"EFFECTIVENESS OF DUAL TASK EXERCISE TO IMPROVE BALANCE AND GAIT PATTERN AMONG PATIENTS WITH CEREBROVASCULAR ACCIDENT (CVA): A QUASI-EXPERIMENTAL STUDY"

Aishwarya Dorannavar[1], Jonathan Borges[2*]
[1]M.Sc. Nursing Student, Department of Medical Surgical Nursing, KAHER Institute of Nursing Sciences, Nehru Nagar, Belagavi, Karnataka, India, Email: aishwaryadorannavar2001@gmail.com
[2]Senior Tutor, Department of Medical Surgical Nursing, KAHER Institute of Nursing Sciences, Nehru Nagar, Belagavi, Karnataka, India, Email: jontyborges@gmail.com
*Corresponding Author
Email: jontyborges@gmail.com
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ABSTRACT
Background: Stroke is one of the leading causes of disability worldwide and commonly results in impaired balance and gait disturbances, limiting functional independence and increasing fall risk. Conventional rehabilitation often focuses on single-task activities; however, daily living activities require simultaneous cognitive and motor performance. Dual task exercise has emerged as an effective rehabilitation strategy to improve balance and gait pattern in stroke survivors.
Aim: To evaluate the effectiveness of dual task exercise in improving balance and gait pattern among patients with cerebrovascular accident (CVA) admitted to a selected tertiary care hospital, Belagavi.
Materials and Methods: A quasi-experimental pre-test post-test control group design was adopted. The study was conducted among 76 stroke patients admitted at KLE'S Dr. Prabhakar Kore Hospital and MRC, Belagavi. Participants were selected using non-probability purposive sampling and divided equally into experimental (n=38) and control (n=38) groups. Baseline balance and gait pattern were assessed using the Berg Balance Scale (BBS) and Dynamic Gait Index (DGI). The experimental group received dual task exercises for four weeks, three sessions per week, 30 minutes per session, along with routine care, while the control group received routine care alone. Data were analyzed using descriptive and inferential statistics including Chi-square test, Mann–Whitney U test, and Wilcoxon Signed-Rank test.
Results: Post-test findings demonstrated significant improvement in the experimental group compared to the control group. The median BBS score improved from 25.50 to 41.00 in the experimental group, whereas the control group showed lesser improvement. Similarly, the DGI score improved significantly in the experimental group from 19.00 to 21.00. Statistical analysis revealed a significant difference between groups (p=0.002). Significant association was observed between balance and gait pattern with age, co-morbidities, and previous history of falls.
Conclusion: Dual task exercise was found to be effective in improving balance and gait pattern among patients with cerebrovascular accident. Incorporating dual task exercises into routine rehabilitation programs may enhance functional independence and reduce fall risk among stroke survivors.
Keywords: Dual task exercise, cerebrovascular accident, balance, gait pattern, stroke rehabilitation, functional mobility
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INTRODUCTION

Stroke, also known as cerebrovascular accident (CVA), is a neurological disorder caused by interruption of blood supply to the brain due to ischemia or hemorrhage. It remains one of the major causes of mortality and long-term disability worldwide. According to global estimates, approximately 12.2 million individuals experience a first-time stroke annually, while more than 101 million people live with stroke-related disabilities. [1]

Motor impairment is one of the most common consequences following stroke. Nearly 70–80% of stroke survivors experience difficulty in balance and gait, resulting in impaired mobility, reduced independence, and increased risk of falls. [2,3] Impaired balance occurs due to damage in motor and sensory pathways, leading to postural instability and difficulty maintaining equilibrium. Studies have reported that 40–70% of stroke survivors experience falls during the first year after stroke. [4]

Gait disturbances are also frequently observed following stroke and include reduced walking speed, shortened stride length, asymmetrical gait, and impaired coordination. These alterations negatively affect daily activities and community participation. [5] Rehabilitation strategies focusing on both motor and cognitive aspects have recently gained attention in improving functional mobility. Dual task exercise refers to simultaneous performance of motor and cognitive tasks. Examples include walking while counting numbers, carrying objects while walking, or maintaining balance while answering questions. This approach enhances motor learning, attention, and postural control. [6] Several studies have demonstrated the effectiveness of dual task training in improving balance, gait, and functional mobility among stroke survivors. [7,8]

Despite advances in rehabilitation, many stroke patients continue to experience mobility limitations. Therefore, the present study was undertaken to assess the effectiveness of dual task exercise in improving balance and gait pattern among patients with cerebrovascular accident at a selected tertiary care hospital in Belagavi.

MATERIALS AND METHODS

Research Approach and Design

An evaluative research approach with quasi-experimental pre-test post-test control group design was adopted for the study.

Setting

The study was conducted in the Neurology ward of KLE'S Dr. Prabhakar Kore Hospital and Medical Research Centre, Belagavi, Karnataka.

Population and Sample

The study population consisted of stroke patients admitted to the selected tertiary care hospital. A total of 76 participants were selected using non-probability purposive sampling technique and equally divided into experimental group (38) and control group (38).

Inclusion Criteria

- Patients aged between 30–60 years
- Patients able to follow verbal instructions
- Patients able to stand and walk with or without assistance
- Patients willing to participate

Exclusion Criteria

- Patients with severe cognitive impairment
- Patients with neurological disorders such as Parkinson's disease or spinal cord injury
- Critically ill patients
- Mentally ill patients

Description of Intervention

The experimental group received dual task exercises for four weeks, three sessions per week, and 30 minutes per session. The intervention included:

- Walking while counting numbers
- Walking while carrying objects
- Standing balance while answering questions
- Walking while naming fruits or animals
- Turning while performing cognitive tasks

The control group received routine care alone.

Data Collection Tools

Data were collected using:

1. Socio-demographic questionnaire
2. Berg Balance Scale (BBS)
3. Dynamic Gait Index (DGI)

Ethical Consideration

Ethical clearance was obtained from the Institutional Ethical Committee of KAHER Institute of Nursing Sciences, Belagavi. Written informed consent was obtained from all participants before data collection.

Statistical Analysis

Data were analyzed using descriptive and inferential statistics. Frequency, percentage, median, Chi-square test, Mann–Whitney U test, and Wilcoxon Signed-Rank test were used for analysis. A p-value less than 0.05 was considered statistically significant.

RESULTS

Distribution of Participants According to Socio-demographic Variables

The majority of participants belonged to the age group of 46–60 years. Most participants had co-morbidities such as hypertension and diabetes mellitus. Previous history of falls was reported among several participants in both groups.

Effectiveness of Dual Task Exercise on Balance

The pre-test balance scores showed no significant difference between the experimental and control groups, indicating baseline comparability. Following intervention, the experimental group demonstrated remarkable improvement in balance

scores.

The median Berg Balance Scale score increased from 25.50 in pre-test to 41.00 in post-test among the experimental group, whereas the control group showed only minimal improvement. The difference was statistically significant (p=0.002).

Effectiveness of Dual Task Exercise on Gait Pattern

The Dynamic Gait Index scores significantly improved in the experimental group following intervention. Median DGI score improved from 19.00 to 21.00 in the experimental group, while the control group demonstrated lesser improvement. Statistical analysis revealed significant difference between groups (p=0.002).

Association Between Socio-demographic Variables and Balance and Gait Pattern

Age, co-morbidities, and previous history of falls showed statistically significant association with balance and gait pattern scores. Gender and marital status did not show significant association.

DISCUSSION

The present study demonstrated that dual task exercise significantly improved balance and gait pattern among stroke patients. Findings of the study are consistent with previous studies reporting beneficial effects of dual task interventions on functional mobility and postural stability among stroke survivors.

The improvement observed in Berg Balance Scale scores indicates enhanced postural control and reduced fall risk following intervention. Similar findings were reported by Yang et al., who observed significant improvement in balance and walking performance after dual task training.

The present study also demonstrated significant improvement in Dynamic Gait Index scores among the experimental group. These findings are supported by previous studies showing enhanced gait speed, stride length, and walking performance after cognitive-motor dual task training.

Dual task exercises likely improve coordination between cognitive processing and motor performance, thereby enhancing balance control and gait efficiency. Incorporating such exercises into rehabilitation programs may improve functional independence and quality of life among stroke patients.

CONCLUSION

The study concluded that dual task exercise is effective in improving balance and gait pattern among patients with cerebrovascular accident. The intervention was simple, safe, economical, and beneficial in enhancing mobility and reducing fall risk. Therefore, dual task exercise can be incorporated into routine stroke rehabilitation programs to improve functional outcomes and independence among stroke survivors.

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TABLES AND GRAPHS

Table 1: Distribution of participants by socio demographic characteristics

		Group (E=1,C=2)			
		Experimental		Control	
		n	%	n	%
Age	15-30	0	0.0	0	0.0
	31-45	11	28.9	13	34.2
	46-60	27	71.1	25	65.8
	>60	0	0.0	0	0.0
Marital status	Single	30	78.9	6	15.8
	Married	8	21.1	32	84.2
	Widowed	0	0.0	0	0.0
	Divorced/Separated	0	0.0	0	0.0
Co-morbidity	Hypertension	14	36.8	16	42.1
	DM	13	34.2	14	36.8
	Heart disease	11	28.9	8	21.1
	Other	0	0.0	0	0.0

Previous history of falls	Yes	21	55.3	23	60.5
	No	17	44.7	15	39.5
Gender	Male	6	75.0	7	87.5
	Female	2	25.0	1	12.5

Table 2: Comparison of Pre-test and Post-test Berg Balance Scale Between Experimental and Control Groups

Berg Balance Scale	Experimental		Control		U	Z	Sig.
	Median	IQR	Median	IQR			
Pre test	25.50	12	25.50	12	710	-0.125	0.901 *MW*
Post test	41.00	13	33.00	11	430	-3.062	0.002 *MW*
Z	-5.166		-4.342				
Sig.	<0.05 *W**		<0.05 *W**				

*<0.05 significance is *W~ Wilcoxon Sign Rank test*
MW ~ Mann Whitney U test

Table 3 : Pre–Post Comparison of Dynamic Gait Index (DGI) Scores in Experimental and control group

DGIS	Experimental		Control		U	Z	Sig.
	Median	IQR	Median	IQR			
Pre test	19.00	2.00	20.00	1.00	647.5	-0.8	0.424 *MW*
Post test	21.00	2.00	19.50	1.00	427	-3.135	0.002 *MW* *
Z	-3.914		-0.528				
Sig.	<0.05 *W* *		0.598 *W*				

*<0.05 significance is *W~ Wilcoxon Sign Rank test*
MW ~ Mann Whitney U test

Table 4 : Association between socio-demographic variables and pre-test Berg Balance Scale scores among experimental and control groups

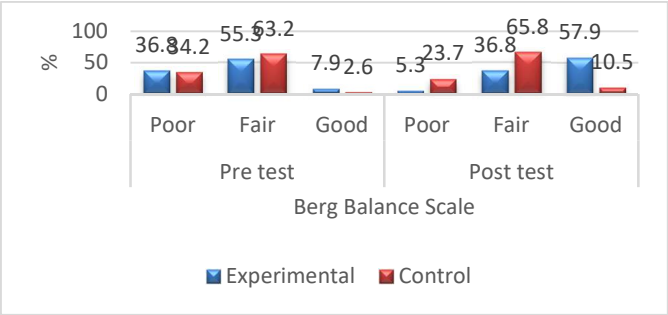
Variable	**Experimental Group χ^2 (p value)**	**Control Group χ^2 (p value)**	**Interpretation**
Age	9.253 (0.006)*	30.540 (<0.05)*	Significant
Co-morbidity	14.455 (0.002)*	9.877 (0.014)*	Significant
Previous history of falls	9.937 (0.004)*	5.833 (0.037)*	Significant

***p < 0.05, statistically significant**

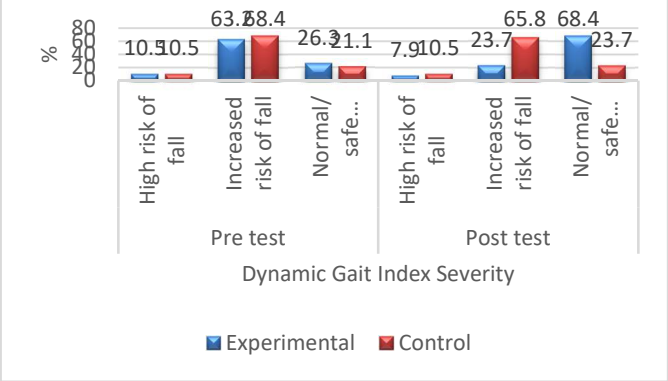
Table 5 : Association between socio-demographic variables and pre-test Dynamic Gait Index scores among experimental and control groups

Variable	**Experimental Group χ^2 (p value)**	**Control Group χ^2 (p value)**	**Interpretation**
Age	9.849 (0.005)*	8.363 (0.009)*	Significant
Co-morbidity	19.871 (<0.05)*	14.309 (0.001)*	Significant
Previous history of falls	6.653 (0.032)*	4.004 (0.125)	Significant only in experimental group

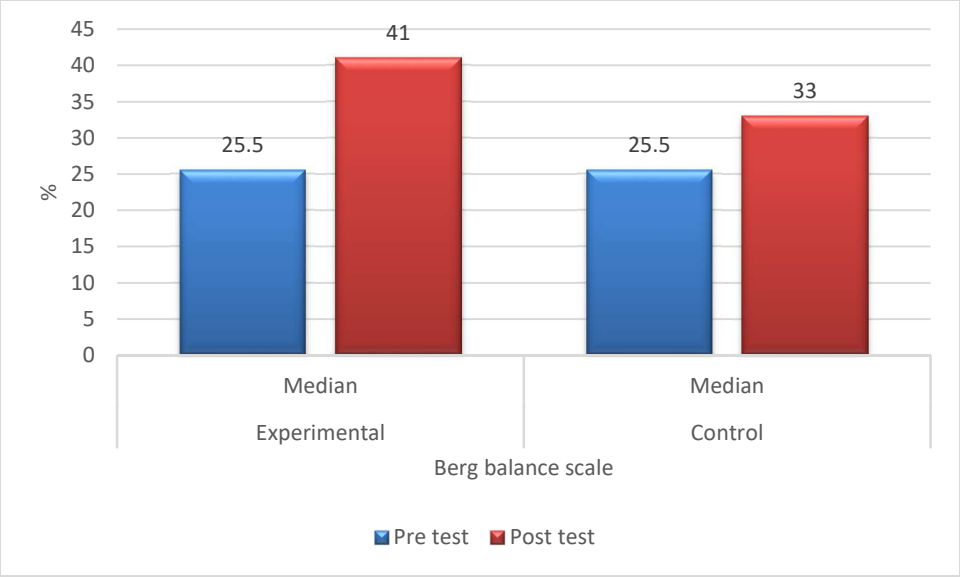
Graph 1: Percentage Distribution of Berg Balance Scale Levels in Experimental and Control Groups During Pre-test and Post-test



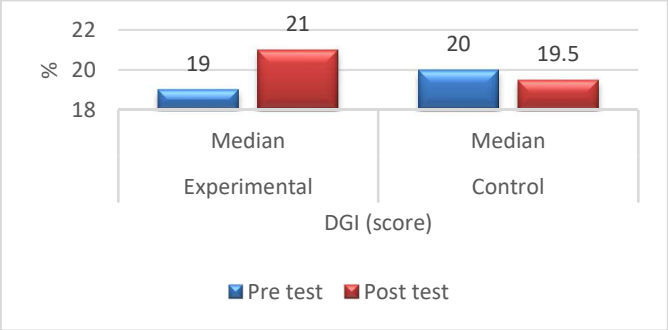
Graph 2: Percentage Distribution of Dynamic Gait Index Severity Levels in Experimental and Control Groups During Pre-test and Post-test



Graph 3: Comparison of pre-test and post-test Berg Balance Scale scores between experimental and control groups.



Graph 4: Comparison of pre-test and post-test Dynamic Gait Index (DGI) scores between experimental and control groups.



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