

Effects of Balance and Cognition Exercises on Fear of Fall in Stroke Patients: Assessor Blinded Randomized Trial

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ABSTRACT

Stroke is the leading cause of death and disability in the world. Stroke patients are more likely to fall and injuries due to various factors like balance, cognition, previous falls, disability etc. It has been observed that in early routine rehabilitation cognition training and balance training is not given. Being important risk factors if it can be modified in early rehabilitation, number of falls might reduce among stroke survivors. So the aim of the study was to check the effects of balance and cognition training on fear of fall among stroke survivors.

Method: Patients were divided into A. Conventional physiotherapy B. Conventional physiotherapy and balance and cognition training groups. All the patients were assessed on berg balance scale, mini mental scale and fear efficacy scale pre and post treatment.

Result: Group A (BBS Z=-3.539, P<0.05, MMS Pre Z=-3.256, P<0.05, FES1 Pre Z=-3.546, P<0.05) Group B (BBS Z=-3.540, P<0.05, MMS Z=-3.536, P<0.05, FES1 Z=-3.520, P<0.05). Group A and B comparison (BBS Z=-3.424, P<0.05, MMS Z=-2.135, P<0.05, FES1 Z=-2.632, P<0.05).

Conclusion: Adding balance and cognition training in early rehabilitation is more useful in reducing fear of fall among stroke survivors.

Key Words: Stroke, falls, cognition, balance

INTRODUCTION

Stroke is classically characterized as a neurological deficit attributed to an acute focal injury of CNS by a vascular cause, including cerebral infarction, intercerebral hemorrhage and subarachnoid hemorrhage and is a major cause of disability and death worldwide¹. Stroke is 2nd leading cause of death worldwide. About 50% of survivors suffered from chronic disability.^{2, 3, 4}

Stroke patients are prone to fall and fall related complication post stroke. Around 14% risk of falling is estimated in stroke survivors.⁵ Stroke patients not only getting injuries but also have activity limitation, increase dependency, and fear of

falling⁶ which affects social and community participation and quality of life.⁷

Stroke is associated with declines in bone mineral density and increase risk of falls which may lead to fragility fractures. Stroke patients have 4 times higher risk of fractures compared to normal individual.⁸⁻¹⁶

Major risk factors for falls among stroke survivors have been identified are impaired mobility; reduce balance, use of psychotropic medications, disability in care of self, depression, cognitive impairments and history of falls.¹⁷

Cognition and balance are few important risk factors responsible for falls in stroke patients which are not well addressed in clinical practice. Keeping these important

risk factors in mind the goal of the study is to check the effects of balance and cognition training on fear of fall in stroke patients.

MATERIALS AND METHODS

Inclusion criteria

- Age above 40 years
- With ability to walk at least 8 meter (with assistive device if required)
- 1 month post stroke to 6 month post stroke
- Patients who are able to read, write and speak

Exclusion criteria

- Major musculoskeletal problems
- Neurological disorder in addition to stroke.
- More than 1 attack of stroke
- Cerebellar lesion

After considering all inclusion and exclusion criteria stroke patients were divided into two groups by random number allocations.

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Total 40 patients were selected. 18 were allocated to Group A while 22 were allocated to Group B. 32 patients completed the study were included for the final data. 2 patients from Group A and 6 from Group B were not able to complete the protocol.

Group A: Received Conventional Exercises for stroke

Group B: Received Balance and Cognitive exercises along with Conventional exercise. (Summary of exercises is listed below)

Summary of exercises included

Conventional Exercises	Balance exercises	Cognitive Exercises
Gentle Active/ Active assisted / Relaxed Passive movements for all joints Stretching maneuver for all tight muscles Reflex Inhibitory pattern position to reduce spasticity Gait training Ice application	Sitting: weight shifting in all direction Sitting: leaning down on elbow, reaching towards weak side Sitting: reaching forward with clap hands Sit to stand activities Standing: close leg standing Standing: Heel Raise Side stepping Cross leg walk Side walk Backward walk Passing ball in the back Perturbations in different direction	Executive functions: Moving colour rings Sort series of words (alphabetically) Sort number in grid (odd/even) Verbal memory: Memorize word and recognize them in list Visual memory: Memorize shape and colours Memorize peoples name and faces Memorize series of numbers or letters Visual attention: Find similar symbols Memorize series of steps Identify moving object Processing speed: Categorized word and place them properly Auditory : Memorize names and their songs Distinguish sound by their pitch, duration and volume.

All patients were given treatment by one therapist only. Protocol was applied in incremental order for the said patient.

Protocol was given for one month. Patients received physiotherapy treatment twice a week.

After 1 month of completion again all patients were assessed on the basis of

balance, cognition and fear of fall with Berg Balance Scale, Mini Mental Scale and Fear efficacy scale respectively

The trial was assessor blinded.

At the end of trial both groups were compared pre and post interventions. All the variables were compared in between the groups.

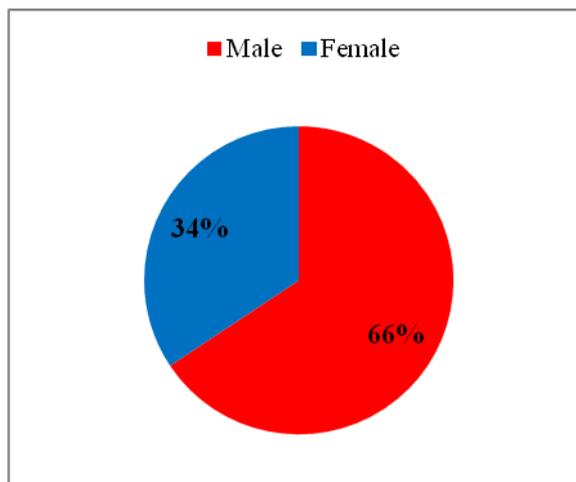
Statistical analysis

Wilcoxon signed ranks test was applied to compare the pre and post values of all outcomes within the group. And Mann-Whitney U test was applied to compare the all variables between the groups.

RESULTS

Table 1. Demographic Data

Characteristics	Group A. Conventional group	Group B. Experimental group
Age	62.18 (9.49)	62.68 (10.16)
Gender	M-10 , F-6	M-11 , F-5



Graph 1. Gender Distribution

Table 2. Group A. Conventional Group (within group) comparison

Outcome measures	Pre (mean±SD)	Post (mean±SD)	Z value	P value
BBS	41.50±4.89	45.37±4.12	-3.539	0.000<0.05
MMS	21.56±3.99	23.00±4.01	-3.256	0.001<0.05
FES1	38.18±16.82	35.25±15.83	-3.546	0.000<0.05

Wilcoxon signed ranks test was applied to compare the pre & post values of all outcome measures of group A. All the variables have P value <0.05 which shows that there is significant difference between pre & post values.

Table 3. Group B. Experimental Group (within group) comparison

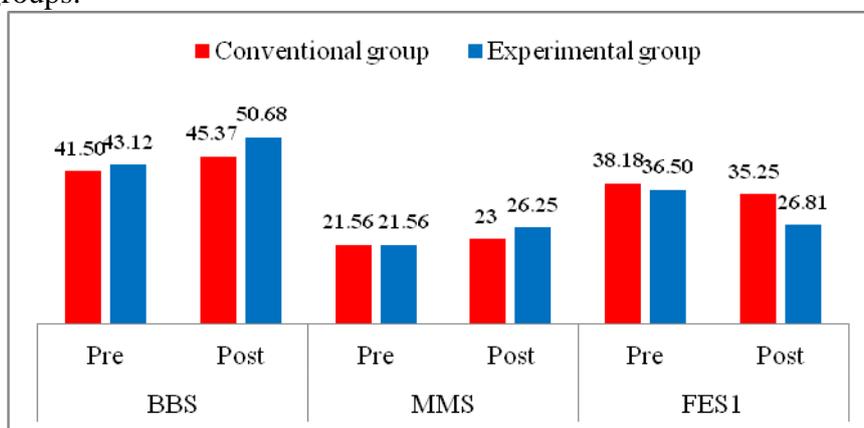
Outcome measures	Pre (mean±SD)	Post (mean±SD)	Z value	P value
BBS	43.12±4.93	50.68±2.62	-3.540	0.000<0.05
MMS	21.56±3.32	26.25±1.57	-3.536	0.000<0.05
FES1	36.50±14.87	26.81±12.04	-3.520	0.000<0.05

Wilcoxon signed ranks test was applied to compare the pre & post values of all outcome measures of group B. All the variables have P value <0.05 which shows that there is significant difference between pre & post values.

Table 4. Comparison between Group A (conventional) and B (Experimental)

Outcome measures	Group A	Group B	Z value	P value
BBS	45.37±4.12	50.68±2.62	-3.424	0.001<0.05
MMS	23.00±4.01	26.25±1.57	-2.135	0.033<0.05
FES1	35.25±15.83	26.81±12.04	-2.632	0.008<0.05

Mann-Whitney U test was applied for between group analysis. P values for all the variables is <0.05, this shows that there is significant difference between outcome measures of both the groups.



Graph 2. Pre and post intervention comparison between the variables

DISCUSSION

The aim of this study was to find out the effectiveness of balance and cognition training on fear of fall among stroke survivors. Study suggests that early use of balance and cognition can reduce the fear of fall among stroke survivors.

A controlled assessor blinded study suggest that Perturbation based balance training in chronic stroke patients had greater improvement in reactive balance control than the control group, and these improvements were sustained 12 months post-training. Final result pertaining to prevention of falls were inconclusive but result show that along with normal rehabilitative exercises such balance exercises might be useful.¹⁸ This supports our conclusion as well. We did not check the effects of only balance and cognition training with control group to avoid ethical issues coming with the patients in control group and interventional group.

A retrospective case control study suggested that patients with cognitive impairment had worse balance function and a higher risk of falls. They need relatively longer time to turn around or sit down. Study indicated that posture control in turning around and sitting down required more cognitive resources in daily life.¹⁹

Patients with Cognitive Impairment had significantly poor balance function than those without Cognitive Impairment. This may be associated with decreased executive function, which is subsumed by frontal regions and is the most common type of impairment in cognitive function. Pahlman et al. reported that differences in BBS scores between patients with and without executive dysfunction were significant in the first year post stroke.²⁰

Study suggest that Exposure to earlier and more frequent mobilization in the acute stage of stroke does not influence cognitive outcome at 3 months.²¹ This further supports our study that cognitive training has to be added separately among stroke patients in addition to early rehabilitative exercises.

Study suggests that Berg Balance scale or gait speed should be used as caution as a fall risk factor in chronic stroke patients. They further emphasized that falls mostly occur during walking and it is necessary to focus on reactive balance and environmental interaction when assessing individuals for risk of falls. Fall prevention program should be design carefully after considering all these factors.²² We did not count the environmental interaction, yet we were able to include perturbation training as reactive balance training. And aim of the study was to include balance and cognition in early rehabilitation to minimize the fear of fall among stroke survivors.

Limitation of study

Area of lesion, extent of lesion was not taken into consideration. Prescribed fixed exercises were given in incremental order after brief assessment. Tailor made treatment was not given to patients. We were unable to include illiterate patients as few cognitive exercises include arithmetic and reading. Study was applied to small number of patients with one month duration only. Fear of fall was judged instead of actual number of falls because of limitation of time.

Further Recommendation

Study can be performed in large population.

Number of falls can be included as outcome measure.

Study can be performed for long duration i.e. minimum 6 months. Environmental interactive factors can be added.

CONCLUSION

Conventional exercises can effectively overcome the fear of fall in post stroke patients. This may lead to reduction in fall incidences. Conventional exercises along with balance and cognition training can effectively overcome the fear of fall in post stroke patients and can lead to reduction in incidences of exercises should

be implemented from the beginning of the rehabilitation to reduce the chances of fall incidences in stroke patients.

A retrospective case control study suggested that patients with cognitive impairment had worse balance function and a higher risk of falls. They needed a longer time to turn around or sit down. Our findings indicated that posture control in turning around and sitting down required more cognitive resources in daily life.

Patients with Cognitive Impairment had significantly poor balance function than those without Cognitive Impairment. This may be associated with decreased executive function, which is subsumed by frontal regions and is the most common type of impairment in cognitive function. Pahlman et al. reported that differences in BBS scores between patients with and without executive dysfunction were significant in the first year post stroke.

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REFERENCES

1. Easton JD, Saver JL, Albers GW, Alberts MJ, Chaturvedi S, Feldmann E, Hatsukami TS, Higashida RT, Johnston SC, Kidwell CS, Lutsep HL, Miller E, Sacco RL. Definition and evaluation of transient ischemic attack: a scientific statement for healthcare professionals from the American Heart Association/American Stroke Association Stroke Council; Council on Cardiovascular Surgery and Anesthesia; Council on Cardiovascular Radiology and Intervention; Council on Cardiovascular Nursing; and the Interdisciplinary Council on Peripheral Vascular Disease. *Stroke*. 2009; 40:2276–2293.
2. Warlow C. P. Epidemiology of stroke. *The Lancet*. 1998;352(3):1–4.
3. Caplan L. R. *Caplan's Stroke: A Clinical Approach*. 3rd. Woburn, England: 2000.
4. Lopez A. D., Mathers C. D., Ezzati M., Jamison D. T., Murray C. J. Global and regional burden of disease and risk factors, 2001: systematic analysis of population health data. *The Lancet*. 2006; 367(9524): 1747–1757.
5. Wagner LM, Phillips VL, Hunsaker AE, Forducey PG. Falls among community-residing stroke survivors following inpatient rehabilitation: a descriptive analysis of longitudinal data. *BMC Geriatr*. 2009; 9(1):46.
6. Schmid AA, Rittman M. Consequences of poststroke falls: activity limitation, increased dependence, and the development of fear of falling. *Am J Occup Ther*. 2009;63(3):310–6.
7. Batchelor FA, Mackintosh SF, Said CM, Hill KD. Falls after Stroke. *Int J Stroke* [Internet]. 2012;7(6):482–90.
8. Ramnemark A, Nyberg L, Lorentzon R, Englund U, Gustafson Y. Progressive hemiosteoporosis on the paretic side and increased bone mineral density in the non-paretic arm in the first year after severe stroke. *Osteoporos Int* 1999;9:269–275.
9. Beaupre GS, Lew HL. Bone density changes after stroke. *Am J Phys Med Rehabil* 2006;85:464–472.
10. orgensen L, Jacobsen BK. Functional status of the paretic arm affects the loss of bone mineral in the proximal humerus after stroke: a 1-year prospective study. *Calcif Tissue Int* 2001;68:11–15.
11. Batchelor F, Hill K, Mackintosh S, Said C. What works in falls prevention after stroke? A systematic review and meta-analysis. *Stroke* 2010;41:1715–1722.
12. Dennis MS, Lo KM, McDowall M, West T. Fractures after stroke: frequency, types and associations. *Stroke* 2002;33:728–734.
13. Myint PK, Poole KE, Warburton EA. Hip fractures after stroke and their prevention. *Q J Med* 2007;100:539–545.
14. Pouwels S, Lalmohamed A, Leufkens B, et al. Risk of hip/femur fracture after stroke: a population-based case-control study. *Stroke* 2009;40:3281–3285.
15. Ramnemark A, Nyberg L, Borssen B, Olsson T, Gustafson Y. Fractures after stroke. *Osteoporos Int* 1998;8:92–95.

16. Brown DL, Morgenstern LB, Majersik JJ, Kleerekoper M, Lisabeth LD. Risk of fractures after stroke. *Cerebrovasc Dis* 2008; 25:95–99
17. Xu T, Clemson L, O’Loughlin K, Lannin NA, Dean C, Koh G. Risk factors for falls in community stroke survivors: a systematic review and meta-analysis. *Arch Phys med Rehabil*. 2018;99(3):563-573.
18. Avril Mansfield, Anthony Aqui, Cynthia J Danells et al. Does perturbation based balance training prevent falls among individual with chronic stroke? A randomized controlled trial. *BMJ Open*. 2018; 8(8)
19. Hui-xian Yu, Zhao- xia Wang, Chang- bin Liu et al. Effect of Cognitive Function on Balance and Posture Control after Stroke. *Neural Plast*. Jan 2021.
20. Pålman U., Gutiérrez-pérez C., Sävborg M., Knopp E., Tarkowski E. Cognitive function and improvement of balance after stroke in elderly people: the Gothenburg cognitive stroke study in the elderly. *Disability and Rehabilitation*. 2011;33(21-22):1952–1962.
21. Toby B Cumming, Julie Bernhardt et al. Early Mobilization after stroke is not associated with cognitive outcome. *Stroke*. 2018.49;2147-2154
22. Jocelyn E Harris, Janice J Eng etc at al. Relationship of balance and mobility to fall incidence in people with chronic stroke. *Physical therapy*. Feb 2005.85;2:150-158

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