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The Effects of a Family Participation Program in Cognitive Rehabilitation on the Functional Outcomes among Acute Stroke Patients: Preliminary Analysis

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ABSTRACT

The cognitive impairment was documented in stroke patients, in addition to disability and might lead to dementia. Hence the proper cognitive program is important in the acute phase. This study is a quasi-experimental research design aimed to evaluate the effect of the family participation program in cognitive rehabilitation on the functional outcomes. Fifty-five acute stroke patients were recruited to study. The study was conducted in a university hospital in Pathum Thani. The experimental group received the cognitive rehabilitation program designed based on Schepp's family participation model by the investigator, whereas the control group received usual care by the nursing staff. The outcomes were evaluated at baseline, 4 and 8 weeks, respectively. The instruments used were the demographic questionnaire, MoCA test and Disability Assessment for Dementia (DAD) test as good reliability for outcome measurements. Data were analyzed using descriptive statistics, and repeated measures ANOVA. The findings showed that the mean score of MoCA test for the experimental group significantly increased over that of the control group ($p<0.001$) and that before starting the program ($p<0.001$). The experimental group mean score of DAD increased significantly at 8 weeks over that from before starting the program ($p<0.05$), but not significantly at 4 weeks ($p>0.05$). Moreover, the experimental group mean score of DAD increased significantly over those in the control group at 4 and 8 weeks, respectively ($p<0.05$).The results demonstrated that the family participation program in cognitive rehabilitation can increase functional outcomes in acute stroke patients. Nurses and healthcare teams can apply this program to improve cognitive function and ADLs among acute stroke patients.

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Keywords: Acute stroke; Family participation program; Cognitive rehabilitation; Functional outcome

1. Introduction

Stroke is a major public health problem worldwide leading to disability in adults and mortality secondary to cardiovascular disease [1]. In Thailand, among non-communicable disease (NCDs) patients, stroke is the primary cause of death and the morbidity trends to be increasing similarly to the global situation [2]. This might reflect the increment of stroke incidence in the country. Moreover, the unpublished data from Thammasat University Hospital shows the Acute Ischemic Stroke (AIS) patients admitted to the hospital increasing annually from 857, 975 and 996 in 2014, 2015 and 2016, respectively. Wolf and colleagues also reported the mortality rate of AIS at the critical phase of 5-10% whereas the stroke survivors suffering from disability was 65% [3]. Similarly, Suwanwela [2] reported 50% of disability from stroke in Thailand as well as various symptoms consisting of hemiparesis, dysarthria, dysphagia and abnormal language and communication [4]. Additional to those disabled physical symptoms, the alteration of memory such as Vascular Cognitive Impairment (VGI) was also noted in stroke survival patients [5].

Cognitive impairment, which refers to inability to perceive and integrate the data for appropriate behaviors as well as cognitive dysfunction such as improper decisions, shortage of learning, alteration of memory and difficulty of new learning, was found 40-50% as stroke's complication and affected the patient's daily living [6-8]. The symptoms and severity of cognitive impairment would depend on pathology of affected lesions [9-10]. Lacunar infarction was the most frequently occurring type, accounting for 55% which involved white matter of the brain that connected to central nervous influencing nerve synapsis with the result of impairment of cognitive [11]. The rehabilitation or proper management of this impairment is required to halt the leading cause of dementia. Dementia was prevalent in 36-67% of stroke patients [10, 12]. In Thailand, the incidence rate of dementia in stroke survival reached 50% and was at least 1 mode of cognitive impairment. Those stroke survival patients accounted for 10-19% who had developed dementia [13]. A one year follow-up report of stroke survival at Thammasat University Hospital found that 20-30% had cognitive impairment and half of them developed dementia afterward [4]. Hence, dementia might occur after a stroke.

The cognitive impairment also influenced patient rehabilitation and recovery due to alteration of ability to perform Activities of Daily Living (ADL) [14, 15]. Dodge et al reported that patients with cognitive impairment had altered the ability to perform ADL more than those without cognitive impairment [16] particularly executive functions [17, 18] as they were the process of intellectual of brain function to express its behavior in performing activities of daily living [19]. These basic functions of living need to be enhanced before leading to severe consequences such as impaired social engagement, ADL dependence that affects the patient's quality of life with impact on the care-giver and family [20, 21]. Furthermore, it impacts the economy through increased healthcare expenditure [22, 23].

After the acute phase of AIS, the mode of cognitive impairment might be varied and require a suitable rehabilitation program in a timely manner in order to prevent delayed recovery and difficulty of functional training [24]. The cognitive

impairment can be decreased soon after the acute phase and can be dramatically decreased at week 4 [25]. Hence, various modes of cognitive rehabilitation need to be started at 24-48 hours after clinical stability and repeated continuously to preserve the brain plasticity in order to maintain the regenerative mechanism so as to have better nerve synapsis [26-27]. The brain plasticity also requires regular and continuous stimulation [28-29]. Langer et al [29] reported that the working memory program increased the fronto-parietal network and capacity of memory as well as the blood supply to the brain and connected nerve fiber at the center of data management [30].

Doornhein & De Haan mentioned that an individual cognitive rehabilitation program consisting of 6 memory steps such as connection, language and eyes, remember and recall, and summary; implemented for 4 weeks, increased the cognitive capacity [31]. More individual programs of global problem strategy for 8 and 12 weeks were able to enhance capacity of administration skill [32, 33]. Li et al [34] demonstrated a 6-week program whereas Zucchella et al used a 4-week multifaceted program to input the cognitive capacity [24].

In Thailand, the cognitive training has been studied in the dementia elderlies and it was found that the mean cognitive score for the intervention group was significantly better that those for the control group [35-36]. These few studies in stroke patients at chronic phase with dementia were conducted to train 3 domains of cognitive ability such as attention memory and executive function with the satisfactory result increasing cognitive function significantly [37]. Similarly, the training program of concentration and memory was able to improve the concentration and memory domains significantly compared to the control group [38]. Furthermore, the cognitive training also increased the capacity to perform their duties in addition to increasing cognitive capacity [39-41]. However, the cognitive rehabilitation remains kept with the patient has not been well promoted to the family and care-giver. Hence the alternative care-giver programs are highly further recommended for cognitive rehabilitation.

The cognitive rehabilitation program should be implemented at the hospital after clinical stability is seen and continued regularly as home program since the patients require appropriate care, assistance and are still dependent [42-43]. Particularly during the first week after discharge home, when patient and family may develop stress and anxiety [44].

Hence the family should provide support to patients and encourage them to continue the rehabilitation program. The effectiveness and efficiency of the program depends both on the patients and family since the family members stay close to the patient. Thus, family members play an important role in providing care in the rehabilitation phase [45-46]. The family participation model developed by Schepp (1995) has been applied as the conceptual framework for this program to achieve functional outcome at 4 weeks. Therefore, the outcome was assessed at week 4 and also the delayed response at week 8. Moreover, this study was designed to measure the improving cognitive ability and capacity to perform ADL over time.

2. Materials and Methods

2.1 Participants

The quasi-experimental research has been designed for this study to compare the functional outcome between intervention and control groups. The study was approved by the Human Research Ethic Committee of Thammasat University group number 3 before commencing. The patients with ischemic stroke who were admitted to the stroke unit, Thammasat University Hospital, after critical phase have been screened for the study. The

inclusion criteria were mild to moderate severity as National Institute of Health Stroke Scale (NIHSS) score of 0-15; 24-hours stable clinical condition as seen by no NIHSS score change, no IICP and no stroke progression; stable vital signs with less than 20% fluctuation and mild cognitive impairment as determined by a Montreal Cognitive Assessment (MoCA) score of less than 25. Patients were excluded if they had aphasia, comorbidities with cognitive dementia and Alzheimer's Disease, dementia as documented on Thai Mental State Examination (TMSE) score less than 23, and depression as documented on Patient Health Questionnaire -2 (PHQ-2) score more than 0. The discontinuation criteria were worsened neurological signs or more severity symptoms, decreased levels of consciousness in which the NIHSS score change of more than 4 was observed, unstable vital signs within 24 hours, unable to comply with the protocol, required prolonged hospitalization more than 7 days due to complication, and re-hospitalization during follow up phase.

The inclusion criteria for care-givers that they were family members 18 years old or older, able to provide care from the start of the program to its completion, able to communicate, consented to participation and were able to attend the family participation program throughout the study period. Care-givers who were unable to comply with the program would be excluded from the study. In cases where the primary care-giver changed or researchers were unable to contact the care-giver after discharge home the patient was dropped from the study. Care-givers also were able to withdraw from the study at any time.

The sample size was calculated at the power of 80% with the significant level set at 0.05. The mean and standard deviation (SD) for the experimental group from previous studies 26.48 and 1.33 whereas those for control as 24.60 and 1.99 were used and granted that the sample size required 30 patients per group to test this hypothesis [38, 47].

Fifty-five patients were eligible and recruited to the study in which 25 patients were allocated to the experimental group receiving the family participation program during admission for 3-5 days with reminding whereas 30 patients were controlled receiving conventional program including medical treatment, physiotherapy (PT) rehabilitation, stroke education for secondary prevention then followed up for 8 weeks. Both groups had been evaluated at baseline, week 2, 4 and 8. The data were collected by research assistant including demographic, vital signs, lesions, modified Rankin Scale (mRS) and NIHSS at baseline or MoCA and Disability Assessment for Dementia (DAD) for subsequent visits. The phone call at week 1, 3, 5 and 6 was performed to assess the compliance and to remind patients and care-givers.

2.2 A family participation program for experimental group

The family participation program consisted of 6 modules such as attention, memory, visuospatial, category, abstract and executive function conducted by a special nurse professional via the well-designed manual of cognitive rehabilitation for family participation. The program had been validated before use with good content validation (Content Validity Index, 0.96), and good reliability for MoCA (Cronbach alpha, 0.91), DAD (Cronbach alpha, 0.98). This program was provided individually to the experimental group for 3-5 days during hospitalization and again at subsequent clinic visits and visits along with the evaluation of their performance.

2.3 Data analysis and statistics

The measurement data were counted for frequency, percentage and tabulation and employed the χ^2 test to compare between the experimental group

versus the control group. Both MoCA and DAD mean scores for each domain and sum scores at baseline, 4 and 8 weeks were compared between the experimental group and the control group in which repeated ANOVA was employed to test the statistical significance at 0.05.

The preliminary data of 25 patients in the intervention group versus 30 patients in the control group had been analyzed by repeated ANOVA without assumption of homogeneity of variance so as to see the meaningful clinical data at the time of analysis. However, the final data analysis will be performed later.

3. Results and Discussion

3.1 Results

Fifty-five patients completed the study procedures and showed the following baseline characteristics: age of 60.1 ± 12.8 (mean±SD) (range 30-85 year), Male: Female ratio of 1.9: 1, comorbidity of 76.4% HT, 34.5%DM, 85.5%HLP, 10.9%AF, 32.7% smoking, 25.5% alcohol intake and NIHSS mean score 3.25 ± 2.8 (mean ± SD) (min, max: 0-13). The demographic data at baseline for both experimental groups versus control were not statistically different ($p>0.05$) (shown in Table 1.)

When comparing the outcomes between groups, the result showed that the experimental group increased the mean score of the MoCA test significantly more than those in the control group ($p<0.001$) and then before starting the program ($p<0.001$). The experimental group significantly increased the mean score of DAD at 8 weeks compared to the score before starting the program ($p<0.05$), but not significantly at 4 weeks ($p>0.05$). Moreover, the experimental group increased the mean score of DAD over that of the control group at 4 and 8 weeks respectively ($p<0.05$) (shown in Table 2.)

3.2 Discussion

The cognitive rehabilitation in the stroke patients seem to be improved after 3 months in the chronic phase. Hence in the acute phase, the cognitive rehabilitation program requires implementation to facilitate the cognitive domain such as memory training, executive training, and attention training and so on, which also was reported by Spikman et al [33]. In addition, this study also revealed that family participation facilitated the functional outcomes as explained by the Schepp (1995) model, mentioned previously. Our result also showed significant improvement of the cognitive domain as had been observed by Zucchella et al. [24]. However, the result did not reveal improvement of the executive function as previously confirmed by Poulin et al. [29] at a 3 month follow up visit. Our study did not reflect this. It might be due to short duration of training period and outcome evaluation then the extension of training period is suggested. For the functional outcome, previously [15] the improvement of cognitive rehabilitation was not well reflected in the cognitive domain; however, our study showed significant improvement of the cognitive domain. Additionally, the result of some studies revealed that the cognitive rehabilitation was improved more through multidomain training than in single domain training [24, 34] which is similar to the result for our study. The limitations of our study that are the short duration of training and the program was not designed to address the specific cognitive domain impairment. Further studies are suggested to address these limitations.

Table 1. Demographic and Disease Related Characteristics of the Participants.

Characteristics	Categories	Exp. (n=30)	Cont. (n=25)	Chi-Square	
Gender				1.00	NS
	Male	16 (64%)	20 (66.6%)		
	Female	9 (36%)	10 (33.3%)		
Age				1.00	NS
	≤ 65	16 (64%)	19 (63.3%)		
	> 65	9 (36%)	11 (36.7%)		
Education				.472	NS
	Primary	9 (36%)	12 (40%)		
	High school	12 (48%)	10 (33.3%)		
	Graduate	4 (16%)	8 (26.7%)		
Comorbidity					
	Hypertension	19 (76%)	23 (76.7%)	1.00	NS
	Diabetes mellitus	9 (36%)	10 (33.3%)	1.00	NS
	Hyperlipidemia	20 (80%)	27 (90%)	.446	NS
	Atrial Fibrillation	2 (8%)	4 (13.3%)	.678	NS
	Smoking	7 (28%)	11 (36.7%)	.572	NS
	Alcohol consumption	5 (20%)	9 (30%)	.537	NS
Lesion				.763	NS
	subcortical	15 (60%)	20 (66.7%)		
	frontal	5 (20%)	4 (13.3%)		
	pons	2 (8%)	3 (10%)		
	occipital	-	1 (3.3%)		
	MCA	1 (4%)	-		
	TIA	2 (8%)	2 (6.7%)		
NIHSS				.954	NS
	0-4	19 (76%)	23 (76.7%)		
	5-15	6 (24%)	7 (23.3%)		

Exp.=Experimental group; Cont.=Control group;

Table 2. A repeated measure ANOVA to evaluate each domain of MoCA and DAD in Acute Stroke Patients comparing between experimental group versus control group at baseline versus follow up visits at week 4 and week 8.

Variable	Group	F	Sig.	
MoCA				
Executive function	Within	.723	.449	NS
	Between	2.099	.153	NS
Naming	Within	2.017	.138	NS
	Between	2.896	.095	NS
Attention	Within	6.911	.002*	
	Between	.150	.700	NS
Language	Within	4.858	.010*	
	Between	10.996	.002*	
Abstraction	Within	10.598	.000**	
	Between	41.907	.000**	
Recall (memory)	Within	88.435	.000**	
	Between	18.427	.000**	
Orientation	Within	1.932	.160	NS
	Between	6.784	.012*	
Sum MOCA Score	Within	89.393	.000**	
	Between	42.368	.000**	

DAD			
Initiation	Within	8.948	.000**
	Between	7.396	.009*
Planning	Within	25.628	.000**
	Between	7.004	.011*
Action	Within	.883	.375 NS
	Between	.503	.481 NS
Sum Score	Within	55.123	.000**
	Between	5.341	.025*

* P<0.05 **P<0.001 NS= Not Significant

MoCA = Montreal Cognitive Assessment
DAD = Disability Assessment for Dementia

4. Conclusion

The cognitive rehabilitation strategies are important for acute stroke patients to regain their cognitive functions. The early cognitive training program with multi-domain should be applied.

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