

Effect of Early Balance Exercise on Dependency Level in Patients with Stroke

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Abstract

Background: Stroke is the primary global factor contributing to adult disability. It is minimizing the patient's ability to carry out everyday activities; 40% of patients with stroke have total dependence to carry out daily activities six months after a stroke. Trunk function and sitting balance are essential components of recovery following a stroke. Objective: The aims of the present study is to identify the effect of early sitting balance exercises on the level of dependency in patients with stroke. Methods: A quasi-experimental study was performed at Imam Al-Hussein Medical City from September 26th, 2022, to June 13th, 2023. A non-probability purposive sampling consisted of sixty patients with acute stroke; they were divided into control and intervention groups. Patients in the intervention group were instructed to perform five balance exercises for 15–30 minutes/two sessions per day for 14th days. These exercises include shifting weight from side to side, reaching, seated leg lifts, single-leg knee extensions, and reaching with clasped hands. While patients in the control group just received routine medical treatment. The study instrument consisted of two main parts: part one included patient's socio-demographics and medical data, and the second part was used to assess the level of dependency using a Modified Barthel index that consists of 10 items. Both a descriptive analysis procedure and an inferential analysis procedure (e.g., independent sample T-test, and paired sample T-test) were used to investigate and measure the study results; a p-value of <0.05 was detected to be statistically significant. Results: Most patients (86.7%) in the intervention group had a severe dependency level in the pre-test, while at the post-test period, 53.3%, 20%, and 20% of patients in the intervention group had moderate dependency levels, slight dependence, and independence, respectively. A significant statistical difference at a p value of 0.001 was found between the control and intervention groups after the performance of sitting balance exercises. Conclusion: The performance of early sitting balance exercises post-stroke for 15–30 minutes, two sessions per day for 14 days, significantly decreases dependency levels and achieves independence in a person's activities of daily living.

Keywords: Stroke; Dependency; Siting balance exercises; Activity of daily living (ADL).

Introduction

Stroke is determined as the most important cause of mortality and disability worldwide because it affects physical, psychological, and cognitive capabilities and is associated with multiple symptoms of cerebral vascular problems, such as balance problems, motor weakness, paresthesia, gait disturbance, language problems, cognitive impairment, and swallowing disorders [1]. Dependency in daily living activities is a prevalent immediate

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and long-term side effect of stroke [2]. It is indicated that 60% of patients, whose age was 71 years on average, required assistance with activities of daily living (ADL) 36–48 hours after the stroke [2]. Following a stroke, the majority of ADL recovery typically occurs during the first six weeks and is correlated with the severity of the initial stroke. ADL often do not change or get better in the later stages after stroke [2].

Stroke decreases mobility in more than half of stroke patients age 65 and older, and stroke causes up to 50% of patients to be chronically disabled, and over 80% in the sub-acute phase experience a balance disturbance [3]. It is reducing the ability to implement daily tasks, and at six months after a stroke, 40% of patients with stroke have difficulties performing basic ADL, and after a stroke, even after four years, 30% express participation limitations [3]. Multiple physical activities and exercise therapies are performed for the purpose of rehabilitation by stroke patients [1]. The most important component of rehabilitation for patients after stroke is motor therapy [4]. Thus, improving sitting balance and trunk function are important components of stroke rehabilitation. Sitting balance is considered an early predictor of long-term ADL [5]. In a cohort study conducted at the Sahlgrenska University Hospital. Indicated that the early assessments of activities of daily living after stroke can be used to understand the needs of rehabilitation post-stroke. This study mentioned the importance of early exercises but didn't apply the sitting balance exercises in acute stroke for improving dependency level [2]. Furthermore, many studies focus on improving sitting balance, however, there is a need to explore new techniques to enhance sitting balance after stroke, especially in the acute stage, when there is the most chance for neuroplasticity and recovery [6].

Objectives:

The study aims to detect the level of dependency among patients with stroke, identify the effect of using sitting balance exercises on dependency level for patients with stroke.

Study design and participants:

A quasi-experimental study was performed at the medical wards of Imam Al-Hussein Medical City in Holy Kerbala, Iraq. The study was started from September 26 to June 13, 2023. A nonprobability sampling method consists of 60 patients with acute stroke who can sit independently for at least one minute without support, those not able to stand without assistance for more than 1 minute, and those who agree to participate in this study. The participants were divided into two groups: the control and intervention groups. Each of the control and intervention groups had 30 patients (Figure 1).

Data collection instruments: The data were collected using the instrument consists of two parts: First part: Socio-demographic features and clinical data that include 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 used to assess the level of dependency by using a Modified Barthel index, which was first published in 1965 by Barthel and Mahoney in the Maryland State Medical Journal and was modified by Shah, et al., (1989) and consists of 10 items to determine the dependency in activities of daily living. The dependency scores were classified into five levels: 'total dependence' (Modified Barthel Index Score 0–20), 'severe dependence' (Modified Barthel Index Score 21–60), 'moderate dependence' (Modified Barthel Index Score 61–90), 'slight dependence' (Modified Barthel Index Score 91–99), and 'independence' (Modified Barthel Index Score –100) [8]. The content and face validity of the study instrument were determined by a panel of fifteen experts, and its reliability was determined through a pilot study by using Cronbach's alpha of 0.84 and a correlation coefficient of 0.92.

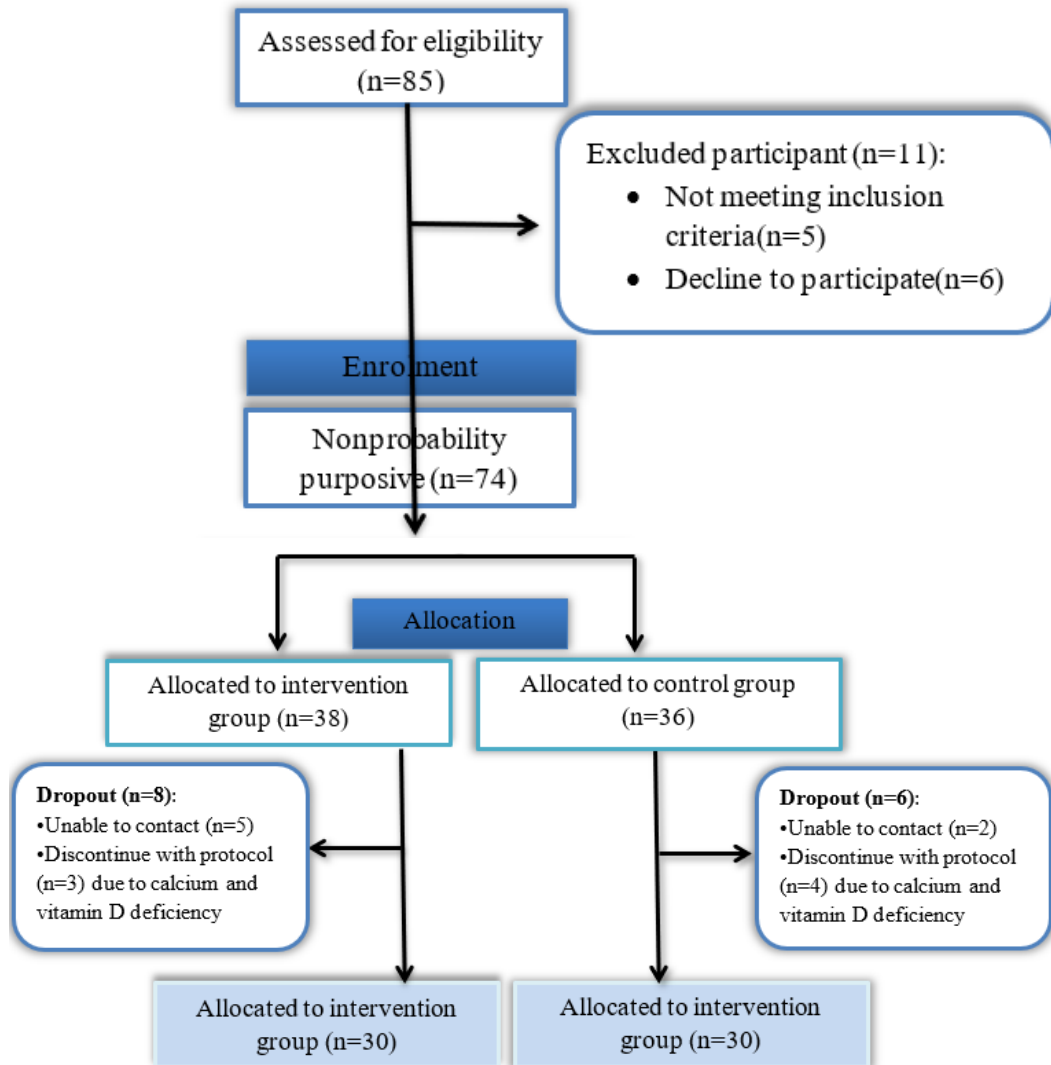


Figure (1-1): Flowchart of the eligibility criteria

Intervention: The interventional protocol for this study was prepared by the researchers after reviewing related previous studies [5,6]. During their hospital stay and subsequently twice daily for 14 days at home, for 15 to 30 minutes each session, all patients in the intervention group were trained on how to perform sitting balancing exercises. The sitting balance exercises consist of five exercises, according to Hoffman (2022), that include: Shifting weight from side to side exercises: tell the patient to maintain a straight back, slowly move their weight to one side, hold it there for a short period of time, then return to the center. On the opposite side, repeat. The patient can carry out this exercise 20–30 times in one session.; Reaching exercises: inform the patient to hold a ball at a distance of about an arm's length from the observer. The patient carefully reaches for the ball as they place it in different locations. Repeat the exercise 10–15 times; Seated leg lifts: encouraging the patient to sit up straight and use his hands to help stabilize himself. Hold one leg up while maintaining a bent knee for roughly five seconds. Repeat with the other leg. Depending on the patient's strength, perform the exercise 5–10 more times; Single-leg knee extensions: inform the patient to sit up straight, keeping their abdominal muscles tight, and to stretch one leg to the side before lowering it to the floor. Follow the same procedure with the other leg. Perform two sets of 15 exercises. Reaching with clasped hands: instruct the patient to keeping his or her hands clasped together, reach his or her hands straight forward to the point where the entire body is active but not in any danger

of falling. Hold for five seconds, then instruct the patient to lean back in the chair and sit normally. Repeat the exercise 10 times [7].

The researchers followed up with the patients two times a day to remind them to perform the exercises and to instruct them on the protocol. The follow-up method was performed through the phone by creating communication groups on social media sites (WhatsApp and Telegram) and by communicating with patients through telephony (SIM-card). During this follow-up, the researchers monitored the patient's adherence and responses to the intervention. Patients in the control group just received the routine care provided to all patients in the study setting. The levels of dependency were measured for all patients in the intervention and control groups before the intervention and immediately after the completion of the intervention; all participants continued to receive their conventional stroke care. The data collection process was carried out from January 17th to May 10th, 2023.

Statistical analysis: The IBM statistical package for social sciences version 26 was used to examine the data. The Shapiro-Wilk test was employed to determine whether the data were normal, and it revealed that the data had a normal distribution. A descriptive statistical procedure, e.g., frequency, percentage, and mean of score, was used to summarize the study result, and an inferential analysis procedure, e.g., paired sample T-tests were used for within-group comparisons, independent sample T-test were used for between-group comparisons, and Chi square test were used to investigate the difference among groups. A p-value of <0.05 was determined to be statistically significant.

Ethical considerations: an ethical authorization was achieved from the Ethical Committee at the College of Nursing/University of Kerbala (code: IQUOKCON. 1506.68) on November, 6th, 2022. Moreover, the study was recorded in the Iranian Registry of Clinical Trials (code: IRCT202307044058671N1). Each patient who took part in this study provided their informed consent, and it is presumed that they have the right to withdraw at any moment.

Results:

Table 1 shows that more than half of the patients in the intervention group were within the age groups of 60–69 years old and accounted for 53.3%, while about three-quarters of the control group were 50 years and older and accounted for 72.4%. Regarding gender, 56.7% of the intervention group were female, while 46.7% of the control group were male. Concerning the educational levels, this table shows that 30.0% and 43.3% of participants in the intervention and control groups, respectively, were at the elementary school level. Furthermore, more than one-third (40.0%) of the patients in the intervention group and 50.0% in the control group had hypertension and diabetes. Regarding the type of stroke, about two-thirds (66.7%) of the intervention group and more than one-half (53.3%) of the control group had hemorrhagic strokes.

Table (1): Comparisons the participants' socio-demographic characteristics and medical data between control and intervention groups:

Variables	Intervention group		Control group		P-value	
	Frequency	%	Frequency	%		
Age categories	19 -29	0	0	2	6.7	0.242 ^a
	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 ^b
	Female	17	56.7	16	53.3	
Marital	Single	0	0	2	6.7	

status	Married	20	66.7	19	63.3	0.569 ^a
	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 ^a
	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 ^a
	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	
Pre-exciting chronic diseases	Hypertension	11	36.7	6	20.0	0.667 ^a
	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 ^b
	Hemorrhagic stroke	20	66.7	16	53.3	NS
Time period after stock (days)	2-12	19	63.3	23	76.7	0.440 ^a
	13-22	3	10.0	2	6.7	
	23-32	2	6.7	3	10.0	
	>32	6	20.0	2	6.7	
Number of stroke incidence	One time	23	76.7	22	73.3	1.000 ^a
	Two time	6	20.0	7	23.3	
	Three time	1	3.3	1	3.3	

%=Percentages; MS=Mean of score; SD=Standard deviations; NS=Non-significant (P value >0.05), a Independent-sample t-test, b Chi-square test.

Table 2 shows that a significant statistical difference in the dependency level was found between the pre-test and post-test periods for the application of sitting balance exercises of the intervention group for 14 days at a p-value of 0.001, while a non-significant statistical difference in the dependency level was found at a p-value of 0.565 between the pretest and posttest for the control group. Most patients (76.7% and 80%) in the control group had severe dependency levels in the pretest and posttest, respectively. Conversely, 86.7% of patients in the intervention group had a severe dependency level in the pre-test, while at the post-test period, 53.3%, 20%, and 20% of patients in the intervention group had moderate dependency levels, slight dependence, and independence, respectively.

Table (2): Comparison the dependency levels within groups at pre-test and post-test period:

Dependency Levels	Control group		P-value ^a	Intervention group		P-value ^a
	Pre-test	Post-test		Pre-test	Post-test	
	f (%)	f (%)		f (%)	f (%)	
Total dependent	0 (0%)	0 (0%)	0.565 NS	0 (0%)	0 (0%)	0.001 S
Severe dependent	23(76.7%)	24(80%)		26(86.7%)	2(6.7%)	
Moderate dependent	7 (23.3%)	6 (20%)		4(13.3%)	16(53.3%)	
Slight dependent	0 (0%)	0 (0%)		0 (0%)	6 (20%)	
Independence	0 (0%)	0 (0%)		0 (0%)	6 (20%)	
Total	30 (100%)	30 (100%)		30 (100%)	30 (100%)	
MS ± SD	2.23±0.43	2.20±0.40		2.13±0.34	3.53±0.89	

f= frequencies; %=Percentage; a paired-sample t-test; NS= (P-value >0.05); S=Significant (P-value ≤0.05).

Table 3 shows that no significant differences at a p value of 0.362 were found in the dependency level between intervention and control groups before the interventional protocol, while after 14 days of intervention, significant differences at a p value of 0.001 were found between both groups.

Table (3): Comparison the dependency level between groups in two-time period:

Dependency Levels	Pre-test		P-value ^a	Post-test		P-value ^a
	Control group	Intervention group		Control group	Intervention group	
	f (%)	f (%)		f (%)	f (%)	
Total dependent	0 (0%)	0 (0%)	0.362 NS	0 (0%)	0 (0%)	0.001 S
Severe dependent	23(76.7%)	26(86.7%)		24(80%)	2(6.7%)	
Moderate dependent	7 (23.3%)	4(13.3%)		6 (20%)	16(53.3%)	
Slight dependent	0 (0%)	0 (0%)		0 (0%)	6 (20%)	
Independence	0 (0%)	0 (0%)		0 (0%)	6 (20%)	
Total	30 (100%)	30 (100%)		30(100%)	30 (100%)	
MS ± SD	2.23±0.43	2.13±0.34		2.20±0.40	3.53±0.89	

f=frequencies; %=Percentage; a independent-sample t-test; NS=Non significant; S=Significant (P-value ≤0.05).

Discussion:

The results of the current study exposed the benefits of performing sitting balance exercises for patients with acute stroke. As shown in Table 2, most patients (76.7% and 80%) in the control group had severe dependency levels in the pre-test and post-test, respectively. Conversely, 86.7% of patients in the intervention group had a severe dependency level in the pre-test, while in the post-test period, 53.3%, 20%, and 20% of patients in the intervention group had moderate dependency levels, slight dependence, and independence, respectively. In a cohort longitudinal study that reported that dependency for performing activities of daily living was determined to be one of the main consequences in patients with stroke, most patients with stroke may complain of dependency in personal activities within the first two days after stroke and last for three and twelve months later in this group of patients. In this study, in the 36–48 hours following a stroke, two-thirds (60%) of the 366 eligible patients were dependent on activities of daily living. Both uni-variable and multi-variable logistic regression analyses revealed that patients who were dependent within the first two days' post stroke had increased probabilities of remaining dependent three months' post stroke as well as one year later [2].

Our findings exposed significant differences in the dependency level between the pre-test and post-test periods for the application of sitting balance exercises by the intervention group for 14 days at a p-value of 0.001, while non-significant differences in the dependency level at a p-value of 0.565 were found between the pre-test and post-test periods for the application of sitting balance exercises by the intervention group for 14 days at a p-value of 0.001, while a non-significant statistical difference in the dependency level at a p-value of 0.565 was found between the pre-test and post-test for the control group. The results of the study that was conducted by Lestari and Sunaryo, (2021) revealed that the results of statistical tests in the control and intervention groups indicated that the balance exercise had an effect on patients' improvement in independence in carrying out daily tasks, with a p value of 0.047 [9]. In a double-blinded, randomized controlled study, concluded that exercises alone or exercise combined with trunk

balancing exercises can significantly improve ambulation, balance, and functional condition in patients with early stroke [10].

When comparing the dependency level between the two groups of patients in a two-time period, the present study result exposed non-significant differences at a p value of 0.362 in the dependency level between intervention and control groups before the interventional protocol, while after 14 days of intervention a significant difference at a p value of 0.001 were found between both groups. Therefore, the application of sitting balance exercises with conventional therapy can improve dependency levels post-stroke much more than conventional therapy alone. In our setting the conventional therapy is a form of stroke rehabilitation program that are mainly consisting of range of motion exercises. According to study results done in the rehabilitation department of a hospital in Solo, Indonesia, to investigate the impact of balance exercises on decreasing the independence of daily activities in stroke patients, it was concluded that the use of balance exercise is able to increase the level of independence of the patient, so that this therapy might be administered sooner after a stroke to improve brain circulation and muscle strength [9]. Another study by Mahmood et al., (2022), which conducted a study on chronic ischemic stroke patients, concluded that core stability training is superior to conventional physical therapy for treating trunk deficits, functional ambulation, and quality of life in stroke patients [11]. In a single center, a parallel-group randomized controlled trial was conducted to estimate the effect of exercise therapy on balance in the chronic stage after stroke. The level of independence in ADL was measured in the study using the Modified Barthel Index. When making use of an independent sample T test to compare the experimental and control groups, it was shown that there was a significant difference in the Modified Barthel Index ($P = 0.49$), demonstrating a high level of ADL functioning. Therefore, this group of stroke survivors who were in the final phases of recovery would gain a lot from this technology-supported sitting balance therapy [4].

Study limitations: The main limitation of the present study was that the patients self-administered sitting balance exercises at home; thus, they might not have followed the intervention closely because of physical or psychological issues. Additional study is recommended to assess the long-term impacts of sitting balance on other physical limitations after stroke.

Conclusion:

Performing early sitting balance exercises within 24-48 hours after stroke for 15–30 minutes/two sessions a day for 14th days would significantly decrease the dependency level and achieve independence in personal everyday life activities.

Nursing implications: patients with stroke complain of many physical disabilities. Thus, the nurse must act to provide holistic care for patients with stroke by enabling them to perform activities of daily living independently as much as possible, thereby enhancing their functional abilities and decreasing the risk of falling. In order to provide a realistic nursing role for such patients and to potentially increase the standard of nursing care, it is crucial to incorporate sitting balancing exercises into routine hospital care. Sitting balance exercises can be given to stroke patients to reduce their dependency level, which will afterwards improve their functional capacities. Sitting balance exercises can be performed independently anytime and anyplace, which broadens their usefulness.

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Conflict of Interest: Nothing will occur to harm anyone.

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