunar	17 (22.7)	25 (33.8)	
TACS	4 (5.3)	2 (2.7)	0.430*
PACS	51 (68.5)	45 (60.8)	
PCS	3 (4.0)	2 (2.7)	
Stroke side			
Right	38 (50.7)	32 (43.2)	0.364*
Left	37 (49.3)	42 (56.8)	
Barthel index	10 (5-30)	15 (10-40)	0.409†
MRS	5 (4-5)	5 (4-5)	0.921†

Data are expressed in frequency (percentage), Mean (±SD) or Median (IQR). p values were obtained by ‡independent sample t test, *Chi-square test or †Mann-Whitney U test. TACS: Total anterior circulation syndrome; PACS: Partial anterior circulation syndrome; PCS: Posterior circulation syndrome.

control arms, respectively (p=0.409). The median (IQR) MRS score was 5 (4-5) in both arms (p=0.921). Both the arms were comparable regarding patients' demographic and clinical characteristics at baseline.

In this study, median number of caregivers for individual patient was 3 and 2 in intervention and control arm, respectively (p=0.301). In both arms, caregivers were predominantly female and middle aged. Majority of the caregivers in both arms were house makers. Regarding educational qualification of the caregivers, majority of them had education of SSC or above. Majority of the caregivers were either spouse or offspring of the patient. Both the intervention and control arms were similar at baseline in terms of the care givers' characteristics (Table II).

Main outcome measures were BI and MRS score which were assessed at 2 months, 4 months and 6 months after enrollment to compare the change from the baseline values. At baseline the BI score was similar (p=0.409) in intervention and control arms. After 2, 4 and 6 months, score improved

significantly in both arms (p<0.001). However, it was consistently and significantly higher in the intervention arm than the control arm (p=<0.001, p=0.001 and p=<0.001 respectively). Similar effect was also evident from MRS score. It showed no difference at baseline between two arms (p=0.921) and a significantly gradual decline was observed in both arms at 2, 4 and 6 months follow-up (p<0.001). Like BI, better change was noticed in intervention arm than control arm (p=0.001, p=0.002 and p=0.037 at 2, 4 and 6 months, respectively). Out of 75, 14 patients in intervention arm and out of 74, 20 patients in control arm, died during this period. Though the death rate was lower in intervention group than control group, the difference failed to reach statistical significance (p=0.224) (Table III).

BI score of 60 was the cut off between independence and more marked dependence considered in the study. Figure I shows that significantly more patients achieved BI score e"60 after 6 months in intervention group compared to control group (47/52, 90.4% and 32/43, 74.4% in

Table-II
Distribution of baseline demographic characteristics of the main care givers stratified by study arms

Characteristics	Intervention (n=75)	Control (n=74)	p value[†]
Age (years)	35 (25-41)	32 (23-50)	0.645[†]
Sex	25 (33.3)	15 (20.3)	0.072[*]
	50 (66.7)	59 (79.7)	
Occupation			
House makers	44 (58.7)	44 (59.5)	0.922[*]
Others [a]	31 (41.3)	30 (40.5)	
Education			
Below SSC	28 (37.3)	23 (31.1)	0.421[*]
SSC & above	47 (62.7)	51 (68.9)	
Relation with patient			
Spouse	23 (30.7)	29 (39.2)	0.275[*]
Others[b]	52 (69.3)	45 (60.8)	

Data are expressed in frequency (percentage) or Median (IQR). [a]Included service and student; [b]Included son, daughter, daughter in law; P values were obtained by [†]Mann-Whitney U test or [*]Chi-square test.

Table-III
Comparison of outcome parameters at different times in two groups

Time	Intervention[a]	Control[b]	P value[†]
BI			
Baseline	10 (5-30)	15 (10-40)	0.409[†]
After 2 months	82 (50-100)	45 (20-80)	<0.001[†]
After 4 months	95 (70-100)	65 (32-95)	0.001[†]
After 6 months	100 (88-100)	70 (53-95)	<0.001[†]
	[Q]p=<0.001	[Q]p=<0.001	
MRS			
Baseline	5 (4-5)	5 (4-5)	0.921[†]
After 2 months	3 (2-4)	4 (2-5)	0.001[†]
After 4 months	2 (1-3)	3 (2-4)	0.002[†]
After 6 months	2 (1-2)	3 (1-3)	0.037[†]
	[Q]p=<0.001	[Q]p=<0.001	
Mortality at 6 months	14 (18.7)	20 (27.0)	0.224[*]

[a]At 2, 4 and 6 moths, sample size were 58, 53 and 52 respectively; [b]At 2, 4 and 6 months, sample size were 55, 45 and 43 respectively. P values were obtained by [†]Mann-Whitney U test, [*]Chi-square test or [Q] by Friedman test.

intervention and control group, respectively; p=0.038). It indicates that, caregiver training gained the benefit of functional independence by 17.6% relative to that occurred among the control group patients.
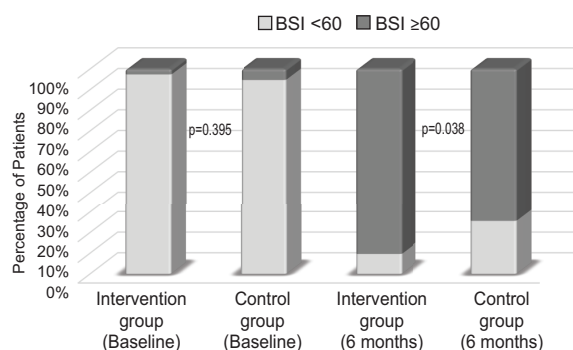

Fig.-1 : *Comparison of functional independence in two groups at 6 months follow-up.*

Discussion:
In contrary to most high-income countries, majority of stroke patients at CMCH and many other public tertiary hospitals in Bangladesh go home before having proper knowledge and preparation of being cared at home. In this context, role of informal caregivers from family and relatives is very important for the stroke outcome. However, currently there is no structured way of training caregivers to look after stroke patients post-discharge. From the present study, it was observed that a structured training of the caregivers brought a significant positive impact on functional independency. This finding was encouraging because in most of the cases, family caregivers monitor patients' health conditions, oversee and support their rehabilitation activities, assist in daily activities, and provide emotional support at home. However, without proper evidence-based training, the care quality is far from the standard resulting in extra physical and psychological burden of caregivers[15]. Till now, in Bangladesh, few studies have addressed the effect of caregiver education on the functional outcomes of stroke patients and caregiver burden[14]. Rahman et al. observed that, BI in intervention group was 6.2 ± 4.0 and 56.3 ± 9.0 at discharge and after 2 months, respectively. In the control group, the corresponding figures were 4.9 ± 4 and 28.2 ± 7.8, respectively[14]. Similarly, in

the present study, significant differences were observed at the end of 2, 4 and 6 months of enrollment. These findings are also consistent with Mudzi W who found better functional outcome at 3 and 12 months in the experimental group receiving caregiver education measured in BI score (P = 0.01 and P=0.05 respectively) [12]. However, Kalra et al. reported that stroke patients in the caregiver training group experienced no difference in functional abilities, despite improved quality of life and mood outcomes at 3 and 12 months[9]. Similarly, a larger, multicenter, cluster randomized controlled trial included 928 patients from 36 stroke units in UK and reported that patients' functional outcome, measured by the self-reported Nottingham Extended Activities of Daily Living scale, was similar between those allocated in the LSCTC intervention group and those allocated for the usual care[13]. This discordance of functional outcome in different studies was probably due to difference of the standard of 'usual care' provided to control arms in different hospital set-ups. Moreover, a remarkable difference of duration of hospital stay after stroke could play an important role in making the difference. In this study, the median length of hospital stay of patients with ischemic stroke was 5 days. This compares poorly with the average length of stay in countries such as Australia, Finland and South Africa, where it is around 30-34 days[16]. A longer period of hospital stay and having higher standard of usual care during that period in control arm in some studies might bring a better outcome in control arm, which resulted in a non-significant difference with intervention arm. Unlike those, in our study, trained caregivers of stroke patients in intervention arm, who were discharged following a very short period of hospital stay, were more prepared and committed in comparison to caregivers of control arm in taking care of their patients; hence, could make a significant difference[17]. For the same reasons, in the present study, caregiver training had the significant beneficial effect of improving functional independence by 17.6%, relative to the control group. From the number needed to treat, one stroke patient with BI e"60 was achieved for every 6 caregivers trained (95% CI= 3 to 152). It is

therefore quite clear that caregiver education has a significant effect on the improvement of functional ability of post-stroke patients.

Regarding mortality, the present study demonstrated that caregiver education has no significant effect on the reduction of post-stroke death at 6 months. However, caregiver education had the effect of reducing the risk of death by 30.7%, relative to the control arm. If we can reduce the risk of death by any percentage among our patients, that is a worthwhile activity. From the number needed to treat, one patient death was prevented for every 12 caregivers trained. Like the findings of the present study, previous single center study did not observe any significant effect of care giver training on case fatality rate[9].

There were no significant differences between the two groups at baseline suggesting that randomization was effective in ensuring equality between the two groups. There were more male (60%) than female (40%) patients in the study group. This agrees with findings in other study conducted in Bangladesh where it was shown that more males suffer from stroke compared to females[18]. The observation of lower percentage of female stroke patients in this study implies a low prevalence of stroke among females. Mean age of the stroke patients, which is around sixty years in this study, is consistent with the findings from other studies in and around our country[18,19]. On the other hand, this mean age is much lower compared to those from other countries, for example the mean age of patients with stroke is 67.3 years in Belgium[20].

The caregivers were largely females (66.7% and 79.7% in intervention and control group, respectively) with a median age of around 30 years in both groups. This agrees with the literature in that females usually form the bulk of caregivers when a family member falls sick[21,22]. Societal and family norms dictate that women are 'natural caregivers'[21].

Loss to follow-up is very important in determining a study's validity because patients lost to follow-up might have a different prognosis than those who completed the study. A good rule of thumb is that <5% loss leads to little bias, while >20% poses serious threats to validity[23]. In the present study overall 20 patients (13.4%) were lost to follow-up.

It was 12% in the intervention group and 15% in the control group. Considering a worst-case scenario in calculating the difference in death rate between two groups revealed the same results as per protocol analysis (p=0.229).

Limitations: The findings of the study need to be interpreted in the context of its limitations. It had relatively smaller sample size and patients were selected from a single center. Thus, it is generalizable to those who present to a government tertiary care level hospital of Bangladesh. Follow-up period was relatively shorter. Impact of training on caregiver's mental and physical health was not addressed. Cost effectiveness of the intervention was not evaluated.

Conclusion:
In conclusion, the present study has demonstrated that structured training of caregivers in basic knowledge about stroke, nursing, moving, handling and facilitation of activities of daily living before discharge from hospital significantly improved the functional independency at six months. Patients' mortality was not significantly influenced by caregiver training.

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