

Original Article

Effects of aquatic physiotherapy on the improvement of balance and corporal symmetry in stroke survivors

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Abstract: Introduction: One of the main problems associate with hemiparesis after stroke is the decrease in balance during static and dynamic postures which can highly affect daily life activities. Objective: To assess the effects of aquatic physiotherapy on the balance and quality of life (SS-QoL) of people with pos stroke. Methods: Chronic stroke participants received at total 18 individual sessions of aquatic physiotherapy using the principle of Halliwick (2x of 40 minutes per week). The outcomes measured were: Berg Balance scale, Timed up & go test (TUG), Stroke Specific Quality of Life Scale (SS-QoL) and baropodometric analysis. These assessment were performed before and one week after intervention. Results: Fifteen participants were included in this study. The mean age was 58.5 and 54% was male. After intervention, participants had a significant improvement on their static balance measured by Berg Balance scale and TUG. Dynamic balance had a significant trend of improvement in mediolateral domain with eyes closed and during sit-to-stand. The mobility domain of the SS-QoL questionnaire was significant higher after intervention. Conclusions: Our results suggest that aquatic physiotherapy using the method of Halliwick can be a useful tool during stroke rehabilitation to improve balance. However, this improvement may not have significant impact of their quality of life.

Keywords: Stroke, physiotherapy, balance, quality of life

Introduction

Stroke is a vascular disorder that leads an acute loss of brain function for 24 hours or more. According to the World Health Organization, out of the 15 million people have a stroke each year; 5 million will be permanently [1, 2]. In Brazil, the disease is the leading cause of death and disability, generating great economic and social impact. This makes stroke one of leading cause of disability in the world [3, 4]. Moreover, those who survive a stroke will require help with normal daily activities [2, 5].

The effects of a stroke may include motor, sensory, Mental, speech deficits which can all affect quality of life. The severity of these effects will depend on the localization of the artery damaged, lesion extension, age, level of activity before injury, presence of pre-morbidities, and type of treatment given during acute and chronic phase [2, 5, 6]. The alteration of

sensory and motor systems might result in postural alteration, which is commonly found in hemiplegic stroke people. This is because when standing they move their body weight towards the normal side causing an abnormal postural alignment [2]. Therefore, functional daily activities such as walking, stepping up/down gutters that require high level of synergic movements and include control of posture and balance are highly affected [7].

Rehabilitation after stroke is been shown to be very important on the recovery of function. However, there are many tools that can be used in rehabilitation and more studies are needed to understand their value [8]. This is the case of aquatic physiotherapy where the Halliwick method can be employed. The Halliwick concept is a structured learning progress that aims to improve independence in the water and gain better movement control and balance. It involves ten phases: mental adjustment, disengage-

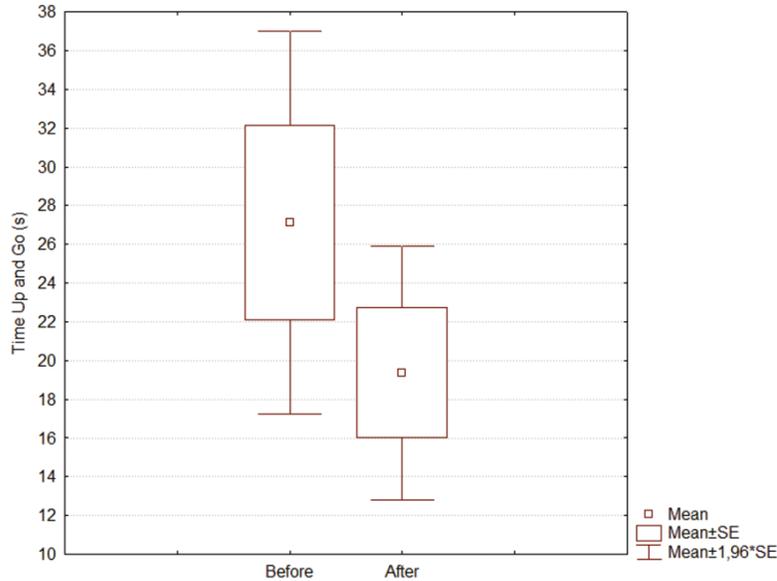


Figure 1. Data are expressed as Mean±SEM and CI.

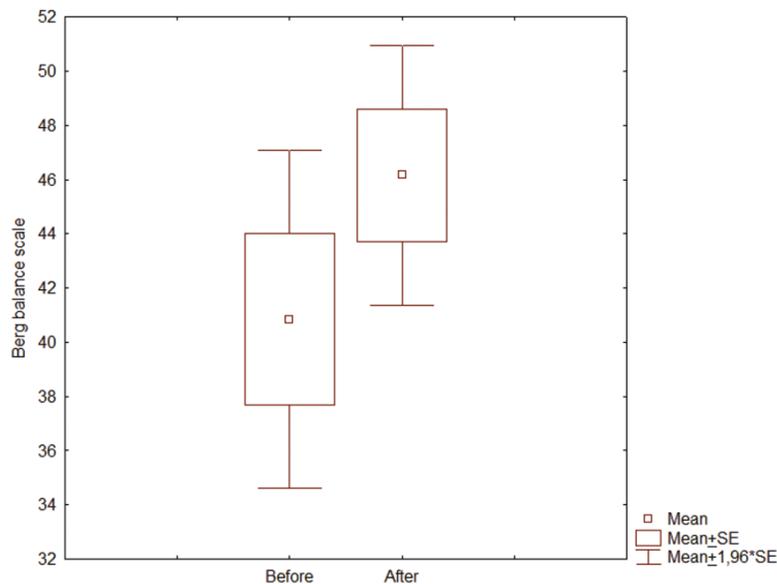


Figure 2. Data are expressed as Mean±SEM and CI.

ment, transversal rotational control, sagittal rotation control, longitudinal rotation control, combined rotation, upthrust, balance, turbulent gliding, simple progression and basic swimming movement [9, 10].

The aim of this study was to assess whether aquatic physiotherapy can improve balance and quality of life (SS-QoL) in people with chronic stroke.

Materials and methods

This study was performed at the Physiotherapy Clinic of the Pontific Catholic University of Paraná (PUCPR), Brazil. Ethics was approved by the University ethics committee. All the participants included in this study gave consent according to the PUCPR guidelines.

Participants were included if they had one stroke event only, were clinically stable, able to walk and were at the stage 4 of the Brunnstrom classification. Exclusion criteria were presence of any co-morbidity that could influence physical performance, cognitive impairment and an absolute contraindication to aquatic physiotherapy.

Participants received at total 18 individual sessions of aquatic physiotherapy using the principle of Halliwick (40-minute sessions, twice a week). The assessments were performed at baseline and after intervention. This consisted of the Timed up and go test, the Berg Balance scale, Baropodometer and the Stroke Specific Quality of Life Scale (SS-QoL) questionnaire.

Data distribution of the Berg Balance scale, Timed up & go test, Baropodometer and SS-QoL questionnaire was tested using Shapiro-Wilk. If the data was normal distributed we used t-test to measure differences between before and after intervention. If data was not normally distributed non-parametric Wilcoxon test was used. Comparison were considered statistically significant when $p < 0.05$. Data are present as mean±SD.

Table 1. Descriptive and interferential statistics of mediolateral domain baropodometry assessment with participants in different situations

Situation	Baseline		Follow-up assesment		t	p
	Mean	SD	Mean	SD		
Open eyes	19.9	2.1	18.8	2.3	1.343	0.204
Closed eyes	20.2	2.3	18.7	2.4	1.849	0.089
Sitting to standing	21.8	3.0	20.1	3.1	2.960	0.063

Table 2. Descriptive and interferential statistics of anteroposterior domain baropodometry assessment with participants in different situations

Situation	Baseline		Follow-up assesment		t	p
	Mean	SD	Mean	SD		
Open eyes	29.1	4.1	28.5	3.8	0.540	0.599
Closed eyes	31.5	4.2	30.3	4.5	1.376	0.194
Sitting to standing	30.0	4.9	30.6	5.2	-0.510	0.620

Table 3. Data are expressed as Mean±SD

	Initial	Final	t	p
Energy	8.5±3.7	9.4±4.5	-0.69	0.50
Family roles	6.0±3.5	8.2±3.4	-1.46	0.17
Language	17.4±4.6	17.8±5.6	-0.25	0.81
Mobility	16.2±4.8	18.8±4.6	-4.32	0.00
Mood	14.7±7.0	18.0±7.0	-1.45	0.17
Personality	8.6±3.8	9.8±4.4	-1.29	0.22
Self-care	18.1±5.1	19.9±3.8	-1.79	0.10
Social roles	12.4±5.6	10.3±4.9	1.25	0.23
Thinking	10.8±3.5	10.7±3.8	0.13	0.90
Upper extremity funcional	10.6±8.0	10.0±7.7	0.69	0.50
Vision	14.5±1.0	14.3±1.0	0.64	0.53
Work/Productivity	7.5±3.2	8.6±4.4	-0.98	0.34
Total score	145.3±24.4	155.8±33.4	-1.61	0.13

Results

The mean age of the included participants was 58.5 years, 90% of them had an ischemic stroke and 54% were male.

Our results showed a statistically significant decrease on the time Timed up & go test after intervention (19.4±12.1) in comparison with before (27.1±18.2) intervention. (W=0.7; p=0.002) (Figure 1).

The Berg Balance scale was also significant different after intervention (t=3.95; p=0.002) (Figure 2).

Regarding the baropodometry assessment, there was no significant difference on the laterolateral domain eyes open (t=1.343; p=0.204). However, there was a positive trend on sitting-to-standing domain eyes closed (t=1.849, p=0.089; t=2.960, p=0.063, respectively) (Table 1). No difference was found on the anteroposterior domain in all tasks (eyes open, sitting to standing and eyes open) (Table 2).

The SS-QoL questionnaire had a statistically significant difference regarding the Mobility domain. Before intervention the mean score was 16.2±4.8 whereas after intervention was 18.8±4.6 (t=-4.32; p=0.00). Importantly, the Self-Care domain was higher after intervention (18.1±5.1 versus 19.9±3.8; t=-1.79; p=0.10). Similar finding was also observed on the total score of the SS-QoL (145.3±24.4 versus 155±33.4; t=-1.61; p=0.13) (Table 3).

Discussion

The popularity of aquatic physiotherapy has increased between neurological rehabilitation physiotherapist and researchers because of the benefits that the water provides [11]. The water environment acts as a partial support to the body allowing mobilization of articulations. Also, aquatic rehabilitation provides motor and sensory stimuli that can potentially induce plasticity [12].

The present study showed that the Halliwick method improved balance and the mobility domain of SS-QoL in Stroke survivors.

Overall, aquatic exercise improves motor function, static and dynamic balance in people who suffered stroke [13-15]. It can be argued, that these improvements might be superior through aquatic therapy as gravity is eliminated than over-ground therapy [16].

Our Berg Balance Scale assessment demonstrated a significant improvement of dynamic balance. Similar findings where aquatic physiotherapy was superior to over-ground therapy have also been reported in the literature [15, 18]. Contrary, Gaiger [19] reported that only conventional therapy was able to improve balance and Douris [17] that both type of interventions were equally effective.

Muscle weakness and spasticity developed after stroke lead to difficulties in performing functional tasks, therefore, test such TUG will take longer to be completed [20]. However, our results demonstrated a decrease in time to complete the test with a significant improvement. These results are in agreement with those of other studies [19, 21, 22]. It has been suggested that TUG is a measured of functional mobility as decrease in TUG time is highly correlated with functional capacity, balance and walking speed.

We used baropodometry to assess three items (eyes open, eyes closed and stand) and two domains (Anteroposterior and mediolateral displacement), the results showed a significant trend of improvement in the mediolateral displacement domain, eyes closed and sitting-to-standing items. These results differ from previous findings. Lee [14] showed in stroke people who underwent water or over-ground therapy that the mediolateral domain with eyes closed and opened improved in both groups (water and ground therapy), whereas on the anteroposterior only water therapy improved all domains. One fact that might explain these results is noises during the test that can lead to distraction of the participant [23, 24]. Hemiparetic people with high motor deficits develop effective compensation strategies based on the asymmetry of weight bearing and lateral control to perform tasks. These strategies seem to be influence by the level of attention of the hemiparetic and also lack of confidence, this is in addition to the natural loss of physical ability and difficult to maintain posture and static balance that occurs during aging [25].

Posture among others sensorial information is based on somatosensory, vestibular and visual systems and people with deficit in one of these will adjust to depend on the remaining intact system [26]. Massara in: [26] suggested that

balance is also influenced by factors such as personality and socio environmental. Therefore, the individuality of each person with various circumstances present in life will develop a specific body posture involving balance, neuromuscular coordination and adaptation, which will represent a body movement [26].

The mobility domain of the SS-QoL questionnaire was significant higher after intervention. This can be due to the high number of males on the present study (53.8%). Delboni [27] showed that man have superior mobility recovery than woman after stroke. Other facts such as lesion area, age and cognition may also have influenced our results. The study of Neto [28] demonstrated that people who had an ischemic stroke had poorer quality of life than people who had a hemorrhagic; these findings are consisted with our results as the majority of the participants included in the study had an ischemic stroke. It is well known that people with chronic neurological disorders have poor quality of life, which may affect their recovery [29-31]. Chronic neurological patients tends to suffer a worsening in their quality of life due to physical and cognitive limitations in addition to psychological and/or economic changes [28]. Therefore, deficit in balance has a high impact in activities of daily living leading to serious physical, psychological and social problems. This emphasise the need to prevent fall to ensure better quality of life and independency [4, 31, 32].

Conclusion

In conclusion, aquatic physiotherapy may improve balance and quality of life of stroke participants. Although this study had limitations, we hope our results contribute to the understanding of the Halliwick method as an intervention to enhance SS-QoL of people with stroke.

Disclosure of conflict of interest

None.

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