FATIGUE AMONG STROKE INDIVIDUALS WITH LESIONS IN DIFFERENT HEMISPHERES AND LOCATIONS

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Abstract: Fatigue is a common problem among people after stroke that may hamper full participation in a rehabilitation program. A high incidence of fatigue has been reported in people with post stroke. The combination of stroke, fatigue, and sedentary lifestyle can create a morbid downward-spiral in terms of quality of life and functions. Therefore, it is essential to better understand the nature of fatigue. As Fatigue is a common problem among people after stroke with higher incidence involving various lesion of location, the study was aimed to see the difference in fatigue among stroke individuals with lesions in different hemispheres and locations. A Cross sectional study was done consisting of 30 subjects (45-70yrs). All the subjects were given a fatigue questionnaire (FAS) sheet to fill up. Subjects in the group were asked to perform Six-Minute-Walk Test (6MWT) used to induce fatigue prior to assessing the level of fatigue. Then the distance covered during 6minute was measured and fatigue level was measured by using fatigue index (VAFS). The result showed that there was no statistical significant difference in fatigue between right & left hemisphere, ischemic & hemorrhagic stroke and different locations involved (thalamus, putamen, cortex, corona radiata & internal capsule). So the study concluded that there was no significant difference in fatigue among stroke individuals with lesions in different hemispheres and locations.
Index terms: Fatigue, Stroke, Hemiplegia, Cerebrovascular accident

I. INTRODUCTION

Stroke is often referred to as a cerebrovascular accident (CVA). It is defined as a sudden, non-convulsive loss of neurologic function due to an ischemic or hemorrhagic intracranial vascular event [(1)]. Fatigue is a common problem among people after stroke [(2,3)] that may hamper full participation in a rehabilitation program[(4)]. The prevalence of fatigue following stroke and Transient Ischemic Attack (TIA) is disputed, with prevalence ranging from 30% to 72% reported [(5)]. Fatigue has been defined as a feeling of early exhaustion, weariness, lack of energy, and aversion to effort. [(2)] A high incidence of fatigue has been reported in people with post stroke in various studies.[(6, 7, 8)]

In 1989 Funk and colleagues proposed a neurophysiological model in an attempt to explain fatigue in terms of central and peripheral nervous system components.[(9)] Impairment of central component leads to decreased motivation and transmission of messages from the brain and spinal cord. It also leads to exhaustion of brain cells in the hypothalamic region. Impairment of the peripheral component can change complex biochemical interactions between nerve and muscle that generate the force to movement.[(9)] Glader et al suggest that survivors of stroke with fatigue have a higher fatality rate 3 years after stroke possibly associated with sedentary lifestyle.[(7)] In survivors of stroke, decreased aerobic capacity,[(10-13)]decreased endurance,[(14)] and increased energy expenditure associated with impaired motor movements[(11,15)] may be related to fatigue and can further affect daily functions such as walking[(16)] and further rehabilitation. Survivors of stroke may experience increased energy expenditure during gait due to the inability to activate normal motor patterns; [(11)] such limitation may cause poor biomechanical efficiency and promote an earlier onset of fatigue. Physical impairment, therefore, is an important contributing factor to fatigue in people post-stroke.[(17, 18)] There appear to be multiple contributors of fatigue including depression, chronic pain, sleep disorder, immobility, and lack of exercise.[(19)] Fatigue also impacts on performance of daily activities, especially those requiring physical effort.[(4)] Researchers have recently begun to explore the negative impact of fatigue on stroke rehabilitation. [(8)]

As stroke is more common in the elderly, fatigue is an important issue due to its association with deterioration of various aspects of everyday life. The combination of stroke, fatigue, and sedentary lifestyle can create a morbid downward-spiral in terms of quality of life and functions. Therefore, it is essential to better understand the nature of fatigue. If more contributing factors of fatigue could be identified, clinicians will be able to modify therapeutic treatment accordingly for post-stroke rehabilitation[(20)]. The treatment of the patient will also vary according to severity of fatigue as patient with elevated fatigue severity has poorer falls efficacy in stroke, [(17)]. So the objective of the present study was to investigate the difference in fatigue among stroke individuals with lesions in different hemispheres and locations.

II. METHODOLOGY

Study was conducted as a part of partial fulfillment of the completion of post graduation in Physiotherapy. Study was approved by ethical committee of the institution. Study design was cross sectional study and convenient sampling was adopted. 30 subjects diagnosed by a Neurophysician with stroke (finding of CT or MRI are taken into consideration) who were referred to physiotherapy clinic for rehabilitation were included in the study. The other inclusion criteria are a single stroke at least 6 months prior confirmed by clinical assessment Subjects scoring 5 each in "walking" & "sit to stand" subgroups of motor assessment scale (MAS) [(21)], Subjects with Mini-Mental-Status-Exam (MMSE) [(22)] score of 25 or more, which indicated the ability understand instructions and communicate verbally & Subjects of age between 45-60 yrs of either gender, Subjects scoring 0-13 in Beck depression inventory BDI -II scale.[(23)] Subjects with any musculoskeletal condition that could potentially affect the ability to perform the motor tasks of the study, Subjects with significant cardiac arrhythmia, hypertrophic cardiomyopathy, severe aortic stenosis, or pulmonary embolus, Subjects with recent symptoms of chest discomfort & BMI more than 24 were excluded from the study.

Informed consent was taken from the subjects. Subjects who fulfilled the inclusion and exclusion criteria were given a fatigue questionnaire (FAS) [(24)] to measure the resting fatigue level. The procedure to be performed was instructed to the subjects. Subjects in the group were asked to perform Six-Minute-Walk Test (6MWT) as by the guidelines of ATS [(25)] to induce fatigue prior to assessing the level of fatigue. The clinical utility of 6MWT in neurological condition is well established in the literature. [(26)] The 6MWT was performed on a 100-feet walkway with

length of 30 meter distance. Subjects was informed that the goal of the test was to cover as much distance as possible during 6 minutes and then the distance covered & fatigue level was measured by using Fatigue Index (VAFS) [27] where fatigue was measured using a 10-point verbal analogue scale where 0 indicates "very alert" and 10 "extremely fatigued.

Finally based on the availability of subjects, they were categorized according to their lesion of location as the hemisphere involvement (Right & Left), type (ischemic and hemorrhagic) & various locations ; cortex, corona radiata (CR), internal capsule (IC), putamen, and thalamus. The data was recorded and analysed by using SPSS software (version 17) for Windows. Alpha value was set at .05. Descriptive statistics was used to analyze demographic variables (age, time period since onset) background variables (MMSE, MAS score of sitting to standing & walking component, BDI, BMI) and outcome variables (6MWD, FAS & VAFS). Unpaired t- test was used to find out the 6MWD between the right &left side hemisphere lesion and also between ischemic & hemorrhagic stroke Mann-Whitney U test was used to compare the FAS &VAFS between the right &left side hemisphere lesion and also between ischemic & hemorrhagic stroke. One way ANOVA was used to find out the 6MWD between different lesion locations; thalamus, cortex, corona radiata, internal capsule & putamen. Kruskal-wallis test was used to compare FAS &VAFS between different lesion locations; thalamus, cortex, corona radiata, internal capsule & putamen.

III. RESULTS & DISCUSSION

Results

The mean age of the subjects was 57.40 years, the mean duration of stroke was 4.03 years, the mean MMSE score was 27.60, the mean BDI score was 3.10 and the mean BMI being 21.67 $kg/m^{(2)}$. Table I represents the data of outcome variables of different side lesion location with 20 right hemispheric and 10 left hemispheric involvements. Table 2 represents the data of outcome variables of different type of lesion with 20 ischemic and 10 hemorrhagic involvements which were not statistically significant. The outcome variables such as 6 minute walk test distance (6MWD), Fatigue Index (VAFS) and fatigue assessment scale (FAS) were not statistically significant when compared between right sided and left sided lesions. Also when compared between ischemic and hemorrhagic lesions, the variables were not statistically significant. Out of 30 subjects, 14 subjects were thalamic lesions (46%), 6 were lesions in putamen (20%), 5 were lesions within the cortex (17%), 3 were lesions within the internal capsule (10 %) and remaining 2 were lesion in the corona radiata (7%) (Figure I). There were no statistically significant differences in outcome variables between locations of lesion mentioned above (Table III). In the given tables, all the data were represented in terms of mean and SD.

Table I: Between group difference for different side of hemisphere

Sl.No	Variable	Right sided	Left sided	p-value
1	No. of Subjects	20	10	-
2	6MWD	313.5± 42.83	329.5± 55.40	0.389
3	FAS	19.65 ± 3.03	19.4± 1.65	0.713
4	VAFS	2.95 ± 1.64	2.30 ± 1.49	0.328

Table II: Between group difference for different type of lesion

Sl.No.	Variable	Ischemic	Hemorrhagic	p-value
1	No. of Subjects	20	10	-
2	6MWD	323.5± 49.74	310 ± 41.63	0.467
3	FAS	18.9± 1.65	20.90 ± 3.67	0.214
4	VAFS	2.45 ± 1.39	3.30 ± 1.89	0.267

Table III: Between group difference for different location of lesion

Sl. No	Variable	Thalamus	Cortex	Corona Radiata	Internal Capsule	Putamen	p-value
1	No. of Subjects	14	5	2	3	6	

2	6MWD	327.14 ± 45.31	312.00 ±55.29	325 ±35.36	360 ±52.92	283.33 ± 28.75	>0.172
3	FAS	19.14 ±2.18	20.00 ±1,41	18.00 ± 0.00	18.00 ±0.00	21.50 ± 4.28	>0.259
4	VAFS	2.86 ± 1.56	2.40 ±1.82	2.50 ± 2.12	2.00 ± 1.73	3.17 ± 1.72	>0.912

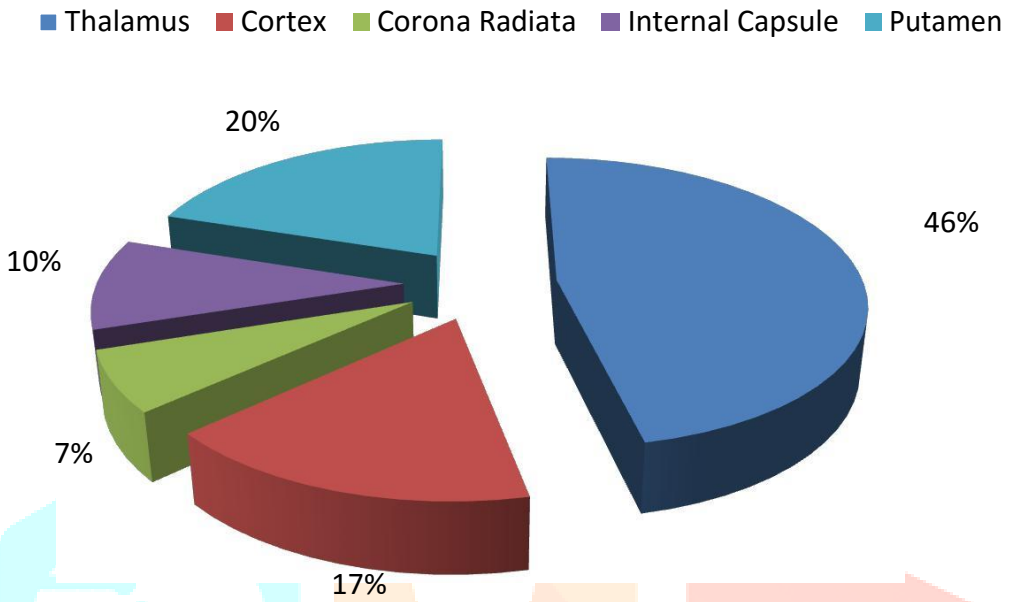

Fig I: Number of subjects with different location of lesions

Discussion

As Fatigue is a common problem among people after stroke with higher incidence involving various lesion of location hence this study was aimed to see the difference in fatigue among stroke individuals with lesions in different hemispheres and locations. 30 subjects were included in the study. Among these, 21 were males and 9 were females. Demographic data, baseline variables (MMSE, BDI, and BMI, MAS sitting to standing& walking component) as well as the measured tools (6MWD, FAS and VAFS) for correlating lesion location involved and fatigue were recorded.

The outcome variables used in the study was FAS, VAFS & 6MWD. According to a study done by Otto et al [(28)] FAS is an adequate measure of fatigue in patients with stroke. Benjamin Y. Tseng conducted a study [(27)] on measurement of fatigue level after inducing fatigue in post stroke subjects with VAFS which gave accurate measure one for post stroke fatigue cases. Myla Goldman[(29)] mentioned that 6MWT is a sub maximal exercise test used to assess exercise tolerance and the exercise tolerance is inversely related to fatigue.

The result of analysis between group differences for different side of hemisphere showed mean 6MWD covered was 313.50 for right hemisphere lesion and mean 329.50 for left hemisphere lesion; the mean FAS score was 19.65 in right hemisphere& mean 19.40 for left hemisphere and the mean VAFS score was 2.95 in right hemisphere & mean 2.30 for left hemisphere involvement which was not statistically not significant. This is in accordance with a study done by Janet L. Ingles [(2)] which concluded that fatigue was not related to time post stroke severity or lesion location. However study done by stein[(30)] and colleagues reported that patients with right brain damage complain more frequently of fatigue in assessment for depression. The present study also did not show much difference between right and left hemispheric lesions. The reason could be that sample size and cross sectional design of this study may not have been sufficient to detect significant predictor of fatigue.

Result did not show any significant change in fatigue between different lesion type as the mean 6MWD covered was 323.50 in ischemic & mean of 310 in hemorrhagic involvement; the mean FAS score was 18.90 in ischemic & mean 20.90 in hemorrhagic; the mean VAFS score was 2.45 in ischemic & 3.30 in hemorrhagic. So all result showed that there is no significant difference in fatigue with type of lesions as ischemic and hemorrhagic which is in accordance with a study done by Paul Dorman et al[(31)] where author concluded that it may be possible that fatigue may have central origin i.e.it might be direct consequence of a cerebral infarct or cerebral hemorrhage.

It did not show any significant difference in fatigue with the mean data of 6MWD covered, the mean FAS score and the mean VAFS score with involvement of different location: thalamus, cortex, corona radiata, internal capsule and putamen. This is accordance with the study done by Nyland [(32)] & staub[(6)] which suggested that fatigue is more common in brain stem stroke although other studies did not find any association between brain stem stroke & fatigue. A study done by Chia-Ling et.al [(33)] stated that motor recovery and functional outcome after stroke correlated with brain lesion profile that combined delimiting size and locations of lesions. Even in pyramidal lesions functional outcome did not correlate with relative lesion size but motor recovery correlate with posterior part of corona radiata. Few subjects have shown their lesion of location with multiple area involvement. This could be the reason in the present study why there was no difference in fatigue with involvement of multiple locations..

According to Vera P. Schepers [34] the determinants depression, age, sex, and locus of control explained one fifth of the variance of fatigue impact scores. Therefore, most fatigue impact remained unexplained. They expect that a number of factors did not take into account might be associated with post stroke fatigue. For example; the level of physical fitness according to Potempa K [35] could be an important factor contributing to post stroke fatigue. Fatigue could be due to the side effect of using certain medications. Even sleep apnea, which is commonly associated with stroke, might also be taken into consideration. [36]. According to Franklin KA [37] environmental factors and personal characteristics, such as coping strategies, might be relevant for post stroke fatigue as well. Additional research is needed to clarify the impact of such factors on post stroke fatigue. According to kunesch and coworker[38] recovery of post stroke is similar with cortical and subcortical structure affecting pyramidal tract although pantano[39] reported that patients with lesions of parietal lobe showed a more severe motor deficit than with cortical lesions.

The study had some limitations, as sample size was small so the results cannot be generalized. The study was confined to only a part of Bangalore. The data was not so homogenous; Females were very less as compared to male subjects, Right hemisphere lesions were more as compared to the left hemisphere lesions, Ischemic involvement was more than hemorrhagic. Other potential factors such as multiple lesion location, medication, life style would have affected the present study. Further study can be performed to find out the difference in fatigue between lesions of brain stem & cerebellum as this study did not include this areas. Study can be performed to assess the fatigue difference with respect to duration of post stroke i.e. acute, sub acute and chronic. Study can be done to devise appropriate rehabilitation strategies to manage fatigue in post stroke. Study can be performed by measuring fatigue with respect to the flexion and extension synergy in lower limbs among stroke individuals

IV. Conclusion

The primary objective of the study was to find out the difference in fatigue among stroke individuals with lesion in different hemisphere and location. The result of the study explained that there was no statistical significance in fatigue level between right & left hemisphere; between ischemic & hemorrhagic and between different lesion location-thalamus, corona radiata, cortex, putamen & internal capsule. Therefore the null hypothesis is accepted which states that there will be no significant difference in fatigue among stroke individuals with lesions in different hemispheres and locations.

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