RESEARCH ARTICLE

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Effect of Aquatic Therapy on Balance in Chronic Stroke Survivors

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Abstract

Background: Stroke is leading cause of impairment and disability globally. The primary and secondary impairments that arise in stroke make subject functionally dependent on everyone. Balance is a vital component that is necessary for activities of daily living. After stroke, the subject looses control over automatic postural mechanisms that are necessary for maintaining static and dymanic balance. Unless balance is properly achieved, further progression in treatment cannot be achieved. It is necessary to device protocols that overcome the latency in scientific methodologies and help in improvement of balance after stroke. **Objective:** To determine the effect of Aquatic therapy on balance in chronic post stroke survivors. **Material and Methods:** This was an experimental study where 20 subjects of stroke having impairments in balance were enrolled. Group A received conventional therapy and Group B received conventional along with aquatic therapy. Pre intervention assessment was done with the help of Berg balance scale. The treatment was given for three weeks (5 times/week). Post intervention changes were taken after 3 weeks. Statistical analysis was done using students T- test. **Results:** Results showed statistical improvement in control of balance with help of aquatic therapy along with conventional exercises over conventional alone. The Berg balance score of both confirms it (Mean of Group B is 42.5 over group A : 30.6) The time period required for this was comparatively less when compared with conventional exercises. **Conclusion:** Conventional exercises along with Aquatic therapy has shown to be significantly effective in improvement of balance in long standing stroke survivors.

Major Findings: Conventional exercises practiced in aquatic mode have shown to be more beneficial in improving balance in individuals who have chronic stroke.

Keywords: Aquatic Therapy, Balance, Physiotherapy, Stroke

1. Introduction

Stroke is one of the lives threatening health condition which occurs when there is lack of blood supply or rupture of blood vessels inside the brain. Due to lack of blood or rupture of vessels, brain cells start to die as the level of oxygen decreases. The revised definition of stroke emphasizes clinical and tissue criteria and can be widely used in research and public health[1]. Preventability and treatment in stroke are linked[2]. Risk factors of stroke are modifiable and non modifiable in nature. Modifiable risk factors include hypertension, diabetes, excessive alcohol intake, smoking, excessive weight, sedentary lifestyle, food with high sodium and fat content, use of oral contraceptive pills[3] and mental stress. Non modifiable risk factors include age, gender, race, heredity and past history of stroke or transient ischemic attack. But overall awareness in society is very less. Mass media has been shown to be the source of information about risk factors in stroke[4]. In India, the prevalence of stroke is high in people of age 45 years and above. In a study by Kodali *et al*., hypertension, family history and less physical activity have been found to be significant contributors to stroke[5]. Motor function is commonly affected. It is due to damage to any area of the brain which regulates motor control. Primary motor cortex (M1), Premotor area, Parietal cortex, Cerebellum and Basal Ganglia control normal motor behaviors in an individual. The presenting motor and non motor

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problems after stroke are different as gender varies[6]. In order to decide appropriate interventions, it is necessary to understand the correct clinical problems and meaningful ways to address them. Subjects may experience weakness, paralysis and stiffness within the muscles. Identification of correct patho mechanics is necessary to differentiate various causes and thus set appropriate goals to achieve it. Rapid recovery takes place in initial 3 to 4 months. Some subjects demonstrate spontaneous recovery while few ones recover fully. Evidence have shown that it is very challenging to recover fully in hemorrhagic stroke. muscle wasting is very common after one year of stroke. 21% of subjects have been shown to develop cachexia one year later. This means that there must be reduction in body weight after stroke. Balance issues are very common in stroke due to paralysis to one side of the body. There is alteration in normal anatomical arrangement of the body. Automatic postural reactions may be lost after stroke. stroke may result in impaired muscle control and strength, in coordination in lower limbs and lack of core stability. All these factors contribute to lack of balance in stroke survivors. After stroke, there is weakness in one side of the body. This makes it difficult to maintain static and dynamic balance of the body. There could be alteration in sensation of affected leg. If the subject cannot feel the position of his/her leg then it becomes difficult to know and move. This will result in loss of balance. Many people after stroke may have additional problems like difficult to concentrate, vision problems, spatial neglect, pusher syndrome, ataxia, vertigo, infections of inner ear. All these factors contribute to alteration in balance in both acute as well as chronic stroke survivors. Improvement is rapid in initial days but can continue slowly for months and years. Balance is necessary to reduce the fear and prevalence of falls in both acute and chronic stages of stroke. Postural instability is significantly greater even up to 4 years in stroke survivors[7]. Arlene A. Schmid et.al concluded that in chronic stroke impairment in balance and risk of fall is high which is associated with lower quality of life[8]. Physiotherapy interventions have been shown to improve balance in stroke[9]. Variety of therapeutic approaches has been worked on balance in acute stages of stroke. As the diseases becomes chronic, anatomical changes in soft and hard tissues of body makes it more difficult to reverse the impairments. Newer methodologies need to be tried. Aquatic environment has rehabilitation potential in both acute and chronic diseases. By understanding its physiology, a appropriate therapeutic exercise protocol can be framed for impairments in chronic stroke with special emphasis on balance and also for different population[10]. Balance and self efficacies are associated with fall history in chronic stroke[11]. studies have shown its benefits on stroke induced disabilities. But further research needs to be undertaken to bring it into action for management of stroke[12]. This is the novel thought for my study.

2. Materials and Methods

This study was undertaken after getting it approved from Institutional ethics committee of Krishna Institute of Medical Sciences Deemed to be a university, Karad (KIMSDU/ IEC/08/2022 Protocol Number 124/2022-23).

2.1 Study Type

This is an experimental study where effect of aquatic therapy was seen on balance in chronic stroke survivors. It is a randomized clinical trial with 20 subjects fulfilling the inclusion and exclusion criteria

2.2 Sampling Technique

Simple Random Sampling.

2.3 Outcome Measure: Berg Balance Scale

It is a scale which safely measures the ability of individual to safely balance in series of performed tasks. It has total 14 items consisting of five point evaluation with score ranging from 0 to 4 where 0 indicates lowest level of function and 4 indicates highest level of function. This scale can be evaluated in approximately 20 minutes. This scale is psychometrically sound for measurement of impairments in balance for stroke individuals[13].

2.4 Procedure

The subjects were divided into two groups. Group A received conventional therapy and Group B received conventional along with aquatic therapy. On initial day, pre intervention assessment was done with help of Berg balance scale. The treatment was given for three weeks (5 times/week). Post intervention assessment was done again. Data analysis was done with the help of SPSS software. The changes in balance impairment were derived with appropriate statistical measures.

2.5 Statistical Analysis

Total number of subjects: 20

Simple random sampling

Group A : Conventional therapy n=10 subjects

Group B: Conventional along with aquatic n=10 subjects

Analysis by students t - test

Table 1. Demographic distribution of subjects included in the study

Demographic variables of 20 subjects		
Sex distribution	Males : 11	Females : 09
Side affected	Right hemiplegia : 09	Left hemiplegia : 11
Type of stroke	Ischemic : 08	Hemorrhagic :12
Number of stroke	First : 18	Second :02
Average Age	57	

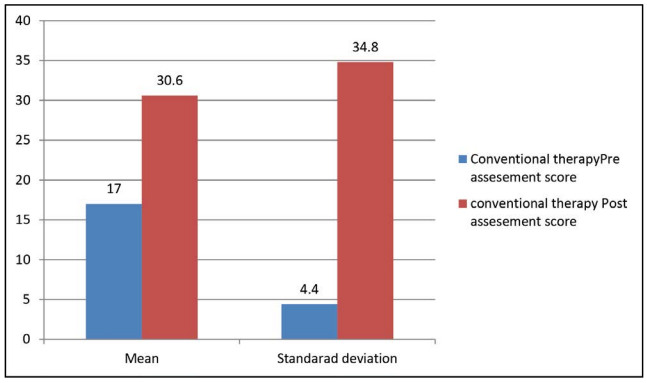
3. Results

Total 20 subjects fulfilling the criteria were included. 11 males and 9 females were part of this study. 9 subjects had right sided Hemiplegia and 11 had left sided. The average age of participants in the study was 57.

3.1 Berg Balance Scale

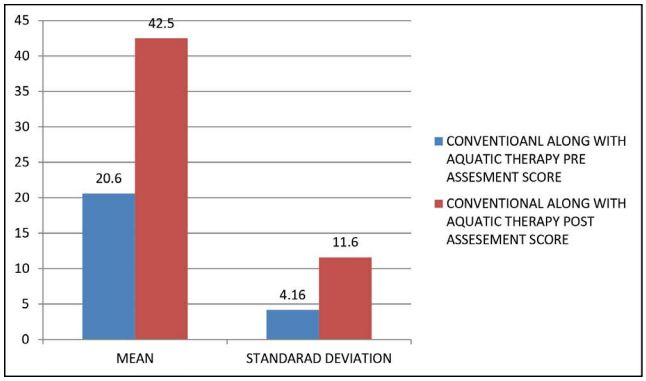
3.1.1 Within Group Comparison: (Paired t test)

Group A: Conventional Therapy



P < 0.001 which is considered to be extremely significant.
Figure 1. Comparison of pre and post changes in conventional therapy.

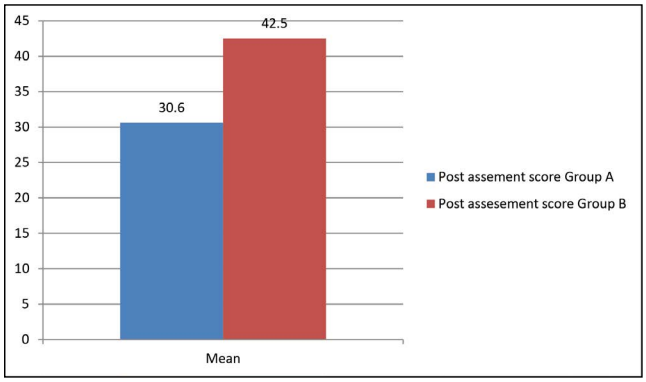
Group B: Conventional along with Aquatic Therapy



P < 0.001 which is considered to be extremely significant.
Figure 2. Comparison of pre and post changes in conventional along with aquatic therapy.

3.1.2 Between Group Comparisons: (Unpaired t test)

For comparison between both the groups unpaired t test was used.



P < 0.001 which is considered to be extremely significant
Figure 3. Comparison of post changes between both the groups.

4. Discussion

The overall burden of stroke is very high which includes increased prevalence, death ratio and economic harm. This is especially seen in lower and middle economic countries[14]. In chronic stroke survivors, falls occur frequently due to lack of balance which directly affects the mobility as well. In this study the effect of aquatic therapy has been analyzed on balance issues in stroke survivors of 6 months and older. Majority of times subjects uses

compensatory mechanisms to maintain mobility, gait and performances. This directly affects their functional capacities due to which quality of life is also compromised.

4.1 Berg Balance Scale

Conventional exercises are traditional ones practiced world wide. Many therapeutic interventions are practiced to regain balance control. There are many drawbacks of these exercises as they do not significantly improve reactive balance control which is very important for recovery in conditions like stroke[15]. Studies have shown that short periods of aquatic training have shown to improve balance and in turn walking in subjects with stroke[16]. Aquatic therapy has been shown to be advantageous over land based exercises due to feasibility, time efficient strategy and has shown to improve muscle oxidative capacity and body composition[17]. The prevalence of falls in water is very less in stroke individuals. Conventional exercises alone lacks in specificity to issues like maintenance of tone, persistence of effects that have been achieved after treatments. The time required for neuronal plasticity is long with traditional exercises. Aquatic therapy provides a different environment for the subjects to exercise. Principles of buoyancy are used to direct the movement, resist the movement to improve voluntary control, isolate the mass movements patterns in upper and lower limbs, reduce spasticity in trunk musculature which is directly helpful for improving dynamic balance in stroke. Aqua exercises increases interaction between body segments and microgravity influences the biomechanics of stroke by reorganization of sensor motor relations which stimulates the hierarchies of nervous systems[18]. Exercising in water takes away excessive pressure on joints, bones and muscles. Therefore the red flags of spasticity can be minimized and repetition of movements could be increased. Increase in movements will help to establish interneuron circuits and enhance Engram formations in brain. This will directly improve balance and mobility in chronic stroke.

Warmth water will allow relaxing the muscles completely thereby helping in normalizing of hyper tone in trunk and limb muscles. This medium has been effective in improving concentration, endurance and flexibility in long standing stroke. Lower gravity levels increase the base for moving the body and allow muscle to move freely without much discomfort or strain. Buoyancy has been found to challenge the body by pushing effect thereby improving postural reactions from the body that helps to enhance segmental control in stroke. Water has been shown to dilate the blood vessels which increase the blood supply to the muscles. This mechanism is helpful in reducing hypertonicity in lower limb muscles making isolated movement easy. Aquatic therapy has been shown to improve balance function in subjects with Parkinson disease[19,20] and even in elderly population[21]. In this study it has been found that adding medium of water is significantly improving balance in long standing stroke. This medium has been found to significantly improve cardio respiratory fitness is which is severely compromised in late stroke survivors.

5. Conclusion

The study concludes that aquatic therapy has been found to be significantly better for improve balance in chronic stroke survivors.

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