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Effect of Cognitive Behavioral Therapy on Functional Outcomes in Patients with Stroke

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ABSTRACT

Upper extremity impairment is a common motor deficit after a stroke, and 30–60% of stroke sufferers have disability and inability to use their affected upper extremity in their daily lives. Stroke survivors with cognitive dysfunctions are most likely to be dependent in activities of daily living. Further deterioration is possible as a result of limitation in activities. Psychiatric problems are also common among stroke survivors. This may delay recovery process and further impair cognitive function due to adaptations to unhealthy lifestyles or noncompliance to rehabilitation**.** Cognitive behavioral training (CBT) increase blood supply to 20% of different brain areas, and facilitation of internancial neurons activity. Cognitive behavioral training (CBT) act as Incentive therapy focuses on active participation, self-esteem, motivational features such as score keeping, and competition. The ultimate objective of physiotherapy is for patients to return to full independence and their former occupations.The purpose of this study was to investigate the effect of cognitive behavioral training on functional outcomes in stroke patients.40 stroke patients from both sexes participated in this study 20 patients for each group. Random distribution for patients to 2 groups; Group (A) exposed cognitive behavioral therapy for 60 min and selected physical therapy program for 30 min, every other day for 24 sessions, total duration of session (90 min). Control group (B) received the same selected physical therapy program for 60 min, every other day for 24 sessions total duration of session (60 min). Changing in affected upper extremity motor impairment were measured (Dash scale, Wolf scale and Jammar hand dynamometer).

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INTRODUCTION

Stroke characterized as neurological deficit attributed to acute focal injury of central nervous system through vascular cause as cerebral infarction, intracerebral, and subarachnoid hemorrhage (Sacco *et al.*, 2013). Stroke is the second leading cause of death worldwide and is the major cause of morbidity, particularly in middle aged and elderly population (Lee *et al.*, 2014), deficit mostly post stroke is hemiparesis of contralateral upper limb, with more 80% of stroke patients experiencing acutely and more 40% chronically (Cramer *et al.*, 1997). Impairments as disabilities of common activities such as reaching, holding onto objects for a review on precision grip deficits (Bleyenheuft and Thonnard, 2010).

The incidence of cognitive deficit increases three times after stroke. Some of the patients recover completely from physical disability after the stroke but are often unable to cope with activities of daily life because of cognitive impairment (Desmond *et al.*, 2002). Originally it was designed to treat depression and, now using for several mental health. Computerized cognitive training involves structured practices on standardized and cognitively challenging tasks (Kueider *et al.*, 2012; Jak *et al.*, 2013).

In this study, we assessed the effects of cognitive behavioral training on functional outcomes in stroke patients

PATIENTS AND METHODS

Forty patients presented clinically with cerebrovascular stroke (CVS) were participated in this study. The patients were selected from inpatients units of Neurology, Medicine faculty, Cairo University, and the outpatient's clinic from the Faculty of Physical Therapy, Cairo University.

Forty stroke patients were diagnosed by a neurologist based on careful clinical assessment and radiological studies (computed axial tomography and /or magnetic resonance imaging) for brain. Ages ranged from 45 to 65 years. The Patients were (mild cognitive impairment) assessed by mini mental state examination (MMSE) score between (18-23). The patients were medically stable with mild degree of spasticity (grade 1 and 1+ according to Modified Ashworth Scale). Their duration of illness ranged from six months to 24 months. All patients' level of education was the same. Exclusion criteria were as follow; Hemiparesis due to any cause other than vascular insult. Hemiparesis due to vertebrobasilar stroke. History of visual, auditory and other neurological disorders affecting their cognitive training (e.g.blindness, deafness). Medications that may affect cognition.

Moderate and severe cognitive impaired patients. Illiterate patients. Uncooperative patients. Any previous cognitive training. Any other orthopedic abnormalities as severe osteoarthritis, osteoporosis and recent or old malunion fractures of upper limbs.

Ethical committee of faculty of physical therapy and informed consent for all participants were approved. Random distribution for patients to 2 equal groups, Study group (I) cognitive behavioral therapy and selected physical therapy program, Control group (II) performed selected physical therapy program only.

The following measures for motor function assessment used. The JAMAR Hand Dynamometer displays grip force up to 200 EP or 90 kg. DASH assessment disorders and measure disability of upper extremities and monitor changes or functional over time. Wolf Motor Function Test is quantitative index of upper extremity motor and instructive for assessing motor status of high function chronic patients had stroke and traumatic brain injury. Mindful Attention Awareness Scale (MAAS) has demonstrated high test-retest reliability, discriminant and convergent validity, known-groups validity, and criterion validity.

Patients with (CVS) stroke received cognitive training via Rehacom system for eight weeks, three sessions per week, day after day. The duration of session was 60 minutes with 10 minutes in between the two procedures, the two procedures are applied at each session for example application of attention concentration training with figural memory, application of reaction behavior training with logical thinking.

Rehacom was done at cognition laboratory at Physical Therapy Faculty, training of figural memory, attention concentration, reaction behavior and logical thinking. The investigator made appropriate adjustment of the Rehacom before the patient sat in front of Rehacom. Every patient assumed acomfortable sitting position on achair with suitable height infront of the screen. The device and the procedure were explained in details for each patient before starting training to be aware about the training procedure. Each patient trained on use device.

Patients were answering the tasks by pressing the simple keys of the custom panel. Attention concentration training consists of 24 levels of difficulties. Figural memory training consists of 9 levels of difficulties. Reaction behavior training consists of 16 levels of difficulties. Logical thinking training consists of 23 levels of difficulties.

In the training session, every patient was starting training from level one and when the patient successfully finished the level, the training then progresses to the level of difficulty. The patients received selected physical therapy program including (range of motion exercise (active assisted, and active resisted exercises), positioning, passive, active stretching exercises and home routine exercises).

Statistical analysis

In this study, outcome was the motor function of

Table 1: Descriptive statistics and t-test for comparing the mean age and duration of illness of the study and control groups

	Study group	Control group	MD	t	p	Sign
Age	57.5 ± 6.61	54.65 ± 7.38	2.85	1.28	0.2	
Duration of illness (months)	12.6 ± 4.3	12.9 ± 5.2	-0.3	-0.19	0.84	

Table 2: Frequency distribution and chi squared to comparing sex distribution among study /control groups

	Study group	Control group	χ2 value	p-value	Sig
Females	2 (10%)	3 (15%)	0.22	0.63	
Males	18 (90%)	17 (85%)			

Table 3: Mean Dash scale pre and post treatment

Dash scale	Pre $\overline{X}$ ±SD	Post $\overline{X}$±SD	MD	% of change	P-value	Sig
Study group	3292.5 ± 79.51	815 ± 46.87	2477.5	75.24	0.0001	
Control group	3257.5 ± 81.55	1430 ± 55.36	1827.5	56.1	0.0001	
MD	35	-615				
P-value	0.17	0.0001				
Sig						

Table 4: Mean Wolf scale pre and post treatment

Wolf scale	Pre $\overline{X}$ ±SD	Post $\overline{X}$ ±SD	MD	% of change	P-value	Sig
Study group	174.47 ± 2.04	86.78 ± 2.49	87.69	50.26	0.0001	
Control group	175.52 ± 2.24	113.94 ± 2.93	61.58	35.08	0.0001	
MD	-1.05	-27.16				
P-value	0.13	0.0001				
Sig						

Table 5: Mean MAAS pre and post treatment

MAAS	Pre $\overline{X}$±SD	Post $\overline{X}$ ±SD	MD	% of change	P-value	Sig
Study group	26.15 ± 2.51	86.3 ± 1.34	-60.15	230.01	0.0001	
Control group	26.8 ± 1.43	64.8 ± 2.83	-38	141.79	0.0001	
MD	-0.65	21.5				
P-value	0.32	0.0001				
Sig						

Table 6: Mean hand grip force pre and post treatment.

Hand grip force (kg)	Pre $\overline{X} \pm$SD	Post $\overline{X} \pm$SD	MD	% of change	P-value	Sig
Study group	8.25 ± 1.4	27.35 ± 2.03	-19.1	231.51	0.0001	
Control group	8.7 ± 0.92	20.85 ± 1.53	-12.15	139.65	0.0001	
MD	-0.45	6.5				
P-value	0.24	0.0001				
Sig						

Table 7: Correlation between MAAS, Dash scale, Wolf scale, and hand grip force

		r value	p value	Sig
MAAS	Dash scale	-0.97	0.0001	
	Wolf scale	-0.96	0.0001	
	Hand grip force (kg)	0.88	0.0001	

upper extremity measured by the Dash scale, Wolf scale and hand grip force. Statistical analysis by using SPSS 22. Descriptive statistics and t-test for comparing characteristics in studed groups. Chi squared for comparing sex distribution. Mixed MANOVA to comparing time and treatment effects and the interaction was done by Dash scale, Wolf scale, MAAS and hand grip force. Person Product Moment Correlation Coefficient was conducted to determine the correlation between MAAS, Dash scale, Wolf scale, and hand grip force($p < 0.05$).

RESULTS

Demographic data

Study group 20 patients with stroke. Mean ± SD age and illness for 57.5 ± 6.61 years and 12.6 ± 4.3 months respectively (Table 1).Control group 20 patients with stroke. Mean ± SD age and illness for 54.65 ± 7.38 years and 12.9 ± 5.2 months respectively. No significant differences in age and illness duration and sex distribution were observed (Tables 1 and 2).

The sex distribution in the study group revealed that there were 2 (10%) females and 18 (90%) males. The sex distribution in the control group revealed that there were 3 (15%) females and 17 (85%) males. There was no significant difference in between both groups ($p = 0.63$) (Table 2).

Motor assessments

Study group gained greater improvement than control group in clinical motor scores post intervention in (GI) and (GII) both dash, wolf, MAAS and hand grip scores. Comparison of revealed a statistically significant difference (Tables 3, 4, 5 and 6).

Relationship between MAAS, Dash scale, Wolf scale, and hand grip force

The correlation between MAAS and Dash scale was strong negative significant correlations ($r = -0.97$, $p = 0.0001$) (Table 7).

The correlation between MAAS and Wolf scale was strong negative significant correlations ($r = -0.96$, $p = 0.0001$) (Table 7).

The correlation between MAAS and hand grip force was strong positive significant correlations ($r = 0.88$, $p = 0.0001$) (Table 7).

DISCUSSION

In the current study, a highly significant difference was observed between study group A and control group B regarding the level of functional outcomes in affected upper extremity, also a significant difference was detected between both groups A&B in cognitive functions post treatment.

This indicates that the cognitive behavioral therapy has a positive effect on the functional outcomes of upper limb in stroke patients. The results of the current study agreed with previous studies (Kerr *et al.*, 2011; Gordon *et al.*, 2004; Ploughman *et al.*, 2015, 2007; Moftah and Jadavji, 2019).

The present study findings agreed with (Flavia *et al.*, 2010) who demonstrated that cognitive rehabilitation is very important for stroke patients to improving capability to perform daily activities and could also compensated to impaired nervous system. Computer- assisted cognitive rehabilitation gives instant and direct feedback to patient performance.

These improvements were achieved through computer- based cognitive training program. This may be explained visual and auditory feedback activates unused or underused synapses as such; continued training might establish new sensory engrams and help to perform tasks without feedback. biofeedback could be neural plasticity by engaging auxiliary sensory inputs (Huang *et al.*, 2006).

In addition, the training conducted in form of wii game (motivation and interest) which lead to the reactivation for brain neurotransmitters. This was reflected by improvement of the patient's level of alertness, visual attention during treatment program by providing continuous visual stimuli through the dynamic screen along with auditory stimuli that lead to improvement of level of functional performance of stroke patients during activities of daily living (Kim *et al.*, 2011).

The computer-based training has effects on the neural level. Function and structural changing in brain post computer-based cognitive training, they found, white matter connectivity measures changed during the training period (Nordvik *et al.*, 2012). The current study findings were in agreement with (Björkdahl *et al.*, 2013) who demonstrated that cognitive training enhance function of daily life and reduce effect of fatigue in daily living activities.

Also there is long term effect of cognitive training on functional and cognitive performance of stroke patients that was sustained after termination of the program by three months.

The present study findings agreed with (Kerr *et al.*, 2011) Behavioral training can facilitate functional outcome and support post-stroke plasticity.

The current study findings agreed with (Gordon *et al.*, 2004; Ploughman *et al.*, 2015) who demonstrated that cognitive motor rehabilitation after stroke may be a catalyst to promote neuroplasticity in the brain and functional recovery.

The current study findings agreed with (Ploughman *et al.*, 2007). Exercise improves attention and cognitive function, which may enhance re-learning of motor skills after stroke

The current study findings were in agreement with (Nan *et al.*, 2019) Neurofeedback training inducing many brain plasticity and associate with improving of emotional state, cognitive, and motor functions.

Current study findings disagreed with (Brown *et al.*, 1999; Maylor *et al.*, 2001), who demonstrated that Cognitive-motor interventions are interventions which combine cognitive with physical rehabilitation task, or perform dual-task. Interventions give negative effect on postural or functional outcomes and perform concurrent cognitive task in stroke patients.

The present study results agreed with (Harley *et al.*, 2006) who found that dual task training elicits cognitive performance and postural stability needed for accurate motor function of upper extremities.

The current study can be explained by (Haggard *et al.*, 2000) who found that dual task in stroke patients were significantly correlated with activities of daily living measured by Barthel ADL index.

Our finding of current study demonstrated significantly increase in value for hand grip force of post treatment compared with that of control group. That indicated that cognitive training has a significant effect on hand grip strength.

CONCLUSIONS

Based on the scores and findings of this study, it was concluded that the cognitive behavioral training had a significant effect on functional outcomes in stroke patients.

There were a significant improvement of the study group(A) more than in control group (B) post treatment, Therefore the cognitive behavioral training combined with selected physical therapy program is recommended with physical therapy rehabilitation to improve functional outcomes in upper limbs for stroke patients.

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Conflict of Interest

None

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