

Assessment of Effect of TENS, EMS, Active and Passive Exercises in Chronic Hemiplegic Stroke Patients Using Modified Ashworth Scale

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Abstract

Background: The aim is to assess effect of TENS, EMS, active and passive exercises in chronic hemiplegic stroke patients using Modified Ashworth Scale. **Subjects and Methods:** All were divided into 4 groups of 20 each. Group A hemiplegic subjects were given TENS, group B hemiplegic subjects were given EMS, group C hemiplegic participants were subjected to active and passive exercise and group D hemiplegic participants were subjected to active and passive exercise along with TENS and EMS. Spasticity was calculated by the MAS. The Timed Up and Go (TUG) test was used to evaluate dynamic balance. **Results:** The mean pre- treatment FMA value in group A was 26.5 and post-treatment FMA was 41.7, in group B pre- treatment FMA value was 26.8 and post- treatment FMA value was 42.2, in group C pre- treatment FMA value was 26.8 and post- treatment FMA value was 43.8 and in group D pre- treatment FMA value was 26.9 and post- treatment FMA value was 45.1. The mean pre- treatment NDS value in group A was 25.6 and post- treatment NDS was 18.4, in group B pre- treatment NDS value was 25.8 and post- treatment NDS value was 25.4 and post- treatment NDS value was 17.3 and in group D pre- treatment NDS value was 25.8 and post- treatment NDS value was 15.2. The mean pre- treatment MAS value in group A was 2.67 and post- treatment MAS was 2.04, in group B pre- treatment MAS value was 2.80 and post- treatment MAS value was 2.70, in group C pre- treatment MAS value was 2.82 and post- treatment MAS value was 1.98 and in group D pre- treatment MAS value was 2.67 and post- treatment MAS value was 1.82. The mean pre- treatment TUG value in group A was 26.1 and post- treatment TUG was 21.4, in group B pre- treatment TUG value was 25.4 and post- treatment TUG value was 22.8, in group C pre- treatment TUG value was 26.8 and post- treatment TUG value was 25.8 and in group D pre- treatment TUG value was 26.6 and post- treatment TUG value was 20.2. **Conclusion:** Physiotherapy is one of effective management in retaining strength, spasticity and range of movement in post stroke patients. Early rehabilitation such as TENS, EMS and active and passive exercise, in patients with acute CVA, body balance and movement coordination training can help them improve their ability to move their hemiplegic lower extremity.

Keywords: Hemiplegic, Stroke, Physiotherapy.

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Introduction

Hemiplegia is defined as paralysis of facial muscles, upper and lower limb of one side of body or hemiplegia refers to muscle feebleness of both arm and leg of same side of the body (left or right).^[1] Hemiplegia affects contra lateral cerebral hemisphere, internal capsule, brain stem or ipsilateral upper cervical cord, haemorrhagic shock is its most common cause.^[2] Cerebral venous sinus thrombosis, head injury, brain tumor haemorrhage, acute central nervous system infection, demyelinating illness e.g., dispersed encephalomyelitis or multiple sclerosis and Todd's paresis

are other causes of hemiplegia.^[3]

Hemiplegia is managed by treating underlying cause and by various multiple forms of therapy to restore motor functions. Motor function in hemiparetic limb can be improved with physiotherapy.^[4,5] Surgical intervention can also be used to correct neurological damage in few cases. Lower limb disability is common after stroke and it impact quality of life of the stroke survivors. Weakness of muscles and pattern of natural movements which decrease the capacity to do daily life works such as brisk walk, using

stairs and basic household works.^[6] Altered levels of consciousness (coma, diminished arousal levels) can occur due to severe brain damage. Teasdale and Jennett developed Glasgow coma scale, which is gold standard to document level of coma. The functional area examined in GCS are the opening of eye, motor response and verbal responses.^[7] Levels of consciousness are documented by therapist using standard expressive terms: standard, weariness, obtundation, stupor and unconsciousness. Total score of GCS comprises of 15. 8 or maybe less than 8 score of GCS indicates unconsciousness.^[8,9] The present study compared effect of TENS, EMS, active and passive exercises in chronic hemiplegic stroke patients using Modified Ashworth Scale.

Subjects and Methods

After considering the utility of the study and obtaining approval from ethical review committee of the institute, we selected 80 patients with stroke of either gender.

All were divided into 4 groups of 20 each. Group A hemiplegic subjects were given TENS, group B hemiplegic subjects were given EMS, group C hemiplegic participants were subjected to active and passive exercise and group D hemiplegic participants were subjected to active and passive exercise along with TENS and EMS. Spasticity was calculated by the MAS. When performing the MAS, the patient's ankle is passively extended from the point of maximum plantar flexion to the point of no pain, and the examiner rates the patient's ankle using a scale from 0 to 4 (0, 1, 1+, 2, 3, and 4), with 0 representing normal or very low muscle tone and 4 denoting that passive extension is impossible. The examiner repeats the measurement three times while placing one hand on the patient's calf to ensure that the knee does not move while the patient is lying supine and the other hand supporting the patient's ankle dorsiflexion.

The Timed Up and Go (TUG) test was used to evaluate dynamic balance. This test calculates the time needed for a patient to stand up from a 46-cm-high chair, at the say of 'start' and walk 3 m in forward direction, and go back to the chair. Patients wore their regular footwear, and used gait-assistance tools. A timer was used for 3 repeated calculations. Software called SPSS 18.0 was used to generate and statistically analyze the data. Percentages (%) were used to show the data. The study performed a t-test and gave measurement results as mean. The results were compiled and subjected for statistical analysis using Mann Whitney U test. P value less than 0.05 was set significant.

Results

Group A hemiplegic patients were treated with TENS. Group B hemiplegic patients were treated with EMS. Group C hemiplegic patients were treated Active and passive

exercise. Group D hemiplegic patients were treated with active and passive exercise along with TENS and EMS. There were 12 males and 8 females in group A, group B had 10 males and 10 females, group C had 9 males and 18 females and group D had 13 males and 7 females [Table 1]. Age group 40-50 years comprised of 5 (11.3%) males and 6 (16.7%) females, 50-60 years had 10 (22.7%) males and 12 (33.3%) females, 60-70 years had 16 (36.3%) males and 14 (38.8%) females and >70 years had 13 (29.5%) males and 4 (11.1%) females [Table 2].

The mean SBP in group A was 120.4 mm Hg and DBP was 68.4 mm Hg, in group B was 124.6 mm Hg and 70.2 mm Hg, in group C was 126.2 mm Hg and DBP was 72.6 mm Hg, in group D was 130.8 mm Hg and 74.2 mm Hg respectively. A non- significant difference was observed ($P > 0.05$) [Table 3].

The mean pre- treatment FMA value in group A was 26.5 and post- treatment FMA was 41.7, in group B pre- treatment FMA value was 26.8 and post- treatment FMA value was 42.2, in group C pre- treatment FMA value was 26.8 and post- treatment FMA value was 43.8 and in group D pre- treatment FMA value was 26.9 and post- treatment FMA value was 45.1. Intra- group and inter- group comparison revealed significant difference in all group D ($P < 0.05$) [Table 4].

The mean pre- treatment NDS value in group A was 25.6 and post- treatment NDS was 18.4, in group B pre- treatment NDS value was 25.8 and post- treatment NDS value was 20.7, in group C pre- treatment NDS value was 25.4 and post- treatment NDS value was 17.3 and in group D pre- treatment NDS value was 25.8 and post- treatment NDS value was 15.2. Intra- group and inter- group comparison revealed significant difference in all group ($P < 0.05$) [Table 5].

The mean pre- treatment MAS value in group A was 2.67 and post- treatment MAS was 2.04, in group B pre- treatment MAS value was 2.80 and post- treatment MAS value was 2.70, in group C pre- treatment MAS value was 2.82 and post- treatment MAS value was 1.98 and in group D pre- treatment MAS value was 2.67 and post- treatment MAS value was 1.82. Intra- group comparison revealed significant difference in group C and D ($P < 0.05$) while inter- group comparison found to be non- significant ($P > 0.05$) [Table 6].

The mean pre- treatment TUG value in group A was 26.1 and post- treatment TUG was 21.4, in group B pre- treatment TUG value was 25.4 and post- treatment TUG value was 22.8, in group C pre- treatment TUG value was 26.8 and post- treatment TUG value was 25.8 and in group D pre- treatment TUG value was 26.6 and post- treatment TUG value was 20.2. Intra- group and inter- group comparison revealed significant difference in group A, C and D ($P < 0.05$) while group C showed non- significant difference ($P > 0.05$) [Table 7].

Table 1: Distribution of patients

Groups	A	B	C	D
Treatment	TENS	EMS	Active and passive exercise	Active and passive exercise, TENS and EMS
Male: Female	12:8	10:10	9:11	13:7

Table 2: Age wise distribution of patients

Age group (Years)	Male	Percentage	Female	Percentage
40-50	5	11.3	6	16.7
50-60	10	22.7	12	33.3
60-70	16	36.3	14	38.8
>70	13	29.5	4	11.1
Total	44	100	36	100

Table 3: Assessment of blood pressure

Groups	Mean SBP (mm Hg)	Mean DBP (mm Hg)
Group A	120.4	68.4
Group B	124.6	70.2
Group C	126.2	72.6
Group D	130.8	74.2
P value	0.06	0.08

Table 4: Comparison of Fugl-Meyer assessment (FMA) in all groups

FMA	Group								P value
	A		B		C		D		
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	
Mean	26.5	41.7	26.8	42.2	26.8	43.8	26.9	45.1	0.021
P	0.04		0.03		0.01		0.001		

Table 5: Comparison of neurologic deficit scale (NDS) in all groups

NDS	Group								P value
	A		B		C		D		
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	
Mean	25.6	18.4	25.8	20.7	25.4	17.3	25.8	15.2	0.01
P	0.03		0.05		0.02		0.001		

Table 6: Comparison of Modified Ashworth Scale (MAS) in all groups

MAS	Group								P value
	A		B		C		D		
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	
Mean	2.67	2.04	2.80	2.70	2.82	1.98	2.67	1.82	0.51
P	0.81		0.92		0.05		0.01		

Table 7: Comparison of timed up and go (TUG) in all groups

TUG	Group								P value
	A		B		C		D		
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	
Value	26.1	21.4	25.4	22.8	26.8	25.8	26.6	20.2	0.031
P	0.04		0.05		0.32		0.01		

Discussion

The present study describes the use TENS, EMS, active and passive exercise treatments for lower limb stroke rehabilitation and analyze the outcome of their different combinations. There were 12 males and 8 females in group A, group B had 10 males and 10 females, group C had 9 males and 18 females and group D had 13 males and 7 females.

Kwong et al,^[10] shown the efficiency of bilateral TENS combined with TOT versus unilateral TENS combined with TOT in treating chronic stroke patients who have lower limb motor dysfunction. With 20 sessions spread out over a 10-week period, 80 patients were randomly allocated to either bilateral TENS with TOT or one-sided TENS with

TOT. Results included the timed up and go test, step test, berg balance scale, and lower limb motor coordination test's maximum strength of muscles. Each applicant was evaluated starting from the beginning after every ten, twenty, and three months of training. The applicants in the bilateral TENS plus TOT group improved their paretic ankle dorsiflexion strength more and in the Timed up and Go test completion time than patients in the TENS plus TOT group.

Age group 40-50 years comprised of 5 (11.3%) males and 6 (16.7%) females, 50-60 years had 10 (22.7%) males and 12 (33.3%) females, 60-70 years had 16 (36.3%) males and 14 (38.8%) females and >70 years had 13 (29.5%) males and 4 (11.1%) females. The mean SBP in group A was 120.4 mm Hg and DBP was 68.4 mm Hg, in group B was 124.6 mm

Hg and 70.2 mm Hg, in group C was 126.2 mm Hg and DBP was 72.6 mm Hg, in group D was 130.8 mm Hg and 74.2 mm Hg respectively. Zhonggiu Hong T AL,^[11] in his studies reported that the NMES (neuromuscular electrical stimulation) have to be promising therapy in management of chronic stroke rehabilitation for betterment of lower limb activities and its performance.

The mean pre- treatment FMA value in group A was 26.5 and post- treatment FMA was 41.7, in group B pre-treatment FMA value was 26.8 and post- treatment FMA value was 42.2, in group C pre- treatment FMA value was 26.8 and post- treatment FMA value was 43.8 and in group D pre- treatment FMA value was 26.9 and post- treatment FMA value was 45.1. Jung K et al,^[12] studied that neuro rehabilitation by task related training (TRT) combined with TENS is helpful in decreasing motor impairment and restoring functional motor ability in chronic stroke patients with upper limb muscle paralysis.

The mean pre- treatment NDS value in group A was 25.6 and post- treatment NDS was 18.4, in group B pre-treatment NDS value was 25.8 and post- treatment NDS value was 20.7, in group C pre- treatment NDS value was 25.4 and post- treatment NDS value was 17.3 and in group D pre- treatment NDS value was 25.8 and post- treatment NDS value was 15.2. PB mills And Dossa F,^[13] in their study conducted in 2016, The use of a combination of TENS and TRT to improve motor function in stroke patients with aberrant muscle stiffness in the upper limb has been found to be extremely effective.

The mean pre- treatment MAS value in group A was 2.67 and post- treatment MAS was 2.04, in group B pre-treatment MAS value was 2.80 and post- treatment MAS value was 2.70, in group C pre- treatment MAS value was 2.82 and post- treatment MAS value was 1.98 and in group D pre- treatment MAS value was 2.67 and post- treatment MAS value was 1.82. The mean pre- treatment TUG value in group A was 26.1 and post- treatment TUG was 21.4, in group B pre- treatment TUG value was 25.4 and post-treatment TUG value was 22.8, in group C pre- treatment TUG value was 26.8 and post- treatment TUG value was 25.8 and in group D pre- treatment TUG value was 26.6 and post- treatment TUG value was 20.2. Knutson J.S et al,^[14] with regards to the Neuromuscular Electrical Stimulation for Motor Restoration in Hemiplegia. They observed that NEMS leads to direct stimulation of peripheral nerves which causes limb movement and is helpful in regaining the motor function of affected limb.

Conclusion

Physiotherapy is one of effective management in retaining strength, spasticity and range of movement in post stroke patients. Early rehabilitation such as TENS, EMS and active and passive exercise, in patients with acute CVA, body balance and movement coordination training can help them improve their ability to move their hemiplegic lower extremity.

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