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ORIGINAL RESEARCH

The Role of Sitting Balance Exercises in Minimizing the Risk of Fall among Patients with Stroke.

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ABSTRACT

Background: Cerebrovascular accident (stroke) frequently results in problems with balance, which increase the risk of falling. Patients with stroke might improve their balance skills and reduce the occurrence of falls by engaging in sitting balance training exercises.

Objectives: The current study aims to examine the effect of sitting balance exercises on the risk of fall in patients with stroke.

Methodology: A quasi-experimental design was performed on sixty patients with acute stroke by using a purposive sampling method. The recruited patients were divided to experimental and control groups with 30 patients each. Patients in the experimental group were followed to perform sitting balance exercises two sessions per day for 14th days, whereas the patients enrolled in the control group received a routine conventional care.

Results: More than half of patients participating in the experimental group were within the age groups of 60-69 years old and accounted for 53.3%, 56.7% of the experimental group were female while 46.7% of the control group were males. Before applying sitting balance exercises, the experimental group's overall mean score for the level of falling incidences risk level was 1.2±0.40 and 2.1 ±0.86 after implementing the intervention. There is a significant statistical difference in the level of falling risk between the two groups after implementing the interventional protocol at a P<0.001.

Conclusion: Performing of sitting balance exercises immediately after diagnosis with stroke was significantly improved stetting balance and decreased the incidence of falling in patients with stroke.

Keywords: Stroke, Siting Balance Exercises, Risk of fall.

INTRODUCTION

Stroke is a neurological problem that is potentially fatal and the most important cause of morbidity, disability, and death (Tan, et al., 2023). According to the Global Burden of Disease research, stroke incidence accounted for 12.2 million, prevalent instances of stroke accounted for 101 million, and stroke deaths accounted for 6.55 million, with 143 million disability-adjusted living years (DALYs) lost due to stroke (Venketasubramanian and Chan, 2023). Stroke was the third most significant cause of death in forty-seven of the fifty-seven countries represented by the World Health Organization (WHO), and in the

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top ten leading causes of death in fifty-four countries (World Health Organization, 2020). According to a report from the Centers for Disease Control and Prevention (CDC), stroke will account for one in every six cardiovascular disease deaths in 2021 (Centers for Disease Control and Prevention, 2023). According to WHO data, 20,793 stroke fatalities occurred in Iraq in 2020, accounting for 14.19% of all deaths (World Health Organization, 2020). Iraq ranks 31 in the world in terms of age-adjusted mortality, with a rate of 128.44 per 100,000 residents (World Health Organization, 2020).

Patients who survive an acute ischemic stroke experience a wide range of early and late consequences such as falling. Fall is one of the most widespread incidences for patients with stroke, with a reported incidence ranging from 7% in the 1st week after stroke to 73% one year later (Djurovic, et al., 2021). Stroke disturbed patients sitting balance and increase the risk of falling, limit functional mobility, make the patient dependent, and make them inactive socially (Deshmukh and Dixit, 2020). Stroke survivors have a significant rate of falls within the first 6 months of recovery, ranging from 23 to 50% (Tan, et al., 2023). Falls in stationary healthcare may result in a variety of unfavorable effects, including injuries and an extended rehabilitation period, an increased length of hospital stays, increased healthcare expenditures, and legal implications (Djurovic, et al., 2021). Approximately 30% of hospital falls have been documented to result in some form of harm, with serious consequences (Djurovic, et al., 2021).

Most patients with acute and subacute stroke have disturbed sitting balance (Lee, et al., 2020). Impaired trunk control in stroke survivors may make sitting and standing balance problematic (Huseyinsinoglu et al.,2022). Postural instability can occur in those with stroke due to a range of problems in the systems that control posture, such as afferents for sensation, motor approaches and thinking processes (Mahran and Alkushi, 2017). Postural control disorder has been associated with an increased likelihood of falling and injuries (Cabanas-Valdés, et al., 2021). A delay in trunk muscular activity impairs the patient's positioning perception and sitting balance (Mahmood, et al., 2022).

Diminished physical activities, social loneliness, and increase the level of dependency—all these problems may result from fear of falling. Consequently, reduced risk and fear of fall are related with balance improvement as well as improved quality of life (Cabanas-Valdés, et al., 2021). Falls can impose severe psychological (falling fear and sadness), social (social isolation), and economic burdens on stroke patients and care providers (Yang, et al., 2021).

Various fall prevention strategies aimed at stroke survivors have been developed over the last few decades. Balance training, strength training, treadmill training, and other exercise-based training programs, as well as the use of assistive devices for foot-drop, are among the interventions available (Yang, et al., 2021). Given the variety of strategies and their varying levels of efficiency, it is vital to establish which ones are beneficial in reducing falls among people with stroke in order to properly guide the utilization of useful fall prevention programs (Yang, et al., 2021). The balance abilities of patients with stroke and the prevention or minimization of falls can be achieved through balance training (Tan, et al., 2023). Thus, restoring sitting balance can be achieved by performing sitting balance exercises after a stroke to manage balance problems.

AIMS OF THE STUDY

The current study aims to examine the effect of sitting balance exercises on the risk of fall in patients with stroke.

METHODOLOGY

Research Design: The current study used a quasi-experimental design.

Participant and Sampling: 60 patients with acute stroke were included whom chose purposely to this study.

Ethical considerations:

An approval was achieved by the Research Ethical Committee at the University of Kerbala, College of Nursing. Informed consent was attained from each participant to be enrolled in this study and given the right to be withdrawn from the study at any time.

Materials & Measures:

The level of balance was measured using Berg Balance Scale (BBS) before the application of interventional protocol, two sessions per day for 14 days of sitting balance exercises that consisted of five exercises namely: shift weight side to side, reaching, seated leg lift, single-leg knee extensions, and reach with clasped hands. The levels of balance were measured immediately after the completion of the intervention; all participants continued to receive their conventional stroke care. A questionnaire form was organized by the researchers to collect all the related data associated with the study sample involved two main parts: first part includes socio-demographic and clinical data, includes ages, genders, marital status, educational level, residency, occupation, chronic diseases, type of stroke, location of stroke, period after stroke, recurrence of stroke, height and weight. The second part was assessed the level of balance ability using Berg balance scale (BBS) that was developed by Katherine Berg in 1989 to determine the balance ability (Miranda-Cantellops &Tiu, 2023), which involved 14 items, each item consisted of a five-point Likert scale ranging from 0 to 4, with 0 indicating the low level of function and 4 the high level of function and takes about 20 minutes to complete. Highest possible score 56, Score of < 45 indicates a more risk of falling ,41-56 low fall risk, 21-40 medium fall risk, and 0 –20 high fall.

Data Analysis:

Data were analyzed by using the program of IBM Statistical Package of Social Sciences (SPSS) Version 26. Both descriptive statistical analysis procedures (e.g., frequency, percentage, and mean of score) and inferential statistical analysis such as a paired sample T-test was used to assess differences between pre and posttest within the same group and an independent sample T-test was used to assess differences in parameters between two groups of patients regarding the fall risk. A p-value of <0.05 was determined to be statistically significant.

RESULTS

Table (1) indicates that more than one-half of the patients in the experimental group were within the age groups of 60-69 years old and accounted for 53.3% while more than one-third of the control groups were within the age groups of 60-69 years old and accounted for 36.7%. Regarding to gender 56.7%, and 53.3% of the of the experimental and control group respectively were females. Concerning to the educational levels, this table indicate that's 30.0%, and 43.3% of participants the experimental and control groups respectively were have elementary school level. These results indicate that's no statistically significant differences were seen between the experimental and control groups regarding patient socio-demographic characteristics (P>0.05).

Table (2) indicates that 40.0% of the participants in the experimental group while 50.0% of the control groups had hypertension and diabetic. About two third (66.7%) of the experimental group and more than one-half (53.3%) of the control group have hemorrhagic stroke. Approximately three-quarters (76.7%), and (73.3%) of patients in the experimental and control groups respectively have the first time exposed to stroke, with less than 12 days' duration.

Table (3) shows the distribution of patients based on their fall risk level prior to and after the implementation of sitting balance exercises. There were statistically significant differences between pre- and post-sitting balance exercises (P <0.001).

Table (4) revealed a non-significant statistical difference (P-value = 0.393) in fall risk level between experimental and control groups before the interventional protocol, but after 14 days of intervention, there is a significant statistical difference (P <0.005) between both groups.

Table (5) shows a statistically significant difference (at P-value < 0.05) in fall risk levels among patients with stroke related to the time period after stroke, while all other socio-demographic variables and clinical data among stroke patients in the experimental group were not.

DISCUSSION:

Regarding the socio-demographic data as listed in Table 1, the results indicate that's no statistically significant differences were seen between the experimental and control groups regarding patient socio-demographic characteristics (P>0.05). In relation with patients age groups, the results come in agreement with the result of the cross-sectional study that was done by Lee, (2021), which stated that the mean age was 59.7 in the experimental group and 61.2 in the control group. Regarding to patient's gender, the results of this study agree with a study conducted by Lee, (2021) stated that about 56% of participants were female, and stroke prevalence was more common in women than in men.

Regarding the educational status, a higher percentage of the patients in the experimental group were unable to read and write. The results of this study agree with the result of a study conducted by Jackson, et al., (2018) found that higher incidence of stroke is linked with reduced educational levels.

Regarding the participant's clinical characteristics, the results indicate that no statistically significant differences were seen between the experimental and control groups regarding patient clinical data (P-value > 0.05). It showed that more than one-half of the patients in the experimental group had hypertension, which accounted for 40.0%, while more than one-half of the control groups had hypertension and diabetes, which accounted for 50.0%. The results of this study agree with the result of the study conducted by Chang, et al., (2021), who reported that during a 1-year follow-up, it was found that individuals with type 2 diabetes mellitus and hypertension had a higher rate of new strokes and recurrences, with 51% of participants having hypertension and 37.3% having both hypertension and diabetes.

Concerning the type of stroke 63.3% of the experimental group had hemorrhagic strokes, while the control group had about 53.3%. The results of this study agree with a study conducted by Lee, et .al, (2021) indicated that 64% of the control group had a hemorrhagic stroke, compared to 85% of the experimental group. The results of this study disagree with a study conducted by Deshmukh and Dixit, (2020) stated that out of the 40 stroke patients, 11 (27.5%) had hemorrhages, while 29 (72.5%) had ischemic strokes. Regarding to site of stroke, 63.3% of the experimental group were affected in the right lobe of the brain while control group were accounted about 50%. The results of this study agree with the result of a study conducted by Kim, et al., (2019) indicated that the left hemisphere was impacted in 46.6 percent and the right hemisphere in 53.4%.

Concerning the fall risk level by using the Berg balance scale (BBS) between the experimental and control groups, there were significant statistical differences between pre- and 14-day-post-application of sitting balance exercise at P-value≤0.005. Implementing the interventional protocols significantly increases the balance ability. This result agrees with the result of a study conducted by Junata, et al., (2021) in which the Kinect-based Rapid Movement Training (RMT) program significantly improved balance control in chronic stroke survivors (Berg Balance Scale: pre = 49.13, post = 52.75; P =.001). BBS improvements enhanced overall gross balance and decreased fall risk.

Regarding the comparison level and total cumulative score of balance level for experimental and control groups, there were no significant statistical differences (p=0.393) in fall risk level between experimental and control groups before the interventional protocol. After 14 days of intervention, there were significant statistical differences (p<0.001) between both groups in favor of the experimental group. The results of this study agree with the results of a study in China conducted by Tan, et.al., (2023), revealed that there was no significant difference in balance function and fall risk ability scores between the two groups among a total of 112 stroke patients who were at high risk for falls prior to treatment (P > 0.05). After three months of therapy, the study group's balance function ability scores were significantly greater than those of the control group, and their fall risk ratings were significantly reduced (P < 0.05).

Concerning the association between the effectiveness of sitting balance exercises on fall risk-related balance with patients' socio-demographic and clinical data, the results indicate there are no significant statistical association regarding these data while related to the time period after stroke there is no significant statistical association. The results of this study agree with a cross-sectional study that included adult stroke survivors conducted by Kossi, et al., (2021) showed that balance impairments were significantly correlated with post-stroke duration at a P-value < 0.01.

Conclusion:

The application of sitting balance exercises at two sessions per day for 14 days is an effective method help to minimize the fall risk level in patients with acute stroke. Therefore, this study supports the use of sitting balance exercises after stroke during acute phase.

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TABLES:

Table (1): Distribution of patients according to their socio-demographic characteristics

Variables		Experimental group		Control group		χ2
		Frequency	%	Frequency	%	
Age categories	19 -29	0	0	2	6.7	0.242 NS
	30 -39	2	6.7	0	0	
	40 -49	4	13.3	6	20.0	
	50 – 59	8	26.7	11	36.7	
	60 -69	16	53.3	11	36.7	
	MS ± SD	57.1± 9.54		54.0±11.4		
Gender	Male	13	43.3	14	46.7	0.687 NS
	Female	17	56.7	16	53.3	
Marital status	Single	0	0	2	6.7	0.569 NS
	Married	20	66.7	19	63.3	
	Divorced	1	3.3	0	0	
	Widowed	9	30.0	9	30.0	
Educational status	Not read and write	10	33.3	7	23.3	0.789 NS
	Read and write	3	10	3	10.0	
	Elementary school	9	30.0	13	43.3	
	Middle school	5	16.7	4	13.3	
	Secondary school	1	3.3	2	6.7	
	Diploma	2	6.7	0	0	
	Bachelor's degree and above	0	0	1	3.3	
Occupation	Worker	9	30.3	7	23.3	0.138 NS
	Farmer	0	0	3	10.0	
	Governmental employee	5	16.7	3	10.0	
	Retired	2	6.7	3	10.0	
	Housewife	14	46.7	14	46.7	

f= frequencies; %=Percentages; MS = Mean of score; SD = Standard Deviation; χ2= chi square, S: Significant (P value ≤ 0.05).

Table (2): Distribution of patients according to their clinical data

Variables		Experimental group		Control group		χ2
		Frequency	%	Frequency	%	
Pre-exciting chronic diseases	Hypertension	11	36.7	6	20.0	0.667 NS
	Diabetic	6	20.0	7	23.3	
	Hypertension and diabetic	12	40.0	15	50.0	
	None	1	3.3	2	6.7	
Type of stroke	Ischemic stroke	10	33.3	14	46.7	0.150 NS
	Hemorrhagic stroke	20	66.7	16	53.3	
Time period after stroke (days)	2-12	19	63.3	23	76.7	0.440 NS
	13-22	3	10.0	2	6.7	
	23-32	2	6.7	3	10.0	
	>33	6	20.0	2	6.7	
Number of stroke incidence	One time	23	76.7	22	73.3	1.000 NS
	Two time	6	20.0	7	23.3	
	Three time	1	3.3	1	3.3	

f= frequencies; %=Percentages; χ2= chi square, NS: Non-Significant (P value >0.05); S: Significant (P value ≤ 0.05).

Table (3): The frequency and percentage of balance levels for the control and experimental groups in the pre and post-test periods with comparison significant for each group

No.	Levels	Control group				p-value	Experimental group				p-value
		Pretest		Posttest			Pretest		Posttest		0.000[a]
1.	High fall risk	F	%	F	%	0.186[a]	F	%	F	%	S
		25	83.3	26	86.7	NS	24	80.0	9	30.0	
2.	Moderate fall risk	5	16.7	3	10.0		6	20.0	8	26.7	
3.	Mild fall risk	0	0	1	3.3		0	0	13	43.3	

NS: Non-Significant (P value >0.05); S: Significant (P value ≤ 0.05), f.: frequency; %: percentage; a: paired sample T-test.

Table (4): Comparison the effect of sitting balance exercises on the balance levels between the experimental group and the control group

Variables		Control group		Experimental group		P-value	Control group		Experimental group		P-value
No.	Fall risk level	Pretest		Pretest			Posttest		Posttest		0.000[b]
		F	%	F	%		F	%	F	%	S
1.	High fall risk	25	83.3	24	80.0	0.393[b]	26	86.7	9	30.0	
2.	Moderate fall risk	5	16.7	6	20.0	NS	3	10.0	8	26.7	
3.	Mild fall risk	0	0	0	0		1	3.3	13	43.3	
	M±SD	**1.1±0.37**		**1.2±0.40**			**1.1±0.46**		**2.1±0.86**		

NS: Non-Significant (P value >0.05); S: Significant (P value ≤ 0.05), f.: frequency; %: percentage, MS: mean, b: independent sample T-test.

Table (5): Association between the effectiveness of sitting balance exercises on balance among stroke patients with their socio-demographic characteristics and clinical data

Demographic data	Comparative patterns	df	F	p-value	Sig.
Age groups	Between Groups	16	1.596	0.200	NS
	Within Groups	13			
Educational status	Between Groups	5	1.155	0.360	NS
	Within Groups	24			
Occupation	Between Groups	3	2.537	0.079	NS
	Within Groups	26			
Pre-exciting chronic diseases	Between Groups	4	0.558	0.695	NS
	Within Groups	25			
Number of stroke incidence	Between Groups	2	0.303	0.741	NS
	Within Groups	27			
Time period after stroke	Between Groups	15	2.371	0.057	S
	Within Groups	14			

df=Degree of Freedom; F=statistics; P-value= Probability value; NS=Non-significant (p-value > 0.05); S=Significant (p-value <0.05).